ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਡੱਬਵਾਲੀ ਰੋਡ, ਬਠਿ

**Maharaja Ranjit Singh Punjab Technical University**

**Dabwali Road, Bathinda -151001**

**(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)**

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**INVITATION FOR 6th MEETING OF FACULTY OF SCIENCES OF MRSPTU TO BE HELD ON 14.09.2023.**

**To**

1. **Dr. Sandeep Kansal,**
Dean Faculty of Sciences,
Maharaja Ranjit Singh Punjab Technical University, Bathinda

2. **Dr. Sanjay Bhatnagar**
Head, Deptt of Computational Sciences MRSPTU, Bti.
(87250-72319) sanjay@mrsptu.ac.in

3. **Dr. Seema Sharma**
Head, Department of Chemistry,
MRSPTU, Bathinda
(94171-14169) harprit6920@gmail.com

4. **Dr. Kawaljit Singh Sandhu**
Head, Deptt of Food Science & Technology
MRSPTU, Bathinda
(70157-09403) kssandhu@mrsptu.ac.in

5. **Dr. Mamta Kansal**
Head, Deptt of Mathematics, MRSPTU, Bathinda
(88722-11700) mamtakansal@mrsptu.ac.in

6. **Dr. Jasbir Singh Hundal**
Professor, Deptt of Physics, MRSPTU, Bathinda
(95928-03250) jashundal@yahoo.com

7. **Dr. Karanvir Singh**
Professor, Deptt of Mathematics
MRSPTU, Bathinda (88722-11150)
karanvir@mrsptu.ac.in

8. **Dr. Ajay Kumar Mittal**
Professor, Deptt of Mathematics
Aryabhatta Group of Institutes, Barnala
(98786-77011) ajay11mittal@gmail.com

**9.Dr. Manish Gupta**
Deptt of Applied Sciences, Baba Farid CET, Bti
(95011-15418) manishgupta.bti@gmail.com

**10. Dr. Sudhanshu Pratap Singh**
Deptt. of Chemistry, MRSPTU, Bti
(99971-82264) chemsudhanshu@mrsptu.ac.in

**11. Dr. Anju Sharma**
Head, Deptt of Computational Sciences, PSAEC, Patiala
(98889-97297) anjusharma@mrsptu.ac.in

**12. Dr. Santosh Kumar Mahapatra**
Professor, Department of Physics
School of Basic Sciences, Central
University of Punjab, Ghudda, Bathinda
(98776-29971, 94715-58674)
sk.mahapatra@cup.edu.in

**13. Dr. Rajesh Kumar,**
Professor, Department of Chemistry
Central University of Punjab, Bathinda
(99149-69694) rajeshchem01@gmail.com

**14. Dr. Kawaljeet Singh**
Professor & Director Univ Computer Centre
Punjabi University, Patiala
(99150-99557) singhkawaljeet@pbi.ac.in

**15. Dr. Parminder Singh**
Professor, Deptt. of Mathematics,
GNDU, Amritsar (95011-12968) singhparam@gmail.com

**16. Dr. D C Saxena**
Professor, Department of Food Engg & Tech
Sant Longowal Institute of Engineering and Technology, Longowal, Sangrur, Punjab
(9815608859) dcsaxena@yahoo.com

**Sir/Madam,**

It is to inform you that 6th Meeting of Faculty of Sciences of Maharaja Ranjit Singh Punjab Technical University has been scheduled on 14.09.2023 at 03.15pm in online mode through Google meet. Link for meeting is shared below. You are requested to make it convenient to attend this online meeting. Concerned chairpersons of BOS are requested to present the syllabi and other agendas related to their departments at the time of meeting.

**6th Faculty of Sciences Meeting**
Thursday, September 14 · 3:00 – 6:00pm
Video call link: https://meet.google.com/jzb-qdjy-ewg
Or dial: (US) +1 304-825-5539 PIN: 221 817 909#

**Dr. Seema Sharma**
**Member & Convener**
**Faculty of Sciences**
**MRSPTU, Bathinda**

**Copy to:**

a. **Registrar, MRSPTU Bathinda (Through mail)**
b. **Dean Academics, MRSPTU Bathinda (Through mail)**
c. **All Concerned Through mail)**

**ITEM NO. 06.01 TO APPROVE THE MINUTES OF MEETING OF FOLLOWING BOARD OF STUDIES:**

A. The minutes of meeting of Board of Studies in Chemistry held on 22.06.2023 (**ANNEXURE-06.01 -A)**.
B. The minutes of meeting of Board of Studies in Computational Sciences held on 30.05.23 **(ANNEXURE-06.01 - B)**.
C. The minutes of meeting of Board of Studies in Computational Sciences held on 20.07.2023 **(ANNEXURE-06.01 - C)**.
D. The minutes of meeting of Board of Studies in Computational Sciences held on 28.07.2023 **(ANNEXURE-06.01 -D)**.
E. The minutes of meeting of Board of Studies in Physics held on 29.08.2023. **(ANNEXURE – 06.01.-E)**

*Put up before Faculty of Sciences for approval for further recommending it to Academic Council please.*

**ITEM NO.06.02 TO APPROVE THE SYLLABI & SCHEME OF UG and PG PROGRAMME IN THE DEPARTMENT OF CHEMISTRY**

Syllabi of following UG/PG Programmes have been prepared by the concerned Board of Studies as per following details and are put up before *Faculty of Sciences for deliberation & approval for further recommending it to Academic Council please.*

| **S. No.** | **ITEM** | **Annexure** |
|---|---|---|
| 1. | Scheme and Syllabus of Integrated Degree B.Sc.-M.Sc. (Forensic Science) ($1^{st}$ –$6^{th}$ Sem.) for Batch 2023 onwards | 06.02 - A |
| 2. | Scheme and Syllabus of B.Sc. (Non-Medical) ($1^{st}$ – $6^{th}$ Sem.) for Batch 2022 onwards (New CO's) | 06.02 – B |
| 3. | Scheme and Syllabus of M.Sc. Chemistry ($1^{st}$ –$4^{th}$ Semester) (CO's revised only) | 06.02 – C |
| 4. | Scheme and Syllabus of B.Sc. Chemistry ($1^{st}$ to $6^{th}$ Semester) (CO's revised only) | 06.02 - D |

**ITEM NO.06.03 TO APPROVE THE SYLLABI & SCHEME OF UG PROGRAMME IN THE DEPARTMENT OF COMPUTATIONAL SCIENCES**

Syllabi of following UG Programmes have been prepared by the concerned Board of Studies as per following details and are put up before *Faculty of Sciences for deliberation & approval for further recommending it to Academic Council please.*

| **S. No.** | **ITEM** | **Annexure** |
|---|---|---|
| 1. | Scheme and Syllabus of BA (Computer Science) ($1^{st}$ –$6^{th}$ Sem.) for Batch 2023 onwards | 06.03 – A |
| 2. | Scheme and Syllabus of B.Sc. (Graphics and Web Designing) ($2^{nd}$ to $4^{th}$) for Batch 2021 onwards | 06.03 - B |

**ITEM NO.06.04 TO APPROVE THE SYLLABI & SCHEME OF UG AND PG PROGRAMME IN THE DEPARTMENT OF FOOD SCIENCE & TECHNOLOGY & AGRICULTURE**

Syllabi of following UG/PG Programmes have been prepared by the concerned Board of Studies as per following details and are put up before *Faculty of Sciences for deliberation & approval for further recommending it to Academic Council please.*

| S. No. | ITEM | Annexure |
|---|---|---|
| 1. | Scheme and Syllabus of B.Sc. (Food Science and Technology) / Bachelor of Food Science and Technology (Hons.) (1st –6th Sem.) for Batch 2021 onwards with addition of Course Objectives and Outcomes | 06.04 – A |
| 2. | Scheme and Syllabus of M.Sc. (Food Science and Technology) (1st – 4th Sem.) for Batch 2021 onwards with addition of Course Objectives and Outcomes. | 06.04 – B |
| 3. | Syllabus of B.Sc. (Hons.) Agriculture (6th Sem.) for Batch 2K19 onwards | 06.04 - C |

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਡੱਬਵਾਲੀ ਰੋਡ, ਬਠਿੰਡਾ।

**Maharaja Ranjit Singh Punjab Technical University**

**Dabwali Road, Bathinda -151001**

**(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)**

**Department of Chemistry**

hodchemistry@mrsptu.ac.in

**Ref. No. CHEM/23/** 1820

**Dated:** 20/06/2023

## Minutes of Meeting

An online BOS meeting was held on 02.06.2023 at 03.15pm. Following members were present.

1. Dr. Seema Sharma, Chairperson, BOS
2. Dr. Virender Singh, Member, Central University of Punjab
3. Dr. Rajesh Kumar, Member, Central University of Punjab
4. Dr. Nimisha Singh, Member, BFCET, Bathinda
5. Dr. Sudhanshu Pratap Singh, Member
6. Dr. Kewal Kumar, Member
7. Dr. Kirandeep Kaur, Member
8. Dr. Meenu, Member
9. Ms. Krishma, Member

After the deliberation with the members of BOS, the following decisions were taken

1. All the board members approved the newly incorporated CO's in the syllabus for Chemistry related courses of B.Sc. (Non-Medical)
2. Board Members suggested corrections in spelling/grammar/reference books.
3. One of the board members suggested inclusion of Chemical Kinetics in the syllabus.

The suggestion at Sr. No. 02 & 03 were noted & assured the members that the needful will be done in this regard

(Joined Online)
Dr Virender Singh
Member

(Joined Online)
Dr. Rajesh Kumar
Member

(Joined Online)
Dr. Nimisha Singh
Member

(Joined Online)
Ms. Krishma
Member

Dr. Meenu
Member

Kirandeep Kaur
Dr. Kirandeep Kaur
Member

Kewal Kumar
Dr. Kewal Kumar
Member

S. Singh
Dr. Sudhanshu Pratap Singh
Member

S. Singh
20-6-23
Dr. Seema Sharma
Chairperson, BOS

**Dean Faculty of Sciences**
**MRSPTU, Bathinda**

Enclosed is copy of emails of BoS members showing their approvals in this regard.

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਡੱਬਵਾਲੀ ਰੋਡ, ਬਠਿੰਡਾ।

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***DEPARTMENT OF CHEMISTRY***

***hodchemistry@mrsptu.ac.in***

*Ref. No. Chem/23.*1847.. **Dated** 21/07/2023

## Minutes of Meeting

A meeting of BOS members of Chemistry & Special Invitees was held on 21.07.2023 at 11:00AM in the office of HOD, Chemistry to design scheme & syllabus of five year integrated (B.Sc. & M.Sc.) programme in Forensic Science. The following members were present.

1. Dr. Seema Sharma, Chairperson BOS, Chemistry.
2. Dr. Amit Bhatia, HOD Pharmacy Department, MRSPTU, Bathinda (special invitee)
3. Dr. Om Prakash Jasuja, Professor & Head Deptt. of Forensic Science, RIMT University, Mandi Gobindgarh (special invitee & expert)
4. Ms. Ravinder Kaur, Alumnus of Punjabi University Patiala (special invitee & expert)
5. Dr. Sudhanshu Pratap Singh, BOS member
6. Dr. Kewal Kumar, BOS member
7. Dr. Kirandeep Kaur, BOS member
8. Dr. Meenu, BOS member

The following are the minutes of meeting:

1. The study scheme of already running B.Sc., Forensic Science programme under MRSPTU was compared with model curriculum of UGC
2. Dr. Om Prakash Jasuja, expert of Forensic Science proposed a study scheme & syllabus for five year integrated program in Forensic Science. All the other members gave their consent to the proposed scheme & syllabus.
3. Minor modification in the proposed scheme & syllabus which are required as per academic requirement of MRSPTU, were deliberated.
4. It was discussed that the possibility of alignment of syllabus of subject related to existing courses of basic sciences with the proposed subjects in the study scheme of programme related to forensic science, should be explored.
5. Requirement of equipments for labs of first year and books was discussed.

| | | |
|---|---|---|
| **Dr. Meenu**<br>**BOS member** | **Dr. Sudhanshu Pratap Singh**<br>**BOS member** | Kewal Kumar<br>**Dr. Kewal Kumar**<br>**BOS member** |
| Kirandeep Kaur<br>**Dr. Kirandeep Kaur**<br>**BOS member** | Ravinder Kaur<br>**Ms. Ravinder Kaur**<br>**Special Invitee & Expert** | **Dr. Amit Bhatia**<br>**Special Invitee** |
| 21/07/23<br>**Dr. Seema Sharma**<br>**Chairperson BOS** | | **Dr. Om Prakash Jasuja**<br>**Special Invitee & Expert** |

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ, ਡੱਬਵਾਲੀ ਰੋਡ, ਬਠਿੰਡਾ।

**Maharaja Ranjit Singh Punjab Technical University**

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**(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015)**

***DEPARTMENT OF CHEMISTRY***

***hodchemistry@mrsptu.ac.in***

***Ref. No: Chem/22/.1340...***

***Dated 27 / 04 /2022***

## Minutes of Meeting

An online BOS meeting was held on 27.04.2022 at 11.30am. Following members were present.

1. Dr. Seema Sharma, Chairperson, BOS
2. Dr. Subodh Kumar, Member, BOS
3. Dr. Sonal Singhal, Member, BOS
4. Dr. Manjeet Kaur, Member, BOS
5. Dr. Nimisha Singh, Member, BOS
6. Ms. Neha, Member, BOS
7. Dr. Sudhanshu Pratap Singh, Member, BOS
8. Dr. Kewal Kumar, Member, BOS
9. Dr. Meenu, Member, BOS

Agenda:

To finalize the following

1. The scheme of B.Sc. (Non-Medical)
2. Syllabus of B.Sc. (Non-Medical)/1st year
3. Syllabus of Bridge course in Chemistry
4. New Course outcomes of already run B.Sc. (Hons.) Chemistry & M.Sc. Chemistry

After the deliberation with the members of BOS, the following decisions were taken

1. Members approved the scheme of B.Sc. (Non-Medical)
2. Members granted approval to syllabus of B.Sc. (Non-Medical) / 1st year. However they suggested that the compulsory subjects like English, Drug Abuse, Environment Science and life of Maharaja Ranjit Singh should be taught separately in one month before the start of regular semester.
3. All the members agreed to the syllabus of Bridge Course. The syllabus of Bridge course is adopted as such from "Lecture Based Modules for Bridge Course in Chemistry" available on AICTE website.
4. The members were in agreement with the new course outcomes for already existing syllabus of B.Sc. (Hons) and M.Sc. Chemistry.

(Joined Online)
Dr. Subodh Kumar, Member

(Joined Online)
Dr. Sonal Singhal, Member

(Joined Online)
Dr. Manjeet Kaur, Member

(Joined Online)
Dr. Nimisha Singh, Member

(Joined Online)
Ms. Neha, Member

Dr. Meenu
Member

Dr. Sudhanshu Pratap Singh,
Member

Dr. Kewal Kumar,
Member

27/04/22
Dr. Seema Sharma
Chairperson

Maharaja Ranjit Singh
Punjab Technical University
Badal Road, Bathinda-151001, Punjab (INDIA)
Department of Computational Sciences

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ
ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ,
ਬਾਦਲ ਰੋਡ, ਬਠਿੰਡਾ 151001) ਪੰਜਾਬ (ਭਾਰਤ)
ਕੰਪਿਊਟੇਸ਼ਨਲ ਸਾਇੰਸਜ ਵਿਭਾਗ

*(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015 under section 2(f) of UGC Act)*

Ref No/CS/23: 8544.

Dated : 30/5/23

# Minutes of Meeting

The BoS of Computer Application in Online mode meeting was held in the office of the Head, Department of Computational Sciences on 26-05-2023 (Monday) at 3:30 P.M. The following members were present:

1. Prof Sanjay Bhatnagar, Head, Dept. of Computational Sciences MRSPTU, Bathinda
2. Dr. Vishal Goyal, Professor, Dept. of Computer Science, Punjabi University, Patiala
3. Dr Munish Kumar, Assistant Prof, Dept. of Computational Sciences, MRSPTU, Bathinda
4. Dr. Anju Sharma, Assistant Prof, Dept. of Computational Sciences, MRSPTU, Bathinda

ITEM NO. CONFIRMATION OF THE MINUTES OF 13th MEETING OF BoS Members:

1. **Syllabus of B.Sc Graphics & Web Designing 3rd and 4th Semester.**
   **Decision:** The Scheme and Syllabus are framed deliberated & approved.

2. **CO-PO of BCA 7th, 8th, 9th & 10th Semester.**
   **Decision:** CO-PO mapping is framed deliberated & approved.

3. **CO-PO of Bridge Course (MCA)**
   **Decision:** CO-PO mapping is framed deliberated & approved

4. **Syllabus of B.A with Computer Science in Punjabi Medium**
   The matter was deliberated and it was observed that the syllabus of B.A cannot be framed by the BoS of Computational Sciences. It has to be framed & approved by the BoS of Humanities. The BoS of Computational Sciences can frame the syllabus of Computer Science Subjects only as it is done by other nearby Universities.

5. **Modification in existing programs as per NEP-2020:**
   The matter in view of the email dated 31-05-2023 in regards to NEP -2020 was discussed as it was submitted that all members must give their views & inputs to frame the scheme in regards to the NEP 2020 It was also deliberated that:
   i. After completing 1st year of BCA/B.Sc Graphics, the students can be given the Diploma Certificate.
   ii. After 2nd year advanced Diploma Certificate.
   iii. After 3 years, the degree of the program will be given.

- The details will be deliberated in the next BoS meeting.

The meeting ended with the thanks to chair

Online Attend (Dr.Anju Sharma) | 26/5/23 (Dr. Munish Kumar) | Online Attend (Dr. Vishal Goyal) | 26/5/23 (Prof. Sanjay Bhatnagar)

4/7/23 AR DAA-I

**Maharaja Ranjit Singh**

**Punjab Technical University**

**Badal Road, Bathinda-151001, Punjab (INDIA)**

**Department of Computational Sciences**

**ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ**

**ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ,**

**ਬਾਦਲ ਰੋਡ, ਬਠਿੰਡਾ 151001, ਪੰਜਾਬ (ਭਾਰਤ)**

**ਕੰਪਿਊਟੇਸ਼ਨਲ ਸਾਇੰਸਜ ਵਿਭਾਗ**

***(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015 under section 2(f) of UGC Act)***

Ref./CS/2023-24/ 8591/A

Dated 20/7/2023.

## Minutes of Meeting

In continuation of Letter No Ref No/CS/23L1579 Dated 06-07-2023 a meeting was held in the office of Dean Academic Affairs where the Principal of GGS College of Management & Technology Giddarbaha was also present:

The meeting was held in the O/o Dean Academic Affairs in the presence of

Dr. K.S. Sandhu, Associate Dean Academic Affairs
Dr. Satnam Singh, Asstt. Dean Academic Affairs
Dr. Jayaashish Sethi, Principal GGS CMTG
Dr. Sanjay Bhatnagar, Hod Computational Sc.
Dr. Munish Kumar, Asstt. Prof, Computational Sc.
Dr. Mukesh, Asstt Prof. Math
Dr. Sukhwinder Singh, Director, Physical Education Sports, GZSCCET, MRSPTU, Bti

Also the member of UBS, Board of study was contacted.

In the meeting it was decided that following members will coordinate towards the preparation syllables and scheme, of subjects of BA (Computer Science)

| Sr. n | Course | Coordinator |
|---|---|---|
| 1 | Courses related Computer Science | Prof. Sanjay Bhatnagar, Associate Prof.<br>Dr. Munish Kumar, Asstt. Prof. |
| 2 | Courses related to Mathematics | Dr. Mamta Kansal, Associate Prof<br>Dr. Mukesh, Asstt. Prof. |
| 3 | Course Punjabi & Physical Education | Dr. Sukhwinder Singh, Director, Physical Education Sports, GZSCCET, MRSPTU, Bathinda |
| 4 | Course English, Business/Economics Etc | Dr. Veerpal Kaur, Associate Prof.<br>Dr. Pritpal Singh Bhullar. Asstt. Prof. |
| 5 | All other courses of BA | Dr. Jayaashish Sethi, Principal, GGS<br>Dr. Satnam Singh, Asstt. Prof. |

1. Also, it was decided that in the next meeting of BoS the syllabus and scheme of B.A. (Ist Year) w.r.t. CO.PO etc will be prepared and finalized on top priority.
2. Efforts will be made to prepare the syllabus up to six semesters.
3. Above mentioned members are corporate to prepare the syllabus of B.A. Computers Sci. and will attend the meeting of BoS (Computational Sciences)

Sanjay 06/07/23

8/7/23

Dr. Satnam Singh | Prof. Sanjay Bhatnagar | Dr. Munish Kumar

Dr. Mukesh | Dr.Sukhwinder Singh

Maharaja Ranjit Singh
Punjab Technical University
Badal Road, Bathinda-151001, Punjab (INDIA)
Department of Computational Sciences

ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ
ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ,
ਬਾਦਲ ਰੋਡ, ਬਠਿੰਡਾ 151001) ਪੰਜਾਬ (ਭਾਰਤ)
ਕੰਪਿਊਟੇਸ਼ਨਲ ਸਾਇੰਸਜ ਵਿਭਾਗ

*(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015 under section 2(f) of UGC Act)*

Ref No/CS/23: 8608/A Dated : 28/7/23.

# Mintues of Meeting

In BoS held on 28-07-2023 (Friday), the following members were present:

1. Prof Sanjay Bhatnagar, Head, Dept. of Computational Sciences MRSPTU, Bathinda
2. Dr Munish Kumar, Assistant Prof, Dept. of Computational Sciences, MRSPTU, Bathinda (online)
3. Dr. Anju Sharma, Assistant Prof, Dept. of Computational Sciences, MRSPTU, Bathinda (online)
4. Dr. Sukhwinder Singh, Director Physical Education & Sports, MRPTU, Bathinda (special Invite)
5. Dr. Satnam Singh, Assistant Dean (Academic Affairs) MRSPTU, Bathinda (special Invite)
6. Dr. Pritpal Singh Bhullar, Assistant Prof., UBS, MRSPTU, , Bathinda (special Invite)
7. Dr. Mamta Kansal, Head Deptt. of Mathematics, MRSPTU, Bathinda (special Invite)

**The following items were delibrated & decided**

**Item :1 Syllabus of BA (Computer Science)**

The syllabus was deliberated with the coordinators (as per MoM) mentioned below:

| Sr. No | Course | Coordinator |
|---|---|---|
| 1 | Courses related Computer Science | Prof. Sanjay Bhatnagar, Associate Prof.<br>Dr. Munish Kumar, Asstt. Prof. |
| 2 | Courses related to Mathematics | Dr. Mamta Kansal, Associate Prof<br>Dr. Mukesh, Asstt. Prof. |
| 3 | Course Punjabi & Physical Education | Dr. Sukhwinder Singh, Director, Physical Education Sports, GZSCCET, MRSPTU, Bathinda |
| 4 | Course English, Business/Economics Etc | Dr. Veerpal Kaur, Associate Prof.<br>Dr. Pritpal Singh Bhullar. Asstt. Prof. |
| 5 | All other courses of BA | Dr. Jayaashish Sethi, Principal, GGS<br>Dr. Satnam Singh, Asstt. Prof. |

Are approved.

**Item :2 Syllabus of B.Sc (Grahics & Web Designing) 1st Sem.**

In Syllabus of HVPE in Unit -1 the syllabus of C++ is mentioned which needs to be removed. Also it was decided that the scheme & syllabus of common courses be prepared & approved by the concerned BoS. Such as the syllabus of HVPE in all programs and any change by the concerned BoS in the Scheme & syllabus be effected in all progame be prepared by UBS the same may be offered deaprtment.

**Item :3 Bridge course of Mathematics for MCA Students**

The elligibilty of MCA is Passed any graduation degree (e.g.: B.E. / B.Tech. / B.Sc./ B.Com./ B.A. / B.Voc. etc.) preferably with Mathematics at 10+2 Level or at Graduation Level from the University recognized by the UGC and also obtained at least 50% marks (45% marks in case of

**Maharaja Ranjit Singh**
**Punjab Technical University**
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**Department of Computational Sciences**

**ਮਹਾਰਾਜਾ ਰਣਜੀਤ ਸਿੰਘ**
**ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ,**
**ਬਾਦਲ ਰੋਡ, ਬਠਿੰਡਾ 151001) ਪੰਜਾਬ (ਭਾਰਤ)**
**ਕੰਪਿਊਟੇਸ਼ਨਲ ਸਾਇੰਸਜ ਵਿਭਾਗ**

*(Established by Govt. of Punjab vide Punjab Act No. 5 of 2015 under section 2(f) of UGC Act)*

Ref No/CS/23:_____________ Dated : _________

candidates belonging to reserved category) in the qualifying Examination. (for students having no Mathematics background compulsory bridge course will be framed by the respective University / Institution and additional bridge course related to computer subjects as per the norms of the concerned University)who had not done math in +2 or the students who had not mathematics background. It is compulsory for those students study bridge course framed by the University.

In light of the necessity of bridge course of Mathematics subject, it was decided that the department of Mathematics has prepared a similar bridge course for B.Tech students. The same syllabus may also be taught a Bridge Course to MCA Students as per the requirement of the eligibility.

Sanjay 28/07/23 | 28/7/23 | Online Attend.

1. Prof. Sanjay Bhatnagar
2. Dr. Munish Kumar
3. Dr. Anju Sharma
4. Dr. Sukhwinder Singh
5. Dr. Satnam Singh
6. Dr. Pritpal Singh Bhullar
7. Dr. Mamta Kansal

Maharaja Ranjit Singh Punjab Technical University
Dabwali Road, Bathinda -151001
(Estb. under Act 5(2015) of Punjab Govt & approved under section 2 (f) & 12 B of the UGC)

## Department of Physics

Ref No : Phy/23/ 1273 Dated 29-08-23

**Sub:** **Minutes of 10th Meeting of BoS (Physics)**: Regarding Drug Abuse, Env. Sci. & English.

In reference to the meeting held on 20.01.2022 in office of Dean Academics Affairs, MRSPTU, It has been instructed to have the common syllabus of Drug Abuse, Environmental Science and English/ Communicative English in undergraduate programs at University level departments and suggested to review the scheme and syllabus for the above mentioned subjects.

The syllabi and copy of minutes of meeting (Ref. No. DAA/MRSPTU/2022/3554 dated 21st January, 2022) was sent to all BOS members of Physics via E-mail dated 24th August, 2023 as detailed below*.

*The details of the existing and modified courses for B.Sc. (Hons.) Physics is as follows:

| Sr. No. | Semester | Existing Course Name, Code and credit details | | Modified Course Name, Code and credit details | |
|---|---|---|---|---|---|
| 1 | 1st | Communicative English (BHUMA0-001) | LT P C 2 0 0 2 | English (BHSMC0-042) | LT P C 2 0 0 2 |
| 2 | 2nd | Drug Abuse: Problem, Management and Prevention (BMNCC0-004) | LT P C 2 0 0 0 | Drug Abuse: Problem, Management and Prevention (BMNCC0-041) | LT P C 2 0 0 0 |
| 3 | 2nd | Environmental Sciences (BMNCC0-002) | LT P C 2 0 0 2 | Environmental Sciences (BHSMC0-041) | LT P C 3 0 0 3 |

The consent and approval for the implication of the modified scheme and syllabi for B.Sc. (Hons.) Physics program from batch 2023 onwards from external BOS members Dr. Santosh Kumar Mahapatra Professor, Dr. Rohit Mehra, Associate Professor & Dr. Manoj Sharma, Professor has been received via email and enclosed.

Internal Members of BOS

Dr. Supriya Rani
(One Post-Graduate),
meritorious alumnus

Dr. Gagan Gupta, AP
(Member)

Dr. Satnam Singh, AP 29/08/2023
(Member)

Dr. Pooja Devi, AP
(Member)

Dr. Veena Sharma, AP
(Member)

29/8/23
Chairman BOS-cum-
Prof. & Head
Deptt. of Physics

**ADAA.**

MRSPTU
Bathinda

Head Deptt. of Physics MRSPTU Bathinda <hodphysics@mrsptu.ac.in>

# Regarding consent and approval of modification in three courses of B.Sc. (Hons.)Physics

4 messages

**Head Deptt. of Physics MRSPTU Bathinda** <hodphysics@mrsptu.ac.in> Thu, Aug 24, 2023 at 4:19 PM
To: "Dr. Sandeep kansal" <skansal@mrsptu.ac.in>, Veena Sharma <veenasharma@mrsptu.ac.in>, "Dr. pooja Physics" <drpooja@mrsptu.ac.in>, "Dr. Satnam Singh Bhamra" <satnam@mrsptu.ac.in>, Gagan Gupta Physics <gagangupta@mrsptu.ac.in>, supriyagoyal22@gmail.com, Sanjiv Puri <sanjivpuriucoe@gmail.com>, Dr Rohit Mehra <mehrar@nitj.ac.in>, msharma@thapar.edu, ajitjainvip@gmail.com, manpreet kaur <kaur72543@gmail.com>, SANTOSH MAHAPATRA <skmahapatra741973@gmail.com>, SANDEEP KANSAL <skansal2k16@gmail.com>

Dear BOS Members (Physics),

In reference to the minutes of meeting (Ref. No. DAA/MRSPTU/2022/3554 dated 21st January, 2022) from the office of Dean Academics Affairs, MRSPTU (copy enclosed), It has been instructed to have the common syllabus of Drug Abuse, Environmental Science and English/ Communicative English in undergraduate programs at University level departments and suggested to review the scheme and syllabus for the above mentioned subjects.

The details of the existing and modified courses for B.Sc. (Hons.) Physics is as follows

| Sr. No. | Semester | Existing Course Name, Code and credit details | | | Modified Course Name, Code and credit details | | |
|---|---|---|---|---|---|---|---|
| 1 | 1st | Communicative English | BHUMA0-001 | LT P C 2 0 0 2 | English | BHSMC0-042 | LT P C 2 0 0 2 |
| 2 | 2nd | Drug Abuse: Problem, Management and Prevention | BMNCC0-004 | LT P C 2 0 0 0 | Drug Abuse: Problem, Management and Prevention | BMNCC0-041 | LT P C 2 0 0 0 |
| 3 | 2nd | Environmental Sciences | BMNCC0-002 | LT P C 2 0 0 2 | Environmental Sciences | BHSMC0-041 | LT P C 3 0 0 3 |

The existing and modified study scheme and syllabi has been enclosed for your reference.

Kindly give your consent and approval for the implication of the same for B.Sc. (Hons.) Physics program from batch 2023 onwards.

Early response would be appreciated.

Regards

Dr. Sandeep Kansal
Chairman BOS Physics -cum-
Prof. & Head
Department of Physics
Maharaja Ranjit Singh Punjab Technical University, Bathinda-151001 (Punjab)
Ph. :+91-87250-72490

**5 attachments**

**Drug abuse problem, management and prevention.docx**
14K

**English.docx**
14K

Environmental sciences.docx
14K

EXISTING STUDY SCHE AND SYLLABUS.pdf
674K

Modified study scheme.docx
51K

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**MANOJ SHARMA** <msharma@thapar.edu> Thu, Aug 24, 2023 at 5:14 PM
To: "Head Deptt. of Physics MRSPTU Bathinda" <hodphysics@mrsptu.ac.in>

Dear sir
The documents related to three courses of B.Sc.( Hons) Physics, look in order and I approve the same for further necessary action.
Sincerely
Manoj Kumar Sharma
[Quoted text hidden]

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**Dr Rohit Mehra** <mehrar@nitj.ac.in> Thu, Aug 24, 2023 at 8:17 PM
To: "Head Deptt. of Physics MRSPTU Bathinda" <hodphysics@mrsptu.ac.in>

Dear Dr Kansal
I give my consent for the same and agree with the suggested changes.

Yours Truly,
Dr. Rohit Mehra
Ph.D. (Nuclear Physics); A.I.C.C.E.
Associate Professor
Department of Physics
Dr. B. R. Ambedkar National Institute of Technology, Jalandhar, Punjab, India. 144001.
Address: G. T. Road Bye Pass, Jalandhar-144011, Punjab (India).
Phone: +91-181-2690301-302, +91-181-2690453, +91-181-2690603
Fax: +91-181-2690320, +91-181-2690932
Mobile: +91-98885-34590
Alternate e-mail: mehrar@nitj.ac.in,rohitmimit@gmail.com
website: http://www.nitj.ac.in/index.php/nitj_cinfo/Faculty/91

ORCID ID:http://orcid.org/0000-0001-8925-5912

Scopus Author ID: https://www.scopus.com/authid/detail.uri?authorId=15219829700

Google Scholar Link: https://scholar.google.co.in/citations?hl=en&user=fb0aZBAAAAAJ

Web of Science Researcher : https://publons.com/researcher/1502150/dr-rohit-mehra/

Research Gate ID: https://www.researchgate.net/profile/Rohit_Mehra2/scores

Mendeley Profile: https://www.mendeley.com/profiles/rohit-mehra2/

Microsoft Acdemic Search Id: https://academic.microsoft.com/profile/0g9hej1e-j2ej-4f50-eg01-420534793653/mehrar

Vidwan Profile URL: https://vidwan.inflibnet.ac.in/profile/89977

[Quoted text hidden]

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**SANTOSH MAHAPATRA** <skmahapatra741973@gmail.com> Fri, Aug 25, 2023 at 1:19 PM
To: "Head Deptt. of Physics MRSPTU Bathinda" <hodphysics@mrsptu.ac.in>

Dear Sir,
It is approved from my side.
Regards

On Thu, 24 Aug, 2023, 4:19 pm Head Deptt. of Physics MRSPTU Bathinda, <hodphysics@mrsptu.ac.in> wrote:
[Quoted text hidden]

Modified Study Scheme

# B.Sc. (Hons.) PHYSICS SYLLABUS

**B.Sc (HONS.) PHYSICS:** It is an Under Graduate (UG) programme in Physics of 03 years (6 semesters) duration and is in accordance with UGC Choice Based Credit System (CBCS).

**ELIGIBILITY FOR ADMISSION:** Should have passed 10+2 examination with at least 50% marks with English, Physics, Chemistry, Mathematics / Biology

**COURSE STRUCTURE:** As per the UGC guidelines, UG degree with Honours in Physics includes Core Courses (CC), Ability Enhancement Compulsory Courses (AECC), Discipline Specific Electives (DSE), Generic Electives (GE), Skill Enhancement Courses (SEC) and Non Credit Courses (NCC). On the basis of these guidelines, the course structure for B.Sc. (Hons.) Physics has been designed as detailed below.ics

| Sem. | Course Type | | | | | | Contact Hours | Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|
| | CC | DSE | GE | SEC | AECC | NCC | | | |
| I | 2 | 0 | 2 | 1 | 1 | | 32 | 900 | 25 |
| II | 2 | 0 | 2 | | 1 | 1 | 30 | 900 | 23 |
| III | 3 | 0 | 2 | | | | 34 | 900 | 27 |
| IV | 3 | 0 | 1 | | | 1 | 30 | 800 | 23 |
| V | 2 | 2 | 0 | 1 | | | 32 | 700 | 26 |
| VI | 2 | 2 | 0 | | | | 28 | 600 | 24 |
| Tota | 14 | 4 | 7 | 2 | 2 | 2 | ----- | 4800 | 148 |

## STUDY SCHEME

1st Semester

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BHSMC0-042 | AECC-I | English | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| BMATH5-101<br>BMATH5-102 | GE-I | Mathematics-I<br>Basic Mathematics-I* | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-101 | CC-I | Electricity and Magnetism | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-102 | CC-II | Mechanics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-101 | GE-II | Inorganic Chemistry – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-104 | CC-I Lab | Electricity and Magnetism Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-106 | CC-II Lab | Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-103 | GE-II Lab | Inorganic Chemistry – I Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| BPHYS1-108 | SEC-I | Computational Physics Skills | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| | | Total | 17 | 1 | 14 | 440 | 460 | 900 | 25 |

*Students from Medical stream will study Basic Mathematics – I and Students from Non Medical stream will study Mathematics – I

Modified Study Scheme

# B.Sc. (Hons.) PHYSICS SYLLABUS

2nd Semester

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BHSMC0-041 | AECC-II | Environmental Sciences | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| BMATH5-201 | GE-III | Mathematics-II | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BMATH5-202 | | Basic Mathematics-II* | | | | | | | |
| BPHYS1-201 | CC-III | Thermal Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-202 | CC-IV | Waves and Optics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-201 | GE-IV | Organic Chemistry – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-204 | CC-III Lab | Thermal Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-205 | CC-IVLab | Waves and Optics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-203 | GE-IVLab | Organic Chemistry – I Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| BMNCC0-041 | NCC-I | Drug Abuse: Problem, Management and Prevention | 2 | 0 | 0 | 40 | 60 | 100 | |
| | | Total | 19 | 1 | 10 | 420 | 480 | 900 | 23 |

*Students from Medical stream will study Basic Mathematics–II and Students from Non Medical stream will study Mathematics-II

3rd Semester

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BMATH5-301 | GE-V | Mathematics-III | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-301 | CC-V | Analog System and Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-302 | CC-VI | Elements of Modern Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-303 | CC-VII | Quantum Mechanics and Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-102 | GE-VI | Physical Chemistry- I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-305 | CC-V Lab | Analog System and Applications Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-306 | CC-VI Lab | Elements of Modern Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-307 | CC-VII Lab | Quantum Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-104 | GE-VI Lab | Physical Chemistry - I Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| | | Total | 19 | 1 | 14 | 440 | 460 | 900 | 27 |

4th Semester

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BMATH5-401 | CC-VIII | Mathematics-IV | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYS1-401 | CC-IX | Digital System andApplications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-401 | CC-X | Solid State Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-202 | GE-VII | Physical Chemistry- II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-404 | CC-IX Lab | Digital System and Applications Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-405 | CC-X Lab | Solid State Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-204 | GE-VII Lab | Physical Chemistry II Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| BMNCC0-001 | NCC-II | Constitution of India | 2 | 0 | 0 | 60 | 40 | 100 | |
| | | Total | 18 | 2 | 10 | 400 | 400 | 800 | 23 |

Modified Study Scheme

# B.Sc. (Hons.) PHYSICS SYLLABUS

Credit

| 5th Semester | | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Subject Code | Course Type | Subject | L | T | P | Internal | External | Total | |
| BPHYS1-501 | CC-XI | Mathematical Physics – I | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYS1-502 | CC-XII | Statistical Mechanics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-503 | CC-XII Lab | Statistical Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-504 | SEC-II | Basic Instrumentation Skills | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective – I (Select any One Subject and Corresponding Lab with total Six Credit) | | | | | | | | | |
| BPHYD1-511 | DSE-I | Experimental Techniques | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-512 | | Experimental Techniques Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-513 | | Nano Materials and Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-514 | | Nano Materials and Applications Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-515 | | Communication System | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-516 | | Communication System Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective – II (Select any One Subject of Six Credit) | | | | | | | | | |
| BPHYD1-521 | DSE-II | Nuclear and Particle Physics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYD1-522 | | Physics of the Earth | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYD1-523 | | Biological Physics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| | | Total | 16 | 4 | 12 | 340 | 360 | 700 | 26 |

| 6th Semester | | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Subject Code | | Subject | L | T | P | Internal | External | Total | |
| BPHYS1-601 | CC-XIII | Mathematical Physics – II | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYS1-602 | CC-IV | Electromagnetic Theory | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-603 | CC-IV Lab | Electromagnetic Theory Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective – III (Select any One Subject of Six Credit ) | | | | | | | | | |
| BPHYD1-611 | DSE-III | Classical Dynamics | 5 | 1 | 0 | 40 | 60 | 100 | 6 |
| BPHYD1-612 | | Astronomy and Astrophysics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYD1-613 | | Applied Dynamics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| Departmental Elective – IV (Select any One Subject and Corresponding Lab with total Six Credit) | | | | | | | | | |
| BPHYD1-621 | DSE-IV | Medical Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-622 | | Medical Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-623 | | Physics of Devices and Communication | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-624 | | Physics of Devices and Communication Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-625 | | Atmospheric Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-626 | | Atmospheric Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-627 | | Digital Signal Processing | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-628 | | Digital Signal Processing Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| | | Total | 16 | 4 | 8 | 280 | 320 | 600 | 24 |

Drug Abuse: Problem, Management and Prevention and Introduction and Constitution of India are non-

Modified Study Scheme



credit courses; however, it is necessary to secure at least E grade in each.

Modified Study Scheme
Syllabus

# Drug abuse: problem, management and prevention

**Subject Code: BMNCC0-041** | **L T P C 2 0 0 0** | **Duration: 30Hrs.**

**UNIT-I** **(6 Hours)**

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

**UNIT-II** **(8 Hours)**

Consequences of Drug Abuse: Individual: Education, Employment, Income. Family: Violence. Society: Crime. Nation: Law and Order problem.

**UNIT-III** **(8 Hours)**

Prevention of Drug Abuse: Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny. School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

**UNIT-IV** **(8 Hours)**

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environmental intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

**Recommended Books:**


1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills,1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi,1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books,1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications,Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 &2004.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,2013.
9. BhimSain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar,2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, 2000.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press,2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, 2017. 1
14. 'World Drug Report', United Nations Office of Drug and Crime,2016.
15. 'World Drug Report', United Nations Office of Drug and Crime,2017.

Modified Study Scheme
Syllabus

# English

**Subject Code: BHSMC0-042** | **L T P C 2 0 0 2** | **Duration: 30 Hours**

**UNIT-I** **(8 Hours)**

**Communication Skills:** Introduction, Definition, the Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

**Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

**UNIT-II** **(7 Hours)**

**Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

**Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

**UNIT-III** **(7 Hours)**

**Communication Styles:** Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

**UNIT-IV** **(8 Hours)**

**Interview Skills:** Purpose of an interview, Do's and Don'ts of an interview

**Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

**Group Discussion:** Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

**Recommended Books:**


1. Ruther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education,2011.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press,2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson,2013.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life,2011.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquettefor Success', 5th Edition, Pearson,2013.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1 st Edition, Universe of Learning LTD,2010.

Modified ~~Study Structure~~ Syllabus


7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI,2011.
8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press,2011.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., 2011.
10. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw HillEducation, 2011.
11. John A., 'Effective Communication', 4th Edition, Pan MacMillan, 2009.
12. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill,1999

Modified ~~Study Scheme~~ Syllabus

# Environmental sciences

**Subject Code: BHSMC0-041** **L T P C 3 0 0 3** **Duration: 45 Hrs.**

**Unit-I** **(08 Hours)**

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

**Unit-II** **(15 Hours)**

Natural resources and associated problems
a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

**Unit-III** **(12 Hours)**

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c) (d) Desert ecosystem (e) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit- IV** **(10 Hours)**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

**Recommended Books (Latest edition):**


1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment

Existing Study Scheme and Syllabus

# B.Sc. (Hons.) PHYSICS SYLLABUS 2019 BATCH ONWARDS

**B.Sc (HONS.) PHYSICS:** It is an Under Graduate (UG) programme in Physics of 03 years (6 semesters) duration and is in accordance with UGC Choice Based Credit System (CBCS).

**ELIGIBILITY FOR ADMISSION:** Should have passed 10+2 examination with at least 50% marks with English, Physics, Chemistry, Mathematics / Biology

**COURSE STRUCTURE:** As per the UGC guidelines, UG degree with Honours in Physics includes Core Courses (CC), Ability Enhancement Compulsory Courses (AECC), Discipline Specific Electives (DSE), Generic Electives (GE), Skill Enhancement Courses (SEC) and Non Credit Courses (NCC). On the basis of these guidelines, the course structure for B.Sc. (Hons.) Physics has been designed as detailed below.ics

| Sem. | Course Type | | | | | | Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| | CC | DSE | GE | SEC | AECC | NCC | | |
| I | 2 | 0 | 2 | 1 | 1 | | 900 | 25 |
| II | 2 | 0 | 2 | | 1 | 1 | 900 | 23 |
| III | 3 | 0 | 2 | | | | 900 | 27 |
| IV | 3 | 0 | 1 | | | 1 | 800 | 21 |
| V | 2 | 2 | 0 | 1 | | | 800 | 26 |
| VI | 2 | 2 | 0 | | | | 600 | 24 |
| **Total** | **14** | **4** | **7** | **2** | **2** | **2** | **4900** | **146** |

## STUDY SCHEME

**1st Semester**

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BHUMA0 -001 | AECC-I | Communicative English | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| BMATH5-101 / BMATH5-102 | GE-I | Mathematics-I / Basic Mathematics-I* | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-101 | CC-I | Electricity and Magnetism | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-102 | CC-II | Mechanics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-101 | GE-II | Inorganic Chemistry – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-104 | CC-I Lab | Electricity and Magnetism Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-106 | CC-II Lab | Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-103 | GE-II Lab | Inorganic Chemistry – I Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| BPHYS1-108 | SEC-I | Computational Physics Skills | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| | | **Total** | - | - | - | **440** | **460** | **900** | **25** |

*Students from Medical stream will study Basic Mathematics – I and Students from Non Medical stream will study Mathematics – I

Existing Study scheme + Syllabus



2nd Semester

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BMNCC0-002 | AECC-II | Environmental Sciences | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| BMATH5-201 | GE-III | Mathematics-II | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BMATH5-202 | | Basic Mathematics-II* | | | | | | | |
| BPHYS1-201 | CC-III | Thermal Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-202 | CC-IV | Waves and Optics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-201 | GE-IV | Organic Chemistry – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-204 | CC-III Lab | Thermal Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-205 | CC-IVLab | Waves and Optics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-203 | GE-IVLab | Organic Chemistry – I Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| #BMNCC0-004 | NCC-I | Drug Abuse: Problem, Management and Prevention | 2 | 0 | 0 | 100 | -- | 100 | |
| | | Total | - | - | - | 420 | 480 | 900 | 23 |

*Students from Medical stream will study Basic Mathematics–II and Students from Non Medical stream will study Mathematics-II
#Will be implemented from 2021 Batch onwards

3rd Semester

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BMATH5-301 | GE-V | Mathematics-III | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-301 | CC-V | Analog System and Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-302 | CC-VI | Elements of Modern Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-303 | CC-VII | Quantum Mechanics and Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-102 | GE-VI | Physical Chemistry- I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-305 | CC-V Lab | Analog System and Applications Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-306 | CC-VI Lab | Elements of Modern Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-307 | CC-VII Lab | Quantum Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-104 | GE-VI Lab | Physical Chemistry - I Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| | | Total | - | - | - | 440 | 460 | 900 | 27 |

4Th Semester

| Subject Code | Course Type | Subject | Contact Hrs. L | T | P | Marks Internal | External | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|
| BMATH5-401 | CC-VIII | Mathematics-IV | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-401 | CC-IX | Digital System and Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-402 | CC-X | Solid State Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BCHMS1-202 | GE-VII | Physical Chemistry- II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-404 | CC-IX Lab | Digital System and Applications Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-405 | CC-X Lab | Solid State Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BCHMS1-204 | GE-VII Lab | Physical Chemistry II Lab | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| BMNCC0-001 | NCC-II | Constitution of India | 2 | 0 | 0 | 60 | 40 | 100 | |
| | | Total | - | - | - | 400 | 400 | 800 | 21 |

Existing Study Scheme & Syllabi

# B.Sc. (Hons.) PHYSICS SYLLABUS 2019 BATCH ONWARDS

Credits

| 5th Semester | | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Subject Code | Course Type | Subject | L | T | P | Internal | External | Total | |
| BPHYS1-501 | CC-XI | Mathematical Physics – I | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYS1-502 | CC-XII | Statistical Mechanics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-503 | CC-XII Lab | Statistical Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYS1-504 | SEC-II | Basic Instrumentation Skills | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective – I (Select any One Subject and Corresponding Lab with total Six Credit) | | | | | | | | | |
| BPHYD1-511 | DSE-I | Experimental Techniques | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-512 | | Experimental Techniques Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-513 | | Nano Materials and Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-514 | | Nano Materials and Applications Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-515 | | Communication System | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-516 | | Communication System Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective – II (Select any One Subject of Six Credit) | | | | | | | | | |
| BPHYD1-521 | DSE-II | Nuclear and Particle Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-522 | | Nuclear and Particle Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-523 | | Physics of the Earth | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYD1-524 | | Biological Physics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| | | Total | - | - | - | 400 | 400 | 800 | 26 |

| 6Th Semester | | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Subject Code | | Subject | L | T | P | Internal | External | Total | |
| BPHYS1-601 | CC-XIII | Mathematical Physics – II | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYS1-602 | CC-IV | Electromagnetic Theory | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYS1-603 | CC-IV Lab | Electromagnetic Theory Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective – III (Select any One Subject of Six Credit ) | | | | | | | | | |
| BPHYD1-611 | DSE-III | Classical Dynamics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYD1-612 | | Astronomy and Astrophysics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| BPHYD1-613 | | Applied Dynamics | 4 | 2 | 0 | 40 | 60 | 100 | 6 |
| Departmental Elective – IV (Select any One Subject and Corresponding Lab with total Six Credit) | | | | | | | | | |
| BPHYD1-621 | DSE-IV | Medical Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-622 | | Medical Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-623 | | Physics of Devices and Communication | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-624 | | Physics of Devices and Communication Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-625 | | Atmospheric Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-626 | | Atmospheric Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BPHYD1-627 | | Digital Signal Processing | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BPHYD1-628 | | Digital Signal Processing Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| | | Total | - | - | - | 280 | 320 | 600 | 24 |

Existing Study Scheme & Syllabus



Drug Abuse: Problem, Management and Prevention and Introduction and Constitution of India are non-credit courses; however, it is necessary to secure at least E grade in each.

## COMMUNICATIVE ENGLISH

**Subject Code: BHUMA0 -001** **L T P C 2 0 0 2** **Duration: 30 Hrs.**

**Course Objectives:**

1. To remove the phobia of conversing in English.
2. To make the learners enable to express themselves among peers & teachers.
3. To enable learners, improve their vocabulary.
4. To introduce them with basic communicative skills in real life situations.
5. To enhance learner's writing ability.

**Course Outcomes:** At the end of the semester, the learner will be able to

1. Remove fear of speaking in English among peers & teachers.
2. Develop the ability to speak in English.
3. Use vocabulary taught for speaking and writing simple sentence for day to day conversation.
4. Use taught vocabulary for writing applications on common issues.

### UNIT-I (8 Hours)

**Introduction**

Theory of Communication, Types and modes of Communication

**Language of Communication**

Verbal and Non-verbal, (Spoken and Written), Personal, Social and Business, Barriers and Strategies Intra-personal, Inter-personal and Group communication.

### UNIT-II (7 Hours)

**Speaking Skills**

Monologue, Dialogue, Group Discussion, Effective Communication/ Mis- Communication, Interview, Public Speech.

### UNIT-III (9 Hours)

**Reading and Understanding**

Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation(from Indian language to English and vice-versa), Literary/Knowledge Texts.

### UNIT-IV (6 Hours)

**Writing Skills**

Documenting, Report Writing, Making notes, Letter writing

**Recommended Text Books / Reference Books:**

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr. Ranjana Kaul, Dr Brati Biswas.

Existing Study Scheme & Syllabi



13. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
14. Motion of particle in a central force field and plot the output for visualization

**Reference Books**


1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher:PHI).
3. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
4. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
5. Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi (1999)
6. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning


## ENVIRONMENTAL SCIENCES

**Subject Code: BMNCC0-002** **L T P C 2 0 0 2** **Duration: 30 Hrs.**

**Course Objective:** To create awareness among students about environment protection.

**Course Outcomes:** Based on this course, the students will understand / evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development.

### UNIT-I

**Natural Resources**

Renewable and Non-renewable Resources: Natural resources and associated problems. (a) Forest resources: Use and over-exploitation, deforestation. Timber extraction and their effects on forests and tribal people. (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

### UNIT-II

**Ecosystems**

(a) Concept of an ecosystem. (b) Structure and function of an ecosystem. (c) Producers, consumers and decomposers. (d) Energy flow in the ecosystem. (e) Ecological succession. (f) Food chains, food webs and ecological pyramids.

### UNIT-III

**Environmental Pollution**

Definition (a) Causes, effects and control measures of: i) Air pollution ii) Water pollution iii) Soil pollution iv) Marine pollution v) Noise pollution vi) Thermal pollution vii) Nuclear pollution (b) Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Existing Study Scheme & Syllabus



### UNIT-IV

**Social Issues and the Environment**

(a) From unsustainable to sustainable development (b) Urban problems and related to energy (c) Water conservation, rain water harvesting, Watershed Management (d) Resettlement and rehabilitation of people; its problems and concerns. (e) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

**Recommended Books:**


1. J.G. Henry and G.W. Heinke, 'Environmental Sc. & Engineering', Pearson Education, **2004**.
2. G.B. Masters, 'Introduction to Environmental Engg. & Science', Pearson Education, **2004**.
3. ErachBharucha, 'Textbook for Environmental Studies', UGC, New Delhi.


## MATHEMATICS-II

**Subject Code: BMATH5-201** **L T P C** **Duration:60 Hrs.**

**3 1 0 4**

**Course Objective**: To introduce concept of probability, basic statistics, sequence and series and Partial differentiation.

**Course Outcome**: After the completion of the course, the students will be able to solve the problems related to probability, basic statistics, sequence and series and Partial differentiation.

### UNIT-I (14 Hours)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables;

### UNIT-II (15 Hours)

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

### UNIT-III (15 Hours)

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

### UNIT-IV (16 Hours)

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

**Reference Books:**


1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, 2002.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons,2006.
3. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
4. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, 2010.

Existing Study Scheme & Syllabi



a. Water
b. Alcohol
c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)
6. Chromatography
a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography
b. Separation of a mixture of two sugars by ascending paper chromatography
c. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)

**Reference Books**


• Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
• Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)


## DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

**Subject Code: BMNCC0-004** **L T P C** **Duration: 30 Hrs.**
**2 0 0 0**

**Course Objective:** To familiarize the students about consequences of drug abuse and preventive measures.
**Course Outcome:** It will develop the general consciousness among students about impacts of drug abuse.

**UNIT-I (6 Hours)**

**Meaning of Drug Abuse**
Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

**UNIT-II (8 Hours)**

**Consequences of Drug Abuse**
Individual: Education, Employment, Income. Family: Violence. Nation: Law and Order problem.

**UNIT-III (8Hours)**

**Prevention of Drug Abuse**
Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny.
School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

**UNIT-IV (8 Hours)**

**Treatment and Control of Drug Abuse**
Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group

Existing Study Scheme & Syllabus



therapy and Environme-ntal intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

**Recommended Books:**

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, 1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, 1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, 1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications, Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 & 2004.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi, 2013.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi, 1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, 2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra, Delhi, 2000.
12. S. Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press, 2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Eco -nomic and Political Weekly, 2017.
14. 'World Drug Report', United Nations Office of Drug and Crime, 2016.
15. 'World Drug Report', United Nations Office of Drug and Crime, 2017.

## MATHEMATICS-III

| Subject Code: BMATH5-301 | L T P C<br>3 1 0 4 | Duration: 60 Hrs. |
|---|---|---|

**Course Objective:** To introduce concept of ordinary and partial Differential equations.

**Course Outcome:**The students will be able to use and solve the problems related to concept of ordinary and partial Differential equations.

### UNIT-I (14 Hours)

**First Order Ordinary Differential Equations:** Linear and Bernoulli's equations, exact equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

### UNIT-II (16Hours)

**Ordinary Differential Equations of higher Orders:** Second order linear differential equations with variable coefficients, (complementary function, particular integral) method of variation of parameters, Cauchy-Euler equation.

### UNIT-III (15Hours)

STUDY SCHEME

| 1st Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Sub. Code** | **Subject** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BHSMC0-042 | English | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| BMFSS1-101 | General Forensic Science and Criminal Law | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BMFSS1-102 | Elements of Questioned Document Examination | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-103 | Inorganic Chemistry-I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-104 | Organic Chemistry-I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-108 | Chemistry Lab- I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - I** | | | | | | | | |
| BMFSS1-103 | Biodiversity (Microbes, Algae, Fungi &Archegoniate) | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-104 | Botany Lab. I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-105 | Diversity of Animals-I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-106 | Zoology Lab. I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - II** | | | | | | | | |
| BSNMS1-105 | Differential Calculus-I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-106 | Differential Calculus-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-102 | Mechanics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-107 | Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **22/24** | **0** | **12/8** | **460/440** | **540/560** | **1000** | **28** |

**Type of Courses:** Ability Enhancement Compulsory Course (AECC), Core Course (CC), Skill Enhancement Course (SEC), Discipline Specific Elective (DSE)
* Students can choose group of subjects among Group I and Group II.
**Note : Exit policy is available as per UGC norms**

| 2nd Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| Sub. Code | Subject | L | T | P | Int. | Ext | Total | |
| BMNCC0-041 | Drug abuse: problem, management and prevention | 2 | 0 | 0 | 40 | 00 | 40 | 0 |
| BSNMS1-203 | Physical Chemistry-I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-204 | Organic Chemistry-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BMFSS1-201 | Fingerprints Examination and Forensic Photography | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BMFSS1-202 | Questioned Document and Fingerprint Laboratory | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| BSNMS1-208 | Chemistry Lab-II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - I** | | | | | | | | |
| BMFSS1-203 | Plant Ecology &Taxonomy | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-204 | Botany Lab. II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-205 | Diversity of Animals-II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-206 | Zoology Lab. II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - II** | | | | | | | | |
| BSNMS1-202 | Electricity, Magnetism and EMT | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-205 | Differential Equations-I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-206 | Differential Equations-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-207 | Electricity, Magnetism and EMT Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **19/21** | **0** | **14/10** | **480/460** | **460/480** | **940** | **24** |

| 3rd Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| Sub. Code | Subject | L | T | P | Int. | Ext. | Total | |
| BSNMS1-303 | Inorganic Chemistry-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-304 | Physical Chemistry-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BMFSS1-301 | Criminalistics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BMFSS1-302 | Criminalistics Laboratory | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| BSNMS1-305 | Chemistry Lab III | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - I** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BMFSS1-303 | Plant Anatomy &Embryology | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-304 | Botany Lab. III | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-305 | Physiology & Biochemistry | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-306 | Zoology Lab. III | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - II** | | | | | | | | |
| BSNMS1-306 | Real Analysis-I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-307 | Real Analysis-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-301 | Thermal Physics and Statistical Mechanics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-302 | Thermal Physics and Statistical Mechanics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **17/19** | **0** | **14/10** | **440/420** | **460/480** | **900** | **24** |

| 4th Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Sub. Code** | **Subject** | **L** | **T** | **P** | **Int.** | **Ext** | **Total** | |
| BHSMC0-041 | Environmental Science | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-403 | Organic Chemistry-III | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-404 | Physical Chemistry-III | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-405 | Chemistry Lab-IV | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-401 | Forensic Psychology | 3 | 0 | 0 | 60 | 40 | 100 | 3 |
| **Group - I** | | | | | | | | |
| BMFSS1-402 | Plant Physiology &Metabolism | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-403 | Botany Lab. IV | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-404 | Genetics &Evolutionary Biology | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-405 | Zoology Lab. IV | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - II** | | | | | | | | |
| BSNMS1-401 | Waves and Optics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-402 | Waves and Optics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BSNMS1-406 | Algebra-I | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-407 | Algebra-II | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **Total** | | **20/22** | **0** | **12/8** | **440/420** | **460/480** | **900** | **26** |

| 5th Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Sub. Code** | **Subject** | **L** | **T** | **P** | **Int** | **Ext** | **Total** | |
| BSNMD1-521 | Chemistry of Main group elements | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMD1-522 | Chemistry of Main group elements Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-501 | Fundamentals of Computer Forensics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BMFSS1-502 | Computer Forensics Laboratory | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| **Group - I** | | | | | | | | |
| BMFSS1-503 | Botany-I Cell and Molecular Biology | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-504 | Botany Lab. V | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-505 | Comparative Anatomy & Vertebrates | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-506 | Zoology Lab. V | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - II** | | | | | | | | |
| BSNMD1-531 | Matrices | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMD1-532 | Linear Algebra | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMD1-511 | Digital Analog and Instrumentation | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMD1-512 | Digital Analog and Instrumentation Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **15/17** | **0** | **14/10** | **400/380** | **400/420** | **800** | **22** |

| 6th Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject** | **L** | **T** | **P** | **Int.** | **Ext** | **Total** | |
| BSNMD1-621 | Comprehensive Chemistry | 4 | 0 | 0 | 40 | 60 | 100 | 4 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BSNMD1-622 | Comprehensive Chemistry Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BMFSS1-601 | Forensic Audio Video Examination | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BMFSS1-602 | Forensic Audio Video Examination Laboratory | 0 | 0 | 2 | 60 | 40 | 100 | 1 |
| **Group - I** | | | | | | | | |
| BMFSS1-603 | Economic Botany and Biotechnology | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BMFSS1-604 | Developmental Biology | 0 | 0 | 4 | 40 | 60 | 100 | 2 |
| BMFSS1-605 | Botany Lab. VI | 4 | 0 | 0 | 60 | 40 | 100 | 4 |
| BMFSS1-606 | Zoology Lab.VI | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Group - II** | | | | | | | | |
| BSNMD1-611 | Elements of Modern Physics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMD1-612 | Elements of Modern Physics Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMD1-631 | Numerical Methods | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMD1-632 | ComplexAnalysis | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **Total** | | **15/17** | **0** | **14/10** | **400/380** | **400/420** | **800** | **22** |

# SEMESTER

# FIRST

## ENGLISH

**Subject Code: BHSMC0-042** **L T P C** **Duration:30 Hrs.**
**2 0 0 2**

**Course Objective:** To improve the communication skills of students.
**Course Outcome:** To make student capable for attending interviews and for presenting their research in conferences.

### UNIT-I (8 Hours)

**Communication Skills**: Introduction, Definition, the Importance of Communication,
The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
**Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

### UNIT-II (7 Hours)

**Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.
**Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

### UNIT-III (7 Hours)

**Communication Styles:** Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.
**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

### UNIT-IV (8 Hours)

**Interview Skills:** Purpose of an interview, Do's and Don'ts of an interview
**Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery
**Group Discussion:** Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.
**Recommended Books:**
1. R:uther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education, 2011.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press,2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson, 2013.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life, 2011.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquettefor Success', 5th Edition, Pearson, 2013.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1 st Edition, Universe of Learning LTD,2010.
7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI, 2011.
8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press, 2011.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., 2011. 10. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw Hill Education, 2011.
10. John A., 'Effective Communication', 4th Edition, Pan MacMillan, 2009.
11. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill,1999.

## GENERAL FORENSIC SCIENCE AND CRIMINAL LAW

**Subject Code: BMFSS1-101** **L T P C** **Duration: 45Hrs.**
**3 0 0 3**

**Course Objective:**

1. To familiarize with history of Forensic Science.
2. To understand the importance of Forensic Science
3. To understand the working of Forensic Science labs and Police administration in India.
4. To understand various criminal laws and its importance in Forensic Science.

**Course Outcome (CO):** After the completion of the course, student will be able to:
CO1: Understand the concept of Forensic Science.
CO2: Learn the present scenario of Forensic Science in India and its scope
CO3: Gain knowledge about the various types of crimes.
CO4: Understand Criminal Law.

### UNIT-I (15 Hrs)

**Basic concepts of Forensic Science-I:**Definition of Forensic Science by different authors, History of Forensic Science, Seven principles of Forensic Science, Nature, need, scope and functions of Forensic Science, Tools and techniques in forensic science, Ethics in Forensic Science, Subjective and objective observation, Qualitative and quantitative analysis, Preliminary and confirmatory tests, Positive control, negative control and blank samples.

**Basic concepts of Forensic Science-II:**, Modus operandi and its role in crime records, Corpus delicti, Prima facie, Admissibility of scientific evidence in the courtroom, Frye and Daubert standards.

### UNIT-II (10Hrs)

**Forensic Science Laboratories in India**: Forensic science laboratories (FSLs) in India and its types- Central, State, Regional and Mobile FSLs, Branches of FSLs, Setup of FSLs, Hierarchy of experts in Forensic Science Laboratories, Services provided by FSLs, Functioning of FSLs, roles and responsibilities of forensic scientist, the Laboratory Information Management System(LIMS).

**Report writing and Court testimony**: FIR, Report writing and evidence evaluation, Components of report, Report format in respect of crime scene and laboratory findings, Court trial and testimony, Pre- Court Preparation and Court appearance e

## UNIT-III (13Hrs)

**Criminal Law:**

**Definitions:** Actus rues, Mens rea and its types, Bailable/non-bailableoffences, Cognizable/non-cognizable,Summon cases andwarrant cases.

**Special Forms of Crime:** Organized Crime: Gangs/Criminal Networks, Socio-Economic Crime, Custodial Crime, White-Collar Crime, Crime against Women/Children, Sex Offences.

Correctional Therapy: Probation, Parole, Furlough, Remission and Pardon

**Code of Criminal Procedure (CrPC)**:Sections- 291,292,293.

**Indian Evidence Act (IEA):** Sections-32, 45,46, 47, 57,58, 60, 73, 135,136, 137, 138,141.

**Indian Penal Code(IPC):**Sections(Offencesagainsttheperson)-299,300,302,304B,307,309,319,320,324,326,351,354,359,362,375,376,377and Sections(Offences against property)-378, 383,390,391,420, 463, 497,499, 503and 511.

## UNIT-IV (07 Hrs)

**Indian Constitution**: Article 20 and 21.

Recentamendments in above mentioned sections of all laws.

**Police Administration:** History and development of police administration, Duties, roles, responsibilities and power of Police, Organizational structure of police, Relationship between police and forensic scientist with respect to crime investigation

**People and society :** Custodial deaths, Police and Human Rights.

**Recommended Books:**

1. Siegel J. A. and Mirakovits K: **Forensic Science: The Basics,** CRC Press, 3rd Edition,2016.
2. Siegel J. A. and Saukko P. J.: **Encyclopedia of Forensic Sciences,** Academic Press, 2ndEdition, 2013.
3. SafersteinR: **Forensic ScienceHand Book**,VolI,CRC Press,3rdEdition.2020.
4. SafersteinR: **ForensicScienceHand Book**,VolII,Pearson,2ndEdition.2005.
5. SafersteinR: **Forensic ScienceHand Book**,VolIII,Pearson, 2nd Edition.2010.
6. Saferstein, R: **Criminalistics: An Introduction to Forensic Science**, Pearson, 12thEdition, 2018.
7. SharmaB.R.: **Forensic Science in Criminal Investigation & Trials**, Universal Law Publishing, 6thEdition, 2020.
8. **The Constitution of India** by Legislative Department, Ministry of Law and Justice, Govt. of India.
9. **TheIndianEvidenceAct,1872**byLegislativeDepartment,MinistryofLawandJustice,Govt. ofIndia.

## ELEMENTS OF QUESTIONED DOCUMENT EXAMINATION

**Subject Code: BMFSS1-102** **L T P C** **Duration: 45Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand the importance of Questioned Document as an evidence.
2. To understand the principles of handwriting.
3. To acquire the knowledge of comparison of type written and printed matter.
4. To acquire knowledge of Standards for comparison.

**Course Outcome (CO):** After the completion of the course, student will be able to:
CO1: Understand the concept of Questioned Documents.
CO2: Gain knowledge regarding forgery, its type and examination.
CO3: Gain knowledge of cases which fall under purview of digital crimes.
CO4: Understand the elements involved in investigation of digital crimes.

### UNIT-I (15 Hrs)

**Documents in general:** Importance, Classification and Preliminary Examination. **Elements of Handwriting:** Elements of Execution and Style Development of Individuality in Handwriting and Principles of handwriting identification**.**

### UNIT-II (10Hrs)

**Natural Variations in handwriting:** Definition and nature, Determination of range of variations (consistency) and its importance. **Fundamental divergence sin handwriting:** Its interpretation in relation to identification of handwriting, consideration of various writing instruments used in writing.

### UNIT-III (12Hrs)

**Standards for comparison**: Requested and Collected Standards **Alterations in the document:** Erasures, Additions, Overwriting and Obliterations: their examination **Forgery:** Definitions, types and characteristics **Disguise:** Definition and Characteristics **Indented and Invisible Writings:** Introduction and Methods of examination.

### UNIT-IV (08Hrs)

**Comparison of typewritten and Printed matter:** Working and Types, Printing and Machine Defects, alterations in Printed and typed text. Photostat Machines and Fax machines: Examination of printouts from them. Working and Principle of Projectina /video- spectral comparator (VSC), ESDA, Docucenter Examination of Currency. Comparison of digitally manipulated documents.

**Recommended Books:**

1. Huber, A. R. and Headrike, A.M. (1999), **Handwriting identification: facts and fundamental,** CRC LLC.
2. Ellen, D (Edition 2nd) (1997), **The scientific examination of Documents, Methods and techniques**, Taylor & Francis Ltd.
3. Morris (Edition 1st) (2000), **Forensic Handwriting Identification (fundamental concepts and Principals),**Academic Press Inc.
4. Harrison, W.R (1966**), Suspect Documents & their Scientific Examination**, Sweet & Maxwell Ltd., London.
5. Hilton, O (1982), **The Scientific Examination of Questioned Document**, Elsevier North Holland Inc., New York.
6. Sulner, H.F. (1966), **Disputed Document**, Oceana Publications Inc., New York.
7. Saxena B.L. (1968), **Saxena's Law & Techniques Relating to Finger Prints, Foot Prints & Detection of Forgery**, Central Law Agency, Allahabad (Ed. A.K. Singla).
8. Quirke, A.J. (1930), **Forged, Anonymous &Suspet Documents**, ReorgeRontledge& Sons Ltd., London.
9. Osborn, A. S. (1929), **Questioned Documents**, Boyd Printing Co., Chicago.
10. Levinson, J (2000), **Questioned Documents**, Academic Press, Tokyo.
11. Kelly, J.S and Lindblom, B.S (2006), **Scientific Examination of Questioned Documents,** Taylor & Francis, New York.
12. Brunelle, R.L. and Reed, R.W. (1984), **Forensic Examination of Ink and Paper**, Charles C Thomas Publisher, U.S.A.
13. Baker, J.N. (1955), **Law of Disputed and Forged Documents**, The Michie Company, Virginia

## INORGANIC CHEMISTRY-I

**Subject Code: BSNMS1-103** **L T P C** **Duration: 45Hrs.**
**3 0 0 3**

**Course Objectives**

1. To familiarize with atomic structure, quantum numbers and shapes of orbitals
2. To understand periodic table and periodic properties of elements
3. To understand the concept of crystal structure of molecules
4. To understand the concept of various bonding theories

**Course Outcomes:** The completion of this course will make student to acquire the knowledge of:

CO1: Wave mechanics, atomic theories and shapes of orbitals
CO2: Periodic table and various periodic properties
CO3: Ionic bond and crystal structure of molecules
CO4: Covalent bond, metallic bond and various weak chemical forces

**Unit-I (8 Hrs.)**

**Atomic Structure:**

de-Broglie equation, Heisenberg's Uncertainty Principle and its significance. Schrödinger's wave equation and its derivation, significance of $\psi$ and $\psi^2$. Quantum numbers. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions and distribution curves. Shapes of s, p, d and f orbitals.
Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations.

**Unit-II (7 Hrs.)**

**Chemical Periodicity:**

Effective nuclear charge, shielding or screening effect (Slater rules), variation of effective nuclear charge in periodic table.
Atomic and ionic radii, Ionization enthalpy, Electron gain enthalpy and their trend in groups and periods.
Electronegativity and various scales. Variation of electronegativity with bond order, partial charge, hybridization, group electro negativity.

**Unit-III (15 Hrs.)**

**Chemical Bonding-I:**

**Ionic bond:** General characteristics of ionic compounds, size effects, radius ratio rule and its limitations. Efficiency of packing, Hexagonal close packing, Cubic close packing. Structures of different crystal lattices: Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Pervoskite, Rhenium oxide, Calcium carbide, The calcite and aragonite structures.
Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung

constant, Born-Haber cycle and its application, Solvation energy.

**Unit-IV (15 Hrs.)**

**Chemical Bonding-II:**

**Covalent bond:** Lewis structure, Valence Bond theory, VSEPR theory (Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory), Hybridization, Molecular orbital theory (LCAO method). Molecular orbital diagrams of diatomic and simple polyatomic molecules ($Be_2$, $N_2$, $O_2$, $F_2$, LiH, NO, CO, HCl, $NO_2$, $BeH_2$, $NO_2^-$), Formal charge, Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds (Bond moment, dipole moment, Percentage ionic character)

**Metallic Bond:** Valence bond and band theories. Semiconductors and insulators, defects in solids. **Weak Interactions:** van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, Hydrogen bonding.

**Recommended Books:**

Latest edition of:

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, 'Inorganic Chemistry', ELBS Oxford.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, 'Inorganic Chemistry',Pearson Education, Singapore.
3. J.D. Lee, 'Concise Inorganic Chemistry', ELBS, Oxford.

# ORGANIC CHEMISTRY-I

**Subject Code: BSNMS1-104** **L T P C** **Duration: 45Hrs.**
**3 0 0 3**

**Course Objectives:**
1. To familiarize with the concepts of basics of organic chemistry
2. To understand the concept of mechanisms of organic reactions
3. To familiarize with the chemistry of alkanes and cycloalkanes
4. To understand chemistry of alkenes and alkynes
5. To know the chemistry behind aromatic hydrocarbons

**Course outcomes:** After the completion of course students will acquire the knowledge of:
CO1: Concepts of basics of structure and bonding
CO2: Mechanisms of organic reactions
CO3: Chemistry of aliphatic hydrocarbons
CO4: Chemistry behind aromatic hydrocarbons

## Unit-I (15 Hrs.)

**Structure and Bonding:**
Hybridization, bond lengths, bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

**Mechanism of Organic Reactions:**
Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates (carbocations, carbanions, free radicals, carbenes, arynes and nitrenes). Assigning formal charges on intermediates and other ionic species.
Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

## Unit-II (10 Hrs.)

**Alkanes and Cycloalkanes:**
Introduction, IUPAC nomenclature, Isomerism and classification of carbon atoms of alkanes. Sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey- House reaction and decarboxylation of carboxylic acids). Physical properties and chemical reactions of alkanes.
Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. Cycloalkanes - nomenclature, methods of formation, chemical reactions, Baeyer’s strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring; banana bonds.

## Unit-III (14 Hrs.)

**Alkenes, Cycloalkenes, Dienes and Alkynes:**

*Alkenes* Nomenclature, methods of synthesis (mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination), physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

*Cycloalkenes* Methods of formation, conformation and Chemical reactions of cycloalkenes.

*Dienes* Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2 and 1,4 additions, Diels-Alder reaction.

*Alkynes* Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation, metal-ammonia reductions, oxidation and polymerization.

## Unit-IV (6 Hrs.)

**Aromatic hydrocarbons:**

*Preparation* (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

*Reactions*: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

**Recommended Books:**

Latest edition of:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', JohnWiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

# CHEMISTRY LAB- I

**Subject Code: BSNMS1-108** **L T P C** **Duration:60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To develop basic understanding of various lab practices including safety measures.
2. To understand qualitative semi micro analysis of mixtures.
3. To analyze unknown functional group in organic molecules.
4. To understand various chromatographic techniques used for separation of dyes.

**Course Outcomes:** The students will acquire knowledge of

CO1: Different safety measures in lab
CO2: Analysis of mixture for cations and anions
CO3: Analysis of unknown functional group in organic molecules
CO4: chromatographic techniques used for separation of dyes

**Inorganic Chemistry:**
Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

**Organic Chemistry Laboratory Techniques:**
Detection of various functional groups in organic compounds (containing upto two extra elements)

**Separation of mixtures by Chromatography:** Measure the Rf value in each case (combination of two compounds to be given)
Identify and separate the components of a given mixture of two dyes (red and blue ink, fluorescent and methylene blue) by paper chromatography

**Recommended Books:**
Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis',Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.

**GROUP-1**

## BIODIVERSITY(Microbes, Algae, Fungi &Archegoniate)

**Subject Code: BMFSS1-103** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of biodiversity of microbes, algae, fungi and archegoniate.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

CO1: Microbes, algae, Fungi.
CO2: Archegoniate, Bryophytes.
CO3: Pteridophytes and Gymnosperms.

**Unit- 1(15Hours)**

**Microbes: Viruses** – Discovery, general structure, replication (general account), DNAvirus (T-phage); Lytic and lysogenic cycle, RNA virus (TMV); Economic importance;Bacteria–Discovery,Generalcharacteristicsandcellstructure;Reproduction–vegetative, asexual and recombination (conjugation, transformation and transduction);Economicimportance.

**Algae :** General characteristics; Ecology and distribution; Range of thallus organizationand reproduction; Classification of algae; Morphology and life-cycles of the following:*Nostoc*,*Chlamydomonas, Oedogonium*,*Vaucheria,*Economicimportanceofalgae

**Unit-2(15Hours)**

**Fungi :**Introduction- General characteristics, ecology and significance, range of thallusorganization,cellwallcomposition,nutrition,reproductionandclassification;TrueFungi-Generalcharacteristics,ecologyandsignificance,lifecycleof*Rhizopus*(Zygomycota),*Puccinia*,*Agaricus*(Basidiomycota);SymbioticAssociations-Lichens:Generalaccount,reproductionandsignificance;Mycorrhiza:ectomycorrhizaandendomycorrhiza and their significance, Fungi like organisms Albugo, Phytophthora andslime molds

**Unit-3( 15 Hours)**

**Introduction to Archegoniate :** Unifying features of archegoniates, Transition to landhabit,Alternation ofgenerations

**Bryophytes:** General characteristics, adaptations to land habit, Classification, Range ofthallusorganization.Classification(uptofamily),morphology,anatomyandreproduction of *Marchantia* and *Funaria*. (Developmental details not to be included).Ecologyand economicimportanceofbryophyteswith specialmention of*Sphagnum*.

**Unit-4( 15Hours)**

**Pteridophytes:** General characteristics, classification, Early land plants (*Cooksonia*and*Rhynia*).Classification(uptofamily),morphology,anatomyandreproductionof*Selaginella*,*Equisetum*and*Pteris*(Developmentaldetailsnottobeincluded).Heterospory and seed habit, stelar evolution. Ecological and economical importance ofPteridophytes.

**Gymnosperms:**Generalcharacteristics,classification.Classification(uptofamily),morphology, anatomy andreproduction of *Cycas* and *Pinus*. (Developmental details not tobeincluded). Ecologicalandeconomical importance.

**Recommended Books:**

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi.2ndedition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction,PearsonBenjaminCummings, U.S.A. 10th edition.
3. Sethi,I.K.andWalia,S.K.(2011).TextbookofFungi&TheirAllies,MacMillanPublishersPvt.Ltd., Delhi.
4. B.R.Vashishta,(2016) BotanyForDegreeStudentsFungi.S Chand&Company.
5. GeetaSumbali,(2011)TheFungi.Alphascience IntlLtdSecondEdition.
6. KRAneja&RSMehrotra(2015)AnIntroductiontoMycology.NewAgeInternationalPublishersSecond Edition.

## Botany Lab-1

**Subject Code: BMFSS1-104** **L T P C** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the vegetative and reproductive structures of Nostoc, Chlamydomonas, Oedogonium, Vaucheria, Fucus.
3. To analyse the type of bacteria from slides.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the vegetative and reproductive structures.
**CO3:** Analysis of Pteridophytes and Gymnosperms

1. EMs/Modelsofviruses–T-PhageandTMV,Linedrawing/Photograph of LyticandLysogeniccycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; BinaryFission;Conjugation; Structureof root nodule.
3. Gramstaining
4. Study of vegetative and reproductive structures of *Nostoc, Chlamydomonas* (electronMicrographs),*Oedogonium,Vaucheria,Fucus*andPolysiphonia*throughpermanentslides.
5. *RhizopusandPenicillium*:Asexualstagefromtemporarymountsandsexualstructuresthroughpermanentslides.
6. *Alternaria:* Specimens/photographs and tease mounts.
7. *Puccinia*:Herbariumspecimens of BlackStemRustofWheatandinfectedBarberryleaves
8. *Agaricus*:Specimensofbuttonstage andfullgrownmushroom
9. Lichens:Studyof growthformsoflichens(crustose,folioseandfruticose)
10. Mycorrhiza:ectomycorrhizaandendomycorrhiza(Photographs)
11. ***Marchantia***- morphology of thallus, w.m. rhizoids and scales, v.s. thallus throughgemmacup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore,l.s. sporophyte(allpermanent slides).
12. ***Funaria***- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporaryslides);permanentslides showingantheridialand archegonialheads,l.s.capsuleandprotonema.
13. ***Selaginella***- morphology,w.m.leafwithligule,t.s.stem,w.m.strobilus,w.m.microsporophyllandmegasporophyll(temporaryslides),l.s.strobilus(permanentslide).
14. ***Equisetum***- morphology,t.s.internode,l.s.strobilus,t.s.strobilus,w.m.sporangiophore,w.m.spores(wetanddry)(temporaryslides);t.srhizome(permanent slide).
15. ***Pteris***- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporaryslides),t.s.rhizome,w.m.prothalluswithsex organsand

youngsporophyte(permanentslide).

16. ***Cycas***- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet,v.s.microsporophyll,w.m. spores(temporaryslides), l.s. ovule,t.s. root(permanentslide).
17. ***Pinus***- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m.dwarfshoot,t.s.needle,t.s.stem,,l.s./t.s.malecone,w.m.microsporophyll,w.m.microspores(temporaryslides), l.s. femalecone, t.l.s.&r.l.s. stem (permanent slide).

**Recommended Books:**

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi.2ndedition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction,PearsonBenjaminCummings, U.S.A. 10th edition.
3. Sethi,I.K.andWalia,S.K.(2011).TextbookofFungi&TheirAllies,MacMillanPublishersPvt.Ltd., Delhi.
4. B.R.Vashishta,(2016) BotanyForDegreeStudentsFungi.S Chand&Company.
5. GeetaSumbali,(2011)TheFungi.Alphascience IntlLtdSecondEdition.
6. KRAneja&RSMehrotra(2015)AnIntroductiontoMycology.NewAgeInternationalPublishersSecond Edition.

# DIVERSITY OF ANIMALS-1

**Subject Code: BMFSS1-105** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of biodiversity of animals.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Kingdom Protista
**CO2:** Importance of Arthropodain in Forensic Sciences.
**CO3:** Importance of knowledge of Diversity of Animals in Forensic Science.

## Unit-1(15 Hours)

**KingdomProtista**

Generalcharactersand classificationuptoclasses;LocomotoryOrganelles andlocomotioninProtozoa-Ameoba,Paramecium,Euglena

## Unit-2( 15 Hours)

**PhylumPorifera**

Generalcharactersandclassificationuptoclasses;CanalSystemin*Sycon*

**PhylumCnidaria**

Generalcharactersandclassificationuptoclasses;PolymorphisminHydrozoa,coral&coralreefs

## Unit-3(15Hours)

**PhylumPlatyhelminthes**

Generalcharacters and classification up toclasses;Life history of*Taeniasolium and FasciolaHepatica*

**PhylumAshelminthes**

Generalcharactersandclassificationuptoclass**,**LifeCycleofAscaris,ParasiticadaptationinHelminthes

**PhylumAnnelida**

Generalcharactersandclassificationuptoclasses; MetamerisminAnnelida

## Unit-4( 15 Hours)

**PhylumArthropoda**

Generalcharactersand classificationuptoclasses;
VisioninArthropoda,MetamorphosisinInsects,ImportanceofArthropodainForensic Sciences

**PhylumMollusca**

Generalcharactersandclassificationuptoclasses; Torsioningastropods

**Recommended Books:**


1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002).
3. Invertebrates: A New Synthesis, III Edition, Blackwell Science Young, J. Z. (2004).
4. The Life of Vertebrates. III Edition. Oxford university press.
5. Pough H. Vertebrate life, VIII Edition, Pearson International.
6. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones andBartlett Publishers Inc.

## Zoology Lab-1

**Subject Code: BMFSS1-106** | **L T P C 0 0 4 2** | **Duration: 60Hrs.**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse pond water collected from different places.
3. To analyse the Obelia, Physalia, Millepora etc.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the Ascarislumbricoides and its lifestages (Slides/micro-photographs)
**CO3:** Analysis of Sycon (T.S.and L.S.),Hyalonema,Euplectella,Spongilla

1. StudyofwholemountofEuglena,AmoebaandParamecium,BinaryfissionandConjugationin Paramecium
2. Examinationofpond watercollectedfrom differentplacesfordiversityinprotista
3. StudyofSycon(T.S.andL.S.),Hyalonema,Euplectella,Spongilla
4. StudyofObelia,Physalia,Millepora,Aurelia,Tubipora,Corallium,Alcyonium,Gorgonia,Metridium, Pennatula, Fungia, Meandrina,Madrepora
5. Onespecimen/slideof anyctenophore
6. Study of adult Fasciola hepatica, Taenia solium and their life cycles(Slides/microphotographs)
7. Studyof adult Ascarislumbricoidesanditslifestages (Slides/micro-photographs)
8. TosubmitaProjectReport onanyrelatedtopiconlifecycles/coral/ coralreefs.

**RecommendedBooks:**

1. Ruppert and Barnes, R.D. (2006). *Invertebrate Zoology*, VIII Edition. Holt SaundersInternationalEdition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). *TheInvertebrates: A New Synthesis*,IIIEdition, BlackwellScience

3. Young,J.Z.(2004).*TheLifeofVertebrates*.IIIEdition. Oxforduniversitypress.
4. PoughH.*Vertebratelife*,VIIIEdition,PearsonInternational.
5. HallB.K.andHallgrimssonB.(2008).*Strickberger'sEvolution*.IVEdition.JonesandBartlettPublishersInc.

**GROUP-2**

## DIFFERENTIAL CALCULUS-I

**Subject Code: BSNMS1-105** | **L T P C 3 0 0 3** | **Duration: 45 Hrs.**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of differential calculus.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the concept of Continuity and Differentiability.
CO2: Extend the knowledge to the different type of series, Roll's Theorem and Lagrange Mean Value Theorem
CO3: Develop the skill to sketch the curves in a plane using its mathematical properties in the different coordinate systems of reference.
CO4: Understand the concept of Partial Differential Equation.

### Unit-I (12Hrs.)

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

### Unit-II(11Hrs.)

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $sin\ x$, $cos\ x$, $ex$ , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

### Unit-III(14 Hrs.)

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

### Unit-IV (8 Hrs.)

Partial differentiation-Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative,
Differentiation of implicit functions and composite functions, Jacobians and its properties.

**RecommendedBooks:**

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.

2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

## DIFFERENTIAL CALCULUS-II

| | | |
|---|---|---|
| **Subject Code: BSNMS1-106** | **L T P C**<br>**3 0 0 3** | **Duration: 45 Hrs.** |

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of Differential Calculus.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Apply the knowledge of advanced concepts of calculus in order to study theoretical development of different mathematical techniques and their applications.
CO2: Develop the knowledge of computing arc length, area and volume by using integration.
CO3: Understand the concept of integration and different kind of functions.
CO4: Expand the knowledge of multiple integrals and vector surface integrals.

### Unit-I (12Hrs.)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, Working rule to find the extreme values of a function $z = f(x, y)$, Lagrange's method of undetermined multipliers.

### Unit-II (10Hrs.)

Arc formula for the Cartesian equation $y = f(x)$, other expressions for lengths of arcs, Areas under curves, Area formulas for parametric, Polar equation, Area of the closed curve, Volume and surfaces of revolution of curves.

### Unit-III (12Hrs.)

Integration by partial fractions, Integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic function and of their combinations.

### Unit-IV(11Hrs.)

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Areas and volumes, Centre of mass and gravity, Triple integrals (Cartesian), Simple applications involving cubes, Sphere and rectangular parallelepipeds.

**Recommended Books:**

1. G. B. Thomas, M. D. Weir, J. Hass: Thomas' Calculus (Twelfth Edition), Pearson Education.
2. Gorakh Prasad: Integral Calculus, Fourteenth Edition, Reprint 2007, Pothishala Private Limited, Allahabad.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006

# MECHANICS

**Subject Code: BSNMS1-102** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of mechanics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, student will be able to:

CO1: Understand the concepts of vector calculus and basic laws of motion
CO2: Gain the knowledge about gravitational motion, and global positioning system
CO3: Understand the concepts of harmonic oscillations.
CO4: Learn the concept of theory of Relativity.

## UNIT-I (15 Hrs)

Vector algebra. Scalar and vector products. Derivatives of a vector with respect to aparameter. Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. Momentum and Energy: Conservation of momentum. Work andenergy.
Conservation of energy. Motion of rockets. Rotational Motion: Angular velocity and angular momentum. Torque, Conservation of angular momentum.

## UNIT-II (15Hrs)

**Gravitation:** Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

## UNIT-III (15Hrs)

**Oscillations:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Elasticity: Hooke's law, Stress- strain diagram, Elastic moduli-Relation between elastic constants, Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants, Work done in stretching and work done in twisting a wire, Twisting couple on a cylinder, Determination of Rigidity modulus by static torsion, Torsional pendulum, Determination of Rigidity modulus and moment of inertia, q, η and σ by Searles method.

## UNIT-IV (15 Hrs)

**Special Theoryof Relativity :** Concept of Inertial and non-inertial frames, Concept of ether, Constancy of speed of light, Michelson-Morley Experiment, Galilean transformation, Postulates of Special Theory of Relativity, Lorentz transformation, Length contraction. Time dilation, Relativistic addition of velocities.

**Recommended Books:**

1.University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986.AddisonWesley

2.Mechanics Berkeley Physics course, volume.1: Charles Kittel, et. Al. 2007, TataMcGrawHill.
3.Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley.
4.Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford UniversityPress.
5.University Physics, Ronald Lane Reese, 2003, ThomsonBrooks/Cole.

## MECHANICS LAB

**Subject Code: BSNMS1-107** **L T P C** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To determine the modulus of elasticity.
3. To use basic measurement tools.

**Course Outcomes (COs):**After the completion of the course, Student will be able to

CO1: Use basic measurements tools like Vernier caliper, screw gauge etc.
CO2: Find the Moment of Inertia of a Flywheel.
CO3: Determine the Modulus of elasticity
CO4: Learn about motion of Bar Pendulum and Kater's Pendulum.

**List of Experiments:**

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of aFlywheel.
4. To determine the Young's Modulus of a Wire by Optical LeverMethod.
5. To determine the Modulus of Rigidity of a Wire by Maxwell'sneedle.
6. To determine the Elastic Constants of a Wire by Searle'smethod.
7. To determine g by BarPendulum.
8. To determine g by Kater'sPendulum.
9. To determine g and velocity for a freely falling body using Digital TimingTechnique.
10. To study the Motion of a spring and calculate (a) Spring Constant (b) Value ofg

**RecommendedBooks:**

1. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann EducationalPublishers.

3. Engineering Practical Physics, S.Panigrahi&B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

# SEMESTER SECOND

## DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

**Subject Code: BMNCC0-041** **L T P C** **Duration: 30Hrs.**
**2 0 0 0**

**Course Objective:** To make students aware about drug abuse and its effect on their financial and health status.
**Course Outcome:** To make students aware about treatment and control of drug abuse.

### UNIT-I (6 Hours)

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

### UNIT-II (8 Hours)

Consequences of Drug Abuse: Individual: Education, Employment, Income. Family: Violence. Society: Crime. Nation: Law and Order problem.

### UNIT-III (8 Hours)

Prevention of Drug Abuse: Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny. School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

### UNIT-IV(8 Hours)

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environmental intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

**Recommended Books:**

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills,1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi,1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books,1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications,Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 &2004.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,2013.
9. BhimSain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar,2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, 2000.
12. S.Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press,2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and

Political Weekly, 201

## PHYSICAL CHEMISTRY-I

**Subject Code: BSNMS1-203** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To develop basic understanding of different states of matter.
2. To understand concept of chemical kinetics.
3. To understand underlying processes associated with various states of matter.
4. To familiarize with relevance of matter properties for realistic applications.

**Course Outcomes:** Students will be able to acquire the knowledge of
CO1: Basic understanding of different states of matter
CO2: Rate of chemical reactions and related theories.
CO3: Underlying processes associated with various states of matter
CO4: Relevance of matter properties for realistic applications

**Unit-I (15 Hrs.)**

**Gaseous State:**
Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases (based on Joule-Thomson effect).

**Unit-II (8 Hrs.)**

**Liquid State:**
Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholesteric phases. Thermography and seven segment cell.

**Unit-III (12Hrs.)**

**Solid state:**
Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals.

**Unit-IV (10 Hrs.)**

**Basics of Chemical Kinetics:**

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

**Recommended Books:**

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company.

## ORGANIC CHEMISTRY-II

**Subject Code: BSNMS1-204** **L T PC** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand the concepts of stereochemistry of organic compounds
2. To understand concepts behind aromaticity
3. To understand the concept of mechanisms of organic reactions
4. To familiarize with the aromatic electrophilic substitution reactions
5. To familiarize with the chemistry of alkyl and aryl halides

**Course Outcomes:** After the completion of course students will acquire the knowledge of

CO1: Concepts of stereochemistry of organic compounds
CO2: Concepts behind aromaticity
CO3: Mechanisms of organic reactions
CO4: Aromatic electrophilic substitution reactions
CO5: Chemistry of alkyl and aryl halides

### Unit-I (15Hrs.)

**Stereochemistry of Organic Compounds:**

Concept of isomerism. Types of isomerism Optical isomerisin-elements of symmetry, molecular chirality, enantiomers, stereogeniccentre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & Land R & S systems of nomenclature. Geometric isomerism- determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

### Unit-II (7 Hrs.)

**Arenes and Aromaticity:**

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram, the Huckel rule, aromatic ions.

### Unit-III (11Hrs.)

**Aromatic Electrophilic Substitution:**

Aromatic electrophilic substitution-general pattern of the mechanism, role of $\sigma$ and $\pi$ complexes. Mechanism or nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reaction of alkylbenzenes alkynylbenzenes.

**Unit-IV (12 Hrs.)**

**Alkyl and aryl halides:**

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, $SN^2$ and $SN^1$ reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

**Recommended Books:**

Latest edition of:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', John Wiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

## FINGERPRINTS EXAMINATION AND FORENSIC PHOTOGRAPHY

| Subject Code: BMFSS1-201 | L T P C<br>3 0 0 3 | Duration: 45 Hrs. |
|---|---|---|

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of fingerprints and forensic photography.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, student will be able to:
CO1: Understand the concept of Fingerprints.
CO2: Understand the importance of fingerprint evidence in solving crimes.
CO3: Gain knowledge regarding classification of fingerprints.
CO4: Understand the concept of development of prints.

**Unit-I (15Hrs.)**

History and development of finger prints as a science for personal, identification, Finger PrintsBureau.

**Classification of finger Prints**: Patterntypes,patternarea,Henrysystemofclassification(Primary to tertiary and key classification) extension of Henry system searching of finger prints,classificationsystem, single digit classification system.

**Palm prints, Sole prints:** Importance, classification and examination.

**Unit-II (12 Hrs.)**

**Chance Finger Prints:** Latent prints, plastic prints, causes, composition of sweat. Developmentoflatentfingerprints:Conventionalmethodsasfluorescentpowder, magnetic powder.Fuming–
–methods: Iodine and cynoacrylate methods. Chemical methods: Ninhydrin and its analoguesilver nitrate, enhancement of latent prints, application of laser technologies, met
al depositionmethod.Biological methods of development of latentprints on skin.

**Unit-III (10Hrs.)**

Systematicapproachtolatentprintprocessing,preservingandliftingoffingerprints.PhotographyofFingerPrints,comparisonoffingerprints:basisofcomparison,classcharacteristics,individual characteristics,various typesof ridge characteristics.

Automatic Finger Print Identification system (AFIS) and its variants, digital Image processing offingerprints andtheirenhancement.

## Unit-IV (08 Hrs.)

**Photography:**Basicprinciplesandtechniques,Exposing,Developingand Printing,

ModernDevelopmentsinPhotography,DigitalPhotography,Videography/Highspeed Photography.CrimeSceneandLaboratoryPhotography.

**Recommended Books:**

1) DavidR.Ashbaugh(1999),**QuantitativeandQualitativeFrictionRidgeAnalysis**,CRCPress.

2) E.RolandMenzel(SecondEdition)(1999),**FingerprintDetectionwithLoseres**,MarcelDekker,Inc.

3) CowgerandJamesF.(1993),**FrictionRidgeskin:ComparisonandIdentificationofFingerprints**,Elsevier New York, CRC PressLondon.

4) CumminsandMidlo(1943),**FingerPrints,PalmsandSoles:AnIntroductiontoDermatoglyphics**,TheBlakistonofficeLondon.

5) Cherril,F.R.(1954),**TheFingerPrints.SystematScotlandYard**,HerMajestuy’soffice,London.

6) WentworthandWilder(1957),**PersonalIdentification**,Richard.G. Badger.Boston.

7) Mehta,M.K.(1980),**IdentificationofThumbImpression&CrossExaminationofFinger Prints,** N. M. Tripathi(P)Ltd.Bombay.

8) Moenssens(1975),**FingerPrintsTechniques**,ChittonBookCo.,Philadelphia,NewYork.

9) AllisonH.C.(1st Edition)(1973) **PersonalIdentification**,HolbrookPress.

**10)** Chatterjee S.K. and Hague R.V. (1988), **Fingerprints or Dactyloscopy andRidgeoscopy.**

**11)** E.RonaldMenzel(1997),**AmanualofFingerprintIdentification:FingerPrintDetection with Lasers.**

12) H.C. Lee, R.E. Gaensslen and S.R.Ramotowski (3rd Edition) (2013), **Advances inFingerprintTechnology**, CRC Press, BocaRaton.

13) C. Champod, C. Lennard, P. Margot, M. Stoilovic (2004), **Fingerprints and OtherRidge Skin Impression (International Forensic Science and Investigation Series)**,CRCPress, BocaRaton.

14) B.C. Bridges, Vollmer A. and M. Monir (2002), **Criminal Investigation PracticalFingerPrinting,ThumbImpressions,HandWriting,ExpertTestimony,OpinionEvidence,**Allahabad UniversityBook Agency.

15) DavidR.Ashbaugh(1999),**QuantitativeandQualitativeFrictionRidgeAnalysis**,CRCPress.

16) E.RolandMenzel(SecondEdition)(1999),**FingerprintDetectionwithLoseres**,MarcelDekker,Inc.

17) CowgerandJamesF.(1993),**FrictionRidgeskin:ComparisonandIdentificationofFingerprints**,Elsevier New York, CRC PressLondon.

18) CumminsandMidlo(1943),**FingerPrints,PalmsandSoles:AnIntroductiontoDermatoglyphics**,TheBlakistonofficeLondon.

19) Cherril,F.R.(1954),**TheFingerPrints.SystematScotlandYard**,HerMajestuy'soffice,London.

20) WentworthandWilder(1957),**PersonalIdentification**,Richard.G. Badger.Boston.

21) Mehta,M.K.(1980),**IdentificationofThumbImpression&CrossExaminationofFinger Prints,** N. M. Tripathi(P)Ltd.Bombay.

22) Moenssens(1975),**FingerPrintsTechniques**,ChittonBookCo.,Philadelphia,NewYork.

23) AllisonH.C.(1st Edition)(1973) **PersonalIdentification**,HolbrookPress.

**24)** Chatterjee S.K. and Hague R.V. (1988), **Fingerprints or Dactyloscopy andRidgeoscopy.**

**25)** E.RonaldMenzel(1997),**AmanualofFingerprintIdentification:FingerPrintDetection with Lasers.**

26) H.C. Lee, R.E. Gaensslen and S.R.Ramotowski (3rd Edition) (2013), **Advances inFingerprintTechnology**, CRC Press, BocaRaton.

27) C. Champod, C. Lennard, P. Margot, M. Stoilovic (2004), **Fingerprints and OtherRidge Skin Impression (International Forensic Science and Investigation Series)**,CRCPress, BocaRaton.

28) B.C. Bridges, Vollmer A. and M. Monir (2002), **Criminal Investigation PracticalFingerPrinting,ThumbImpressions,HandWriting,ExpertTestimony,OpinionEvidence,**Allahabad UniversityBook Agency.

29) DaluzH.M(2015),**FingerprintAnalysisLaboratoryWorkbook**,CRCPress.

## QUESTIONED DOCUMENT AND FINGERPRINT LABORATORY

**Subject Code: BMFSS1-202** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To develop and analyse the different fingerprint patterns.
3. To identify core, delta and to do ridge counting and ridge tracing.
4. To use physical and chemical methods to develop latent prints

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysing the fingerprint evidence.
**CO3:** Development of latent print from crime scene.

1. How to procure fingerprints &method of taking fingerprints manually (rolled &plain).
2. To carry out ten digit classification of fingerprints.
3. To identify different fingerprint patterns.
4. To identify core and delta.
5. To carry out ridge tracing and ridge counting.
6. To investigate physical methods of fingerprint detection.
7. To investigate chemical methods of fingerprint detection.
8. Sole prints comparison and their lifting from the scene of crime.
9. Palm prints comparison and their lifting from the scene of crime.
10. Evaluation of Crime scene and photographs.

**Recommended Books:**

1. J.E.Cowger,FrictionRidgeSkin,CRCPress,BocaRaton(1983).
2. D.A.Ashbaugh,Quantitative-QualitativeFrictionRidgeAnalysis,CRCPress,BocaRaton(2000).
3. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge SkinImpressions,CRC Press, BocaRaton (2004).
4. LeeandGaensleen's, Advancesin FingerprintTechnology,3rdEdition,R.S.Ramotowski(Ed.), CRCPress, BocaRaton (2013).

## CHEMISTRY LAB-II

**Subject Code: BSNMS1-208** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand the concepts behind crystallization
2. To understand the determination of melting points and effect of impurities on m.p.
3. To understand various purification techniques used for purification.
4. To make students familiar with the determination of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

**Course Outcomes:** After completion of course students will acquire the knowledge and practical hands on training of

CO1: Purification of organic compound using various solvent combinations
CO2: Determination of melting and boiling points of various organic compound
CO3: Chromatographic techniques
CO4: Calculation of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

**Laboratory Techniques:**

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:
   a. Water
   b. Alcohol
   c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)

**Physical Chemistry:** Experimental Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To determine the viscosity and surface tension of $C_2H_5OH$ and glycerine solution in water
4. Calculation of the enthalpy of ionization of ethanoic acid.

**Recommended Books:**

Latest edition of:

1. H. Denny, W. Roesky, ‘Chemical Curiosites’, WILEY VCH.
2. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.
3. G. Svehla, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.

**GROUP-1**

# PLANT ECOLOGY& TAXONOMY

**Subject Code: BMFSS1-203** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of plant ecology & Taxonomy.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Plant communities and their characteristics.
**CO2:** Ecosystem and its structure.
**CO3**: Pollution and ecological footprints

## Unit-1( 15 Hours)

**Introduction Ecological factors:** Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance. Adaptation of hydrophytes and xerophytes.

**Plant communities:** Characters; Ecotone and edge effect; Succession; Processes and types.

**Ecosystem:** Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramidsproduction and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and Phosphorous
**Pollution:** Types, control and prevention **Ecological Footprints:** Carbon footprint, Carbon dating

## Unit-2( 15 Hours)

**Introduction to plant taxonomy:** Identification, Classification, Nomenclature.

**Identification :** Functions of Herbarium, important herbaria and botanical gardens of the world and India; Documentation: Flora, Keys: single access and multi-access

**Botanical nomenclature:** Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

## Unit-3( 15Hours)

**Classification:** Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (up to series).

## Unit-4 (15Hours)

**Complete description of families :** Brassicaceae ( Brassica, Iberis), Asteraceae (Sonchus, Ageratum), Solanaceae (Solanum, Withania), Lamiaceae (Salvia, Ocimum), Liliaceae, (Asphodelus), Ranunculus (Ranunculus), Gramineae ( Triticum, Oryza)

**Suggested Readings:**

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., NewDelhi.
5. J.S. Singh, S.P. Singh, S.R.Gupta (2015) Ecology ,Environmental Science & Conservation S. Chand Publisher

## BOTANY LAB-2

**Subject Code: BMFSS1-204** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse soil samples
3. To analyse the morphological adaptations of hydrophytes and xerophytes.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the soil
**CO3:** Analysis of microclimatic variables

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b)Study of biotic interactions of the following: Stem parasite (Cuscuta), Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method (Species to be listed).
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):Brassicaceae -Brassica, Alyssum / Iberis; Asteraceae -Sonchus/Launaea, Vernonia/Ageratum, Eclipta/Tridax; Solanaceae -Solanum nigrum, Withania; Lamiaceae -Salvia, Ocimum; Liliaceae - Asphodelus / Lilium / Allium. 8.
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

**Suggested Readings:**

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
3. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., NewDelhi.
5. J.S. Singh, S.P. Singh, S.R.Gupta (2015) Ecology ,Environmental Science & Conservation S. Chand Publisher

## DIVERSITY OF ANIMALS-II

**Subject Code: BMFSS1-205** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of diversity of animals.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** General characteristics and classification of chordates.
**CO2:** Agnatha,Pisces, Aves.
**CO3 :** Reptilia, Mammals and Zoogeography.

### Unit 1(15 Hours)

**Introduction to Chordates** General characteristics and outline classification

**Protochordata**General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

### Unit-2(15 Hours)

**Origin of Chordata** Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

**Agnatha**General characteristics and classification of cyclostomes up to class

### Unit-3( 15Hours)

**Pisces** General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes

**Amphibia** Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians.

## Unit-4( 15Hours)

**Reptilia**

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes**Aves** General characteristics and classification up to order Archaeopteryx-- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

**Mammals** General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

**Zoogeography** Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different.

**Recommended Books:**

1. Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002).
3. Invertebrates: A New Synthesis, III Edition, Blackwell Science Young, J. Z. (2004).
4. The Life of Vertebrates. III Edition. Oxford university press.
5. Pough H. Vertebrate life, VIII Edition, Pearson International.
6. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc

## ZOOLOGY LAB-II

**Subject Code: BMFSS1-206** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the slides prepared
3. To analyse the photographs of various fishes.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the identification marks of poisonous and non-poisonous snakes.
**CO3:** Analysis of Amphibia.

1. Protochordata Balanoglossus, Herdmania, Branchiostoma, Colonial UrochordataSections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules

2. Agnatha,Petromyzon, Myxine

3. Fishes: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish

4. Amphibia: Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

5. Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes

6. Aves:Study of six common birds from different orders. Types of beaks and claws

7. Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceous.

**SUGGESTED READINGS**

1 Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

2 Pough H. Vertebrate life, VIII Edition, Pearson International.

3 Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.

4 Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc

**GROUP-2**

## ELECTRICITY, MAGNETISM AND EMT

**Subject Code: BSNMS1-202** | **L T P C 4 0 0 4** | **Duration: 60 Hrs.**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of electricity, magnetism and emt.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):**After the completion of the course, Student will be able to

CO1: Understand the concepts of vector Algebra.
CO2: Understand the basic concepts of electrostatics
CO3: Gain the knowledge about the basic concepts of magneto-statics
CO4: Learn the concept of Maxwell equation and electromagnetic waves.

**UNIT-I (13Hrs)**

**Vector Analysis:**Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss- divergence theorem and Stoke's theorem of vectors (statement only).

**UNIT-II(16Hrs)**

**Electrostatics:**Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric
medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

**UNIT-III(16Hrs)**

**Magnetism:** Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials. Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magneticfield.

## UNIT-IV(15 Hrs)

**Maxwell`s equations and Electromagnetic wave propagation:** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves,polarization.

**Recommended Books:**

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-HillEducation.
2. Mechanics Berkeley Physics course,volume.1: Charles Kittel, et. Al. 2007, TataMcGrawHill.
3. Electricity and Magnetism, J.H. Fewkes& J. Yarwood. Vol. I, 1991, Oxford Univ.Press.
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya PublishingHouse.
5. University Physics, Ronald Lane Reese, 2003, ThomsonBrooks/Cole.
6. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

## DIFFERENTIAL EQUATIONS-I

| | | |
|---|---|---|
| **Subject Code: BSNMS1-205** | **L T P C**<br>**3 0 0 3** | **Duration: 45 Hrs.** |

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of differential equations.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the concept of ordinary differential equation, its formation, order and degree.
CO2: Apply various methods to solve first order non-linear differential equation.
CO3: Solve linear differential equations of higher order by using various methods.
CO4: Apply differential equations to significant applied and theoretical problems.

### Unit-I (12Hrs.)

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for $x, y, p$. Methods for solving higher-order differential equations, Basic theory of linear differential equations, Wronskian and its properties, Solving a differential equation by reducing its order.

### Unit-II(11Hrs.)

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

### Unit-III(12Hrs.)

General solution of homogeneous equation of second order, principle of superposition for a homogeneous equation, Wronskian, its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

### Unit-IV (10Hrs.)

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

**Recommended Books:**

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover,1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

## DIFFERENTIAL EQUATIONS-II

| | | |
|---|---|---|
| **Subject Code: BSNMS1-206** | **L T P C** | **Duration: 45 Hrs.** |
| | **3 0 0 3** | |

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of differential equations.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the concept of first order and linear partial differential equation.
CO2: Apply various power series methods to find series solution of differential equation.
CO3: Recognize the major classification of PDEs and the qualitative differences between the classes of equations.
CO4: Understand the formation and solution of some significant PDEs like wave and heat equation.

**Unit-I (10Hrs.)**

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

**Unit-II(13Hrs.)**

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Bessel equation and Legendre equation, its properties and their recurrence relations, Hyper geometric equation, Bessel function and their recurrence relations, Strum liouville boundary values.

**Unit-III(12Hrs.)**

Separation of variables in a PDE, Laplace equation: mean value property, Weak and strong maximum principle, Green's function, Poisson's formula, Dirichlet's principle, Existence of solution using Perron's method (without proof).

**Unit-IV (10Hrs.)**

Heat equation: Initial value problem, Fundamental solution, Weak and strong maximum principle and uniqueness results, Wave equation: uniqueness, D'Alembert's method, method of spherical means and Duhamel's principle.

**Recommended Books:**

1. W.E.Boyce and P.C.Diprima: Elementary Differential Equations and Boundary value problems, John Wiley, 1986.
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, 2003.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover,1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

## ELECTRICITY, MAGNETISM AND EMT LAB

| Subject Code: BSNMS1-207 | L T P C | Duration: 60 Hrs. |
|---|---|---|
| | 0 0 4 2 | |

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of electricity, magnetism and emt.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Take measurements by using Multimeter.
CO2: Learn the measurement of charge, current and resistance using Method.
CO3: Determine resonance in LCR circuit.
CO4: Verify the Thevenin, Norton theorem and Maximum Power Transfer Theorem

**List of Experiments:**

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DCCurrent, and (d) checking electricalfuses.
2. Ballistic Galvanometer: (i) Measurement of charge and current sensitivity (ii) Measurementof CDR (iii) Determine a high resistance by Leakage Method (iv) To determine Self Inductance of a Coil by Rayleigh'sMethod.
3. To compare capacitances using De'Sauty'sbridge.
4. Measurement of field strength B and its variation in a Solenoid (DeterminedB/dx).
5. To study the Characteristics of a Series RC circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) QualityFactor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor.
8. To determine a Low Resistance by Carey Foster'sBridge.
9. To verify the Thevenin and Nortontheorem
10. To verify the Superposition, and Maximum Power Transfer theorem.

**RecommendedBooks:**

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann EducationalPublishers.

# SEMESTER THIRD

## INORGANIC CHEMISTRY-II

**Subject Code: BSNMS1-303** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand chemistry of s block element
2. To familiarize with the concepts of acids and bases
3. To understand the concepts behind chemistry of s & p block elements
4. To understand the chemistry of various transition elements.

**Course Outcomes:** After the completion of course students will acquire the knowledge of:

CO1: Concepts behind acids and bases
CO2: Chemistry of s and p block elements
CO3: Concepts of chemistry of various transition elements

### Unit-I (6 Hrs.)

**s-Block Elements:** Comparative studies, diagonal relationship, salient features of hydrides, solvation and complexation tendencies.

**Acids and Bases:** Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

### Unit-II (12 Hrs.)

**p–Block Elements–I:** Comparative study (including diagonal relationship) of groups 13–17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13–17, hydrides of boron–diborane and higher boranes, Borazine, borohydrides, fullerenes. VBT, VSPER theory, MOT.

### Unit-III (12 Hrs.)

**p–Block Elements-II:** Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide ,Silicones and phosphazenes as examples of inorganicpolymers, nature of bonding in triphosphazenes.

### Unit-IV (15 Hrs.)

**Chemistry of Transition Elements:**

Characteristic properties of d–block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their 3d analogues in respect of ionic radii, oxidation states, magnetic behaviour. CFT and CFSE for Octahedral/Tetrahedral complexes.

**Recommended Books:**

Latest edition of:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; Pubs: John Wiley and Sons.
2. Lee, J.D., Concise Inorganic Chemistry;Pubs: Chapman & Hall Ltd.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; Pubs: Oxford University Press.
4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; Pubs: John Wiley and Sons Inc.
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; Pubs: Pearson Education Inc.
7. Jolly, W.L., Modern Inorganic Chemistry; Pubs: Tata McGraw-Hill Publishing Company Limited.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; Pubs: Milestones Publisher.

## PHYSICAL CHEMISTRY-II

**Subject Code: BSNMS1-304** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand energy exchange processes
2. To familiarize with the system of variable compositions.
3. To understand the concepts of thermodynamics.
4. To understand the concept of chemical equilibrium.

**Course Outcomes:** On completion of this course, students will be able to:

CO1: Identify and describe energy exchange processes.
CO2: Manipulate physical parameters to favour a particular process.
CO3: Compare the system properties with variation in composition.
CO4: Identify and analyze uni/multicomponent system.

**Unit-I (14 Hrs.)**

**Thermodynamics-I:**

Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

***First Law of Thermodynamics:*** Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature, Calculation of w,q,dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

***Thermochemistry:*** Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

**Unit-II (15 Hrs.)**

**Thermodynamics-II & III:**

***Second Law of Thermodynamics:*** Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

***Concept of Entropy:*** Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

***Third Law of Thermodynamics:*** Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A &G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P,V and T.

**Unit-III (6 Hrs.)**

**Chemical Equilibrium:**

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of Kp, Kc, Ka and their relationship, Clausius-Clapeyron equation, applications.

**Unit-IV (10 Hrs.)**

**Introduction to Phase Equilibrium:**

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, $CO_2$ and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-$H_2O$), $FeCl_3$-$H_2O$) and $CuSO_4$-$H_2O$) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-$H_2O$ and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consulate temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

**Recommended Books:**

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry;Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book company.

## CRIMINALISTICS

| Subject Code: BMFSS1-301 | L T P C<br>3 0 0 3 | Duration: 45 Hrs. |
|---|---|---|

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of criminalistics.

2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, student will be able to:
CO1: Gain knowledge of Crime scene investigation.
CO2: Gain knowledge regarding physical evidences recovered at crime scene and its importance.
CO3: Understand the concept of Voice analysis.
CO4: Understand the importance of trace evidences and its examination.

**Unit-I (15Hrs.)**

**Crime Scene Investigation:** Definition, Types of crime scene (Primary and Secondary, Indoor, Outdoor and Mobile, other specific types of Crime Scene), Purpose of crime scene examination, First responding officers, Protection of the crime Scene, Documentation of Crime scene, Methods of search for physical clue materials, Plan of Action, Note Taking, Reconstruction of Crime scene, Crime scene sketching, Photography of crime scene, Legal Implications for Crime Scene Searches.
**Physical Evidences:** Definition, their classification, collection, preservation, packing, labelling, sealing, forwarding and transportation, Chain of custody.

**Unit-II (10 Hrs.)**

**Tool marks:** Types, Importance, location, nature, collection and evaluation.
**Restoration of Erased /Obliterated Marks.**
**Track marks:** Types, Importance, nature, location, collection and evaluation.
**Glass:** Types of glass and their composition, Forensic examination of glass, Glass fracture analysis, Interpretation of glass evidence.
Density, Refractive Index; Other Optical Properties of Crystalline Material.
**Paints:** Types of paint and their composition, Forensic examination of paints, Interpretation of paint evidence.

**Unit-III (08 Hrs.)**

**Soil:** Types of soil, Composition and colour of soil, Forensic examination of soil, Interpretation of soil evidence.
**Fibre:** Introduction, morphology of fibre, types, Synthetic fibre analysis, microscopy, optical properties, refractive index, fluorescence, dye analysis, Birefringence, difference between man-made fibres and natural fibres.

**Unit-IV (12 Hrs.)**

**Building Materials:** Types of cement and their composition, Determination of adulterants, Analysis of Bitumen and road material, Analysis of cement mortar and cement concrete and stones.
**Voice Identification:** Introduction, Significance, Theory of generation of voice, Characteristics, Voice Spectrography, Analysis of Audio-Video Signal for Authenticity.
**Forensic examination of electrical appliances/installations.**
**Miscellaneous Clue Materials:** Examination of strings/ropes, Fibers, Threads and fabrics, Wires/cables, Seals, Counterfeit coins.

**Recommended Books:**


1) Horswell J.(2016). The Practice of Crime Scene Investigation. New York, CRC Press.
2) James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. New York, Taylor & Francis.
3) Saferstein R. (8th Edition) (2011): Forensic Science Handbook, Prentice Hall Inc. USA.
4) Nickolas P. and Sherman H. (2006), Illustrated guide to Crime Scene Investigation, CRC press.
5) Siegel J. A. &Mirakovits K.(2006). Forensic Science: The Basics. New York, CRC Press.
6) Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law House.
7) Nordby, James, S.H. & J.J. (2003). Forensic Science: an Introduction to Scientific and Investigative Techniques. USA, CRC Press.
8) Rose P. (2001). Forensic Speaker Identification; Forensic Science Series. London, Taylor and Francis.
9) Bengold&Moryson N. (1999). Speech and Audio Signal Processing. USA, John Wiley & Sons.
10) Gilbert N. (3rd Edition) (1993), Criminal Investigation, Macmillan Publishing company.
11) Saferstein R. (1976), Criminalistics, Prentice Hall Inc. USA.


## CRIMINALISTICS LABORATORY

| Subject Code: BMFSS1-302 | L T P C<br>0 0 4 2 | Duration: 60 Hrs. |
|---|---|---|

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To anaylse the comparison of soil,glass, cloth, bangles, threads.
3. To analyse the biological fluids

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.

**CO2:** Collection of various types of samples from the crime scene

**CO3:** Analysis of paint samples, tyre marks etc.

1.Collection, Packing, Labelling &Forwarding of the Following Physical Evidences:
(A) Biological Fluids (B) Soil/Dust (C) Wet Exhibits (D) Hair/ Fibre (E) Glass Material (F) Liquids (G) Pharmaceutical Products/Drugs of Abuse (H) Botanical Material (I) Shell Case/Cartridge/Bullet/Pellets, (J) Charred Documents etc.
2. Comparison of Soil samples.
3. Comparison of glass pieces.
4. Comparison of Miscellaneous material like Cloth, Bangles, threads etc.
5. To prepare a cast of Shoe prints and their comparison.
6. Examination of Paint samples.
7. Examination of Tyre marks (Digital Matching of Suspected Tyre/Foot Wear Impressions)
8. Detection of adulterants in food.
12. Restoration of Erased Punched Mark on Metal Piece by Chemical Treatment.
13. Identification of Glass Fractures.
14. Comparison of Tool Marks and Fired Cartridge/ Bullet Using Comparison Microscope.

**Recommended Books:**
1) Horswell J.(2016). The Practice of Crime Scene Investigation. New York, CRC Press.
2) James S. H. (2014). Forensic Science: An Introduction to Scientific and Investigative Techniques. New York, Taylor & Francis.
3) Saferstein R. (8th Edition) (2011): Forensic Science Handbook, Prentice Hall Inc. USA.
4) Nickolas P. and Sherman H. (2006), Illustrated guide to Crime Scene Investigation, CRC press.
5) Siegel J. A. &Mirakovits K.(2006). Forensic Science: The Basics. New York, CRC Press.
6) Sharma B.R. (2003). Forensic Science in Criminal Investigation and Trials. India, Universal Law House.
7) Nordby, James, S.H. & J.J. (2003). Forensic Science: an Introduction to Scientific and Investigative Techniques. USA, CRC Press.
8) Rose P. (2001). Forensic Speaker Identification; Forensic Science Series. London, Taylor and Francis.
9) Bengold&Moryson N. (1999). Speech and Audio Signal Processing. USA, John Wiley & Sons.
10) Gilbert N. (3rd Edition) (1993), Criminal Investigation, Macmillan Publishing company.
11) Saferstein R. (1976), Criminalistics, Prentice Hall Inc. USA.

## CHEMISTRY LAB III

**Subject Code: BSNMS1-305** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**
1. To understand the concepts behind Estimation of metals.
2. To synthesis and separation if various inorganic compounds

**Course Outcomes:** After completion of course students will gain the knowledge of:
CO1: Obtaining precise results of estimation by titrations

CO2: Preparation separations of organic compounds.

**Quantitative Analysis:**

i. **Volumetric Analysis**
   a) Determination of acetic acid in commercial vinegar using NaOH.
   b) Determination of alkali content-antacid tablet using HCI.
   c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
   d) Estimation of hardness of water by EDTA.
   e) Estimation of ferrous and ferric by dichromate method.
   f) Estimation of copper using sodiumthiosulphate.

ii. **Gravimetric Analysis**
   Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime)

**Organic Chemistry Laboratory Techniques**

**Thin Layer Chromatography**
   a) Determination of $R_f$ values and identification of organic compounds.
   b) Separation of green leaf pigments (spinach leaves may be used).
   c) Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).
   d) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

**Recommended Books:**
Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall, London.

   J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis, Pearson Education.
4. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education6.
5. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,Textbook of Practical Organic Chemistry, Prentice-Hall.

GROUP-1

## PLANT ANATOMY & EMBRYOLOGY

**Subject Code: BMFSS1-303** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of plant anatomy and embryology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Tissues and organs
**CO2:** Secondary growth, adaptive and protective systems
**CO3 :** Structural organization of flowers.

### Unit-1(15 Hours)

- **Tissues and Organs:** Root and shoot apical meristems; Simple and complex tissues. Structure of dicot and monocot root stem and leaf.
- **Secondary Growth:** Vascular cambium – structure and function, seasonal activity. Secondary growth in root andstem, Wood (heartwood and sapwood).

### Unit-2( 15 Hours)

- **Adaptive and protective systems:** Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.
- **Structural organization of flower:** Structure of anther and pollen; Structure and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

### Unit-3( 15 Hours)

**Pollination and fertilization:** Pollination mechanisms and adaptations; Double fertilization; Seed-structure appendages and dispersal mechanisms.

### Unit-4( 15 Hours)

- **Embryo and endosperm :** Endosperm types, structure and functions; Dicot and monocot embryo; Embryo-endosperm relationship
- **Apomixis and polyembryony:** Definition, types and practical applications

**SuggestedReadings**

1. Bhojwani,S.S.&Bhatnagar,S.P.(2011).EmbryologyofAngiosperms.VikasPublica tionHousePvt.Ltd. New Delhi. 5th edition.
2. Mauseth,J.D.(1988).PlantAnatomy.TheBenjamin/CummingsPublisher,USA.
3. J.P.Goyal&ArunaSaini(2016)Angiosperms:Structure,Development&ReproductionTruema n
4. PC Vasishta(2003). PlantAnatomy. Pradeep Publications

# BOTANY LAB III

**Subject Code: BMFSS1-304** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse slides prepared.
3. To analyse the adaptative anatomy.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the structure of anther
**CO3:** Analysis of Tissues

1. Study of meristems through permanent slides and photographs
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays;* Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent Slides).
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus* (only Permanent slides).
5. Leaf: Dicot and Monocot leaf (only Permanent slides).
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/ campylotropous.
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Calculation of percentage of germinated pollen in a given medium.

**Recommended Books:**

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.

2. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.

3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition

. 4. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.

6. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.

7. Thakur, A.K. and Bassi, S.K. (2008). Diversity of Microbes and Cryptogams. S. Chand & Co., Delhi.

8. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.

9. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India

## PHYSIOLOGY & BIOCHEMISTRY

**Subject Code: BMFSS1-305** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of physiology and biochemistry.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Digestion and absorption of food.

**CO2:** Respiratory Physiology and renal physiology

**CO3:** Endocrine and reproductive physiology.

### Unit-1(15 Hours)

**Digestion and Absorption of Food** Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins; Nervous and hormonal control of digestion (in brief)

### Unit-2(15 Hours)

**Functioning of Excitable Tissue (Nerve and Muscle)** Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding filament theory), Neuromuscular junction

**Respiratory Physiology** Ventilation, External and internal Respiration, Transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases.

### Unit- 3 (15Hours)

**Renal Physiology** Functional anatomy of kidney, Mechanism and regulation of urine formation

**Cardiovascular Physiology** Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG.

### Unit-4 ( 15 Hours)

**Endocrine and Reproductive Physiology** Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), Brief account of spermatogenesis and oogenesis, Menstrual cycle.

**Recommended Books:**

1. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley & Sons, Inc.
2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008) Vander's Human Physiology, XI Edition., McGraw Hill

3. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
5. Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H. Freeman and Co.
6. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/Mc Graw3Hill.

# ZOOLOGY LAB III

**Subject Code: BMFSS1-306** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse temporary mounts.
3. To estimate haemoglobin.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the permanent histological sections of mammalian oesophagus.
**CO3:** Preparati n of haemin and haemochromogen crystals.

1. Preparation of temporary mounts: Neurons and Blood film.
2. Preparation of haemin and haemochromogen crystals.
3. Estimation of haemoglobin using Sahli's haemoglobinometer.
4. Examination of permanent histological sections of mammalian oesophagus, stomach, duodenum, rectum, lung, kidney, thyroid, pancreas, adrenal, testis, ovary.

**SUGGESTED READINGS**

1. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley and Sons, Inc.

2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008). Vander's Human Physiology, XI Edition, McGraw Hill.

3. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.

4. Marieb, E. (1998). Human Anatomy and Physiology, IV Edition, Addison-Wesley. Kesar, S. and Vashisht, N. (2007). Experimental Physiology, Heritage Publishers.

5. Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Company Ltd.

**GROUP-2**

## REAL ANALYSIS-I

**Subject Code: BSNMS1-306** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of real analysis.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the various properties of the real line $\mathbb{R}$.
CO2: Understand the concept of different kinds of sequences, their convergence, squeeze theorem and Cauchy's theorem on limit.
CO3: Apply the various tests for convergence and absolute convergence of an infinite series of real numbers
CO4: Understand the concept of sequence in series function, M-test and power series methods.

**Unit-I(12Hrs.)**

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of BolzanoWeierstrass theorem.

**Unit-II(11Hrs.)**

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

**Unit-III(12Hrs.)**

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof), Definition and examples of absolute and conditional convergence.

**Unit-IV (10Hrs.)**

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

**RecommendedBooks:**

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
5) ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.

6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
7) S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.

## REAL ANALYSIS-II

**Subject Code: BSNMS1-307** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of real analysis.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand properties of Riemann integral and related theorems.
CO2: Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.
CO3: Examine the point wise and uniform convergence using various tests
CO4: To understand basic topology of metric spaces.

**Unit-I(11Hrs.)**

Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem-first and second form, Substitution theorem.

**Unit-II(12Hrs.)**

Pointwise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini’s theorem, The exponential functions logarithmic and trigonometric functions.

**Unit-III (10Hrs.)**

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weirstrass M-test.

**Unit-IV(12Hrs.)**

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set.

**RecommendedBooks:**

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.

2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003. ROBERT G. Bartle and Donald R. Sherbert,
5) Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.

## THERMAL PHYSICS AND STATISTICAL MECHANICS

**Subject Code: BSNMS1- 301** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of thermal physics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):**After the completion of the course, Student will be able to

CO1: Understand the concepts of laws of thermodynamics, entropy.
CO2: Learn about the concepts of Maxwell's thermodynamic relations.
CO3: Gain knowledge of Laws associated with thermal radiations and kinetic theory of gases.
CO4: Understand the concepts of thermodynamic probability, phase space

### UNIT-I(16 Hrs)

**Laws of Thermodynamics:** Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

### UNIT-II (16 Hrs)

**Thermodynamic Potential and Theory of Radiation:** Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, ClausiusClapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, RayleighJeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

### UNIT-III (14 Hrs)

**Kinetic Theory of Gases:**Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

### UNIT-IV (14 Hrs)

**Statistical Mechanics**: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics.

**Recommended Books:**

1. Statistical Physics, thermodynamics and kinetic theory by V.S.Bhatia
2. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
3. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
4. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
5. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 14
6. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears&G.L.Salinger. 1988, Narosa
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
8. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

# THERMAL PHYSICS AND STATISTICAL MECHANICS LAB

**Subject Code: BSNMS1- 302** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the cooling temperature using thermocouple.
3. To calibrate Resistance Temperature device.

**Course Outcome (CO):**After the completion of the course, Student will be able to

CO1: Perform Mechanical Equivalent of Heat and thermal conductivity of related experiments.
CO2: Learn about the variation of thermo emf across two junctions of a thermocouple with temperature.
CO3: Record and analyze the cooling temperature using a thermocouple and suitable data acquisition system.
CO4: Calibrate Resistance Temperature Device (RTD

**List of Experiments:**

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

**Recommended Books:**

1. Advanced Practical Physics for students, B.L.Flint&H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

# SEMESTER FOURTH

## ENVIRONMENTAL SCIENCE

**Subject Code: BHSMC0-041** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To familiarize the student with the basic concept of Environmental and Environmental Chemistry.
2. To elaborate the ecosystem and their properties.
3. To understand the concept of Environmental Pollution and its diverse effect of pollution.
4. To understand the concept of sustainable and unsustainable development and its importance.

**Course Outcomes:** On completion of this course, students will be able to:

CO1: Understand the basics of Environment chemistry
CO2: Analyze the general concept of ecosystem and their components.
CO3: Comprehend the applicability of social issues and Environment.
CO4: Recognize the Environment Pollution and control measures of urban and industrial wastes.

**Unit-I (08 Hours)**

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

**Unit-II (15 Hours)**

Natural resources and associated problems: a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

**Unit-III (12 Hours)**

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit- IV (10 Hours)**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

**Recommended Books:**

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clark R.S., Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment

## ORGANIC CHEMISTRY-III

**Subject Code: BSNMS1-403** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand the chemistry of carboxylic acids and their derivatives
2. To understand the mechanisms of organic reactions
3. To understand ethers epoxides and nitrogen based organic compounds
4. To familiarize with the chemistry of organometallic compounds
5. To understand the chemistry behind heterocyclic compounds

**Course Outcomes:** After the completion of course students will acquire the knowledge of:

CO1: Chemistry behind carboxylic acids and their derivatives
CO2: Mechanisms of organic reactions
CO3: Chemistry of heteroatom based organic molecules.
CO4: Chemistry of organometallic compounds

### Unit-I (12 Hrs.)

**Carboxylic Acids:** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

**Carboxylic Acids Derivatives:** Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

### Unit-II (20 Hrs.)

**Ethers and Epoxides:**

Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction- cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Organic Compounds of Nitrogen: preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilc substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts.

### Unit-III (5 Hrs.)

**Organometallic Compounds:**

Organomagnesium Compounds: The Grignard reagents formation, structure and chemical reactions. Organolithium Compounds: Formation and chemical reactions.

Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.

**Unit-IV (8 Hrs.)**

**Heterocyclic Compounds**

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

**Recommended Books:**

Latest edition of:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry;Pubs: Prentice-Hall.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; Pubs: Pearson Education.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; Pubs: Wiley India.
5. Carey, F.A., Organic Chemistry; Pubs: McGraw-Hill.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; Pubs: Macmillan Publishing Company.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

## PHYSICAL CHEMISTRY-III

**Subject Code: BSNMS1-404** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course objectives:**

1. To understand the redox perspective of various processes.
2. To familiarize with various nuclear and electronic phenomenon.
3. To understand concepts of electrochemistry.
4. To familiarize with basic concept of spectroscopy.

**Course outcomes:** On completion of this course, students will be able to:

CO1: Understand the redox perspective of various processes.
CO2: Understand various nuclear and electronic phenomenon.
CO3: Apply electrochemical concepts and analyse outcomes of different conditions.
CO4: Assign the reasoning for various physical phenomenon.

### Unit-I (12 Hrs.)

**Electrochemistry-I:**

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

### Unit-II (12 Hrs.)

**Electrochemistry – II:**

Types of reversible electrodes-gas metal ion, metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and Single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells-reversible and irreverisible cells, conventional representation of electrochemical cells. EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions ($\Delta G$ $\Delta H$ and K), polarization, over potential and hydrogen overvoltage.

Concentration cells with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pKa, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

### Unit III (10 Hrs.)

**Nuclear Chemistry:**

Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity.

### Unit-IV (11 Hrs.)

**Spectroscopy:** Introduction, Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

**Electronic Spectrum:** Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle.

Qualitative description of s, p, and n M.O., their energy levels and the respective transitions

**Recommended Books:**

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Companies Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry, Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
8. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
9. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book Company.
10. Friedlander, Kennedy, Miller and Macias Nuclear and Radio Chemistry: John Wiley & Sons Inc.
11. Choppin, Lijenzin, Rydberg and Ekberg Radio Chemistry and Nuclear Chemistry Pubs Elsevier.

## CHEMISTRY LAB-IV

**Subject Code: BSNMS1-405** **L T P C** **Duration: 60 Hrs.**

**0 0 4 2**

**Course objectives:**

1. To understand the principle and application of conductometric titrations.
2. To understand various physical processes and their principle.
3. To understand synthesis and analysis of inorganic complexes

**Course outcomes:** On completion of this course, students will be able to:

CO1: Understand the principle and application of conductometric titrations.
CO2: Understand various physical phenomenon and their principle.
CO3: Synthesis and analysis of inorganic complexes.

**I. Synthesis and Analysis**

a) Preparation of Sodium trioxalatoferrate (III)
b) Preparation of Ni-DMG Complex
c) Preparation of Copper tetrammine complex
d) Preparation of cis-bisoxalatodiaquachromate (III) ion

**II. Physical Chemistry**

***a) Conductometric Titrations:***

i. Determine the end point of the following titrations by the conductometric methods.
- Strong acid-Strong base
- Strong acid-Weak base
- Weak acid-Strong base
- Weak acid-Weak base

ii. Determine the composition of a mixture of acetic acid and the hydrochloric acid by conductometric titration.

***b) WeightDetermination***

i. Molecular Weight Determination of acetanilide, napthalane, using camphor as solvent (Rast's methods).
ii. To determine the molecular weight of a polymer by viscosity measurements.

***c) Adsorption***

i. To study the adsorption of acetic acid oxalic/acid from aqueous solutions by charcoal.

d) Phase Equilibria to determine the distribution coefficient of iodine between $CCl_4$ and water.

***e) Refractometry***

i. Determination of refractive index of a liquid by Abbe refractometer, and hence the specific and molar refraction.
ii. To determine the composition of unknown mixture of two liquids by refractive index measurements.

f) Determining the half-life of radio isotope using GEIGER-MULLER COUNTER.

**Recommended Books:**

Latest edition of:

1. H. Denny, W. Roesky, ‘Chemical Curiosites’, WILEY VCH.
2. G. Marr and B.W. Rocket,’Practical Inorganic Chemistry, University Science Books.
3. G. Pass and H. Sutcliffe, ‘Practical Inorganic Chemistry, Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.
5. G. Svehla, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.

# FORENSIC PSYCHOLOGY

**Subject Code: BMFSS1-401** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of Forensic Psychology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, student will be able to:
CO1: Understand the concept of Forensic psychology and Forensic Psychiatry.
CO2: Gain knowledge regarding assessment of mental competency.
CO3: Gain knowledge of psychology behind criminal behavior
CO4: Understand the methods of detection of deception.

**Unit-I (10 Hrs.)**

Basics of Forensic Psychology. Definition and fundamental concepts of forensic psychology and forensic psychiatry.

Psychology and law. Ethical issues in forensic psychology. Assessment of mental competency. Mental disorders and forensic psychology. Psychology of evidence – eyewitness testimony, confession evidence.

**Unit-II (10 Hrs.)**

Criminal profiling. Psychology in the courtroom, with special reference to Section 84 IPC.

Psychology and Criminal Behavior Psychopathology and personality disorder. Psychological assessment and its importance. Serial murderers. Psychology of terrorism.

**Unit III (10 Hrs.)**

Biological factors and crime – social learning theories, psycho-social factors, abuse. Juvenile delinquency – theories of offending (social cognition, moral reasoning), Child abuse (physical, sexual, emotional), juvenile sex offenders, legal controversies.

**Unit-IV (15Hrs.)**

Detection of Deception Tools for detection of deception – interviews, non-verbal detection, statement analysis, voice stress analyzer, hypnosis. Polygraphy – operational and question formulation techniques, ethical and legal aspects, the guilty knowledge test. Narco analysis and brain electrical oscillation signatures – principle and theory, ethical and legal issues.

**Recommended Books:**

1. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton(2005).

2. D.E. Zulawski and D.E. Wicklander, Practical Aspects of Interview and Interrogation, CRC Press, Boca Raton(2002).
3. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey(2004).
4. J.L. Jackson and E. Barkley, Offender Profiling: Theory, Research and Practice, Wiley, Chichester(1997).
5. R. Gupta, Sexual Harassment at Workplace, LexisNexis, Gurgaon(2014).
6. A.A. Moenssens, J. Starrs, C.E. Henderson and F.E. Inbau, Scientific Evidence in Civil and Criminal Cases, 4th Edition, The Foundation Press, Inc., New York(1995).
7. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey(2004).
8. J.C. DeLadurantey and D.R. Sullivan, Criminal Investigation Standards, Harper & Row, New York(1980).
9. J. Niehaus, Investigative Forensic Hypnosis, CRC Press, Boca Raton(1999).
10. E.ElaadinEncyclopediaofForensicScience,Volume2,J.A.Siegel,P.J.Saukkoand
G.C. Knupfer (Eds.), Academic Press, London (2000).

**GROUP-1**

# PLANT PHYSIOLOGY & METABOLISM

**Subject Code: BMFSS1-402** **L T P C** **4 0 0 4** **Duration: 60 Hrs.**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of Plant physiology and metabolism.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Importance of water and its components.

**CO2:** Essential elements and its role.

**CO3:**Composition of phloem.

**Unit-1 (15Hours)**

**Plant-water relations:** Importance of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

**Mineral nutrition :** Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

**Translocation in phloem:** Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading.

**Unit-2(15Hours)**

**Photosynthesis:** Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reactioncenter, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration.

**Respiration:** Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway.

**Unit-3( 15Hours)**

**Enzymes:** Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition

**Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.

**Plant growth regulators:** Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

**Unit-4( 15Hours)**

**Plant response to light and temperature:** Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization. Biological nitrogen fixation; Nitrate and ammonia assimilation.

**Plant growth regulators** Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

**Plant response to light and temperature**

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), redvand far red light responses on photomorphogenesis; Vernalization.

**Suggested Readings**

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5th Edition.

2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.

3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

4. A.N. Parashar (1985), Plant Physiology. Trueman Book Company

# BOTANY LAB-4

**Subject Code: BMFSS1-403** | **L T P C 0 0 4 2** | **Duration: 60 Hrs.**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To determine osmotic potential of plant cell.
3. To demonstrate the hill reaction.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Calculation of stomatal index.
**CO3:**Study the effect of ligt intensity.

**Practical**

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O2 evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

**Demonstration experiments (any four)**

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration
4. R.Q.
5. Respiration in roots.

**Recommended Books**:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
2. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.

4. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.

5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.

6. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.

7. Thakur, A.K. and Bassi, S.K. (2008). Diversity of Microbes and Cryptogams. S. Chand & Co., Delhi.

8. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.

9. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.

## GENETICS AND EVOLUTIONARY BIOLOGY

**Subject Code: BMFSS1-404** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of genetics and evolutionary biology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Mendelian Genetics and its importance in Forensic Science.

**CO2:** Mutation and its types.

**CO3: Sex** determination and how it is used in paternity disputes.

**Unit-1(15 Hours)**

**Mendelian Genetics and its Extension** Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex influenced and sex-limited characters inheritance.

**Linkage** Crossing Over and Chromosomal Mapping Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

**Unit-2(15Hours)**

**Mutations** Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB methods, attached X method.

**Sex Determination** Chromosomal mechanisms of sex determination in Drosophila and Man

**Unit-3(15Hours)**

**Extra-chromosomal Inheritance** Criteria for extra-chromosomal inheritance, Antibiotic resistance in Chlamydomonas, Mitochondrial mutations in Saccharomyces, Infective heredity in Paramecium and Maternal effects.

**Polygenic Inheritance** Polygenic inheritance with suitable examples; simple numericals based on it.

**Unit-4(15Hours)**

**Recombination in Bacteria and Viruses** Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

**Transposable Genetic Elements** Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, Transposons in human.

**Recommended Books**:

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
4. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
5. Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and Bartlett Publishers.

## ZOOLOGY LAB- IV

**Subject Code: BMFSS1-405** **L T P C** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To study the mendelian laws
3. To analyse chi-square using seeds.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the linkage maps
**CO3:** Study of human karyotype.

1. To study the Mendelian laws and gene interactions.
2. Chi-square analyses using seeds/beads/Drosophila.
3. Linkage maps based on data from conjugation, transformation and transduction.
4. Linkage maps based on data from Drosophila crosses.
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.

**SUGGESTED READINGS**

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India

2. Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc

3. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings

4. Russell, P. J. (2009). Genetics- A Molecular Approach.III Edition. Benjamin Cummings

5. Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co

6. Fletcher H. and Hickey I. (2015). Genetics. IV Edition. G

**GROUP-2**

## WAVES AND OPTICS

**Subject Code: BSNMS1-401** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of waves and optics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Understand the concepts of harmonic oscillations and wave motion.
CO2: Gain knowledge of simple harmonic motion and its applications.
CO3: Learn about the concepts of Interference.
CO4: Understand the concepts polarization and diffraction.

### UNIT-I (15 Hrs)

**Harmonic oscillators and Wave Motion:**

Superposition of two collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity

### UNIT-II (15 Hrs)

**Simple Harmonic motion and applications:**

Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria

### UNIT-II (16 Hrs)

**Wave optics and Interference:**

Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes.

**UNIT-IV(14 Hrs)**

**Diffraction and Polarization:**

Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

**Recommended Books:**

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
4. University Physics. FW Sears, MW Zemansky and HD Young1986. Addison-Wesley.

## WAVES AND OPTICS LAB

**Subject Code: BSNMS1- 402** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the motion of coupled oscillation.
3. Todetermiine refractive index and its importance in forensic science.

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Learn about the motion of coupled oscillators and Lissajous Figures
CO2: Understand various diffraction phenomenon using prism and biprism
CO3: Determine the Refractive Index, dispersive Power of the Material, and Resolving Power of prism using various methods
CO4: Understand Schuster`s focusing and photo sensor

**List of Experiments:**

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify λ2 – T Law.
3. To study Lissajous Figures.
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a given Prism using Sodium Light.

7. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
8. To determine the value of Cauchy Constants of a material of a prism.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating.
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

**Recommended Books:**

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 17.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

## ALGEBRA-I

| Subject Code: BSNMS1-406 | L T P C | Duration: 45 Hrs. |
| --- | --- | --- |
| | 3 0 0 3 | |

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of algebra.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the concept of groups and its properties.
CO2: Understand the concept of permutation group and groups of symmetries.
CO3: Analyze & demonstrate different types of algebraic structures such as subgroups, cosets and their properties.
CO4: Understand the concept of normal subgroup and Lagrange's theorem.

**Unit-I(11Hrs.)**

Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity.

### Unit-II(10Hrs.)

circle group, the general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

### Unit-III (12Hrs.)

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets.

### Unit-IV(12Hrs.)

Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

**RecommendedBooks:**

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
4. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.
5. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,1993.
6. Herstein, I.N., 'Topics in Algebra.'2nd Ed, Vikas Publishing House, 1976.

## ALGEBRA-II

| Subject Code: BSNMS1-407 | L T P C<br>3 0 0 3 | Duration: 45 Hrs. |
|---|---|---|

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of algebra.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the concept of Ring and their properties.
CO2: Apply the concepts of isomorphism, homomorphism, ideal and integral domain for rings to solve different

types of problems.

CO3: Access the idea of inner product space and determine its orthogonality on vector space.

CO4: Understand the basic concepts of linear transformations, algebra of transformations, eigenvalues and corresponding eigenvectors.

**Unit-I(12Hrs.)**

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

**Unit-II(11Hrs.)**

Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homomorphism, Isomorphism, Automorphism, Permutation of group, Even and Odd permutation, Cayley theorem, Sylow's theorem.

**Unit-III(12Hrs.)**

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

**Unit-IV(10Hrs.)**

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation

**Recommended Books:**

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, 2004.
2. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,1993.
3. Herstein, I.N., 'Topics in Algebra'2nd Ed., Vikas Publishing House, 1976.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

# SEMESTER FIFTH

## CHEMISTRY OF MAIN GROUP ELEMENTS

| | | |
|---|---|---|
| **Subject Code: BSNMD1- 521** | **L T P C**<br>**4 0 0 4** | **Duration: 60 Hrs.** |

**Course Objectives:**

This course is intended

1. To provide the students an in-depth understanding of the groups of elements in Inorganic Chemistry.
2. To know the periodic properties of s, p and d block elements and their metallurgical purification.
3. To understand the physical and chemical properties of elements and their compounds.

**Course Outcomes:**

CO1: Acquire knowledge and understanding of essential facts, concepts, principles, theories and metallurgical purification techniques related to the elements of periodic table.

CO2: Develop comprehension abilities of structure, bonding and properties of the compound /polymers of the elements.

CO3: Application of the principles of metallurgical process

CO4: To develop skills to evaluate, analyze and solve problems competently.

### Unit-I (15 Hrs.)

**Acids and Bases:** Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

**General Principles of Metallurgy:** Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond's process and Kroll Process.

### Unit-II (18 Hrs.)

**s-and p-Block Elements:** Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale). General characteristics of s-block metals like density, melting and boiling points, flame colour and reducing nature. Oxidation states of s and p block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of s block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of s-block metals.

### Unit-III (10 Hrs.)

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental chemistry wherever applicable:

Diborane and concept of multicentre bonding, hydrides of Groups 13 ($BH_3$), 14, 15, 16 and 17. Oxides of N and P, Oxoacids of P, S and Cl. Halides and oxohalides of P and S ($PCl_3$, $PCl_5$, $SOCl_2$ and $SO_2Cl_2$) Interhalogen compounds.

A brief idea of pseudohalides.

### Unit-IV (17 Hrs.)

**Noble gases:** Rationalization of inertness of noble gases, clathrates, preparation and properties of $XeF_2$, $XeF_4$ and $XeF_6$ ,bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory.

**Inorganic Polymers:** Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$.

**Recommended Books:**

Latest edition of:

1. Lee, J.D. Concise Inorganic Chemistry ELBS
2. Cotton, F.A., Wilkinson, G. &Gaus, P.L. Basic Inorganic Chemistry, Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth-Heinemann.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India.
6. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry, Pearson.
7. Atkin, P. Shriver & Atkins' Inorganic Chemistry, Oxford University Press.

## CHEMISTRY OF MAIN GROUP ELEMENTS LAB

**Subject Code: BSNMD1-522** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand the concepts behind Iodo/Iodimetric titrations
2. To develop basic understanding of gravimetric analysis and estimation of different metals using the concept
3. To make the students understand principles involved in estimation of dissolved impurities of water
4. To familiarize the students with inorganic preparation

**Course Outcomes:** After completion of course students will gain the knowledge and practical hands on training of

CO1: Obtaining precise results of Iodo/Iodimetric titrations
CO2: Gravimetric analysis and estimation of different metalions
CO3: Estimation of dissolved impurities of water
CO4: Preparation of transition metal based inorganic compounds

**List of Experiments:**

1) Iodometric estimation of potassium dichromate and copper sulphate.
2) Iodimetric estimation of antimony in tartaremetic.
3) Estimation of amount of available chlorine in bleaching powder and household bleaches.
4) Estimation of iodine in iodized salts.
5) Iodimetric estimation of ascorbic acid in fruit juices.
6) Estimation of dissolved oxygen in water samples.
7) Gravimetric estimation of sulphate as barium sulphate.
8) Gravimetric estimation of aluminium as oximato complex.
9) Preparation of the following: potash alum, chrome alum, tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

**Recommended Books:**

Latest edition of:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson.

# FUNDAMENTALS OF COMPUTER FORENSICS

**Subject Code: BMFSS1-501** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of computer forensics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, student will be able to:
CO1: Understand the concept of Cyber Crime and Computer crime.
CO2: Gain knowledge regarding electronic evidences recovered at crime scene.
CO3: Gain knowledge regarding forensic tools and techniques used in analyzing the electronic evidences.
CO4: Understand the Mobile phone Forensic.

**Unit-I (15 Hrs.)**

**CyberCrimeandComputercrime:**

Introduction to Digital Forensics, Definition and types of Computer crimes, electronic evidenceandhandling,electronicmedia,collection,searchingandstorageofelectronicmedia,introductiontointernetcrimes,hackingandcracking,creditcardandATMfrauds,webtechnology,cryptographyandemergingdigital crimes.

**BasicsofComputer:**

Computerorganization,componentsofcomputer-inputandoutputdevices,CPU,Memoryhierarchy, types of memory, storage devices, system softwares, application softwares, basics ofcomputerlanguages.

**Unit-II (10 Hrs.)**

**Forensic Tools and Processing of Electronic Evidence**

Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing ofdigitalevidence,digitalimages,damagedSIManddatarecovery,multimediaevidence,retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.

**Unit-III (12 Hrs.)**

**BiometricsFundamentals**

Introduction – Benefits of biometric security – Verification and identification Basic working ofbiometric matching–Accuracy–False matchrate–Falsenon-matchrate–Failuretoenrollrate
– Derived metrics – Layered biometric solutions. Types of Biometric Tools, Fingerprints, Face,IrisandRetinalscan,Voice,DNAandHandwriting.RelevanceofBiometricsinForensicScience.

**Unit-IV (08Hrs.)**

**MobilePhoneForensics**

Crime and mobile phones, forensic procedures for seizing Mobile Phones, Role of IMEI, IMSI,ICCID, CDRs & TDRs in Crime Investigation, Recovery of data available in SIM Card, internal&externalmemoryPhones,Mobile operating systems.

**Recommended Books:**

1. R.K.Tiwari,P.K.SastryandK.V.Ravikumar,ComputerCrimesandComputerForensics,Select Publihers, NewDelhi(2003).
2. C.B. Leshin, Internet InvestigationsinCriminalJustice,PrenticeHall,NewJersey(1997).
3. R.Saferstein,Criminalistics,8thEdition,PrenticeHall,NewJersey(2004).
4. E.Casey,DigitalEvidenceandComputerCrime,AcademicPress, London(2000).

## COMPUTER FORENSIC LABORATORY

**Subject Code: BMFSS1-502** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To identify IP address of the sender of e-mails.
3. To trace routes followed by e-mails and chats.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the encrypted files
**CO3:** Analysis of hidden files.

1. Toidentify,seizeandpreservedigital evidence fromcrimescenes.
2. Todetectdeletions,obliterationsandmodificationsoffilesusingencasesoftware.

3. Totraceroutesfollowed bye-mailsandchats.
4. ToidentifytheIPaddressof the senderofe-mails.
5. Totracetheheaderofanemail.
6. Toidentifyencrypted files.
7. To identifyhiddenfiles.
8. Tousedigitalsignaturesforsecuringe-mailandonlinetransactions.
9. ToacquiredatafromPCs/laptops/HDDs/USBs,pendrives,memorycardsandSIMcards.
10. TocalculatetheHashvalueoffile.

11. TocalculatetheHashvalueofHard-diskandtopreparetheHash tables.

**Recommended Books:**

1. R.K.Tiwari,P.K.SastryandK.V.Ravikumar,ComputerCrimesandComputerForensic s,Select Publishers, NewDelhi(2003).
2. C.B. Leshin, Internet InvestigationsinCriminalJustice,PrenticeHall,NewJersey(1997).
3. R.Saferstein,Criminalistics,8thEdition,PrenticeHall,NewJersey(2004).
4. E.Casey,DigitalEvidenceandComputerCrime,AcademicPress, London(2000).

**GROUP-1**

## CELL AND MOLECULAR BIOLOGY

| Subject Code: BMFSS1-503 | L T P C<br>4 0 0 4 | Duration: 60 Hrs. |
|---|---|---|

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of cell and molecular biology.

2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Techniques in biology and its uses in forensic science.
**CO2:** Cell organelles
.**CO3:** DNA and its importance in Forensic Science.

**Unit-1(15Hours)**

**TechniquesinBiology**:Principlesofmicroscopy;LightMicroscopy;Phasecontrastmicroscopy;Fluorescencemicroscopy;Confocalmicroscopy;SamplePreparationforlightmicroscopy; Electron microscopy (EM)-Scanning EM and Scanning Transmission EM (STEM);SamplePreparationfor electron microscopy;X-raydiffraction analysis.
**CellasaunitofLife**:TheCellTheory;Prokaryoticandeukaryoticcells;Cellsizeandshape;EukaryoticCellcomponents.

**Unit-2(15Hours)**

**CellOrganelles**:Mitochondria:Structure,markerenzymes,composition;Semiautonomousnature; Symbiotic hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA.Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA.ER,Golgi body& Lysosomes: Structures androles.
PeroxisomesandGlyoxisomes:Structures,composition,functionsinanimalsandplantsandbiogenesis.
**Nucleus:**NuclearEnvelope-structureofnuclearporecomplex;chromatin;molecular

Organization,DNApackagingineukaryotes,euchromatinandheterochromatin,nucleolusandRibosomestructure(brief).

**Unit-3(15Hours)**

**Cell Membrane and Cell Wall :** The functions of membranes; Models of membrane structure;Thefluidityofmembranes;Membraneproteinsandtheirfunctions;Carbohydratesinthemembrane;Faces of themembranes; Selectivepermeabilityofthemembranes; Cellwall.

**CellCycle:**OverviewofCellcycle,MitosisandMeiosis;Molecularcontrols.
Genetic material: DNA:Miescher to Watson and Crick- historic perspective, Griffith'sandAvery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure,typesofDNA, types ofgeneticmaterial.

**Unit-4(15Hours)**

**DNAreplication(Prokaryotesandeukaryotes):**bidirectional replication,semi–conservative,semi discontinuous RNA priming, Ǿ (theta) mode of replication , replication oflinear,ds-DNA,replicatingthe5́end oflinearchromosomeincludingreplicationenzymes.
Transcription(ProkaryotesandEukaryotes):TypesofstructuresofRNA(mRNA,tRNA,rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.**Regulationofgeneexpression:**Prokaryotes,LacoperonandTryptophanoperon;andinEukaryotes.

**SuggestedReadings**

1. Karp,G.2010.CellandMolecularBiology:ConceptsandExperiments.6thEdition.JohnWiley &Sons.Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.LippincottWilliams and Wilkins,Philadelphia.
3. Cooper,G.M.andHausman,R.E. 2009.TheCell:A MolecularApproach.5thedition.ASMPress&Sunderland, Washington, D.C.; Sinauer Associates,MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of theCell.7thedition. PearsonBenjaminCummingsPublishing, SanFrancisco.

## BOTANY LAB-5

**Subject Code: BMFSS1-504** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the micrographs of cell organelles.
3. To study mitosis and meiosis.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Procedure of measure of cell size.
**CO3:** Analysis of DNA packaging by micrographs.

1Tostudyprokaryoticcells(bacteria),viruses, eukaryoticcellswiththehelpoflightandElectronmicrographs.
2. Studyofthephotomicrographs of cell organelles
3. Tostudythestructureof plant cell through temporarymounts.
4. To study the structure of animal cells by temporary mounts-squamous epithelial cell andNervecell.
5. Preparationoftemporarymountsofstriatedmusclefiber
6. To prepare temporary stained preparation of mitochondria from striated muscle cells /cheekepithelialcellsusingvital stain Janus green.
7. Studyof mitosis and meiosis (temporarymounts and permanent slides).
8. Studytheeffectoftemperature,organicsolventonsemipermeablemembrane.
9. Demonstrationofdialysisofstarchandsimple sugar.
10. Studyofplasmolysisanddeplasmolysison*Rhoeo*leaf.
11. Measurethecell size(either lengthorbreadth/diameter) bymicrometry.
12. Studythestructureofnuclearporecomplexbyphotograph (fromGerald Karp) Studyofspecialchromosomes (polytene &lampbrush) either byslides or photographs.
13. StudyDNApackagingbymicrographs.
14. Preparationofthekaryotypeandideogramfromgivenphotographofsomaticmetaphasechromosome.

**SuggestedReadings**

1. Karp,G.2010.CellandMolecularBiology:ConceptsandExperiments.6thEdition.JohnWiley &Sons.Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8$^{th}$edition.LippincottWilliams and Wilkins,Philadelphia.
3. Cooper,G.M.andHausman,R.E. 2009.TheCell:A MolecularApproach.5thedition.ASMPress&Sunderland, Washington, D.C.; Sinauer Associates,MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of theCell.7thedition. PearsonBenjaminCummingsPublishing, SanFrancisco.

## COMPARATIVE ANATOMY OF VETEBRATE

**Subject Code: BMFSS1-505** **L T P C** **Duration:60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of anatomy of vertebrae.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Integumentary system in detail.
**CO2:** Skeleton system and its importance in forensic science.
**CO3 :**Nervous system and its functioning.

**Unit-1(15 Hours)**

**IntegumentarySystem**

Structure,functionsandderivativesofintegument

**Skeletal System**

Overviewofaxialandappendicularskeleton,Jawsuspensorium,Visceralarches

**Unit-2(15Hours)**

**DigestiveSystem**

Alimentarycanalandassociatedglands,dentition

**RespiratorySystem**

Skin,gills,lungsandairsacs; Accessoryrespiratoryorgans

**Unit-3(15Hours)**

**CirculatorySystem**

Generalplanofcirculation,evolutionofheartandaorticarches

**UrinogenitalSystem**

Successionofkidney,Evolutionofurinogenitalducts,Typesofmammalianuteri

**Unit-4(15Hours)**

**NervousSystem**

ComparativeaccountofbrainAutonomicnervoussystem,Spinalcord,Cranialnervesinmammals

**SenseOrgans**

ClassificationofreceptorsBriefaccountofvisualandauditoryreceptorsinman

**Recommended Books:**

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons.
4. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
5. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.

## ZOOLOGY LAB-5

**Subject Code: BMFSS1-506** **L T P C** **Duration:60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse the mammalian skull
3. To analyse the dissection of rat

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the disarticulated skeleton of frog, varanus.
**CO3:** Analysis of the disarticulated skeleton of fowl and rabbit.

1. Studyofplacoid,cycloidandctenoidscalesthroughpermanentslides/photographs
2. DisarticulatedskeletonofFrog,Varanus,Fowl,Rabbit
3. Carapaceandplastronofturtle/tortoise
4. Mammalianskulls:Oneherbivorousandonecarnivorousanimal
5. Dissectionofrattostudyarterialandurinogenital system(subjecttopermission)
6. Studyofstructureofanytwoorgans(heart,lung,kidney,eyeandear)fromvideorecording(maybeincludedifdissection notpermitted)
7. Projectonskeletalmodificationsinvertebrates(maybeincludedifdissectionnotpermitted)

**SUGGESTEDREADINGS●**


- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition.McGraw-Hill Higher Education ●
- Kent,G.C.andCarrR.K.(2000).ComparativeAnatomyoftheVertebrates.IXEdition.The McGraw-Hill Companies ●
- Hilderbrand,MandGaslowG.E.AnalysisofVertebrateStructure,JohnWileyandSons●
- Walter,H.E.andSayles,L.P;BiologyofVertebrates,KhoslaPublishingHouse

**GROUP-2**

## MATRICES

**Subject Code: BSNMD1-531** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of matrices.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the concept of vector space.
CO2: Understand the concept of rotation and reflection in a point and numerical approach to eigen values and eigen vectors.
CO3: Develop the knowledge of matrices and its properties.
CO4: Develop the advanced knowledge of matrix and examples of matrix from various fields of sciences.

### Unit-I(12Hrs.)

R, $R^2$, $R^3$ as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of $R^2$, $R^3$.

### Unit-II(12Hrs.)

Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

### Unit-III(9Hrs.)

Types of matrices Rank of a matrix, Invariance of rank under elementary transformations, Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns up-to four.

**Unit-IV(12 Hrs.)**

Matrices in diagonal form, Reduction to diagonal form up-to matrices of order 3, Computation of matrix inverses using elementary row operations, Rank of matrix. Solutions of a system of linear equations using matrices, Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

**RecommendedBooks:**

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

## LINEAR ALGEBRA

**Subject Code: BSNMD1-532** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of linear algebra.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Apply the knowledge of algebra which enable to build mathematical thinking and skills.
CO2: Analyze and solve the problems related to rank and nullity of linear transformation.
CO3: Compute the eigenvalues and corresponding eigenvectors for a square matrix.
CO4: Apply the concepts of isomorphism to solve different types of problems.

**Unit-I(10Hrs.)**

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

**Unit-II(12Hrs.)**

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.

**Unit-III(12Hrs.)**

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

**Unit-IV (11Hrs.)**

Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

**RecommendedBooks:**

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

## DIGITAL ANALOG AND INSTRUMENTATION

| Subject Code: BSNMD1-511 | L T P C<br>4 0 0 4 | Duration: 60 Hrs. |
|---|---|---|

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of digital analog and instrumentation.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):**After the completion of the course, Student will be able to

CO1: Learn the Analog and Digital Circuits
CO2: Basic concepts of Semiconductor Devices
CO3: Learn about the concepts of Amplifiers
CO4: Gain knowledge about the basic physics instruments

**UNIT-I (15 Hrs)**

**Digital Circuits:**

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal

Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method. Binary Addition. Binary Subtraction using 2's Complement Method).

**UNIT-II (15 Hrs)**

**Semiconductor Devices:**

Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.

**UNIT-III (15 Hrs)**

**Amplifiers**:

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff, and Saturation Regions. Current gains $\alpha$ and $\beta$. Relations between $\alpha$ and $\beta$. Load Line analysis of Transistors. DC Load line and Q point. Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers.

**UNIT-IV (15 Hrs)**

**Instrumentation:**

Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers. Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation Timer IC: IC 555 Pin diagram and its application as Astable& Monostable Multivibrator

**Recommended Books:**

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
3. Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
4. Digital Principles & Applications, A.P. Malvino, D.P. Leach & Saha, 7th Ed.,2011,
5. Tata McGraw Hill
6. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
7. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
8. Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning.

## DIGITAL ANALOG AND INSTRUMENTATION LAB

**Subject Code: BSNMD1- 512** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of digital analog and instrumentation.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):**After the completion of the course, Student will be able to

CO1: Verify and design different gates
CO2: Understand Half adder, Full adder and Adder-subtrector
CO3: Design monostable, astable multivibrator using 555 timer
CO4: Understand and design various circuits using Op-amp 741

**List of Experiments:**

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.
4. Half adder, Full adder and 4-bit Binary Adder
5. Adder-Subtractor using Full Adder I.C.
6. To design an astable multivibrator of given specifications using 555 Timer.
7. To design a monostable multivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its frequency Response.
13. To study a precision Differential Amplifier of given I/O specification using Opamp.
14. 14. To investigate the use of an op-amp as a Differentiator
15. To design a Wien Bridge Oscillator using an op-amp.

**Recommended Books:**

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994,Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, PrenticeHall.
4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

# SEMESTER SIXTH

## COMPREHENSIVE CHEMISTRY

**Subject Code: BSNMD1-621** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To understand the concepts behind basics of inorganic chemistry
2. To understand the concept of stereochemistry
3. To familiarize with the Bioinorganic Chemistry.
4. To understand concepts of spectroscopy.

**Course Outcomes:** Students will acquire the knowledge of

CO1: Synthesis and applications of heterocyclic compounds
CO2: Applications of spectroscopy for the structure determination of organic compounds
CO3: Co-ordination Chemistry.
CO4: Role of Bioinorganic Chemistry.

### Unit-I (14 Hrs.)

**Chemistry of 3d Block Elements:** Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

**Organometallic Compounds:** Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

### Unit-II (12 Hrs.)

**Bio-Inorganic Chemistry:** A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to $Na^+$, $K^+$ and $Mg^{2+}$ ions: Na/K pump; Role of $Mg^{2+}$ ions in energy production and chlorophyll. Role of $Ca^{2+}$ in blood clotting, stabilization of protein structures and structural role (bones).

### Unit-III (18 Hrs.)

**Polynuclear and heteronuclear aromatic compounds:**

Properties of the following compounds with reference to electrophilic and nucleophilic substitution reaction

Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.
**Active methylene compounds:** Claisen condensation. Keto-enol tautomerism. Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon).

### Unit-IV (16 Hrs.)

**Application of Spectroscopy to Simple Organic Molecules:**
Electromagnetic radiations, electronic transitions, $\lambda_{max}$ & $\varepsilon_{max}$, chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating $\lambda_{max}$ of conjugated dienes and α,β – unsaturated carbonyl compounds
Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intra molecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions). Application of ultraviolet - visible and infrared spectroscopy in structure elucidation of organic molecules.

**Recommended Books:**
Latest edition of:

1. James E. Huheey, Ellen Keiter& Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
2. G.L. Miessler& Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
3. J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
4. F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley & Sons.
5. I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
6. John R. Dyer: Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall
7. R.M. Silverstein, G.C. Bassler& T.C. Morrill: Spectroscopic Identification of Organic Compounds, John Wiley & Sons.
8. R.T. Morrison & R.N. Boyd: Organic Chemistry, Prentice Hall.
9. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
10. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, Pub: S. Chand.

# COMPREHENSIVE CHEMISTRY LAB

**Subject Code: BSNMD1-622** | **L T P C** **0 0 4 2** | **Duration: 60 Hrs.**

**Course Objectives:**

1. To understand the concepts behind synthesis of various inorganic compounds.
2. To determine the melting points of Inorganic compounds.
3. To understand chemistry involved in Organic functional group determination.

**Course Outcomes:** After completion of course students will acquire the knowledge of:

CO1: Synthesis of Inorganic compounds

CO2: Determination of melting and boiling points of synthesized Inorganic compound

CO3: Organic Functional group tests.

**Inorganic Chemistry**

1) Separation of mixtures by chromatography: Measure the Rf value (Combination of two ions to be given)
   Paper chromatography:
   (a) separation of $Fe^{3+}$, $A1^{3+}$ and $Cr^{3+}$
   (b) separation of $Ni^{2+}$, $Co^{2+}$, $Mn^{2+}$ and $Zn^{2+}$.
2) Preparation of any two of the following complexes and measurement of their conductivity:
   i. tetraamminecarbonatocobalt (III) nitrate
   ii. tetraamminecopper (II) sulphate
   iii. potassium trioxalatoferrate (III) trihydrate

   Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$.

**Organic Chemistry**

Systematic Qualitative Analysis of Organic Compounds possessing mono functional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of their one derivative.

**Recommended Books:**

Latest edition of:

1) A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall.
2) A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall.
3) Vogel`s Textbook of Practical Organic Chemistry, Prentice-Hall.
4) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman.

## FORENSIC AUDIO VIDEO EXAMINATION

| Subject Code: BMFSS1-601 | L T P C<br>3 0 0 3 | Duration: 45 Hrs. |
|---|---|---|

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcome (CO):** After the completion of the course, student will be able to:

CO1: Understand the concept of Forensic audio video analysis.
CO2: Gain knowledge regarding Speech spectrographic analysis.
CO3: Gain knowledge regarding human voice production system
CO4: Understand the Process of speaker recognition.

### Unit-I (10 Hrs.)

**Forensic audio video analysis:** Voltage, decibels, audio line levels, frequency measurements, spectrum analysis, noise characteristics, digital filters and audio enhancement, authentication of recorded audio. **Speech spectrographic**

**analysis:** Magnetic developing and optical methods Falsification in video recording, video frame sequence, method. **Waveform:** Spectroscope, videogrametry and photogrametry techniques, video image analysis, facial image recognition from video frame image.

### Unit-II (10 Hrs.)

**Introduction to Speaker Identification:** Scope, significance, human vocal tract, anatomy, vocal cords, nasal cavity, larynx, trachea, lungs, bronchitis. **Human voice production:** Theories, different types of voice production, vocal fold and air flow oscillation graph analysis. **Speech signals:** Processing of speech signals, pattern recognition, acoustic characteristics, speech signal analysis, tone and voice etc.

### Unit-III (15 Hrs.)

**Introduction to Speech Components:** Basic sound factors in speech, speech components, analogue and digital speech signals, speech anatomy, mechanism of producing speech, principles and methods of speaker recognition. **Acoustic and Auditory Parameters:** Forensic phonetic parameters, Acoustic and Auditory Parameters, linguistic and individual variation factors, qualitative and quantitative parameters, continuous and discrete parameters.

### Unit-IV (10 Hrs.)

**Speaker recognition process:** Fourier analysis, speech enhancement, examination of video and audio signal for authenticity, Voice identification, speaker identification – listener method, computerized approach, analysis of sound spectrogram, sound spectrograph, working and principle.

**Recommended Books:**

1. Saferstein, Richard. CRIMINALISTICS: AN INTRODUCTION TO FORENSIC SCIENCE, Pearson Education, Inc., Upper Saddle River, NJ (2007).
2. Damjanovski, V. CCTV NETWORKING AND DIGITAL TECHNOLOGY, Butterworth-Heinemann: Waltham, MA, 2000.
3. Zakia, R. D. THE FOCAL ENCYCLOPE
4. McClure, David. Report: Focus Group on Scientific and Forensic Evidence in the Courtroom (online), 2007, https://www.ncjrs.gov/pdffiles1/nij/grants/220692.pdf
5. Vancouver Police Department, Integrated Riot Investigation Team, Vancouver Riot 2011: Help Identify Suspects (https://riot2011.vpd.ca/identify-a-suspect)
6. Mellinger, Philip T., "Cracking Watergate's Infamous 18 1/2 Minute Gap", FORENSIC MAGAZINE (online), February 18, 2011, http://www.forensicmag.com/article/cracking-watergatesinfamous-18-12-minute-gap
7. Law Enforcement & Emergency Services Video Association (LEVA) (http://www.leva.org/)
8. International Association for Identification (IAI) (http://www.theiai.org/certifications/video/index.php)

**9.** Scientific Working Group on Imaging Technology (SWGIT) (https://www.swgit.org/)
**10.** Scientific Working Group on Digital Evidence (SWGDE) (https://www.swgde.org/)
**11.** American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB) (http://www.ascld-lab.org/)
**12.** National Technical Investigators Association (NATIA) (http://www.natia.org/i4a/pages/index.cfm?pageid=1)
**13.** BEST PRACTICES FOR THE ACQUISITION OF DIGITAL MULTIMEDIA EVIDENCE, VERSION 3.0 (April 14, 2010), LEVA.
**14.** Cohen N, MacLennan-Brown K. "Retrieval of Video Evidence and Production of Working Copies from Digital CCTV Systems v2.0," (http://tna.europarchive.org/20100413151426/http:/scienceandresearch.homeoffice.gov.uk/hosdb/publications/cctv-publications/66-08_Retrieval_of_Video_Ev12835.pdf?view=Binary), Home Office Scientific Development Branch.
**15.** "Cracking Watergate's Infamous 18½-Minute Gap", (http://www.forensicmag.com/article/cracking-watergates-infamous-18-12- minute-gap), Philip T. Mellinger, 2/18/11, FORENSIC MAGAZINE.
**16.** CRIME LABORATORY EVIDENCE SUBMISSION MANUAL, Florida Department of Law Enforcement, Gerald M. Bailey, Commissioner, 2009. GUIDELINES FOR THE BEST PRACTICE IN THE FORENSIC ANALYSIS OF VIDEO EVIDENCE, LEVA. Housemate tips police to Smith after seeing video (http://articles.cnn.com/2004- 02-05/us/missing.girl_1_susan-schorpen-carlie-brucia-carwash-parkinglot?_s=PM:US) (CNN report).
**17.** LEVA Forensic Video Analysis Certification Program, (http://leva.org/index.php?option=com_content&view=article&id=66&Itemid =144) (accessed 4/2/2012). "Section 7: Best Practices for Forensic Video Analysis," (https://www.swgit.org/pdf/Section 7 Best Practices for Forensic Video Analysis?docID=51SWGIT) guidelines document.
**18.** Technical Support Working Group (TSWG). "Best Practices for the Retrieval of Digital CCTV Systems," (http://www.tswg.gov/subgroups/isf/electronicevidence/DCCTV_Web_.doc.pdf) Home Office Scientific Development Branch.

## FORENSIC AUDIO VIDEO EXAMINATION LABORATORY

| | | |
|---|---|---|
| **Subject Code: BMFSS1-602** | **L T P C**<br>**3 0 0 3** | **Duration: 60Hrs.** |

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To  segregation of speech sample.
3. To analyse the  audio and video evidences and its importance as a evidence.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Extraction of audio from a video recording.
**CO3:** Analysis of speech sample using IPA symbol.

1. Recording the voice of a speaker using a tape recorder and measures for keeping it in the safe custody.
2. Making a working copy of the recording in appropriate format in analog mode.
3. Recording the speech sample of a speaker using digital audio tape recorder.
4. Measures to be taken care during recording the specimen speech sample of a suspect.
5. Digitization of analog speech sample.
6. Segregation of speech sample.
7. Transcription of speech sample using IPA symbols.
8. Selection of verbatim for speaker identification.
9. Extraction of audio from a video recording.
10. Anthropometric measurements in facial recognition from a still image/ photograph.

Recommended Books:

1. Saferstein, Richard. CRIMINALISTICS: AN INTRODUCTION TO FORENSIC SCIENCE, Pearson Education, Inc., Upper Saddle River, NJ (2007).
2. Damjanovski, V. CCTV NETWORKING AND DIGITAL TECHNOLOGY, Butterworth-Heinemann: Waltham, MA, 2000.
3. CRIME LABORATORY EVIDENCE SUBMISSION MANUAL, Florida Department of Law Enforcement, Gerald M. Bailey, Commissioner, 2009. GUIDELINES FOR THE BEST PRACTICE IN THE FORENSIC ANALYSIS OF VIDEO EVIDENCE, LEVA. Housemate tips police to Smith after seeing video (http://articles.cnn.com/2004- 02-05/us/missing.girl_1_susan-schorpen-carlie-brucia-carwash-parkinglot?_s=PM:US) (CNN report).
4. LEVA Forensic Video Analysis Certification Program, (http://leva.org/index.php?option=com_content&view=article&id=66&Itemid =144) (accessed 4/2/2012). “Section 7: Best Practices for Forensic Video Analysis,” (https://www.swgit.org/pdf/Section 7 Best Practices for Forensic Video Analysis?docID=51SWGIT) guidelines document.
5. Technical Support Working Group (TSWG). “Best Practices for the Retrieval of Digital CCTV Systems,” (http://www.tswg.gov/subgroups/isf/electronicevidence/DCCTV_Web_.doc.pdf) Home Office Scientific Development Branch.

**GROUP-1**

# ECONOMIC, BOTANY & BIOTECHNOLOGY

**Subject Code: BMFSS1-603** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of economic, botany and biotechnology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Cereals, legumes, spices, beverages, oils and fats.
**CO2:** Biotechnology and its significance in forensic science.
**CO3:** DNA techniques.

## UNIT-1(10 Hours)

**OriginofCultivatedPlants:**Conceptofcentresoforigin,theirimportancewithreferencetoVavilov'swork
**Cereals:**Wheat-Origin, morphology,use.

## UNIT-2(10Hours)

**Legumes:**GeneralaccountwithspecialreferencetoGramandsoybean
**Spices:**Generalaccountwithspecialreferencetocloveandblackpepper(Botanicalname,family,part used, morphologyand uses)

## UNIT-3(10Hours)

**Beverages:** Tea (morphology,processing, uses
**Oils and Fats:**Generaldescriptionwithspecialreferencetogroundnut
**Fibre Yielding Plants:** GeneraldescriptionwithspecialreferencetoCotton(Botanicalname,family,part used, morphologyand uses)

## UNIT-4(30Hours)

**Introductiontobiotechnology**

**Planttissueculture:**Micropropagation;haploidproductionthroughandrogenesisandgynogenesis;br iefaccountofembryo&endospermculturewiththeir applications
**RecombinantDNATechniques:**Blottingtechniques:Northern,SouthernandWesternBlotting,DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCRand Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA andImmunodetection.Moleculardiagnosisofhumandisease, HumangeneTherapy.

**SuggestedReadings**

1. Kochhar,S.L.(2011). EconomicBotanyintheTropics,MacMillanPublishersIndiaLtd.,New Delhi. 4thedition.
2. Bhojwani,S.S.andRazdan, M.K.,(1996).PlantTissueCulture:TheoryandPractice.ElsevierScienceAmsterdam. TheNetherlands.
3. Glick,B.R.,Pasternak, J.J.(2003).MolecularBiotechnology-PrinciplesandApplicationsofrecombinantDNA. ASM Press, Washington.

# DEVELOPMENTAL BIOLOGY

| Subject Code: BMFSS1-604 | L T P C<br>4 0 0 4 | Duration: 60 Hrs. |
|---|---|---|

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of developmental biology.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes (CO):** The completion of the course will make student to acquire the knowledge of:

**CO1:** Early embryonic development
**CO2:** Late embryonic development.
**CO3:** Implications of developmental biology.

**UNIT-1(15 Hours)**

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Patternformation,Differentiationandgrowth,Differentialgeneexpression,Cytoplasmicdeterminantsandasy mmetriccelldivision.

**Unit-2 (15Hours)**

**EarlyEmbryonicDevelopment**

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External andInternal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula;Fate maps (including Techniques); Early development of frog and chick up to gastrulation; Embryonicinductionandorganizers

**Unit-3(15Hours)**

**LateEmbryonicDevelopment**

FateofGermLayers;Extra-embryonicmembranesinbirds;Implantationofembryoinhumans,Placenta(Structure,types and functionsofplacenta).

Unit-4(15Hours)

**PostEmbryonicDevelopment**

Metamorphosis:Changes,hormonal regulationsinamphibiansandinsects;Regeneration:Modesofregeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each);Ageing: Concepts andTheories

**ImplicationsofDevelopmentalBiology**

Teratogenesis:Teratogenicagentsandtheireffectsonembryonicdevelopment;Invitrofertilization,Stemcell(ESC), Amniocentesis

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**Recommended Books:**

1. Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV• Edition. McGraw-Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
4. Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
5. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.

## BOTANY LAB-6

**Subject Code: BMFSS1-605** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To get familiar with basic tools used in tissue culture.
3. To study the economically important plants.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Molecular techniques nd its uses in forensic science.
**CO3:** Analysis of photographs.

**1.** Studyofeconomicallyimportantplants:Wheat,Gram, Soybean,Blackpepper, CloveTea,Cotton, Groundnutthrough specimens, sectionsandmicrochemicaltests
2. Familiarizationwithbasicequipmentsintissueculture.

3. Studythroughphotographs:Antherculture,somaticembryogenesi s,endospermandembryoculture; micropropagation.

**4.** Studyofmoleculartechniques: PCR,Blottingtechniques, AGE and PAGE.

**Recommended Books:**

**1.** Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV• Edition. McGraw-Hill Higher Education.
**2.** Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
**3.** Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House.
**4.** Gilbert, S. F. (2006). Developmental Biology, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
5. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.

## ZOOLOGY LAB- VI

**Subject Code: BMFSS1-606** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To analyse whole mount and sections f frog through permanent slides.
3. To analyse the whole mounts of developmental stages of hick thorough permanent slides.

**Course Outcomes (CO):** The completion of the practical will make student to acquire the knowledge of:

**CO1:** Different Safety measures in lab.
**CO2:** Analysis of the developmental stages and lifecycle of Drosophila from stock culture.
**CO3:** Study of different sections of placenta.

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-budstage,tadpole(externalandinternalgillstages)

2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak(13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburgerstages)

3. StudyofthedevelopmentalstagesandlifecycleofDrosophilafromstockculture

4. Studyofdifferentsectionsofplacenta(photomicropgraph/slides)

5. ProjectreportonDrosophilaculture/chickembryodevelopment

**SUGGESTED READINGS**

Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates,• Inc., Publishers,Sunderland,Massachusetts,USA
Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, InternationalThompsonComputerPress
Carlson,R.F.Patten's Foundations of Embryology
Kalthoff (2008). Analysis of Biological Development, II Edition,

McGraw Hill•PublishersLewisWolpert

(2002).PrinciplesofDevelopment.IIEdition,OxfordUniversity•Press

**GROUP-2**

## ELEMENTS OF MODERN PHYSICS

| | | |
|---|---|---|
| **Subject Code: BSNMD1-611** | **L T P C**<br>**4 0 0 4** | **Duration: 60 Hrs.** |

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of elements of modern physics.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.

To provide knowledge of latest published findings

**Course Outcome (CO):**After the completion of the course, Student will be able to

CO1: Gain knowledge about crystal structure
CO2: Understand the concepts of quantum mechanics.
CO3: Understand the concepts nuclear Physics.
CO4: Learn about Particle interactions and Conservation Laws.

### UNIT-I (12 Hrs)

**Crystal structure and lattice vibrations:**

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell, Types of Lattices. Miller Indices. Reciprocal Lattice. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Lattice Vibrations in Linear Monoatomic and Diatomic Chains. Concept of phonons, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

### UNIT-II (18 Hrs)

**Introduction to Quantum Mechanics:**

Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson- German experiment. Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. Wave-particle duality, Heisenberg uncertainty principle-impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. One dimensional infinitely rigid box- energy eigenvalues and eigen functions, normalization; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

### UNIT-III (15 Hrs)

**Nuclear Physics:**

Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. Radioactive decay: alpha, beta and gamma decay, internal conversion, positron emission, electron capture, neutrino hypothesis. Interaction of Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter.

**UNIT-IV (15 Hrs)**

**Particle Physics:**

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity,baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

**Recommended Books:**

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson,2009.
3. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw Hill Co.
4. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning.
5. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics, Walter Greiner, 4$^{th}$Edn., 2001, Springer.

## ELEMENTS OF MODERN PHYSICS LAB

**Subject Code: BSNMD1-612** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand basic understanding of lab practices including safety measures.
2. To gain knowledge about absorption and emission spectra and its importance in forensic science.
3. To measure the value of e/m by magnetic focusing.

**Course Outcome (CO):**After the completion of the course, Student will be able to

CO1: Gain practical knowledge about photoelectric effect
CO2: Understand the practically ionization potential, e/m ratio, Boltzmann constant
CO3: Gain knowledge about the absorption and emission spectra.
CO4: Study the diffraction patterns of single and double slits

**List of Experiments:**

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
8. To determine the value of e/m by magnetic focusing.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source-Na light.

**Recommended Books:**

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition,2011, Kitab Mahal, New Delhi.

## NUMERICAL METHODS

**Subject Code: BSNMD1-631** **L T P C** **Duration: 45 Hrs.**

**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of numerical methods.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Learn various types of numerical methods to find the roots of nonlinear equations and solution of a system of linear equations.
CO2: Find values for a tabulated function using interpolation techniques.
CO3: Apply different kind of numerical methods to solve integration.
CO4: Apply various numerical methods to solve ordinary differential equation.

### Unit-I (12Hrs.)

Rate of Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

### Unit-II (12Hrs.)

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae with error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

### Unit-III (13 Hrs.)

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

### Unit-IV (8 Hrs.)

Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

**Recommended Books:**

1) B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2) M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3) S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, 1980.
4) J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., 2001.

## COMPLEX ANALYSIS

**Subject Code: BSNMD1-632** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To ensure students can achieve an up-to-date level of understanding of complex analysis.
2. To provide training in scientific and transferable skills through modular lecture courses, research projects, written work,seminars and supervisions.
3. To provide knowledge of latest published findings.

**Course Outcomes:**

CO1: Understand the calculus of complex functions, concept and consequences of analyticity.
CO2: Formulation of analytic function and their application.
CO3: Evaluation of contour integrals directly by use of Cauchy theorem and Cauchy's integral formula.
CO4: Represent complex function as Taylor, Power and Laurent series.

### Unit-I(11Hrs.)

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

### Unit-II(12Hrs.)

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

### Unit-III (10Hrs.)

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula.

### Unit-IV (12Hrs.)

Liouville's theorem and the fundamental theorem of algebra, Convergence of sequences and series, Taylor series and its examples, Laurent series and its examples, absolute and uniform convergence of power series.

**RecommendedBooks:**

1) James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
2) 2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
3) E.T. Capson,, An Introduction to the Theory of functions of a complex Variable, Oxford university press, 1995.
4) R. Churchill, J.W. Brown, 'Complex Variables and Applications', 6th Edn., New York,

McGraw-Hill, 1996.

5) A.R. Shastri, ‘An Introduction to Complex Analysis’, Macmillan India Ltd., 2003.
6) S. Ponnusamy, Foundation of Complex Analysis, Narosa Book Distributors, 2011.

# Maharaja Ranjit Singh Punjab Technical University
## Bathinda-151001

## FACULTY OF SCIENCES

# SYLLABUS

## FOR

## B.SC. (NON-MEDICAL)

## 2022 BATCH ONWARDS

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**(ii) Subject to change in the syllabi at any time.**

**Please visit the University website time to time.**

# STUDY SCHEME

| 1st Semester | | Course Type | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Sub. Code | Subject | | L | T | P | Int. | Ext. | Total | |
| BHSMC0-042 | English | AECC-I | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| BSNMS1-102 | Mechanics | CC-I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-103 | Inorganic Chemistry-I | CC-II A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-104 | Organic Chemistry-I | CC-II B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-105 | Differential Calculus-I | CC-III A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-106 | Differential Calculus-II | CC-III B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-107 | Mechanics Lab | CC-I Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMS1-108 | Chemistry Lab- I | CC-I Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | | **18** | **0** | **8** | **360** | **440** | **800** | **22** |

**Type of Courses:** Ability Enhancement Compulsory Course (AECC), Core Course (CC), Skill Enhancement Course (SEC), Discipline Specific Elective (DSE)

| 2nd Semester | | Course Type | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Sub. Code | Subject | | L | T | P | Int. | Ext | Total | |
| BMNCC0-041 | Drug abuse: problem, management and prevention | AECC-II | 2 | 0 | 0 | 100 | 00 | 100 | 0 |
| BSNMS1-202 | Electricity, Magnetism and EMT | CC-IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-203 | Physical Chemistry-I | CC-V A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-204 | Organic Chemistry-II | CC-V B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-205 | Differential Equations-I | CC-VI A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-206 | Differential Equations-II | CC-VI B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-207 | Electricity, Magnetism and EMT Lab | CC-IV Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMS1-208 | Chemistry Lab-II | CC-V Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | | **18** | **0** | **08** | **420** | **380** | **800** | **20** |

| 3rd Semester | | Course Type | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| **Sub. Code** | **Subject** | | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BSNMS1-301 | Thermal Physics and Statistical Mechanics | CC-VII | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-302 | Thermal Physics and Statistical Mechanics Lab | CC-VII Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMS1-303 | Inorganic Chemistry-II | CC-VIII A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-304 | Physical Chemistry-II | CC-VIII B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-305 | Chemistry Lab III | CC-VIII Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMS1-306 | Real Analysis-I | CC-IX A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-307 | Real Analysis-II | CC-IX B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-308 | Computational Physics Skills | SEC-I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | | **16** | **0** | **12** | **380** | **420** | **800** | **22** |

| 4th Semester | | Course Type | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| **Sub. Code** | **Subject** | | **L** | **T** | **P** | **Int.** | **Ext** | **Total** | |
| BHSMC0-041 | Environmental Science | AECC-III | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-401 | Waves and Optics | CC-X | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMS1-402 | Waves and Optics Lab | CC-X Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMS1-403 | Organic Chemistry-III | CC-XI A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-404 | Physical Chemistry-III | CC-XI B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-405 | Chemistry Lab-IV | CC-XI Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMS1-406 | Algebra-I | CC-XII A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-407 | Algebra-II | CC-XII B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-408 | Basic Analytical Chemistry | SEC-II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | | **19** | **0** | **12** | **420** | **480** | **900** | **25** |

| 5th Semester | | Course Type | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Sub. Code | Subject | | L | T | P | Int | Ext | Total | |
| BSNMD1-511 | Digital Analog and Instrumentation | DSE-I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMD1-521 | Chemistry of Main group elements | DSE-II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMD1-531 | Matrices | DSE-III A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMD1-532 | Linear Algebra | DSE-III B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMD1-512 | Digital Analog and Instrumentation Lab | DSE-I Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMD1-522 | Chemistry of Main group elements Lab | DSE-II Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMS1-533 | Computer Programming Lab | SEC-III | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | | **14** | **0** | **12** | **340** | **360** | **700** | **20** |

| 6th Semester | | Course Type | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Subject Code | Subject | | L | T | P | Int. | Ext | Total | |
| BSNMD1-611 | Elements of Modern Physics | DSE-IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMD1-612 | Elements of Modern Physics Lab | DSE-IV Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMD1-621 | Comprehensive Chemistry | DSE-V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BSNMD1-622 | Comprehensive Chemistry Lab | DSE-V Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BSNMD1-631 | Numerical Methods | DSE-VI A | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMD1-632 | Complex Analysis | DSE-VI B | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BSNMS1-633 | Numerical Analysis Lab | SEC-IV | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | | **14** | **0** | **12** | **340** | **360** | **700** | **20** |

**Distribution of Credits in various type of Courses:**

| Course Type | Type of Courses in the Programme | | | | Total Credits in Semester |
|---|---|---|---|---|---|
| | AECC | CC | SEC | DSE | |
| Semester-I | 2 | 20 | 0 | 0 | **22** |
| Semester-II | 0 | 20 | 0 | 0 | **20** |
| Semester-III | 0 | 20 | 2 | 0 | **22** |
| Semester-IV | 3 | 20 | 2 | 0 | **25** |
| Semester-V | 0 | 0 | 2 | 18 | **20** |
| Semester-VI | 0 | 0 | 2 | 18 | **20** |
| **Total Credits in Courses:** | **5** | **80** | **8** | **36** | **129** |

**Type of Courses:** Ability Enhancement Compulsory Course (AECC), Core Course (CC), Skill Enhancement Course (SEC), Discipline Specific Elective (DSE)

# SEMESTER FIRST

## ENGLISH

**Subject Code: BHSMC0-042** **L T P C** **Duration:30 Hrs.**
**2 0 0 2**

### UNIT-I (8 Hours)

**Communication Skills**: Introduction, Definition, the Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context

**Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

### UNIT-II (7 Hours)

**Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.

**Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

### UNIT-III (7 Hours)

**Communication Styles:** Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.

**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

### UNIT-IV (8 Hours)

**Interview Skills:** Purpose of an interview, Do's and Don'ts of an interview

**Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

**Group Discussion:** Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

**Recommended Books:**

1. Ruther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education, 2011.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press, 2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson, 2013.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life, 2011.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquette for Success', 5th Edition, Pearson, 2013.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1 st Edition, Universe of Learning LTD,2010.
7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI, 2011.
8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press, 2011.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., 2011. 10. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw Hill Education, 2011.
10. John A., 'Effective Communication', 4th Edition, Pan MacMillan, 2009.
11. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill,1999

## MECHANICS

**Subject Code: BSNMS1-102** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Outcome (CO):** After the completion of the course, student will be able to:
CO1: Understand the concepts of vector calculus and basic laws of motion
CO2: Gain the knowledge about gravitational motion, and global positioning system
CO3: Understand the concepts of harmonic oscillations.
CO4: Learn the concept of theory of Relativity.

### UNIT-I (15 Hrs)

Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. Momentum and Energy: Conservation of momentum. Work and energy.
Conservation of energy. Motion of rockets. Rotational Motion: Angular velocity and angular momentum. Torque, Conservation of angular momentum.

### UNIT-II (15Hrs)

**Gravitation:** Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

### UNIT-III (15Hrs)

**Oscillations:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations. Elasticity: Hooke's law, Stress- strain diagram, Elastic moduli-Relation between elastic constants, Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants, Work done in stretching and work done in twisting a wire, Twisting couple on a cylinder, Determination of Rigidity modulus by static torsion, Torsional pendulum, Determination of Rigidity modulus and moment of inertia, q, η and σ by Searles method.

### UNIT-IV (15 Hrs)

**Special Theory of Relativity:** Concept of Inertial and non-inertial frames, Concept of ether, Constancy of speed of light, Michelson-Morley Experiment, Galilean transformation, Postulates of Special Theory of Relativity, Lorentz transformation, Length contraction. Time dilation, Relativistic addition of velocities.

**Recommended Books:**

1.University Physics. FW Sears, MW Zemansky and HD Young13/e, 1986. Addison Wesley
2.Mechanics Berkeley Physics course, volume.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
3.Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley.
4.Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press.
5.University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

## INORGANIC CHEMISTRY-I

**Subject Code: BSNMS1-103** | **L T P C 3 0 0 3** | **Duration: 45Hrs.**

**Course Objectives**

1. To familiarize with atomic structure, quantum numbers and shapes of orbitals
2. To understand periodic table and periodic properties of elements
3. To understand the concept of crystal structure of molecules
4. To understand the concept of various bonding theories

**Course Outcomes:** The completion of this course will make student to acquire the knowledge of:

CO1: Wave mechanics, atomic theories and shapes of orbitals
CO2: Periodic table and various periodic properties
CO3: Ionic bond and crystal structure of molecules
CO4: Covalent bond, metallic bond and various weak chemical forces

**Unit-I (8 Hrs.)**

**Atomic Structure:**
de-Broglie equation, Heisenberg's Uncertainty Principle and its significance. Schrödinger's wave equation and its derivation, significance of $\psi$ and $\psi^2$. Quantum numbers. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions and distribution curves. Shapes of s, p, d and f orbitals.
Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitations.

**Unit-II (7 Hrs.)**

**Chemical Periodicity:**
Effective nuclear charge, shielding or screening effect (Slater rules), variation of effective nuclear charge in periodic table.
Atomic and ionic radii, Ionization enthalpy, Electron gain enthalpy and their trend in groups and periods.
Electronegativity and various scales. Variation of electronegativity with bond order, partial charge, hybridization, group electro negativity.

**Unit-III (15 Hrs.)**

**Chemical Bonding-I:**
**Ionic bond:** General characteristics of ionic compounds, size effects, radius ratio rule and its limitations. Efficiency of packing, Hexagonal close packing, Cubic close packing. Structures of different crystal lattices: Sodium chloride, Cesium chloride, Wurtzite, Zinc blende, Fluorite, Rutile, Cristobalite, Nickel arsenide, Pervoskite, Rhenium oxide, Calcium carbide, The calcite and aragonite structures.
Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

**Unit-IV (15 Hrs.)**

**Chemical Bonding-II:**

**Covalent bond:** Lewis structure, Valence Bond theory, VSEPR theory (Prediction of structures and variation of bond angles on the basis of VSEPR theory, Shortcomings of VSEPR theory), Hybridization, Molecular orbital theory (LCAO method). Molecular orbital diagrams of diatomic and simple polyatomic molecules ($Be_2$, $N_2$, $O_2$, $F_2$, LiH, NO, CO, HCl, $NO_2$, $BeH_2$, $NO_2^-$), Formal charge, Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds (Bond moment, dipole moment, Percentage ionic character)

**Metallic Bond:** Valence bond and band theories. Semiconductors and insulators, defects in solids. **Weak Interactions:** van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interaction, Hydrogen bonding.

**Recommended Books:**

Latest edition of:

1. D.F.C. Shriver, P.W. Atkins and C.H. Langford, 'Inorganic Chemistry', ELBS Oxford.
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, 'Inorganic Chemistry', Pearson Education, Singapore.
3. J.D. Lee, 'Concise Inorganic Chemistry', ELBS, Oxford.

## ORGANIC CHEMISTRY-I

**Subject Code: BSNMS1-104** **L T P C** **Duration: 45Hrs.**
**3 0 0 3**

**Course Objectives:**
1. To familiarize with the concepts of basics of organic chemistry
2. To understand the concept of mechanisms of organic reactions
3. To familiarize with the chemistry of alkanes and cycloalkanes
4. To understand chemistry of alkenes and alkynes
5. To know the chemistry behind aromatic hydrocarbons

**Course outcomes:** After the completion of course students will acquire the knowledge of:
CO1: Concepts of basics of structure and bonding
CO2: Mechanisms of organic reactions
CO3: Chemistry of aliphatic hydrocarbons
CO4: Chemistry behind aromatic hydrocarbons

**Unit-I (15 Hrs.)**

**Structure and Bonding:**
Hybridization, bond lengths, bond angles, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding.

**Mechanism of Organic Reactions:**
Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents- electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates (carbocations, carbanions, free radicals, carbenes, arynes and nitrenes). Assigning formal charges on intermediates and other ionic species.
Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetic and stereochemical studies).

**Unit-II (10 Hrs.)**

**Alkanes and Cycloalkanes:**
Introduction, IUPAC nomenclature, Isomerism and classification of carbon atoms of alkanes. Sources, methods of formation (with special reference to Wurtz reaction, Kolbe reaction, Corey- House reaction and decarboxylation of carboxylic acids). Physical properties and chemical reactions of alkanes.
Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity. Cycloalkanes - nomenclature, methods of formation, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring; banana bonds.

**Unit-III (14 Hrs.)**

**Alkenes, Cycloalkenes, Dienes and Alkynes:**

*Alkenes* Nomenclature, methods of synthesis (mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination), physical properties and relative stabilities of alkenes. Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$, Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes. Industrial applications of ethylene and propene.

*Cycloalkenes* Methods of formation, conformation and Chemical reactions of cycloalkenes.

*Dienes* Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions – 1, 2 and 1,4 additions, Diels-Alder reaction.

*Alkynes* Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroboration oxidation, metal-ammonia reductions, oxidation and polymerization.

**Unit-IV (6 Hrs.)**

**Aromatic hydrocarbons:**

*Preparation* (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

*Reactions*: (Case benzene): Electrophilic substitution: nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

**Recommended Books:**

Latest edition of:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', JohnWiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

## DIFFERENTIAL CALCULUS-I

**Subject Code: BSNMS1-105** | **L T P C 3 0 0 3** | **Duration: 45 Hrs.**

**Course Outcomes:**

CO1: Understand the concept of Continuity and Differentiability.
CO2: Extend the knowledge to the different type of series, Roll's Theorem and Lagrange Mean Value Theorem
CO3: Develop the skill to sketch the curves in a plane using its mathematical properties in the different coordinate systems of reference.
CO4: Understand the concept of Partial Differential Equation.

**Unit-I (12Hrs.)**

Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

**Unit-II (11Hrs.)**

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of $sin\ x$, $cos\ x$, $ex$ , $\log(1+x)$, $(1+x)^m$, Maxima and Minima, Indeterminate forms.

**Unit-III (14 Hrs.)**

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

**Unit-IV (8 Hrs.)**

Partial differentiation - Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative,
Differentiation of implicit functions and composite functions, Jacobians and its properties.

**Recommended Books:**

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

## DIFFERENTIAL CALCULUS-II

| Subject Code: BSNMS1-106 | L T P C<br>3 0 0 3 | Duration: 45 Hrs. |
|---|---|---|

**Course Outcomes:**

CO1: Apply the knowledge of advanced concepts of calculus in order to study theoretical development of different mathematical techniques and their applications.
CO2: Develop the knowledge of computing arc length, area and volume by using integration.
CO3: Understand the concept of integration and different kind of functions.
CO4: Expand the knowledge of multiple integrals and vector surface integrals.

### Unit-I (12Hrs.)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, Working rule to find the extreme values of a function $z = f(x, y)$, Lagrange's method of undetermined multipliers.

### Unit-II (10Hrs.)

Arc formula for the Cartesian equation $y = f(x)$, other expressions for lengths of arcs, Areas under curves, Area formulas for parametric, Polar equation, Area of the closed curve, Volume and surfaces of revolution of curves.

### Unit-III (12Hrs.)

Integration by partial fractions, Integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, Trigonometric, Exponential and Logarithmic function and of their combinations.

### Unit-IV(11Hrs.)

Double integrals (Cartesian), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: Areas and volumes, Centre of mass and gravity, Triple integrals (Cartesian), Simple applications involving cubes, Sphere and rectangular parallelepipeds.

**Recommended Books:**

1. G. B. Thomas, M. D. Weir, J. Hass: Thomas' Calculus (Twelfth Edition), Pearson Education.
2. Gorakh Prasad: Integral Calculus, Fourteenth Edition, Reprint 2007, Pothishala Private Limited, Allahabad.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, Prentice Hall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

## MECHANICS LAB

**Subject Code: BSNMS1-107** | **L T P C 0 0 4 2** | **Duration: 60Hrs.**

**Course Outcomes (COs):** After the completion of the course, Student will be able to

CO1: Use basic measurements tools like Vernier caliper, screw gauge etc.
CO2: Find the Moment of Inertia of a Flywheel.
CO3: Determine the Modulus of elasticity
CO4: Learn about motion of Bar Pendulum and Kater's Pendulum.

**List of Experiments:**

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To determine g and velocity for a freely falling body using Digital Timing Technique.
10. To study the Motion of a spring and calculate (a) Spring Constant (b) Value of g

**Recommended Books:**

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

## CHEMISTRY LAB- I

**Subject Code: BSNMS1-108** **L T P C** **Duration:60Hrs.**
**0 0 4 2**

**Course Objectives:**
1. To develop basic understanding of various lab practices including safety measures.
2. To understand qualitative semi micro analysis of mixtures.
3. To analyze unknown functional group in organic molecules.
4. To understand various chromatographic techniques used for separation of dyes.

**Course Outcomes:** The students will acquire knowledge of
CO1: Different safety measures in lab
CO2: Analysis of mixture for cations and anions
CO3: Analysis of unknown functional group in organic molecules
CO4: chromatographic techniques used for separation of dyes

**Inorganic Chemistry:**
Semi Micro analysis. Cation analysis, Separation and identification of ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with no interference.

**Organic Chemistry Laboratory Techniques:**
Detection of various functional groups in organic compounds (containing upto two extra elements)

**Separation of mixtures by Chromatography:** Measure the Rf value in each case (combination of two compounds to be given)
Identify and separate the components of a given mixture of two dyes (red and blue ink, fluorescent and methylene blue) by paper chromatography

**Recommended Books:**
Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry', University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis',Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.

# SEMESTER SECOND

## DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

**Subject Code: BMNCC0-041** **L T P C** **Duration: 30Hrs.**
**2 0 0 0**

### UNIT-I (6 Hours)

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

### UNIT-II (8 Hours)

Consequences of Drug Abuse: Individual: Education, Employment, Income. Family: Violence. Society: Crime. Nation: Law and Order problem.

### UNIT-III (8 Hours)

Prevention of Drug Abuse: Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny. School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

### UNIT-IV (8 Hours)

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environmental intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

**Recommended Books:**

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, 1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, 1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, 1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications,Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 &2004.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,2013.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, 2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, 2000.
12. S.Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press, 2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, 2017. 1
14. 'World Drug Report', United Nations Office of Drug and Crime, 2016.
15. 'World Drug Report', United Nations Office of Drug and Crime,2017

## ELECTRICITY, MAGNETISM AND EMT

**Subject Code: BSNMS1-202** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Understand the concepts of vector Algebra.
CO2: Understand the basic concepts of electrostatics
CO3: Gain the knowledge about the basic concepts of magneto-statics
CO4: Learn the concept of Maxwell equation and electromagnetic waves.

### UNIT-I (13Hrs)

**Vector Analysis:** Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss- divergence theorem and Stoke's theorem of vectors (statement only).

### UNIT-II (16Hrs)

**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

### UNIT-III (16Hrs)

**Magnetism:** Magnetostatics: Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para- and ferro-magnetic materials. Electromagnetic Induction: Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field.

### UNIT-IV (15 Hrs)

**Maxwell`s equations and Electromagnetic wave propagation:** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic dielectric medium, transverse nature of EM waves, polarization.

**Recommended Books:**

1. Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education.
2. Mechanics Berkeley Physics course, volume.1: Charles Kittel, et. Al. 2007, Tata McGraw Hill.
3. Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
4. Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
5. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
6. D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

## PHYSICAL CHEMISTRY-I

**Subject Code: BSNMS1-203** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To develop basic understanding of different states of matter.
2. To understand concept of chemical kinetics.
3. To understand underlying processes associated with various states of matter.
4. To familiarize with relevance of matter properties for realistic applications.

**Course Outcomes:** Students will be able to acquire the knowledge of

CO1: Basic understanding of different states of matter
CO2: Rate of chemical reactions and related theories.
CO3: Underlying processes associated with various states of matter
CO4: Relevance of matter properties for realistic applications

### Unit-I (15 Hrs.)

**Gaseous State:**

Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter, Liquefaction of gases (based on Joule-Thomson effect).

### Unit-II (8 Hrs.)

**Liquid State:**

Intermolecular forces, structure of liquids (a qualitative description) Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid, Classification, structure of nematic and cholesteric phases. Thermography and seven segment cell.

### Unit-III (12Hrs.)

**Solid state:**

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals.

### Unit-IV (10 Hrs.)

**Basics of Chemical Kinetics:**

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

**Recommended Books:**

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs: Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, 2nd edition, Pubs: McGraw-Hall Book company.

## ORGANIC CHEMISTRY-II

**Subject Code: BSNMS1-204** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand the concepts of stereochemistry of organic compounds
2. To understand concepts behind aromaticity
3. To understand the concept of mechanisms of organic reactions
4. To familiarize with the aromatic electrophilic substitution reactions
5. To familiarize with the chemistry of alkyl and aryl halides

**Course Outcomes:** After the completion of course students will acquire the knowledge of

CO1: Concepts of stereochemistry of organic compounds
CO2: Concepts behind aromaticity
CO3: Mechanisms of organic reactions
CO4: Aromatic electrophilic substitution reactions
CO5: Chemistry of alkyl and aryl halides

### Unit-I (15Hrs.)

**Stereochemistry of Organic Compounds:**

Concept of isomerism. Types of isomerism Optical isomerisin-elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & Land R & S systems of nomenclature. Geometric isomerism- determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

### Unit-II (7 Hrs.)

**Arenes and Aromaticity:**

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure, MO diagram, the Huckel rule, aromatic ions.

### Unit-III (11Hrs.)

**Aromatic Electrophilic Substitution:**

Aromatic electrophilic substitution-general pattern of the mechanism, role of σ and π complexes. Mechanism or nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reaction of alkylbenzenes alkynylbenzenes.

**Unit-IV (12 Hrs.)**

**Alkyl and aryl halides:**

Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, $SN^2$ and $SN^1$ reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions. The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

**Recommended Books:**

Latest edition of:

1. Morrison and Boyd, 'Organic Chemistry', Prentice Hall.
2. Solomons, 'Fundamentals of Organic Chemistry', John Wiley.
3. F.A. Carey, 'Organic Chemistry', McGraw Hill,Inc.
4. L.G. Wade Jr., 'Organic Chemistry', Prentice Hall.
5. S.M. Mukherji, S.P. Singh and R.P. Kapoor, 'Organic Chemistry', Vol.-I, II & III, Wiley Eastern Ltd. (New Age International).

## DIFFERENTIAL EQUATIONS-I

| Subject Code: BSNMS1-205 | L T P C<br>3 0 0 3 | Duration: 45 Hrs. |
|---|---|---|

**Course Outcomes:**

CO1: Understand the concept of ordinary differential equation, its formation, order and degree.
CO2: Apply various methods to solve first order non-linear differential equation.
CO3: Solve linear differential equations of higher order by using various methods.
CO4: Apply differential equations to significant applied and theoretical problems.

### Unit-I (12Hrs.)

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for $x, y, p$. Methods for solving higher-order differential equations, Basic theory of linear differential equations, Wronskian and its properties, Solving a differential equation by reducing its order.

### Unit-II (11Hrs.)

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

### Unit-III(12Hrs.)

General solution of homogeneous equation of second order, principle of superposition for a homogeneous equation, Wronskian, its properties and applications, Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters, solutions of simultaneous equations.

### Unit-IV (10Hrs.)

Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

**Recommended Books:**

1. Shepley L. Ross, Differential Equations, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill, International Edition, 1967.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover, 1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

## DIFFERENTIAL EQUATIONS-II

**Subject Code: BSNMS1-206** | **L T P C** **3 0 0 3** | **Duration: 45 Hrs.**

**Course Outcomes:**

CO1: Understand the concept of first order and linear partial differential equation.
CO2: Apply various power series methods to find series solution of differential equation.
CO3: Recognize the major classification of PDEs and the qualitative differences between the classes of equations.
CO4: Understand the formation and solution of some significant PDEs like wave and heat equation.

**Unit-I (10Hrs.)**

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

**Unit-II (13Hrs.)**

Power Series solution about an ordinary point, solutions about singular points, The method of Frobenius, Bessel equation and Legendre equation, its properties and their recurrence relations, Hyper geometric equation, Bessel function and their recurrence relations, Strum liouville boundary values.

**Unit-III (12Hrs.)**

Separation of variables in a PDE, Laplace equation: mean value property, Weak and strong maximum principle, Green's function, Poisson's formula, Dirichlet's principle, Existence of solution using Perron's method (without proof).

**Unit-IV (10Hrs.)**

Heat equation: Initial value problem, Fundamental solution, Weak and strong maximum principle and uniqueness results, Wave equation: uniqueness, D'Alembert's method, method of spherical means and Duhamel's principle.

**Recommended Books:**

1. W.E.Boyce and P.C.Diprima: Elementary Differential Equations and Boundary value problems, John Wiley, 1986.
2. R. K. Jain and S.R.K.Iyengar: Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House, 2003.
3. E.L.Ince: Theory of Ordinary Differential Equations. Dover, 1956.
4. M. Braun, 'Differential Equations and Their Applications', 4th Edn., Springer, 2011.
5. F. Braue and J.A. Nohel, 'The Qualitative Theory of Ordinary Differential Equations', Dover Publications, 1989.
6. E.A. Coddington, 'Ordinary Differential Equations', Tata McGraw Hill, 2002.

## ELECTRICITY, MAGNETISM AND EMT LAB

**Subject Code: BSNMS1-207** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Take measurements by using Multimeter.
CO2: Learn the measurement of charge, current and resistance using Method.
CO3: Determine resonance in LCR circuit.
CO4: Verify the Thevenin, Norton theorem and Maximum Power Transfer Theorem

**List of Experiments:**

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. Ballistic Galvanometer: (i) Measurement of charge and current sensitivity (ii) Measurement of CDR (iii) Determine a high resistance by Leakage Method (iv) To determine Self Inductance of a Coil by Rayleigh's Method.
3. To compare capacitances using De' Sauty's bridge.
4. Measurement of field strength B and its variation in a Solenoid (Determined B/dx).
5. To study the Characteristics of a Series RC circuit.
6. To study the a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor
7. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor.
8. To determine a Low Resistance by Carey Foster's Bridge.
9. To verify the Thevenin and Norton theorem
10. To verify the Superposition, and Maximum Power Transfer theorem.

**Recommended Books:**

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.

## CHEMISTRY LAB-II

**Subject Code: BSNMS1-208** | **L T P C 0 0 4 2** | **Duration: 60 Hrs.**

**Course Objectives:**

1. To understand the concepts behind crystallization
2. To understand the determination of melting points and effect of impurities on m.p.
3. To understand various purification techniques used for purification.
4. To make students familiar with the determination of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

**Course Outcomes:** After completion of course students will acquire the knowledge and practical hands on training of

CO1: Purification of organic compound using various solvent combinations
CO2: Determination of melting and boiling points of various organic compound
CO3: Chromatographic techniques
CO4: Calculation of physical properties i.e; Viscosity, surface tension, rate of reaction and enthalpy of reaction.

**Laboratory Techniques:**

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:
   a. Water
   b. Alcohol
   c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (boiling point lower than and more than 100 °C by distillation and capillary method)

**Physical Chemistry:** Experimental Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To determine the viscosity and surface tension of $C_2H_5OH$ and glycerine solution in water
4. Calculation of the enthalpy of ionization of ethanoic acid.

**Recommended Books:**

Latest edition of:

1. H. Denny, W. Roesky, ‘Chemical Curiosites’, WILEY VCH.
2. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.
3. G. Svehla, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education.

# SEMESTER THIRD

## THERMAL PHYSICS AND STATISTICAL MECHANICS

**Subject Code: BSNMS1- 301** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Understand the concepts of laws of thermodynamics, entropy.
CO2: Learn about the concepts of Maxwell's thermodynamic relations.
CO3: Gain knowledge of Laws associated with thermal radiations and kinetic theory of gases.
CO4: Understand the concepts of thermodynamic probability, phase space

### UNIT-I (16 Hrs)

**Laws of Thermodynamics:** Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

### UNIT-II (16 Hrs)

**Thermodynamic Potential and Theory of Radiation:** Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

### UNIT-III (14 Hrs)

**Kinetic Theory of Gases:** Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

### UNIT-IV (14 Hrs)

**Statistical Mechanics**: Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law, distribution of velocity, Quantum statistics, Fermi-Dirac distribution law, electron gas, Bose-Einstein distribution law, photon gas, comparison of three statistics.

**Recommended Books:**

1. Statistical Physics, thermodynamics and kinetic theory by V.S.Bhatia
2. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill.
3. A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press.
4. Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications.
5. Heat and Thermodynamics, M.W.Zemasky and R. Dittman, 1981, McGraw Hill 14
6. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
8. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. chand Publications.

## THERMAL PHYSICS AND STATISTICAL MECHANICS LAB

**Subject Code: BSNMS1- 302** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Perform Mechanical Equivalent of Heat and thermal conductivity of related experiments.
CO2: Learn about the variation of thermo emf across two junctions of a thermocouple with temperature.
CO3: Record and analyze the cooling temperature using a thermocouple and suitable data acquisition system.
CO4: Calibrate Resistance Temperature Device (RTD

**List of Experiments:**

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. Measurement of Planck's constant using black body radiation.
3. To determine Stefan's Constant.
4. To determine the coefficient of thermal conductivity of copper by Searle's Apparatus.
5. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
6. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method.
7. To determine the temperature co-efficient of resistance by Platinum resistance thermometer.
8. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
9. To record and analyze the cooling temperature of an hot object as a function of time using a thermocouple and suitable data acquisition system.
10. To calibrate Resistance Temperature Device (RTD) using Null Method/Off-Balance Bridge.

**Recommended Books:**

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

## INORGANIC CHEMISTRY-II

**Subject Code: BSNMS1-303** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**
1. To understand chemistry of s block element
2. To familiarize with the concepts of acids and bases
3. To understand the concepts behind chemistry of s & p block elements
4. To understand the chemistry of various transition elements.

**Course Outcomes:** After the completion of course students will acquire the knowledge of:
CO1: Concepts behind acids and bases
CO2: Chemistry of s and p block elements
CO3: Concepts of chemistry of various transition elements

### Unit-I (6 Hrs.)

**s-Block Elements:** Comparative studies, diagonal relationship, salient features of hydrides, solvation and complexation tendencies.

**Acids and Bases:** Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

### Unit-II (12 Hrs.)

**p–Block Elements–I:** Comparative study (including diagonal relationship) of groups 13–17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13–17, hydrides of boron–diborane and higher boranes, Borazine, borohydrides, fullerenes. VBT, VSPER theory, MOT.

### Unit-III (12 Hrs.)

**p–Block Elements-II:** Carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalide ,Silicones and phosphazenes as examples of inorganicpolymers, nature of bonding in triphosphazenes.

### Unit-IV (15 Hrs.)

**Chemistry of Transition Elements:**

Characteristic properties of d–block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry. General characteristics of elements of Second and Third Transition Series, comparative treatment with their 3d analogues in respect of ionic radii, oxidation states, magnetic behaviour. CFT and CFSE for Octahedral/Tetrahedral complexes.

**Recommended Books:**

Latest edition of:

1. Cotton, F.A., Wilkinson, G., Gaus, P.L., Basic Inorganic Chemistry; Pubs: John Wiley and Sons.
2. Lee, J.D., Concise Inorganic Chemistry;Pubs: Chapman & Hall Ltd.
3. Shriver, D.E., Atkins, P.W., Inorganic Chemistry; Pubs: Oxford University Press.
4. Douglas, B., Medaniel, D., Atenander, J., Concepts and Models of Inorganic Chemistry; Pubs: John Wiley and Sons Inc.
5. Porterfeild, W.W., Wesky, A., Inorganic Chemistry; Pubs: Addison-Wesky Publishing Company.
6. Miessler, G.L., Tarr, D.A., Inorganic Chemistry; Pubs: Pearson Education Inc.
7. Jolly, W.L., Modern Inorganic Chemistry; Pubs: Tata McGraw-Hill Publishing Company Limited.
8. Purcell, K.F., Kotz, J.C., Inorganic Chemistry; Pubs: W.B.Saunders Company.
9. Puri, B.R., Sharma, L.R., Kalia, K.K., Principles of Inorganic Chemistry; Pubs: Milestones Publisher.

## PHYSICAL CHEMISTRY-II

**Subject Code: BSNMS1-304** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand energy exchange processes
2. To familiarize with the system of variable compositions.
3. To understand the concepts of thermodynamics.
4. To understand the concept of chemical equilibrium.

**Course Outcomes:** On completion of this course, students will be able to:

CO1: Identify and describe energy exchange processes.
CO2: Manipulate physical parameters to favour a particular process.
CO3: Compare the system properties with variation in composition.
CO4: Identify and analyze uni/multicomponent system.

### Unit-I (14 Hrs.)

**Thermodynamics-I:**

Definition of thermodynamic terms: System, surroundings etc. Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.

***First Law of Thermodynamics:*** Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's law-Joule-Thomson coefficient and inversion temperature, Calculation of w,q,dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

***Thermochemistry:*** Standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy. Kirchhoff's equation.

### Unit-II (15 Hrs.)

**Thermodynamics-II & III:**

***Second Law of Thermodynamics:*** Need for the law, different statements of the law, Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature.

***Concept of Entropy:*** Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

***Third Law of Thermodynamics:*** Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions; Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change, Variation of G and A with P,V and T.

**Unit-III (6 Hrs.)**

**Chemical Equilibrium:**

Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Determination of Kp, Kc, Ka and their relationship, Clausius-Clapeyron equation, applications.

**Unit-IV (10 Hrs.)**

**Introduction to Phase Equilibrium:**

Statement and meaning of the terms-phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system-water, $CO_2$ and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-$H_2O$), $FeCl_3$-$H_2O$) and $CuSO_4$-$H_2O$) system. Freezing mixtures, acetone-dry ice. Non-ideal system-azeotropes-HCl-$H_2O$ and ethanol-water system. Partially miscible liquids Phenol-water, trines-thylamin-water, Nicotine-water System. Lower and upper consulate temperature, Effect of impurity on consolute temperature, immiscible liquids, steam distillation. Nernst distribution law-thermodynamic derivation and applications.

**Recommended Books:**

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry; Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Dogra, S.K., Dogra, S., Physical Chemistry Through Problems; Pubs:Wiley Eastern Limited.
8. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
9. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
10. Metz, C.R., Theory and Problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book company.

## CHEMISTRY LAB III

**Subject Code: BSNMS1-305** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**
1. To understand the concepts behind Estimation of metals.
2. To synthesis and separation if various inorganic compounds

**Course Outcomes:** After completion of course students will gain the knowledge of:
CO1: Obtaining precise results of estimation by titrations
CO2: Preparation separations of organic compounds.

**Quantitative Analysis:**

**i. Volumetric Analysis**
- a) Determination of acetic acid in commercial vinegar using NaOH.
- b) Determination of alkali content-antacid tablet using HCI.
- c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
- d) Estimation of hardness of water by EDTA.
- e) Estimation of ferrous and ferric by dichromate method.
- f) Estimation of copper using sodiumthiosulphate.

**ii. Gravimetric Analysis**

Analysis of Cu as CuSCN and Ni as Ni (dimethylgloxime)

**Organic Chemistry Laboratory Techniques**

**Thin Layer Chromatography**
- a) Determination of $R_f$ values and identification of organic compounds.
- b) Separation of green leaf pigments (spinach leaves may be used).
- c) Preparation and separation of 2, 4. dinitrophenylhydrazones of acetone, 2-butone, 2-Butanone, hexan-2 and 3-one using toluene and light petroleum (40 : 60).
- d) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

**Recommended Books:**
Latest edition of:

1. H. Denny, W. Roesky, ‘Chemical Curiosites’, WILEY VCH.
2. G. Marr and B.W. Rocket,’Practical Inorganic Chemistry’, University Science Books.
3. G. Pass and H. Sutcliffe, ‘Practical Inorganic Chemistry’, Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, ‘Vogel’s Textbook of Quantitative Analysis, Pearson Education.
5. G. Svehla, ‘Vogel’s Textbook of Quantitative Analysis’, Pearson Education6.
6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G.,Textbook of Practical Organic Chemistry, Prentice-Hall.

## REAL ANALYSIS-I

**Subject Code: BSNMS1-306** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Outcomes:**

CO1: Understand the various properties of the real line ℝ.
CO2: Understand the concept of different kinds of sequences, their convergence, squeeze theorem and Cauchy's theorem on limit.
CO3: Apply the various tests for convergence and absolute convergence of an infinite series of real numbers
CO4: Understand the concept of sequence in series function, M-test and power series methods.

### Unit-I (12Hrs.)

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano Weierstrass theorem.

### Unit-II (11Hrs.)

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

### Unit-III (12Hrs.)

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof), Definition and examples of absolute and conditional convergence.

### Unit-IV (10Hrs.)

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, M-test, Statements of the results about uniform convergence and integrability and differentiability of functions, Power series and radius of convergence.

**Recommended Books:**

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003.
5) ROBERT G. Bartle and Donald R. Sherbert, Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.
7) S.C. Malik and Savita Arora, Mathematical Analysis, New Age International Publisher, Reprint 2008.

## REAL ANALYSIS-II

**Subject Code: BSNMS1-307** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Outcomes:**

CO1: Understand properties of Riemann integral and related theorems.
CO2: Illustrate the effect of uniform convergence on the limit function with respect to continuity, differentiability, and integrability.
CO3: Examine the point wise and uniform convergence using various tests
CO4: To understand basic topology of metric spaces.

### Unit-I (11Hrs.)

Definition of Riemann integral, Its examples and properties, Bounded theorem, Riemann integrable functions, Cauchy criterion, The Squeeze theorem, Classes of Riemann integrable functions, Additivity theorem, Fundamental theorem- first and second form, Substitution theorem.

### Unit-II (12Hrs.)

Pointwise and Uniform convergence, Interchange of limit and continuity, Interchange of limit and derivatives, Interchange of limit and integral, Bounded convergence theorem, Dini's theorem, The exponential functions logarithmic and trigonometric functions.

### Unit-III (10Hrs.)

Absolutely and uniformly convergent series of functions defined on a domain, Interchange of integral and summation, Tests for uniform convergence—Cauchy criterion, Weirstrass M-test.

### Unit-IV (12Hrs.)

Metric spaces, Examples of metric spaces, Neighbourhood of a point, Limit point and isolated points of a set, Closed set, Interior point of a set, Open set, Perfect set, Bounded set, Dense set, Union and intersection of open sets, Closure of a set.

**Recommended Books:**

1) T. M. Apostol, Calculus (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2) R.G. Bartle and D. R Sherbert, Introduction to Real Analysis, John Wiley and Sons (Asia) P. Ltd., 2000.
3) E. Fischer, Intermediate Real Analysis, Springer Verlag, 1983.
4) K.A. Ross, Elementary Analysis- The Theory of Calculus Series- Undergraduate Texts in Mathematics, Springer Verlag, 2003. ROBERT G. Bartle and Donald R. Sherbert,
5) Introduction to Real Analysis, 3/e, John Wiley & Sons, Inc. 2000.
6) Walter Rudin, Principles of Mathematical Analysis, 3/e, McGraw-Hill, 1976.

## COMPUTATIONAL PHYSICS SKILLS

**Subject Code: BSNMS1-308** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Learn the Importance of computers in Physics
CO2: Enhance skill in Linux and FORTRAN,
CO3: Understand the concepts of statements
CO4: Gain knowledge about the Computer programing

**Introduction:**

Importance of computers in Physics, paradigm for solving physics problems for solution. Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal.

**Scientific Programming**:

Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic.

**Control Statements:**

Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DOWHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines.

**Visualization:**

Introduction to graphical analysis and its limitations. Introduction to Gnuplot. Importance of visualization of computational and computational data.

**Programming:**

1. To print out all natural even/ odd numbers between given limits.
2. To find maximum, minimum and range of a given set of numbers.
3. Calculating Euler number using exp(x) series evaluated at x=1.
4. To compile a frequency distribution and evaluate mean, standard deviation etc.
5. To evaluate sum of finite series and the area under a curve.
6. To find the product of two matrices

7. To find a set of prime numbers and Fibonacci series.
8. To write program to open a file and generate data for plotting using Gnuplot.
9. Plotting trajectory of a projectile projected horizontally.
10. Plotting trajectory of a projectile projected making an angle with the horizontally.
11. To find the roots of a quadratic equation.
12. Motion of a projectile using simulation and plot the output for visualization.
13. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs for visualization.
14. Motion of particle in a central force field and plot the output for visualization

**Recommended Books:**

1. Introduction to Numerical Analysis, S.S. Sastry, 5th Edn., 2012, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77". V. Rajaraman (Publisher:PHI).
3. Gnuplot in action: understanding data with graphs, Philip K Janert, (Manning 2010)
4. Schaum's Outline of Theory and Problems of Programming with Fortran, S Lipsdutz and A Poe, 1986Mc-Graw Hill Book Co.
5. Computational Physics: An Introduction, R. C. Verma, et al. New Age International Publishers, New Delhi (1999)
6. A first course in Numerical Methods, U.M. Ascher and C. Greif, 2012, PHI Learning

# SEMESTER FOURTH

## ENVIRONMENTAL SCIENCE

**Subject Code: BHSMC0-041** | **L T P C 3 0 0 3** | **Duration: 45 Hrs.**

**Course Objectives:**

1. To familiarize the student with the basic concept of Environmental and Environmental Chemistry.
2. To elaborate the ecosystem and their properties.
3. To understand the concept of Environmental Pollution and its diverse effect of pollution.
4. To understand the concept of sustainable and unsustainable development and its importance.

**Course Outcomes:** On completion of this course, students will be able to:

CO1: Understand the basics of Environment chemistry
CO2: Analyze the general concept of ecosystem and their components.
CO3: Comprehend the applicability of social issues and Environment.
CO4: Recognize the Environment Pollution and control measures of urban and industrial wastes.

### Unit-I (08 Hours)

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

### Unit-II (15 Hours)

Natural resources and associated problems: a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

### Unit-III (12 Hours)

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

### Unit- IV (10 Hours)

Environmental Pollution: Air pollution; Water pollution; Soil pollution

**Recommended Books:**

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clark R.S., Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment

## WAVES AND OPTICS

**Subject Code: BSNMS1-401** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcome (CO):** After the completion of the course, Student will be able to
CO1: Understand the concepts of harmonic oscillations and wave motion.
CO2: Gain knowledge of simple harmonic motion and its applications.
CO3: Learn about the concepts of Interference.
CO4: Understand the concepts polarization and diffraction.

### UNIT-I (15 Hrs)

**Harmonic oscillators and Wave Motion:**
Superposition of two collinear Harmonic oscillations: Linearity and Superposition Principle. (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats). Superposition of Two Perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves. Spherical waves, Wave intensity

### UNIT-II (15 Hrs)

**Simple Harmonic motion and applications:**
Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria

### UNIT-II (16 Hrs)

**Wave optics and Interference:**
Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer: Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index and Visibility of fringes.

### UNIT-IV (14 Hrs)

**Diffraction and Polarization:**
Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.

**Recommended Books:**
1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics, H.R. Gulati and D.R. Khanna, 1991, R. Chand Publication.
4. University Physics. FW Sears, MW Zemansky and HD Young1986. Addison-Wesley.

## WAVES AND OPTICS LAB

**Subject Code: BSNMS1- 402** | **L T P C** **0 0 4 2** | **Duration: 60 Hrs.**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Learn about the motion of coupled oscillators and Lissajous Figures
CO2: Understand various diffraction phenomenon using prism and biprism
CO3: Determine the Refractive Index, dispersive Power of the Material, and Resolving Power of prism using various methods
CO4: Understand Schuster`s focusing and photo sensor

**List of Experiments:**

1. To investigate the motion of coupled oscillators.
2. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment and to verify $\lambda 2$ – T Law.
3. To study Lissajous Figures.
4. Familiarization with Schuster`s focussing; determination of angle of prism.
5. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
7. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
8. To determine the value of Cauchy Constants of a material of a prism.
9. To determine the Resolving Power of a Prism.
10. To determine wavelength of sodium light using Fresnel Biprism.
11. To determine wavelength of sodium light using Newton's Rings.
12. To determine the wavelength of Laser light using Diffraction of Single Slit.
13. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating.
14. To determine the Resolving Power of a Plane Diffraction Grating.
15. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.

**Recommended Books:**

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 17.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

## ORGANIC CHEMISTRY-III

**Subject Code: BSNMS1-403** | **L T P C 3 0 0 3** | **Duration: 45 Hrs.**

**Course Objectives:**

1. To understand the chemistry of carboxylic acids and their derivatives
2. To understand the mechanisms of organic reactions
3. To understand ethers epoxides and nitrogen based organic compounds
4. To familiarize with the chemistry of organometallic compounds
5. To understand the chemistry behind heterocyclic compounds

**Course Outcomes:** After the completion of course students will acquire the knowledge of:

CO1: Chemistry behind carboxylic acids and their derivatives
CO2: Mechanisms of organic reactions
CO3: Chemistry of heteroatom based organic molecules.
CO4: Chemistry of organometallic compounds

### Unit-I (12 Hrs.)

**Carboxylic Acids:** Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation.

**Carboxylic Acids Derivatives:** Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanisms of esterification and hydrolysis (acidic and basic).

### Unit-II (20 Hrs.)

**Ethers and Epoxides:**

Nomenclature of ethers and methods of their formation, physical properties. Chemical reaction-cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Organic Compounds of Nitrogen: preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes, Mechanisms of nucleophilc substitution in nitroarenes and their reduction in acidic, neutral and alkaline media. Reactivity, Structure and nomenclature of amines, Methods of preparation of amines by Reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction. Physical properties. Stereochemistry of amines. Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Amine salts as phase-transfer catalysts.

**Unit-III (5 Hrs.)**

**Organometallic Compounds:**

Organomagnesium Compounds: The Grignard reagents formation, structure and chemical reactions. Organolithium Compounds: Formation and chemical reactions.

Organozinc and Organo copper Compounds: Nomenclature, structural features, Methods of formation and chemical reactions.

**Unit-IV (8 Hrs.)**

**Heterocyclic Compounds**

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

**Recommended Books:**

Latest edition of:

1. Morrison, R.T., Boyd, R.N., Organic Chemistry;Pubs: Prentice-Hall.
2. Wade Jr., L.G., Singh, M.S., Organic Chemistry; Pubs: Pearson Education.
3. Mukherji, S.M., Singh, S.P., Kapoor, R.P., Organic Chemistry; Pubs: Wiley Eastern Limited, 1985, Vol.I, II, III.
4. Solomons, T.W., Fryhle, C.B., Organic Chemistry; Pubs: Wiley India.
5. Carey, F.A., Organic Chemistry; Pubs: McGraw-Hill.
6. Streitwieser, A., Clayton, Jr., Heathcock, H., Introduction to Organic Chemistry; Pubs: Macmillan Publishing Company.
7. Introduction to Organic Chemistry, Sireitwieser, Heathcock and Kosover, Macmilan.

## PHYSICAL CHEMISTRY-III

**Subject Code: BSNMS1-404** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course objectives:**

1. To understand the redox perspective of various processes.
2. To familiarize with various nuclear and electronic phenomenon.
3. To understand concepts of electrochemistry.
4. To familiarize with basic concept of spectroscopy.

**Course outcomes:** On completion of this course, students will be able to:

CO1: Understand the redox perspective of various processes.
CO2: Understand various nuclear and electronic phenomenon.
CO3: Apply electrochemical concepts and analyse outcomes of different conditions.
CO4: Assign the reasoning for various physical phenomenon.

**Unit-I (12 Hrs.)**

**Electrochemistry-I:**

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductivity measurements: determination of degree of dissociation, determination of Ka of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

**Unit-II (12 Hrs.)**

**Electrochemistry – II:**

Types of reversible electrodes-gas metal ion, metal ion, metal insoluble salt-anion and redox electrodes. Electrode reactions. Nernst equation, derivation of cell E.M.F. and Single electrode potential, standard hydrogen electrode, reference electrodes, standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells-reversible and irreverisible cells, conventional representation of electrochemical cells.
EMF of a cell and its measurements. Computation of cell. EMF, Calculation of thermodynamic quantities of cell reactions ($\Delta G$ $\Delta H$ and K), polarization, over potential and hydrogen overvoltage.
Concentration cells with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.
Definition of pH and pKa, determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiometric methods. Buffers-mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts. Corrosion-types, theories and methods of combating it.

**Unit III (10 Hrs.)**

**Nuclear Chemistry:**

Introduction: Radioactivity, Nuclear Structure, Size of Nucleus, Mass Defects and Binding Energy, Nuclear Stability, Nuclear Forces, Nuclear Spin and Moments of Nuclei, Nuclear Models, Nuclear Decay Processes, The Laws of Radioactive Decay, Soddy-Fajans Group Displacement Law, Rate of Nuclear Decay and Half Life Time (Kinetics of Radioactive Decay), Induced Nuclear Reactions, Types of Nuclear Processes, High Energy Nuclear Reactions, Nuclear Reaction Cross-Section, Artificial radioactivity, Detection and Measurement of Radioactivity, Nuclear Fission, Nuclear Fusion, Applications of Radioactivity.

**Unit-IV (11 Hrs.)**

**Spectroscopy:** Introduction, Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

**Electronic Spectrum:** Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle.

Qualitative description of s, p, and n M.O., their energy levels and the respective transitions

**Recommended Books:**

Latest edition of:

1. Atkins, P., Paula, J.de, Atkins Physical Chemistry; Pubs: Oxford University Press.
2. Puri, B.R., Sharma, L.R., Pathania, M.S., Principles of Physical Chemistry; Pubs: Vishal Publishing Co.
3. Barrow, G.M., Physical Chemistry; Pubs: McGraw Hill Companies Inc.
4. Rao, C.N.R., University General Chemistry; Pubs: Macmillan of India.
5. Berry, R.S., Rice, S.A., Ross, J., Physical Chemistry, Pubs: Oxford University Press.
6. Albert, R.A., Silbey, R.J., Physical Chemistry; Pubs: John Wiley & Sons Inc.
7. Levine, I.N., Physical Chemistry; Pubs: Tata McGraw Hill Publishing Co. Ltd.
8. Moore, W. J., Basic Physical Chemistry; Pubs: Prentice Hall of India Pvt. Ltd.
9. Metz, C.R., Theory and problems of Physical Chemistry; Schaum's outline series, Pubs: McGraw-Hall Book Company.
10. Friedlander, Kennedy, Miller and Macias Nuclear and Radio Chemistry: John Wiley & Sons Inc.
11. Choppin, Lijenzin, Rydberg and Ekberg Radio Chemistry and Nuclear Chemistry Pubs Elsevier.

## CHEMISTRY LAB-IV

**Subject Code: BSNMS1-405** | **L T P C 0 0 4 2** | **Duration: 60 Hrs.**

**Course objectives:**

1. To understand the principle and application of conductometric titrations.
2. To understand various physical processes and their principle.
3. To understand synthesis and analysis of inorganic complexes

**Course outcomes:** On completion of this course, students will be able to:

CO1: Understand the principle and application of conductometric titrations.
CO2: Understand various physical phenomenon and their principle.
CO3: Synthesis and analysis of inorganic complexes.

**I. Synthesis and Analysis**

a) Preparation of Sodium trioxalatoferrate (III)
b) Preparation of Ni-DMG Complex
c) Preparation of Copper tetrammine complex
d) Preparation of cis-bisoxalatodiaquachromate (III) ion

**II. Physical Chemistry**

***a) Conductometric Titrations:***

i. Determine the end point of the following titrations by the conductometric methods.
   - Strong acid-Strong base
   - Strong acid-Weak base
   - Weak acid-Strong base
   - Weak acid-Weak base

ii. Determine the composition of a mixture of acetic acid and the hydrochloric acid by conductometric titration.

***b) Weight Determination***

i. Molecular Weight Determination of acetanilide, napthalane, using camphor as solvent (Rast's methods).
ii. To determine the molecular weight of a polymer by viscosity measurements.

***c) Adsorption***

i. To study the adsorption of acetic acid oxalic/acid from aqueous solutions by charcoal.

d) Phase Equilibria to determine the distribution coefficient of iodine between $CCl_4$ and water.

***e) Refractometry***

i. Determination of refractive index of a liquid by Abbe refractometer, and hence the specific and molar refraction.
ii. To determine the composition of unknown mixture of two liquids by refractive index measurements.

f) Determining the half-life of radio isotope using GEIGER-MULLER COUNTER.

**Recommended Books:**
Latest edition of:

1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH.
2. G. Marr and B.W. Rocket,'Practical Inorganic Chemistry, University Science Books.
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry, Chapman and Hall, London.
4. J. Mendham, R.C. Denney, J.D. Barnes, M.Thomas, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education.

## ALGEBRA-I

**Subject Code: BSNMS1-406** | **L T P C 3 0 0 3** | **Duration: 45 Hrs.**

**Course Outcomes:**

CO1: Understand the concept of groups and its properties.
CO2: Understand the concept of permutation group and groups of symmetries.
CO3: Analyze & demonstrate different types of algebraic structures such as subgroups, cosets and their properties.
CO4: Understand the concept of normal subgroup and Lagrange’s theorem.

### Unit-I (11Hrs.)

Definition and examples of groups, examples of abelian and non-abelian groups, the group Zn of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity.

### Unit-II (10Hrs.)

circle group, the general linear group GLn (n,R), groups of symmetries of (i) an isosceles triangle, (ii) an equilateral triangle, (iii) a rectangle, and (iv) a square, the permutation group Sym (n), Group of quaternions.

### Unit-III (12Hrs.)

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets.

### Unit-IV (12Hrs.)

Index of subgroup, Lagrange’s theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

**Recommended Books:**

1. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.
2. M. Artin, Abstract Algebra, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, Contemporary Abstract Algebra, 4th Ed., Narosa, 1999.
4. George E Andrews, Number Theory, Hindustan Publishing Corporation, 1984.
5. Surjeet Singh and QaziZameeruddin, ‘Modern Algebra.’ 7th Ed, Vikas Publishing House, New Delhi, 1993.
6. Herstein, I.N., ‘Topics in Algebra. ’2nd Ed, Vikas Publishing House, 1976.

## ALGEBRA-II

**Subject Code: BSNMS1-407** | **L T P C** **3 0 0 3** | **Duration: 45 Hrs.**

**Course Outcomes:**

CO1: Understand the concept of Ring and their properties.
CO2: Apply the concepts of isomorphism, homomorphism, ideal and integral domain for rings to solve different types of problems.
CO3: Access the idea of inner product space and determine its orthogonality on vector space.
CO4: Understand the basic concepts of linear transformations, algebra of transformations, eigenvalues and corresponding eigenvectors.

### Unit-I(12Hrs.)

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Zn the ring of integers modulo n, ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions.

### Unit-II (11Hrs.)

Subrings and ideals, Integral domains and fields, examples of fields: Zp, Q, R, and C. Field of rational functions. Homomorphism, Isomorphism, Automorphism, Permutation of group, Even and Odd permutation, Cayley theorem, Sylow's theorem.

### Unit-III (12Hrs.)

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

### Unit-IV (10Hrs.)

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and non singular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation

**Recommended Books:**

1. David S. Dummit and Richard M Foote, 'Abstract Algebra,' John Wiley & Sons, 2004.
2. Surjeet Singh and QaziZameeruddin, 'Modern Algebra.' 7th Ed, Vikas Publishing House, New Delhi,1993.
3. Herstein, I.N., 'Topics in Algebra' 2nd Ed., Vikas Publishing House, 1976.
4. John B. Fraleigh, A First Course in Abstract Algebra, 7th Ed., Pearson, 2002.

## BASIC ANALYTICAL CHEMISTRY

**Subject Code: BSNMS1-408** **L T P C** **0 0 4 2** **Duration: 60 Hrs.**

**Course Objectives**

1. To develop ability of analytical thinking.
2. To understand scientific data analyses.
3. To understand various analytical techniques.
4. To develop ability to analyze different types of samples.

**Course Outcomes:** On completion of this course, students will be able to:

CO1: Develop analytical thinking.
CO2: Analyse data in scientific manner.
CO3: Develop understanding of various analytical techniques.
CO4: Analyse different types of samples.

**Introduction:**

Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

**Analysis of soil:**

Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators. Determination of pH of soil samples. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

**Analysis of water:**

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. Determination of pH, acidity and alkalinity of a water sample. Determination of dissolved oxygen (DO) of a water sample.

**Analysis of food products:**

Nutritional value of foods, idea about food processing and food preservations and adulteration. Identification of adulterants in some common food items like coffee powder, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.
Analysis of preservatives and colouring matter.

**Chromatography:**

Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.
Paper chromatographic separation of mixture of metal ion ($Fe^{3+}$ and $Al^{3+}$).
To compare paint samples by TLC method.

**Ion-exchange:**

Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion

/ cation exchange resin (using batch procedure if use of column is not feasible).

**Analysis of cosmetics:**
Major and minor constituents and their function
Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.
Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

**Suggested Applications (Any one):**

a) To study the use of phenolphthalein in trap cases.
b) To analyze arson accelerants.
c) To carry out analysis of gasoline.

**Suggested Instrumental demonstrations**:

a) Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
b) Spectro photometric determination of Iron in Vitamin / Dietary Tablets.
c) Spectro photometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

**Recommended Books:**
Latest edition of:

1. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. Instrumental Methods of Analysis. Wadsworth Publishing Co. Ltd., Belmont, California, USA.
2. Skoog, D.A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed.
3. Skoog, D.A.; West, D.M. & Holler, F.J. Fundamentals of Analytical Chemistry, Saunders College Publishing, Fort Worth.
4. Harris, D. C. Quantitative Chemical Analysis, W. H. Freeman.
5. Dean, J. A. Analytical Chemistry Notebook, McGraw Hill.
6. Day, R. A. & Underwood, A. L. Quantitative Analysis, Prentice Hall of India.
7. Freifelder, D. Physical Biochemistry, W.H. Freeman and Co., N.Y.USA.
8. Cooper, T.G. The Tools of Biochemistry, John Wiley and Sons, N.Y. USA. 16.
9. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall.
10. Vogel, A. I. Vogel's Quantitative Chemical Analysis, Prentice Hall.
11. Robinson, J.W. Undergraduate Instrumental Analysis, Marcel Dekker, Inc. New York.

# SEMESTER FIFTH

## DIGITAL ANALOG AND INSTRUMENTATION

**Subject Code: BSNMD1-511** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Learn the Analog and Digital Circuits
CO2: Basic concepts of Semiconductor Devices
CO3: Learn about the concepts of Amplifiers
CO4: Gain knowledge about the basic physics instruments

### UNIT-I (15 Hrs)

**Digital Circuits:**

Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates.De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean algebra. Fundamental Products. Minterms and Maxterms. Conversion of a Truth Table into an Equivalent Logic Circuit by (1) Sum of Products Method. Binary Addition. Binary Subtraction using 2's Complement Method).

### UNIT-II (15 Hrs)

**Semiconductor Devices:**

Semiconductor Diodes: p and n type semiconductors. Barrier Formation in PN Junction Diode. Qualitative Idea of Current Flow Mechanism in Forward and Reverse Biased Diode. PN junction and its characteristics. Static and Dynamic Resistance. Principle and structure of (1) LEDs (2) Photodiode (3) Solar Cell.

### UNIT-III (15 Hrs)

**Amplifiers**:

Bipolar Junction transistors: n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Active, Cutoff, and Saturation Regions. Current gains $\alpha$ and $\beta$. Relations between $\alpha$ and $\beta$. Load Line analysis of Transistors. DC Load line and Q point. Voltage Divider Bias Circuit for CE Amplifier. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Class A, B, and C Amplifiers.

### UNIT-IV (15 Hrs)

**Instrumentation:**

Introduction to CRO: Block Diagram of CRO. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. Power Supply: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers. Calculation of Ripple Factor and Rectification Efficiency, Basic idea about capacitor filter, Zener Diode and Voltage Regulation Timer IC: IC 555 Pin diagram and its application as Astable & Monostable Multivibrator

**Recommended Books:**

1. Integrated Electronics, J. Millman and C.C. Halkias, 1991, Tata Mc-Graw Hill.
2. Electronic devices and circuits, S. Salivahanan and N. Suresh Kumar, 2012, Tata Mc-Graw Hill.
3. Microelectronic Circuits, M.H. Rashid, 2ndEdn.,2011, Cengage Learning.
4. Digital Principles & Applications, A.P. Malvino, D.P. Leach & Saha, 7th Ed.,2011,
5. Tata McGraw Hill
6. Microelectronic circuits, A.S. Sedra, K.C. Smith, A.N. Chandorkar, 2014, 6th Edn.,Oxford University Press.
7. Fundamentals of Digital Circuits, A. Anand Kumar, 2nd Edition, 2009, PHI Learning Pvt. Ltd.
8. Modern Electronic Instrumentation & Measurement Tech., Helfrick&Cooper,1990, PHI Learning.

## CHEMISTRY OF MAIN GROUP ELEMENTS

**Subject Code: BSNMD1- 521** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

This course is intended

1. To provide the students an in-depth understanding of the groups of elements in Inorganic Chemistry.
2. To know the periodic properties of s, p and d block elements and their metallurgical purification.
3. To understand the physical and chemical properties of elements and their compounds.

**Course Outcomes:**

CO1: Acquire knowledge and understanding of essential facts, concepts, principles, theories and metallurgical purification techniques related to the elements of periodic table.
CO2: Develop comprehension abilities of structure, bonding and properties of the compound /polymers of the elements.
CO3: Application of the principles of metallurgical process
CO4: To develop skills to evaluate, analyze and solve problems competently.

### Unit-I (15 Hrs.)

**Acids and Bases:** Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

**General Principles of Metallurgy:** Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond's process and Kroll Process.

### Unit-II (18 Hrs.)

**s-and p-Block Elements:** Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale). General characteristics of s-block metals like density, melting and boiling points, flame colour and reducing nature. Oxidation states of s and p block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of s block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of s-block metals.

### Unit-III (10 Hrs.)

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental

chemistry wherever applicable:
Diborane and concept of multicentre bonding, hydrides of Groups 13 ($BH_3$), 14, 15, 16 and 17. Oxides of N and P, Oxoacids of P, S and Cl. Halides and oxohalides of P and S ($PCl_3$, $PCl_5$, $SOCl_2$ and $SO_2Cl_2$) Interhalogen compounds. A brief idea of pseudohalides.

**Unit-IV (17 Hrs.)**

**Noble gases:** Rationalization of inertness of noble gases, clathrates, preparation and properties of $XeF_2$, $XeF_4$ and $XeF_6$ ,bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory.
**Inorganic Polymers:** Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$.

**Recommended Books:**
Latest edition of:

1. Lee, J.D. Concise Inorganic Chemistry ELBS
2. Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, Wiley.
3. Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley & Sons.
4. Greenwood, N.N. & Earnshaw. Chemistry of the Elements, Butterworth-Heinemann.
5. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India.
6. Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry, Pearson.
7. Atkin, P. Shriver & Atkins' Inorganic Chemistry, Oxford University Press.

## MATRICES

**Subject Code: BSNMD1-531** **L T P C** **3 0 0 3** **Duration: 45 Hrs.**

**Course Outcomes:**

CO1: Understand the concept of vector space.
CO2: Understand the concept of rotation and reflection in a point and numerical approach to eigen values and eigen vectors.
CO3: Develop the knowledge of matrices and its properties.
CO4: Develop the advanced knowledge of matrix and examples of matrix from various fields of sciences.

### Unit-I (12Hrs.)

R, $R^2$, $R^3$ as vector spaces over R. Standard basis for each of them. Concept of Linear Independence and examples of different bases. Subspaces of $R^2$, $R^3$.

### Unit-II (12Hrs.)

Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigen values and eigen vectors for such transformations and eigen spaces as invariant subspaces.

### Unit-III (9Hrs.)

Types of matrices Rank of a matrix, Invariance of rank under elementary transformations, Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns up-to four.

### Unit-IV (12 Hrs.)

Matrices in diagonal form, Reduction to diagonal form up-to matrices of order 3, Computation of matrix inverses using elementary row operations, Rank of matrix. Solutions of a system of linear equations using matrices, Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

**Recommended Books:**

1. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

## LINEAR ALGEBRA

**Subject Code: BSNMD1-532** | **L T P C 3 0 0 3** | **Duration: 45 Hrs.**

**Course Outcomes:**

CO1: Apply the knowledge of algebra which enable to build mathematical thinking and skills.
CO2: Analyze and solve the problems related to rank and nullity of linear transformation.
CO3: Compute the eigenvalues and corresponding eigenvectors for a square matrix.
CO4: Apply the concepts of isomorphism to solve different types of problems.

### Unit-I(10Hrs.)

Vector spaces, subspaces, algebra of subspaces, quotient spaces, linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

### Unit-II(12Hrs.)

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.

### Unit-III(12Hrs.)

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

### Unit-IV (11Hrs.)

Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

**Recommended Books:**

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, Introduction to Linear Algebra, 2nd Ed., Springer, 2005.

# DIGITAL ANALOG AND INSTRUMENTATION LAB

**Subject Code: BSNMD1- 512** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Verify and design different gates
CO2: Understand Half adder, Full adder and Adder-subtrector
CO3: Design monostable, astable multivibrator using 555 timer
CO4: Understand and design various circuits using Op-amp 741

**List of Experiments:**

1. To measure (a) Voltage, and (b) Frequency of a periodic waveform using a CRO
2. To verify and design AND, OR, NOT and XOR gates using NAND gates.
3. To minimize a given logic circuit.
4. Half adder, Full adder and 4-bit Binary Adder
5. Adder-Subtractor using Full Adder I.C.
6. To design an astable multivibrator of given specifications using 555 Timer.
7. To design a monostable multivibrator of given specifications using 555 Timer.
8. To study IV characteristics of PN diode, Zener and Light emitting diode
9. To study the characteristics of a Transistor in CE configuration.
10. To design a CE amplifier of a given gain (mid-gain) using voltage divider bias.
11. To design an inverting amplifier of given gain using Op-amp 741 and study its frequency response.
12. To design a non-inverting amplifier of given gain using Op-amp 741 and study its frequency Response.
13. To study a precision Differential Amplifier of given I/O specification using Opamp.
14. 14. To investigate the use of an op-amp as a Differentiator
15. To design a Wien Bridge Oscillator using an op-amp.

**Recommended Books:**

1. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994,Mc-Graw Hill.
2. Electronics: Fundamentals and Applications, J.D. Ryder, 2004, Prentice Hall.
3. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, PrenticeHall.
4. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.

## CHEMISTRY OF MAIN GROUP ELEMENTS LAB

**Subject Code: BSNMD1-522** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand the concepts behind Iodo/Iodimetric titrations
2. To develop basic understanding of gravimetric analysis and estimation of different metals using the concept
3. To make the students understand principles involved in estimation of dissolved impurities of water
4. To familiarize the students with inorganic preparation

**Course Outcomes:** After completion of course students will gain the knowledge and practical hands on training of

CO1: Obtaining precise results of Iodo/Iodimetric titrations
CO2: Gravimetric analysis and estimation of different metalions
CO3: Estimation of dissolved impurities of water
CO4: Preparation of transition metal based inorganic compounds

**List of Experiments:**

1) Iodometric estimation of potassium dichromate and copper sulphate.
2) Iodimetric estimation of antimony in tartaremetic.
3) Estimation of amount of available chlorine in bleaching powder and household bleaches.
4) Estimation of iodine in iodized salts.
5) Iodimetric estimation of ascorbic acid in fruit juices.
6) Estimation of dissolved oxygen in water samples.
7) Gravimetric estimation of sulphate as barium sulphate.
8) Gravimetric estimation of aluminium as oximato complex.
9) Preparation of the following: potash alum, chrome alum, tetraammine copper(II) sulphate monohydrate, potassium trioxalatoferrate(III) (any two, including one double salt and one complex).

**Recommended Books:**
Latest edition of:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson.

## COMPUTER PROGRAMMING LAB

**Subject Code: BSNMS1-533** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Outcomes:** After the completion of the course, Student will be able to:

CO1: Learn the Importance of computers in Physics
CO2: Enhance skill in Linux and FORTRAN
CO3: Understand the concepts of statements
CO4: Gain knowledge about the graphical analysis and importance of visualization of computational and computational data

**List of following programs are as follows:**

1. Operators: Arithmetic, Logical, Conditional, Assignment, Increment/Decrement operators
2. Decision Making: switch, if-else, nested if, else-if ladder, break, continue, go to
3. Loops: while, do-while, for
4. Functions: Definition, Declaration, call by value, Call by reference, Recursive Function
5. Arrays: Arrays declarations, Single and multi-dimensional, Strings and string functions
6. Pointers: Pointer declarations, Pointer to function, Pointer to array.

**Recommended Books:**

1. Shubhnandan Jamwal, ‘Programming in C’, 3rd Edn., Pearson.
2. E. Balagurusamy, ‘Programming in ANSI C’, 3rd Edn., Tata McGraw Hill.
3. V. Rajaraman, ‘Fundamentals of Computers’, 3rd Edn., PHI.
4. P.K. Sinha, ‘Computer Fundamentals’, 5th Edn., BPB Publication.
5. Brian Kernighan and Dennis Ritchie, ‘C Programming Language, 2nd Edn., PHI.
6. Byron Gottfried, ‘Programming with C’, 2nd Edn., Tata McGraw Hill.
7. Yashvant P. Kanetkar, ‘Let us C’, 4th Edn., BPB Publications, New Delhi.
8. R.S. Salaria, ‘Application Programming in C’, 2nd Edn., Khanna Book Publishing.

# SEMESTER SIXTH

## ELEMENTS OF MODERN PHYSICS

**Subject Code: BSNMD1-611** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcome (CO):** After the completion of the course, Student will be able to
CO1: Gain knowledge about crystal structure
CO2: Understand the concepts of quantum mechanics.
CO3: Understand the concepts nuclear Physics.
CO4: Learn about Particle interactions and Conservation Laws.

### UNIT-I (12 Hrs)

**Crystal structure and lattice vibrations:**
Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell, Types of Lattices. Miller Indices. Reciprocal Lattice. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Lattice Vibrations in Linear Monoatomic and Diatomic Chains. Concept of phonons, Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids.

### UNIT-II (18 Hrs)

**Introduction to Quantum Mechanics:**
Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson- German experiment. Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle. One dimensional infinitely rigid box- energy eigenvalues and eigen functions, normalization; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

### UNIT-III (15 Hrs)

**Nuclear Physics:**
Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. Radioactive decay: alpha, beta and gamma decay, internal conversion, positron emission, electron capture, neutrino hypothesis. Interaction of Radiation with matter: Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter.

**UNIT-IV (15 Hrs)**

**Particle Physics:**

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons.

**Recommended Books:**

1. Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill.
2. Modern Physics, John R. Taylor, Chris D. Zafiratos, Michael A.Dubson, 2009.
3. Quantum Physics, Berkeley Physics Course Vol.4. E.H. Wichman, 2008, Tata McGraw Hill Co.
4. Modern Physics, R.A. Serway, C.J. Moses, and C.A.Moyer, 2005, Cengage Learning.
5. Modern Physics, G. Kaur and G.R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics, Walter Greiner, 4th Edn., 2001, Springer.

## ELEMENTS OF MODERN PHYSICS LAB

**Subject Code: BSNMD1-612** | **L T P C** **0 0 4 2** | **Duration: 60 Hrs.**

**Course Outcome (CO):** After the completion of the course, Student will be able to

CO1: Gain practical knowledge about photoelectric effect
CO2: Understand the practically ionization potential, e/m ratio, Boltzmann constant
CO3: Gain knowledge about the absorption and emission spectra.
CO4: Study the diffraction patterns of single and double slits

**List of Experiments:**

1. To determine value of Boltzmann constant using V-I characteristic of PN diode.
2. To determine work function of material of filament of directly heated vacuum diode.
3. To determine value of Planck's constant using LEDs of at least 4 different colours.
4. To determine the ionization potential of mercury.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the absorption lines in the rotational spectrum of Iodine vapour.
7. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.
8. To determine the value of e/m by magnetic focusing.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source-Na light.

**Recommended Books:**

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

## COMPREHENSIVE CHEMISTRY

**Subject Code: BSNMD1-621** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To understand the concepts behind basics of inorganic chemistry
2. To understand the concept of stereochemistry
3. To familiarize with the Bioinorganic Chemistry.
4. To understand concepts of spectroscopy.

**Course Outcomes:** Students will acquire the knowledge of

CO1: Synthesis and applications of heterocyclic compounds
CO2: Applications of spectroscopy for the structure determination of organic compounds
CO3: Co-ordination Chemistry.
CO4: Role of Bioinorganic Chemistry.

### Unit-I (14 Hrs.)

**Chemistry of 3d Block Elements:** Oxidation states displayed by Cr, Fe, Co, Ni and Co. A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

**Organometallic Compounds:** Definition and Classification with appropriate examples based on nature of metalcarbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

### Unit-II (12 Hrs.)

**Bio-Inorganic Chemistry:** A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to $Na^+$, $K^+$ and $Mg^{2+}$ ions: Na/K pump; Role of $Mg^{2+}$ ions in energy production and chlorophyll. Role of $Ca^{2+}$ in blood clotting, stabilization of protein structures and structural role (bones).

### Unit-III (18 Hrs.)

**Polynuclear and heteronuclear aromatic compounds:**

Properties of the following compounds with reference to electrophilic and nucleophilic substitution reaction Naphthalene, Anthracene, Furan, Pyrrole, Thiophene, and Pyridine.

**Active methylene compounds:** Claisen condensation. Keto-enol tautomerism. Synthetic uses of ethylacetoacetate (preparation of non-heteromolecules having upto 6 carbon).

**Unit-IV (16 Hrs.)**

**Application of Spectroscopy to Simple Organic Molecules:**

Electromagnetic radiations, electronic transitions, $\lambda_{max}$ & $\varepsilon_{max}$, chromophore, auxochrome, bathochromic and hypsochromic shifts. Woodward rules for calculating $\lambda_{max}$ of conjugated dienes and $\alpha,\beta$ – unsaturated carbonyl compounds

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intra molecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions). Application of ultraviolet - visible and infrared spectroscopy in structure elucidation of organic molecules.

**Recommended Books:**

Latest edition of:

1. James E. Huheey, Ellen Keiter & Richard Keiter: Inorganic Chemistry:Principles of Structure and Reactivity, Pearson Publication.
2. G.L. Miessler & Donald A. Tarr: Inorganic Chemistry, Pearson Publication.
3. J.D. Lee: A New Concise Inorganic Chemistry, E.L.B.S.
4. F.A. Cotton & G. Wilkinson: Basic Inorganic Chemistry, John Wiley & Sons.
5. I.L. Finar: Organic Chemistry (Vol. I & II), E.L.B.S.
6. John R. Dyer: Applications of Absorption Spectroscopy of Organic Compounds, Prentice Hall
7. R.M. Silverstein, G.C. Bassler & T.C. Morrill: Spectroscopic Identification of Organic Compounds, John Wiley & Sons.
8. R.T. Morrison & R.N. Boyd: Organic Chemistry, Prentice Hall.
9. Peter Sykes: A Guide Book to Mechanism in Organic Chemistry, Orient Longman.
10. Arun Bahl and B. S. Bahl: Advanced Organic Chemistry, Pub: S. Chand.

## COMPREHENSIVE CHEMISTRY LAB

| Subject Code: BSNMD1-622 | L T P C | Duration: 60 Hrs. |
|---|---|---|
| | 0 0 4 2 | |

**Course Objectives:**

1. To understand the concepts behind synthesis of various inorganic compounds.
2. To determine the melting points of Inorganic compounds.
3. To understand chemistry involved in Organic functional group determination.

**Course Outcomes:** After completion of course students will acquire the knowledge of:

CO1: Synthesis of Inorganic compounds
CO2: Determination of melting and boiling points of synthesized Inorganic compound
CO3: Organic Functional group tests.

### Inorganic Chemistry

1) Separation of mixtures by chromatography: Measure the Rf value (Combination of two ions to be given)
   Paper chromatography:
   (a) separation of $Fe^{3+}$, $A1^{3+}$ and $Cr^{3+}$
   (b) separation of $Ni^{2+}$, $Co^{2+}$, $Mn^{2+}$ and $Zn^{2+}$.
2) Preparation of any two of the following complexes and measurement of their conductivity:
   i. tetraamminecarbonatocobalt (III) nitrate
   ii. tetraamminecopper (II) sulphate
   iii. potassium trioxalatoferrate (III) trihydrate

   Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$.

### Organic Chemistry

Systematic Qualitative Analysis of Organic Compounds possessing mono functional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of their one derivative.

**Recommended Books:**

Latest edition of:

1) A.I. Vogel: Qualitative Inorganic Analysis, Prentice Hall.
2) A.I. Vogel: Quantitative Chemical Analysis, Prentice Hall.
3) Vogel's Textbook of Practical Organic Chemistry, Prentice-Hall.
4) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman.

## NUMERICAL METHODS

**Subject Code: BSNMD1-631** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Outcomes:**

CO1: Learn various types of numerical methods to find the roots of nonlinear equations and solution of a system of linear equations.
CO2: Find values for a tabulated function using interpolation techniques.
CO3: Apply different kind of numerical methods to solve integration.
CO4: Apply various numerical methods to solve ordinary differential equation.

### Unit-I (12Hrs.)

Rate of Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, Gauss-Jacobi, Gauss-Siedel and SOR iterative methods.

### Unit-II (12Hrs.)

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulae with error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

### Unit-III (13 Hrs.)

Numerical differentiation and integration: Differentiation at tabulated and non-tabulated points, Maximum and minimum values of tabulated function, Newton-Cotes Formulae-Trapezoidal, Simpson's, Boole's and Weddle's rules of integration, Romberg integration, Gaussian integration, Double integration by Trapezoidal and Simpson rules.

### Unit-IV (8 Hrs.)

Taylor series and Picard's methods, Euler and modified Euler methods, Runge–Kutta methods, Predictor- Corrector methods: Adams-Bashforth and Milne methods.

**Recommended Books:**

1) B. Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, India, 2007.
2) M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New age International Publisher, India, 2007.
3) S.D. Conte and C. De Boor, 'Elementary Numerical Analysis: An Algorithmic Approach', 3rd Edn, Mc Graw Hill, New York, 1980.
4) J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co., 2001.

## COMPLEX ANALYSIS

**Subject Code: BSNMD1-632** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Outcomes:**

CO1: Understand the calculus of complex functions, concept and consequences of analyticity.
CO2: Formulation of analytic function and their application.
CO3: Evaluation of contour integrals directly by use of Cauchy theorem and Cauchy's integral formula.
CO4: Represent complex function as Taylor, Power and Laurent series.

### Unit-I (11Hrs.)

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

### Unit-II (12Hrs.)

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

### Unit-III (10Hrs.)

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy-Goursat theorem, Cauchy integral formula.

### Unit-IV (12Hrs.)

Liouville's theorem and the fundamental theorem of algebra, Convergence of sequences and series, Taylor series and its examples, Laurent series and its examples, absolute and uniform convergence of power series.

**Recommended Books:**

1) James Ward Brown and Ruel V. Churchill, Complex Variables and Applications, 8th Ed., McGraw – Hill International Edition, 2009.
2) 2. Joseph Bak and Donald J. Newman, Complex analysis, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.
3) E.T. Capson,, An Introduction to the Theory of functions of a complex Variable, Oxford university press, 1995.
4) R. Churchill, J.W. Brown, 'Complex Variables and Applications', 6th Edn., New York, McGraw-Hill, 1996.
5) A.R. Shastri, 'An Introduction to Complex Analysis', Macmillan India Ltd., 2003.
6) S. Ponnusamy, Foundation of Complex Analysis, Narosa Book Distributors, 2011.

## NUMERICAL ANALYSIS LAB

**Subject Code: BSNMS1-633** | **L T P C 0 0 4 2** | **Duration: 60 Hrs.**

**Course Outcomes:**

CO1: Apply computer programming to solve algebraic equations, linear systems of equations, ordinary differential equation, eigenvalue problems & Carry out numerical differentiation, integration and interpolation.
CO2: Utilize the symbolic tools of C++ language for solving given problem.
CO3: Understand different modes of a numerical method in order to solve a given problem efficiently.
CO4: Develop understanding of numerical error and applicability of a particular method.

**The following programs of following methods are to be practiced:**

1. To find a real root of an algebraic/ transcendental equation by using Bisection method.
2. To find a real root of an algebraic/ transcendental equation by using Regula-Falsi method.
3. To find a real root of an algebraic/ transcendental equation by using Newton-Raphson method.
4. To find a real root of an algebraic/ transcendental equation by using Iteration method.
5. Implementation of Gauss- Elimination method to solve a system of linear algebraic equations.
6. Implementation of Jacobi's method to solve a system of linear algebraic equations.
7. Implementation of Jacobi's method to solve a system of linear algebraic equations.
8. Implementation of Gauss-Seidel method to solve a system of linear algebraic equations.
9. To find differential coefficients of 1st and 2nd orders using interpolation formulae.
10. To evaluate definite integrals by using Newton - Cotes integral formulae.
11. To evaluate definite integrals by using Gaussian Quadrature.
12. To evaluate double integrals by using Trapezoidal and Simpson method.
13. To compute the solution of ordinary differential equations with Taylor's series method.
14. To compute the solution of ordinary differential equations by using Euler's method.
15. To compute the solution of ordinary differential equations by using Runge -Kutta methods.
16. To compute the solution of ordinary differential equations by using Milne-Simpson method.

**Recommended Books:**

1. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill, New Delhi, 1999.
2. J N Sharma, Numerical Methods for engineers and Scientists (2nd Edn) Narosa Publishing House, New Delhi/ Alpha Science International Ltd. Oxford UK, 2007.
3. Conte and de Boor, Numerical Analysis, McGraw Hill, New York, 1990
4. John H. Mathews, Numerical Methods for Mathematics, Science and Engineering (2nd Edn.), Prentice Hall, New Delhi, 2000.

**Total Contact Hours= 27** **Total Marks= 700** **Total Credits= 23**

| 1st Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MCHMS1-101 | Electronic Spectra & Magnetic Properties of Transition Metal Complexes | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-102 | Organic Reactions & Mechanisms-I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-103 | Thermodynamics& Solid State | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **Departmental Elective-I ( Choose any one)** | | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMD1-111 | Computational Skills & Simulations in Chemistry | | | | | | | |
| MCHMD1-112 | Polymer Chemistry | | | | | | | |
| MCHMD1-113 | Chemical Kinetics & Electrochemistry | | | | | | | |
| **Open Elective** | | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| MCHMS1-104 | Inorganic Chemistry Lab.-I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| MCHMS1-105 | Organic Chemistry Lab.-I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| | **Total** | **19** | **0** | **08** | **320** | **380** | **700** | **23** |

## ELECTRONIC SPECTRA & MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES

**Subject Code: MCHMS1-101** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives**

1. To understand the concept of symmetry elements and symmetry operations.
2. To provide fundamental knowledge of inter electronic repulsion parameters and crystal field strength in various fields.
3. To give knowledge of the Orgel and correlation diagrams.
4. To understand molecular orbital diagrams for octahedral and tetrahedral diagrams

**Course Outcomes**:
The completion of this course will make student to acquire the knowledge of:

1. Interpretation of electronic and magnetic properties.
2. Interpretation of molecular orbital diagrams of octahedral and tetrahedral diagrams for various electronic properties.
3. Concepts of symmetry and group theory in solving chemical structural problems.
4. Use of character tables and application of group theory in spectroscopy.

**UNIT-I** **(13 Hrs.)**

**1. Symmetry**
Symmetry elements, symmetry operations, point group determination, determination of reducible and irreducible representations, character tables, use of symmetry in obtaining symmetry of orbitals in molecules qualitative splitting of s, p, d, f orbitals in octahedral, tetrahedral and square planar fields using character tables and without the use of character tables.

**UNIT-II** **(7 Hrs.)**

**2. Inter Electronic Repulsions**
Spin-spin, orbital-orbital and spin orbital coupling, L.S. and jj coupling schemes, determination of all the spectroscopic terms of $p^n$ , $d^n$ ions, determination of the ground state terms for $p^n$ , $d^n$ , $f^n$ions using L.S. scheme, determination of total degeneracy of terms, order of inter electronic repulsions and crystal field strength in various fields, two type of electron repulsion parameters, term wave functions, spin orbit coupling parameters ($\lambda$) energy separation between different j states

**3. Free Ions in Crystal Field of various Strengths** **(10 Hrs.)**
The effect of Voct on S, P, D and F terms (with help of the character table), Strong field configurations, transition from weak to strong crystal fields, evaluation of strong crystal field terms of $d^2$ cases in octahedral and tetrahedral crystal fields (using group theory), construction of the correlation energy level diagrams of $d^2$ configuration in octahedral and tetrahedral fields, study of energy level diagrams for higher configurations, derivation of selection rules of electronic transitions in transition metal complexes, relaxation of the selection rule in centrosymmetric and non-centrosymmetric molecules, Orgel diagrams, Tanabe Sugano diagrams.

**UNIT-III (13 Hrs.)**

**4. Covalent Character into the Metal Ligand Bond**

Construction of Molecular orbital energy level diagrams for octahedral, tetrahedral and square planar complexes showing σ and π bonding. Transformation properties of atomic orbitals, molecular orbitals for sigma and pi bonding in tetrahedral and octahedral molecules.

**UNIT-IV (9 Hrs.)**

**5. Electronic Spectra of Transition Metal Complexes**

Spectrochemical series, band intensities, factors influencing band widths (variation of 10Dq, vibrational structure, spin orbit coupling, low symmetry components, Jahn-Teller effect), discussion of electronic spectra of octahedral and tetrahedral $d^1 - d^9$ metal ions, calculation of 10Dq and B with and without the use of Tanabe Sugano diagrams, low spin complexes of $Mn^{3+}$, $Mn^{2+}$, $Fe^{3+}$, $Co^{3+}$, $Fe^{2+}$, comment on the spectra of second and third transition series, Charge Transfer spectra, comparison of d – d band with f –f spectra.

**6. Magnetic Properties ( 8 Hrs.)**

General discussion about magnetism in metal complexes (magnetic susceptibility, para-, dia-, ferro-, antiferro- and ferri-magnetic behavior, Curie and Curie Weiss law, magnetic properties of *d* block transition metal ions for $d^1$ to $d^9$ configuration, quenching of orbital magnetic moment, spin only magnetic moment, first order orbital contribution to the magnetic moment, orbital contribution due to spin –orbit coupling.

1. B.N. Figgis, 'Introduction to Ligand Field', Wiley Eastern, **1966**.
2. A.B.P. Lever, 'Inorganic Electronic Spectroscopy', Elsevier, **1984.**
3. R. L. Dutta and A. Syamal, 'Elements of Magnetochemistry', East-West Press Pvt. Ltd. Bangalore, **1993**.
4. J.E. Huheey& Others, 'Inorganic Chemistry: Principles of Structure and Reactivity', Harper Inter-Science, **2006.**
5. Russell S. Drago, 'Physical Method for Chemistry', W.B. Saunders Company, **1992**.
6. F.A. Cotton and G. Wilkinson, 'Advanced Inorganic Chemistry', 6th Edn., Wiley Inter- Science, **2004.**
7. F.A. Cotton, 'Chemical Application of Group Theory', 3rd Edn., Wiley Eastern, **2004**.

## ORGANIC REACTION AND MECHANISM –I

**Subject Code: MCHMS1-102**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**Duration: 60 (Hrs.)**

**Course Objectives:**

1. To familiarize with the methods determining reaction mechanism and various reaction intermediates.
2. To understand the diversity of aliphatic & aromatic nucleophilic and electrophilic reactions.
3. To understand the effect of substrate, leaving group, reaction medium and attacking reagent on substitution and free radical reaction.
4. To acquaint with the named reaction following electrophilic, nucleophilic and free radical mechanism.

**Course Outcomes:**

The students will be able to:

1. Apprehend the basic concepts of organic reactions and understand mechanism of various reactions including stereochemical, mechanistic and conformational aspects.
2. Assess the reaction condition and the factors affecting the rate of reactions following different mechanisms.
3. Apply their understanding about the organic reactions of industrial significance with respect to chemoselectivity and regioselectivity.

Design new organic compounds and sketch their corresponding feasible reaction pathways..

**UNIT-I** **(15 Hrs.)**

**1. Reaction Mechanism: Structure and Reactivity**

Type of mechanisms, types of reactions, kinetic and thermodynamic control of reactions, Hammond's postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining reaction mechanisms, isotope effects. Hard and soft acids and bases. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes.

Effect of structure on reactivity- resonance and field effects, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants.

Stereochemistry: Conformational analysis of Cycloalkanes and Decalins, Effect of conformation on reactivity, Conformation of sugars, Steric-strain due to unavoidable crowding. Elements of symmetry, Chirality, R-S nomenclature, Diastereoisomerism in Acyclic and Cyclic systems, E-Z isomerisms, Interconversion of Fischer, Newman and Sawhorse projections, Molecules with more than one chiral center, Threo and erythro isomers, Methods of resolution, Optical purity,. Optical activity in the absence of chiral carbon (biphenyls, allenes and spiranes), Chirality due to helical shape.

**UNIT-II** **(15 Hrs.)**

**2. Aliphatic Nucleophilic Substitution**

The SN2, SN1, mixed SN1 and SN2 and SET mechanisms.

The neighbouring group mechanism, neighbouring group participation by π- and σ-bonds, anchimeric assistance. Classical and nonclassical carbocations, phenonium ions, norbornyl system, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. The SN1 mechanism, Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity. Gabriel synthesis

**3. Aliphatic Electrophilic Substitution**

Bimolecular mechanisms- SE2 and SE1. The SE1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity, Hell-Volard-Zelinsky reaction.

**UNIT-III** **(15 Hrs.)**

**4. Aromatic Nucleophilic Substitution**

The SNAr, SN1, benzyne and SRN1 mechanisms, Reactivity – effect of substrate structure, leaving group and attacking nucleophile. The Von Richter, Sommelet-Hauser, and Smiles rearrangements.

**5. Aromatic electrophilic substitution**

The arenium ion mechanism, orientation and reactivity in mono substitution and di-substituted aromatics, energy profile diagram, the ortho/para ratio, ipso attack, orientation in other ring systems, quantitative treatment of reactivity in substrates and electrophiles. Diazo coupling, Vilsmeir reaction, Gatterman-Koch reaction, Bechmann reaction, Hoben-Hoesch reaction.

**UNIT-IV** **(15 Hrs.)**

**6. Elimination Reactions**

The E2, E1 and E1cB mechanisms and their spectra. Orientation of the double bond. Reactivity – effects of substrate structures, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination.

**7. Free Radical Reactions**

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactvity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboxylic acids, auto- oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

**Recommended Text Books / Reference Books:**


1. Jerry March & Michael Smith, 'March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure', 6th Edn., John Wiley & Sons, **2007.**
2. Francis A. Carey & Richard J. Sundberg, 'Advanced Organic Chemistry: Structure and Mechanisms, Vol, A', 5th Edn., Springer, **2007**.
3. Francis A. Carey & Richard J. Sundberg, 'Advanced Organic Chemistry: Reaction and Synthesis, Vol. B', 4th Edn., Springer, **2006.**

## THERMODYNAMICS AND SOLID STATE

**Subject Code: MCHMS1-103** **L T P C** **Duration: 60 (Hrs.)**
4 0 0 4

**Course Objectives:**

1. To recall concepts involved in laws of thermodynamics.
2. To introduce various thermodynamic functions and partition function.
3. To introduce microstates, macrostates and different types of statistics.
4. To familiarise with solid state.

**Course Outcomes:**

The students will be able to

1. Understand the concept of classical thermodynamics.
2. Understand statistical thermodynamics and thermodynamic properties in terms of partition functions
3. Apply the concept of thermodynamics in a chemical system.
4. Analyze the crystal structure and defects in the crystal.

**UNIT-I** **(20 Hours)**

**Recall**:

First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases under isothermal and adiabatic conditions, Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, Kirchhoff's equations, Second Law: Concept of entropy; statement of the second law of thermodynamics. Calculation of entropy change for reversible and irreversible processes. Free energy and chemical equilibrium. Gibbs-Helmholtz equation; Thermodynamic equation of state. Maxwell relations.

**UNIT-II** **(15 Hours)**

**Non-ideal Systems**:

Excess functions for non-ideal systems. Activity and activity coefficients and their determination. Concept of fugacity and its experimental determination. Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

**Third Law of the Thermodynamics**:

Identification of statistical and thermodynamic entropy. Nernst postulate, Plank's contribution. Alternate formulation of third law. Evaluation of absolute entropy. Gibbs equations for non-equilibrium systems. Clausius-Clapeyron equation. Chemical potential of ideal gases. Ideal-gas reaction equilibrium-derivation of equilibrium constant. Temperature dependence of equilibrium constant-the van't Hoff equation.

**UNIT-III** **(15 Hours)**

**Statistical Thermodynamics:**
General introduction, microstates, macrostates, thermodynamic probability. Brief introduction to different types of statistics. Ensemble concept. Canonical, grand canonical and microcanocical ensembles. Maxwell Boltzmann distribution law.

**Partition Function and Thermodynamic Properties**: Partition function and its factorization. Translational, rotational, vibrational; electronic and nuclear partition functions. Expressions for internal energy, entropy, Helmholtz function, Gibb's function, pressure, work and heat in terms of partition function. Thermodynamic properties of ideal gases. Vibrational, rotational, electronic and nuclear contributions to the thermodynamic properties.

**UNIT-IV (10 Hours)**

**Crystal structures:** Crystalline and amorphous solids, Crystal size and shapes, Space lattice and unit cell. Bravais lattices, reciprocal lattices, unit cells, Miller indices, Bragg's law, Limiting radius ratio and radius ratio rule, defects in crystals, stoichiometric defects: Shottky defect, Frenkel defect, non-stoichiometric defects: metal excess defect, metal deficiency defect, thermal defects. Line defects: edge dislocation and screw dislocation. Liquid crystals: mesomorphic state, thermotropic mesomorphism, thermography.

**Recommended Text Books / Reference Books:**


1. Aston and Fritz, 'Thermodynamic and Statistical Thermodynamics', John Wiley & Sons, Inc., 1959.
2. Lee, Sears and Turcotte,'Statistical Thermodynamics', Addison-Wesley Publishing Company 1963.
3. Dickerson, 'Molecular Thermodynamics', Benjamin-Cummings Publishing Company, 1969.
4. Glasstone, 'Thermodynamics for Chemists', EWP,2008.
5. R. C. Srivastva, S. K. Saha, A. K. Jain, 'Thermodynamics: A Core Course', PHI, 2007.
6. P. Atkins, J. D. Paula, 'Physical Chemistry', 7$^{th}$Indian Edn.,Oxford University Press, 2007.
7. R. P. Rastogi& R. R. Mishra, 'An Introduction to Chemical Thermodynamics',6$^{th}$Edn., Vikas Publishing House, 2007.

## COMPUTATIONAL SKILLS AND SIMULATIONS IN CHEMISTRY

**Subject code: MCHMD1-111** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives**

1. To learn principles of computational chemistry and computer-based molecular design.
2. To understand the basic concepts of molecular mechanics, semi-empirical method and density-functional theory.
3. To familiarize with different software packages, including MOLDEN for general model building.
4. To understand GAMESS Gaussian for quantum chemical calculations, and BOSS for liquid simulations.

**Course Outcomes**

The students will acquire knowledge of

1. Advantages and principle of computer based calculation methods in chemistry
2. Fundamentals of various calculation methods viz: molecular mechanics, semi-empirical method and density-functional theory.
3. Running calculation and model building using different algorithms in software packages, like Hyperchem, Gaussian
4. Quantum mechanical calculations in gaseous phase with GAMESS and Liquid simulations in BOSS

**UNIT – I** **(15 Hrs.)**

**1. OVERVIEW OF THE COURSE**

Promises of computational chemistry, molecular mechanics of bond vibrations. Minimization methods, forces in polyatomic molecules, intermolecular forces, parameterization and testing of force fields, docking.

**2. MONTE CARLO METHOD (4 Hrs.)**

Principles, chemical & biochemical applications.

**UNIT – II** **(15 Hrs.)**

**3. MO THEORY**

Foundations, semi-empirical MO theory, Ab Initio MO Theory: Basis Sets; Hartree–Fock theory: Principles and applications.

**UNIT – III** **(15 Hrs.)**

**4. TREATMENT OF ELECTRON CORRELATION**

MCSCF, CI methods, Treatment of electron correlation: MP and CC methods.

**UNIT – IV** **(15 Hrs.)**

**5. SPECTROSCOPY**

Vibrational spectroscopy and gas phase thermodynamics, description of electronically excited states. Description of solvent effects.

6. **DENSITY FUNCTIONAL THEORY (DFT)**
   Principles, applications in materials. Transition states in gas phase reactions.

**Recommended Books**


1. Peter Comba, Trevor W. Hambley, 'Molecular Modelling of Inorganic Compounds'**,** John Wiley & Sons, **2009**.
2. F. Jensen, 'Introduction to Computational Chemistry'**,** John Wiley & Sons, **1998**.
3. Warren J. Hehre, 'A Guide to Molecular Mechanics and Quantum Chemical Calculations',
   **2003.**
4. H.D. Holtje, W. Sippl, D. Rognan, G. Folkers, 'Molecular Modeling: Basic Principles and Applications'**,** Wiley, **2008**.
5. Christopher Cramer, 'Essentials of Computational Chemistry, Theories & Models'**,** 2nd Edn., Wiley, **2002**.
6. Note: Freely available packages like GAMESS, MOLDEN, AVOGADOOS, MOPAC may be used for computational Lab.

## POLYMER CHEMISTRY

**Subject Code: MCHMD1-112** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Objective**

1. To recall concepts involved in polymerization..
2. To introduce various mechanism and kinetics of polymer.
3. To introduce properties and factor affecting the properties of polymers
4. To familiarise with applications of polymer.

**Course Outcomes:**

The students will be able to

1. concept of polymers and polymer related termnology.
2. To familiarize with concept of kinetics of Polymerization, Morphology of crystalline polymers.
3. Apply the advanced polymer in various field of industries.
4. Analyze the crystal structure of polymer with advanced characterization techniques.

### UNIT-I (15 Hrs)

**1. INTRODUCTION TO POLYMERS**

IUPAC nomenclature of vinyl, non-vinyl polymers, copolymers and end groups. Abbreviations for polymers. Introduction to industrial polymers-plastic thermoplastic- & thermosetting plastics), fibres (commonly used natural & synthetic fibre).

**2. POLYMERIZATION MECHANISMS**

Mechanism of free radical chain polymerization & ionic chain polymerization-initiators, inhibitors & stereochemistry. Mechanism of coordination chain polymerization (Ziegler-Natta, Cossee), polycondensation step polymerization, polyaddition step polymerization & ring opening step polymerization.

### UNIT-II (15 Hrs)

**1. KINETICS OF POLYMERIZATION MECHANISMS**

Kinetics of free radical chain polymerization, ionic chain polymerization, catalyzed and non-catalyzed polycondensation polymerization including kinetic chain length, chain transfer reactions.

**2. AVERAGE MOLECULAR WEIGHT OF POLYMERS**

Number average molecular weight – its measurement by osmometry (membrane & vapour phase), end group analysis, mass spectrometry. Weight average molecular weight – its measurement by light scattering method (dissymmetry method & Zimm plot method).

Viscosity average molecular weight – its measurement by viscometry. Determination of molecular weight distribution by gel permeation chromatography (size exclusion chromatography).

### UNIT-III (15 Hrs.)

**1. CHEMICAL STRUCTURE & POLYMER MORPHOLOGY**

Macrostructure of polymers**.** Geometrical isomerism & optical isomerism, Tacticity, degree of crystallinity, liquid crystallinity, crystallizability, crystallites (bundles),spherulites, polymer single (ideal) crystals. Glass transition temperature- concept of glassy state, viscoelastic state, viscofluid state for amorphous and crystalline substances including polymers. Specific volume change vs temperature curves.

**a. POLYMER PROPERTIES**

Mechanical properties - tensile strength, compressive strength, flexural strength, impact strength, toughness, fatigue, yield point, elongation at break, tensile modulus, relaxation & retardation (creep) phenomena. Thermal stability, flammability & flame resistance, chemical resistance, degradability, electrical conductivity, nonlinear optical properties.

Polymer additives to modify mechanical, surface, chemical, aesthetic & processing properties.

**UNIT-IV** **(15 Hrs.)**

**1. FIBRES REINFORCED POLYMER COMPOSITES**

Introduction to composites. Polymer matrix materials & fibres reinforcement. Types of fibres- glass, aramid & silica fibres. Advantages & disadvantages of polymer composites.

**2. CHARACTERIZATION TECHNIQUES OF POLYMERS**

Infrared, Raman, NMR, ESR, UV-Vis, fluorescence studies. X-ray scattering, SEM, thermal- DSC, DTA, TMA, TGA studies.

**Recommended Books**

1. D. Campbell and J.R. White, 'Polymer Characterization: Physical Techniques'**,** Chapman and Hall, New York, **1989**.
2. Malcolm P. Stevens, 'Polymer Chemistry: An Introduction'**,** 3rd Edn., Oxford University Press, Indian Edn,, Reprint, **2011**.
3. A.H. Fawcett, 'Polymer Spectroscopy'**,** Wiley, New York, **1996**.
4. R.J. Young, 'Spectroscopy of Polymers'**,** Wiley, New York, **1996**.
5. M. Lewin, S.M. Atlas, E.M. Pearce, 'Flame Retardant Polymeric Materials'**,** Plenum Press, New York, **1975**.
6. E.M. Pearce, Y.P. Khanna, D. Raucher, 'Thermal Characterization of Polymeric Materials'**,** Academic Press, New York,**1981.**
7. I.M. Ward, 'Mechanical Properties of Polymers'**,** Wiley Interscience, New York, **1971**.
8. Jan M. Gooch, 'Encyclopedic Dictionary of Polymers'**,** Springer, **2007**.
9. Anita J. Brandolini, Deborah D. Hills, 'NMR Spectra of Polymers & Polymer Additives'**,** Marcel Dekker, New York, **2000**.
10. Fred W. Wilmeyer, 'Text Book of Polymer Science'**,** A. Wiley Intersciense Publication, 1994.
11. V.R. Gowariker, N.V. Viswanathan, J. Sreedhar; 'Polymer Science'**,** New Age International, **1986**.

## CHEMICAL KINETICS AND ELECTROCHEMISTRY

**Subject Code: MCHMD1-113** | **L T P C** 4 0 0 4 | **Duration: 60 (Hrs.)**

**Course Objectives:**

1. To introduce the concept of activation energy.
2. To introduce various theories of reaction rates.
3. To explain the kinetics of various complex reactions.
4. To introduce various theories of electrolytic solutions and electrolytic conductance.

**Course Outcomes:**

The students will be able to

1. Compare kinetics of various complex reactions and their rate laws.
2. Apply the concept of activation energy while analysing kinetics of reaction.
3. Connect electrolytic solution and conductance.
4. Appraise the concept of interfacial electrochemistry.

**UNIT-I (18 Hrs.)**

Recall of basic concepts of chemical kinetics, methods of determining rate laws, Arrhenius equation, the concept of activation energy, theoretical calculation of energy of activation, collision and transition state theories of rate constants.

Complex reactions- Opposing reactions, parallel reactions and consecutive reactions (all first order type). Kinetics of chain reactions, steady state approximation; determination of reaction mechanisms; detections of radical and kinetics of HBr, $H_2O_2$ reactions, explosion limits, The Eyring equation. Unimolecular reactions and Lindemann's theory, application of following to the reaction kinetics: solvent effect, kinetic isotope effect and salt effect, kinetics of acid, base and enzyme catalysis, Hinshelwood mechanism of catalysis.

**UNIT-II (12 Hrs)**

Electron transfer in homogeneous systems, theory of electron transfer processes, electron tunneling, electron transfer in heterogeneous systems, electrode-solution interface, rate of charge transfer in electrode reactions, study of kinetics of electrode processes.

**UNIT-III (15 Hrs)**

Concept of activity and activity coefficients in electrolytic solutions. The mean ionic activity coefficient. Debye-Huckel theory of electrolytic solutions. Debye-Huckel limiting law (derivation not required). Calculation of mean ionic activity coefficient. Limitations of Debye-Huckel theory. Extended Debye-Huckel law.

Theory of electrolytic conductance. Derivation of Debye-Huckel-Onsager equation – its validity and limitations.

Concept of ion association – Bjerrum theory of ion association (elementary treatment)-ion association constant – Kohlrausch's law and its applications

**UNIT-IV (15 Hrs)**

Electrochemistry: Nernst equation, redox systems, Chemical and concentration cells (with and without transference). Liquid junction potential (LJP) – derivation of the expression for LJP – its determination and elimination**.** Methods of determining structures of electrified interfaces, Guoy-Chapman, Stern. Types of electrodes. Applications of EMF measurements: Solubility product, potentiometric titrations.
Decomposition potential and its significance. Electrode polarization – its causes and elimination. Concentration over-potential.

**Recommended Text Books / Reference Books:**

1. P. Atkins, J. D. Paula, 'Physical Chemistry', 7$^{th}$Indian Edn.,Oxford University Press, 2007.
2. Ira N. Levine, 'Physical Chemistry', McGraw Hill, 2008.
3. D.A. McQuarrie and J.D. Simon, 'Physical Chemistry-A Molecular approach', University Science Books, 1997.
4. J. Rajaraman and J. Kuriacose, 'Kinetics and Mechanism of Chemical Transformations', McMillan, 2011.
5. S. Glasstone, 'Introduction to Electrochemistry', Litton Educational Publishing, 2011.
6. J. O. M. Bockris& A. K. N. Reddy, 'Modern Electrochemistry', Plenum, 1973.
7. E.S. Amis, 'Solvent Effect of Reaction Rates and Mechanism', Academic Press, 1966.
8. K.J. Laidler, 'Chemical Kinetics', McGraw Hill, 1965.

## INORGANIC CHEMISTRY LAB-I

**Subject Code: MCHMS1-104** **L T P C** **Duration: 60 (Hrs.)**
**0 0 4 2**

**Course Objectives**

1. To develop basic understanding of various lab practices including safety measures.
2. To synthesize inorganic complexes and their characterization.

**Course Outcomes**:
The students will acquire knowledge of:

1. Volumetric and gravimetric analysis of cations and anions.
2. Understand complexometric and redox titrations.
3. Syntheses of various complexes and their structural analysis

**Note:**

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given syllabus.

2. Any other subject related experiment can also be included.

**EXPERIMENTS**

**1. Preparation of coordination compounds, their purification by chromatography and elucidation of structures by physical methods (UV, IR, NMR, magnetic susceptibility etc.)**

a. Synthesis of Tris(acetylacetonato)manganese(III), $Mn(acac)_3$ and their characterization.
b. Synthesis and Characterization of Hexamminechromium(III) nitrate $[Cr(NH_3)_6](NO_3)_3$ using magnetic susceptibility balance (MSB) and IR spectroscopy (Green Preparation).
c. Synthesis of Iron(III) dithiocarbamate and its characterization using magnetic succeptibility balance (MSB) and IR spectroscopy.
d. Synthesis and characterization of nitro- and nitritopentamminecobalt(III) chlorides using IR spectroscopy.
e. Synthesis of hexamminecobalt(III) chloride and pentammineaquocobalt(III) chloride.
f. Synthesis of cis- and trans- potassiumdioxalatodiaquochromate(III).

**2. Complexometric Titrations**

a. Determination of calcium in the presence of magnesium using EDTA as titrant
b. Determination of the total hardness (permanent and temporary) of water
c. Determination of calcium in the presence of barium using EDTA as titrant.

**1. Redox Titrations:**

a. Determination of chlorate, preparation of 0.1M cerium(IV) sulphate.
b. Determination of copper, determination of dissolved oxygen.

**Recommended Books**

1. H. Denny, W. Roesky, 'Chemical Curiosites', Wiley VCH,1996.
2. G. Marr and B.W. Rocket, 'Practical Inorganic Chemistry', University Science Books, **1999.**
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', 2nd Edn., Chapman and Hall, London, **1974.**
4. J. Mendham, R.C. Denney, J.D. Barnes, M. Thomas, 'Vogel's Textbook of Quantitative Analysis', 5th Edn., Pearson Education, **2006.**
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', Pearson Education, **2006.**
6. Anil J. Elias, 'A Collection of Interesting General Chemistry Experiments', Orient Longman Ltd., Universities Press (India) Pvt. Ltd., **2008**.
7. http://dst.gov.in/green-chem.pdf

## ORGANIC CHEMISTRY LAB-I

**Subject Code: MCHMS1-105** **L T P C** **Duration: 60 (Hrs.)**
**0 0 4 2**

**Course Objectives**

1. To learn the skills of distillation and separation methods
2. To develop experimental skills of various purification techniques.
3. To impart knowledge of detection related to organic functional groups.
4. To execute various organic preparation methods

**Course Outcomes**:

After the completion of course students will be able to:

1. Carry out distillation and separation methods
2. Identify the TLC of various organic compounds
3. Distinguish and detect organic functional groups
4. Construct various organic preparation methods

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given syllabus.

2. Any other subject related experiment can also be included.

**1. Distillation & Separation**

a. To purify common organic solvents
b. Extract rose oil from rose petals by steam distillation.

**2. Thin Layer Chromatography (TLC):**

a. Identification of phytoconstituents
b. To check TLC purity of Acetaminophen, Aspirin, Caffeine, Phenacetin and Salicylamide after completion of reactions.

**3. Organic Analysis:**

Detection of common functional groups in the given organic compounds and identification of compounds through derivatives.

**4. Organic Preparations:**

a. Benzoylation: Hippuric acid
b. Oxidation: Adipic acid/p-Nitrobenzoic acid
c. Aldol condensation: Dibenzalacetone/Cinnamic acid
d. Sandmeyer's reaction:p-Chlorotoluene
e. Benzfused Heterocycles:Benzimidazole
f. Cannizzaro's reaction: p-Chlorobenzaldehyde as substrate

g. Friedel Crafts reaction: S-Benzoylpropionic acid
h. Aromatic electrophilic Substitution:p-Nitroaniline/p-Iodoaniline

**Recommended Books**

1. David T. Plummer, 'An Introduction to Practical Biochemistry', 3rdEdn., TataMcGraw Hills, **1998**.
2. A.I. Vogel, 'Text Book of Practical Organic Chemistry', 5thEdn., PearsonEducation, **2005**.
3. P.R. Singh, D.S. Gupta and K.S. Bajpai, 'Experimental Organic Chemistry', Vol. 2, Tata McGraw Hill, **1981**.
4. G. Mann, B.C. Saunders, 'Practical Organic Chemistry' ELBS Edn,,**1989**.

N.K. Vishnoi, 'Advanced Practical Organic Chemistry', 2ndEdn.,Vikas PublishingHouse Pvt. Ltd.,**1994.**

**Total Credits= 23**

| 2nd Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MCHMS1-201 | Molecular Spectroscopy-I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-202 | Organometallics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-203 | Organic Reactions & Mechanisms-II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-204 | Seminar - I | 0 | 0 | 2 | 100 | -- | 100 | 1 |
| **Departmental Elective-II ( Choose any one)** | | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMD1-211 | Nano Chemistry | | | | | | | |
| MCHMD1-212 | Bio-organic Chemistry | | | | | | | |
| MCHMD1-213 | Analytical Chemistry | | | | | | | |
| **Departmental Elective-III ( Choose any one)** | | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMD1-221 | Natural Products | | | | | | | |
| MCHMD1-222 | Bio-physical Chemistry | | | | | | | |
| MCHMD1-223 | Asymmetric Synthesis | | | | | | | |
| MCHMS1-205 | Inorganic Chemistry Lab.-II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **20** | **0** | **06** | **360** | **340** | **700** | **23** |

## MOLECULAR SPECTROSCOPY-I

**Subject Code: MCHMS1-201** **L T P C** **Duration: 60 (Hrs.)**
4 0 0 4

**Course Objectives:**

1. To provide the fundamental knowledge of principles of spectroscopy.
2. To understand the application of spectroscopic concepts.
3. To understand the explanation behind the observed features the spectra of compounds.
4. To give the knowledge of structure elucidation based on spectroscopic data.

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**Course Outcomes:**

The students will be able to

1. Understand the basic and advanced concepts of spectroscopy.
2. Apply the concepts of spectroscopy to understand the explanation behind the observed features of spectra
3. Analyze and understand the spectra of compounds.
4. Elucidate the structure of molecules on the basis of given spectroscopic data

### UNIT-I (15 Hours)

**General Features of Spectroscopy**

Introduction to spectroscopy, Nature of electromagnetic radiation, Regions of the electromagnetic spectrum Units and conversion factors, Intensities line width and line width broadening of spectral lines, transition probability, transition moment and selection rules

**Microwave Spectroscopy**

Classification of molecules according to their moment of inertia, Rotational spectra of rigid diatomic molecules, Intensities of spectral lines, isotopic substitution effects. Non-rigid rotator, Polyatomic molecules – Linear and symmetric top molecules, Stark effect

**Raman Spectroscopy**

Introduction, Classical and Quantam theory of Raman effect, Stokes and antistokes lines, anisotropic polarizability, Pure rotational raman spectra of linear and symmetric top molecules, vibrational raman spectra of $H_2O$ and $CO_2$ molecules, Polarisation of the light and raman effect, Rule of mutual exclusion

### UNIT-II (15 Hours)

**Infrared Spectroscopy**

Energy of vibrating diatomic molecule, simple harmonic oscillator, force constants, Fundamental vibration frequencies, Anharmonicity of molecular vibrations and its effect on vibrational frequencies, Frequencies of the vibrational transitions of HCl. Vibrational rotation spectra of CO, P, Q and R branches, Vibrations of polyatomic molecules. Examples of $CO_2$, $H_2O$, Mechanics of measurement of infrared and Raman spectra, absorption of common functional groups, their dependence onchemical environment (bond order, conjugation, H – bonding), Use of group theory to determine the number of active infrared and Raman active lines. Fermi resonance, combination bands and overtones, Infrared spectrometer, Application of IR in structure elucidation of organic compounds – Various Carbonyl compounds, alkane, alkenes, alkynes, unsubstituted, mono and di-substituted aromatic compounds, alcohols, phenols, ethers, Far IR region, Metal ligand vibrations, – CN, Nitronitrito- and CO ligands and the effect of their co-ordination with metal ions and IR spectra.

**UNIT-III (14 Hours)**

**UV and Visible Spectroscopy**

Measurement technique, Beer – Lambert's Law, molar extinction coefficient, oscillator strength and intensity of the electronic transition, Frank Condon Principle, Ground and first excited electronic states of diatomic molecules, relationship of potential energy curves to electronic spectra. Chromophores, auxochromes, electronic spectra of polyatomic molecules, Woodward rules for conjugated dienes and α, β- unsaturated carbonyl groups, extended conjugated and aromatic sterically hindered systems, red shift, blue shift, hypo- and hyperchromic effect.

**UNIT-IV (16 Hours)**

**Mossbauer Spectroscopy**

Mossbauer effect, Principles of Mossbauer spectroscopy, Formation of Mossbauer nuclides, Applications of Mossbauer spectroscopy

**Photoelectron Spectroscopy**

Introduction, Basic principles of electron spectroscopy, Photoelectric effect, Koopman's theorem, X-ray photoelectron spectroscopy (XPS) or ESCA, Instrumentation for XPS, chemical shifts in XPS, applications of XPS, ultraviolet photoelectron spectroscopy (UPS)

**Nuclear Quadrupole Resonance**

Introduction- quadrupole nuclei and quadrupole moment, experimental considerations, Electric Field Gradient (EFG), quadrupole coupling constant (QCC), Splitting in NQR spectra, Applications of NQR spectroscopy

**Recommended Text Books / Reference Books:**

1. Russell S. Drago, 'Physical Method for Chemistry', 2$^{nd}$Edn., Surfside Scientific Publishers,**1992.**
2. R.M. Silverstein, G.C. Bassler, T.C. Morrill, 'Spectrometric Identification of Organic Compounds', 3$^{rd}$Edn., Wiley,**1974**.
3. William Kemp, 'Organic Spectroscopy', 3$^{rd}$Edn., W.H. Freeman,**1991**.
4. Dudley H. Williams & Ian Fleming, 'Spectroscopic Methods in Organic Chemistry', 6$^{th}$Edn., McGraw Hill, Science,**2008.**
5. J.R. Dyer, 'Application of Absorption Spectroscopy of Organic Compounds', Prentice Hall, Englewood Cliffs, N.J.,**1965**.
6. Dudley H. Williams & Ian Fleming, 'Spectroscopic Problems in Organic Chemistry', 5$^{th}$Edn., McGraw Hill, London,**1985**.
7. R.C. Banks, E.R. Matjeka, G. Mercer, 'Introductory Problems in Spectroscopy' Manlo Park, CA,**1980**.
8. G.M. Barrow, 'Introduction to Molecular Spectroscopy', McGraw Hill, New York,**1962**.
9. C.N. Banwell 'Fundamentals of Molecular Spectroscopy' 4$^{th}$Edn., TataMcGrawHill Education,**1994**.
10. D.L. Pavia, G.M. Lampan and G.S. Kriz, 'Introduction to Spectroscopy', 4$^{th}$Edn., Cengage Learning, **2008**.
11. Jag Mohan, 'Organic Spectroscopy-principles and applications', 2$^{nd}$Edn., Narosa

Publishing house Pvt. Ltd., **2007**

12. P S Sindhu, 'Fundamentals of Molecular spectroscopy' $2^{nd}$Edn., New age international Publishers. **2011**

## ORGANOMETALLICS

**Subject Code: MCHMS1-202** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

### Course Objectives

1. To recall classification of ligands and nomenclature of organometallic compounds.
2. To understand structure, bonding and reactivity of organometallic compounds.
3. To familiarize with the role of organometallic compounds in organic syntheses.
4. To understand the applications of organometallic compounds as catalysts.

**Course Outcomes:**

The students will acquire knowledge of

1. Organometallic compounds and their nomenclature.
2. Bonding and reactivity of metal complexes.
3. Role of organometallic complexes in organic syntheses.
4. Importance of catalyst in syntheses.

### UNIT-1 (11 Hrs.)

Introduction- Stability & decomposition pathways, classification of ligands, nomenclature of Organometallic compounds.

18 valence electron rule- Introduction to the 18 valence electron rule, total electron counts and finding metal-metal bonds & related problems.

### UNIT-II (17 Hrs.)

Synthesis, structure, bonding & reactivity of organo transition metal complexes.

a) Carbenes, Carbynes, Alkenes, Alkynes, Allylmoieties, Butadiene, Cyclobutadiene, Cyclopentadiene, Arenes, Cycloheptadienylmoieties & Cyclooctatetraenemoieties, Carbonyl.
b) Ferrocenes- Structure & bonding of ferrocenes, basic chemical reactions of ferrocenes, chirality in ferrocene derivatives, ferrocene based condensation polymers.

### UNIT-III (16 Hrs.)

Organometallic compounds in organic Synthesis-Green rules, synthesis & use of Zinc dialkyls, Collaman's reagent, organ mercuric& chromium carbonyls in organic synthesis, Heck reaction, Hydrozirconation.

### UNIT-IV (16 Hrs.)

Applications of organometallic complexes to Catalysis-Basic principles, Industrial requirements of catalysts, sequences involved in catalytic reaction, asymmetric synthesis using catalyst, Hydrogenation catalysts & their classification, hydrogenation by lanthanide organometallic compounds. Hydro formylation: Cobalt catalyst & phosphine modified cobalt catalysts, Rhodium-phosphine catalysts, factors affecting n/iso ratio of hydro formylation products. Monsato, Cativa & Wacker processes, polymerization & oligomerisation of olefins & dienes, catalyticconverters.

**Recommended Books**

1. 'Basic Organometallic Chemistry: Concepts, Synthesis & Application ofTransition Metals',

CRC Press & Univ. Press, **2010**.
2. R.C. Mehrotra & A, Singh, 'Organometallic Chemistry, A Unified Approach', New Age International.
3. B.D. Gupta & A.J. Elias, 'Basic Organometallic Chemistry', UniversitiesPress.
4. F.A. Cotton & G. Wilkinson, 'Advanced Inorg, Chemistry', WileyIntersciences.

## ORGANIC REACTION AND MECHANISM –II

**Subject Code:MCHMS1-203** | **L T P C** 4 0 0 4 | **Duration: 60 (Hrs.)**

**Course Objectives:**

1. To acquire the knowledge of chemical reactions of Carbon-Carbon and Carbon-Hetero Multiple Bonds .
2. To understand the chemistry behind oxidation, reduction and rearrangement reactions.
3. To acquire the knowledge and use of various reagents and retro synthetic approach used in organic syntheses.
4. To evaluate the organic reactions based on the influence of the substituents on substrate molecule and nature of solvents and other parameters

**Course Outcomes:**

The students will be able to:

1. Understand chemical reactions of Carbon-Carbon and Carbon-Hetero Multiple Bonds .
2. Apprehend the chemistry behind oxidation, reduction and rearrangement reactions.
3. understand use of diverse reagents in organic synthesis and retrosynthetic approach
4. Evaluate the organic reactions based on the influence of the substituents on substrate molecule and nature of solvents and other parameters

### UNIT-I (15 Hrs.)

**1. Addition to Carbon-Carbon and Carbon-Hetero Multiple Bonds:**

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio- and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation. Addition of Grignard reagents, organozinc, organolithium and Gillman reagents to carbonyl and unsaturated carbonyl compounds. Use of other organometallic reagents in addition reactions. Wittig reaction, Mechanism of condensation reactions involving enolates – Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis ofesters.

### UNIT-II (15 Hrs.)

**2. Oxidation :**

Different oxidative processes. Hydrocarbons- alkenes, aromatic rings, saturated C-H groups) activated and inactivated). Alcohols, diols, aldehydes, ketones, ketals and carboxylic acids. Amines, hydrazines, and sulphides.

Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium (III) nitrate, DDQ, PCC, CAN, selenium dioxide, peroxyacids, DCC. Oxidation reactions with special emphasis on Baeyer-villeger reaction, Cannizarro oxidation-reduction reaction.

### UNIT-III (15 Hrs.)

**3. Reduction :**

Different reductive processes, Hydrocarbons- alkanes, alkenes, alkynes and aromatic rings, Carbonyl compounds – aldehydes, ketones, acids, ester and nitriles. Epoxides, Nitro, nitroso, azo and oxime groups, Hydrogenolysis. Sodium borohydride, sodium cyano borohydride, LAH, disobutylaluminium hydride, tin hydride, trialkyl tin hydride, trialkylsilanes, alkoxy substituted LAH, DIBAL, diborane, diisoamyl borane, hexyl borane, 9-BBN, isopinocamphenyl and disiopinocamphenyl borane. Reduction reactions with particular emphasis on Wolf-Kishner reduction, Clemmensen reduction,

**UNIT-IV (15 Hrs.)**

4. **Rearrangements :**
General mechanistic consideration – nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements, Pinacol-pinacolone, Wagner-Meerwein, Demjanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Beckmann, Hofman, Curtius, Schmidt, Shapiro reaction, Fries rearrangement

5. **Retrosynthesis:**
Synthons and synthetic equivalents, Definitions, Guidelines, Functional group interconversions, Use of acetylenes and aliphatic nitrocompounds in organic synthesis; Two-group C-C disconnections – Diels-Alder reaction, 1,3- and 1,5-difunctional compounds (Michael addition and Robinson annulation), Order of events in organic synthesis, Chemoselectivity, Reversal of polarity (umpolung), Cyclisation reactions, Amine synthesis

**Recommended Text Books / Reference Books:**

1. Jerry March & Michael Smith, 'March's Advanced Organic Chemistry:Reactions, Mechanisms, and Structure', $6^{th}$ Edn., John Wiley &Sons,**2007**.
2. Francis A. Carey & Richard J. Sundberg, 'Advanced Organic Chemistry: Structureand Mechanisms, Vol, A', $5^{th}$ Edn., Springer,**2007**.
3. Francis A. Carey & Richard J. Sundberg, 'Advanced Organic Chemistry: Reactionand Synthesis', Vol. B, $4^{th}$ Edn., Springer,**2006.**
4. K.C. Nicolaou and E.J. Sorensen, 'Classics in Total Synthesis: Targets, Strategies, Methods', Wiley,**1996**.

## SEMINAR – I

**Subject Code: MCHMS1-204** | **L T P C 0 0 2 1** | **Duration: 30 Hrs.**

### Course Objectives

1. To guide the students for the selection of topic of presentation of seminar.
2. To guide the students for preparation of powerpoint presentation.
3. To make the students able to present a seminar and handle the questions of the audience.
4. To improve the soft skills of students.

### Course Outcomes

After the completion of this course, the students will be able to

1. Prepare a powerpoint presentation for the seminar to justify the contents of the presentation.
2. Present the seminar before the whole class. This will hone their soft skills.
3. Understand the selected topic thoroughly so as to handle the questions of the audience at the time of presentation.

1. In the beginning of the semester, a teacher will be allocated maximum 30 students. The latter will guide/teach them how to prepare/present 15 minutes Power Point Presentation for the Seminar.

2. If there are more than 30 students in the class, then class will be divided into two group shaving equal students. Each group may be allocated to a different teacher.

3. Each student will be allotted a topic by the teacher at least one week in advance for the presentation. The topic for presentation may be from the syllabus or relevant to the syllabus of the program.

4. During the presentation being given by a student, all the other students of his/her group will attend the seminar. The assessment/evaluation will be done by the teacher. However, Head of Department and other faculty members may also attend the seminar, ask questions and give their suggestions.

5. This is a turn wise continuous process during the semester and a student will give minimum two presentations in a semester.

6. For the evaluation, the following criteria will be adopted,

a) Attendance in seminar: 25 Marks
b) Knowledge of subject along with Questions handling during the seminar: 25 Marks
c) Presentation and communication Skills: 25 Marks
d) Contents of the presentation: 25 Marks.

## NANOCHEMISTRY

**Subject Code: MCHMD1-211** **L T PC 4 0 0 4** **Duration: 60 Hrs.**

**Course Objectives**

1. To understand the concept of self-assembly and its applications to various nanostructures.
2. To understand synthesis of nanomaterials.
3. To provide knowledge of characterization of nanomaterials.
4. To give knowledge of applications of nano materials in biological systems.

**Course Outcomes:**

The students will acquire knowledge of

1. Introduction to the concept of nanochemistry and its classification.
2. Synthesis of nanomaterials by different routes and their characterization.Applications in biological and electronic systems.

### UNIT-I(15Hrs)

**1. Introduction:**

Introdution to nanochemistry and nanotechnology, definition & classification of nanomaterials. Properties & applications of nanomaterials.

**2. Self-Assembly and Nanostructures:**

Types of self-assemblies, self-assembling materials. Use of self-assembly in nano rod devices, nano wires, nano tubes, molecular logic gates, molecular storage devices, DNA, fullerenes, nano gas sensors.

### UNIT-1I(15Hrs.)

**3. Nano Material Synthesis:**

Top down and bottom up approach, synthesis: Vapour phase synthesis by chemical routes; Nucleation & growth from solutions, stabilization against agglomeration. Processing of nano materials; Nano structured sol gel materials. Consolidation of nano crystalline materials by compaction and sintering, nanolithography.

### UNIT-1II(15Hrs.)

**4. Characterization Techniques:**

Characterization of nano structured materials – by scattering techniques, proximal microscopy (AFM & STM).

### UNIT-1V(15Hrs.)

**5. Applications:**

Bionano composites, biometrics, nano technology enabled sensors, Microelectronics, drug delivery, bionano information.

**Recommended Books:**

1. C.P. Poole & F.J. Owens, 'Introduction to Nanotechnology', Wiley,**2003**.
2. M. Ratner & D. Ratner, 'Nanotechnology'**,** Prentice Hall,**2003**.
3. M. Wilson, K. Kannagara, G. Smith, M. Simmons & B. Raguse 'Nanotechnology'**,** CRC Press BocaRaton,**2002**.
4. A. Ozin Geoffery & C. Andre, 'Nanochemistry, A Chemical Approach to Nanomaterials'**,**Arsenault Royal Society of Chemists,**2005**.
5. E. Foster Lynn, 'Nanotechnology, Science Innovation & Opportunity', Pearsoneducation,2007.

## BIO-ORGANICCHEMISTRY

**Subject Code: MCHMD1-212** **L T PC** **Duration: 60 Hrs.**

**4 0 0 4**

**Course Objectives**

1. To describe the concepts behind amino acids, nucleic acids and protein synthesis
2. To explain the kinetics and mechanism of enzyme catalysis
3. To understand and sketch the mechanisms of asymmetric synthesis
4. To describe the concepts of antisense technology in chemotherapy

**Course Outcomes:**

After the completion of course students will be able to:

1. Analyze the concepts related to amino acids/nucleic acids/protein synthesis
2. Explain kinetics and mechanism of enzyme catalysis
3. Use concepts of asymmetric synthesis
4. Describe the concepts of antisense technology in chemotherapy

### UNIT-1 (15 Hrs.)

**Amino Acids and Proteins:**

Structure, classification, synthesis and properties of amino acids, isoelectric point, biosynthesis of amino acids. Peptides: oligo- and polypeptides, geometry of peptide linkage, N-terminal and C-terminal residue analysis, synthesis of peptides-amino and carboxyl protecting groups-solid phase peptide synthesis. Proteins: classification and properties (denaturation, isoelectric point and electrophoresis), primary, secondary, tertiary and quaternary structures of proteins, collagen and triple helix.

### UNIT-1I (15 Hrs.)

**Enzymes and Cofactors:**

Mechanism of enzyme catalysis, Factors influencing enzyme action, Examples of typical enzyme mechanisms: chymotrypsin, ribonuclease and lysozyme, Enzyme-catalyzed addition, elimination, condensation, carboxylation and decarboxylation, isomerization, group transfer and rearrangement reactions-structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid and Vitamin B12. Mechanisms of reactions catalyzed by the above cofactors.

### UNIT-III (15 Hrs.)

**Nucleic Acids and Protein Synthesis:**

Nucleotides and nucleosides, DNA: primary and secondary structure-replication of DNA. RNA and protein synthesis: Messenger RNA synthesis-transcription, Ribosomes-rRNA, Transfer RNA, genetic code translation.

Determination of base sequence of DNA. Polymerase Chain Reaction (PCR). Antisense technology in chemotherapy and other nucleic acid-targeted drugs-intercalates, sequence specific drugs. A brief account of ribozyme and iRNA.

**UNIT-IV (15 Hrs.)**

**Lead and Analogue Synthesis-1:**

Designing organic synthesis-disconnection approach- synthons and synthetic equivalents-one group disconnections: alcohol, olefin, ketone, acids- two group disconnections:1,2-, 1,3-, 1,4- and 1,5-difunctional compounds-convergent synthesis-functional group interconversions- functional group additions-carbon heteroatom bonds-methods for 3- to 6-membered rings.

**Lead and Analogue Synthesis-2:**

Combinatorial synthesis in medicinal chemistry: Solid phase techniques-methods of parallel synthesis-mix and split techniques-dynamic combinatorial chemistry-screening and deconvolution-limitations of combinatorial synthesis Asymmetric synthesis: basic principles-stereo selective and stereospecific reactions- methods for determining enantiomeric excess-chiral auxiliary, reagents and catalysts and their applications (wherever applicable) in alkylation, hydrogenation, hydroxylation, epoxidation and hydroboration of alkenes, reduction of ketones-Cram and Felkin-ahn models. Noyori's BINAP – Jacobson catalyst – Evans catalyst.

**Recommended Books:**

1. Hermann Dugas and C. Penny, 'Bioorganic Chemistry: A Chemical Approach to Enzyme action',Springer-Verlag.
2. N.C. Price and L. Stevens, 'Fundamentals of Enzymology', Oxford UniversityPress.
3. C. Walsh, W.H. Freeman, 'Enzymatic ReactionMechanisms'.
4. Stuart Warren, 'Designing Organic Synthesis: The Disconnection Approach', 2$^{nd}$Edn., Wiley,**1984**.
5. H.B. Kagan, 'Asymmetric Synthesi', Thieme Medical Publishers,**2003**.
6. Francis A. Carey and Richard B. Sundberg, 'Advanced Organic Chemistry: Part-A and Part-B', 5$^{th}$ Edn., Springer,**2007**.

## ANALYTICAL CHEMISTRY

**Subject Code: MCHMD1-213** **L T P C** **Duration: 60 (Hrs.)**
4 0 0 4

**Course Objectives:**

1. To introduce the theory and importance of analytical chemistry.
2. To familiarize with the importance of various methods of quantitative estimations.
3. To introduce various analytical techniques and their significance.
4. To introduce analytical treatment of data for reporting results.

**Course Outcomes:**

The students will be able to:

1. Understand basic concepts and importance of analytical chemistry.
2. Analyse and compile the results of calculations in a scientific manner.
3. Understand various analytical techniques and their significance.
4. Apply the knowledge of analytical chemistry to solve the related problems.

### UNIT-I (18 Hrs.)

**Introduction to Analytical Chemistry**

Classification of Analytical Methods. Types of samples, Preparation of sample for analysis, effect of sampling uncertainties, sample treatment, procedure of sampling of solids, liquids and gases.

**Errors and Evaluation**

Accuracy, precision, sensitivity, detection limits, significant figures, rounding off noise and sources, Uncertainties, errors. Types of errors – determinate and indeterminate errors. Ways of expressing accuracy, absolute and relative errors. Significant figures and propagation of errors. Confidence limit, Test of significance – the F-test and T-test. The statistical Q-test for rejection of a result, calibrations, mean, standard deviations. Linear least squares method. The correlation coefficient. Calculation for the above parameters.

**Thermo analytical Techniques**

Principle of thermogravimetry, thermogravimetric analysis, differential thermal analysis, differential scanning calorimetry, instrumentation for TGA, DTA and DSC, Methodology of TG, DTA and DSC. Application of TG to study of oxalates and chromates, factors affecting TGA and DTA curves. Applications of thermal analysis.

### UNIT-II (15 Hrs.)

**Electrochemical Techniques**

a) D.C Polarography: Instrumentation - Dropping mercury electrode- -polarogram. Types of Currents: Residual, Migration, Limiting. Two and Three electrode assemblies. Ilkovic equation (derivation not required). Applications of polarography in qualitative and quantitative analysis. Analysis of mixtures. Application to inorganic and organic compounds. Determination of stability constants of complexes.

b) Brief account of following techniques:

(i) Pulse technique (ii) Differential pulse technique (iii) Cyclic Voltammetry (iv) Square-wave technique

c) Amperometric titrations: Principle, Instrumentation. Types and applications amperometric titrations.

**Chromatography**

Classification of chromatographic techniques, differential migration rates, partition ratio, retention time, relation between partition ratio and retention time, capacity factor, selectivity factor. Efficiency of separation- resolution, diffusion, plate theory and rate theory HPLC: Principle, instrumentation, supports in HPLC. Applications of HPLC systems. Supercritical fluid chromatography (SFC). Recent developments in SFC and applications.

**UNIT-III (12 Hrs.)**

**Microscopy Techniques**

Basic principle, instrumentation and applications of electron microscopy - SEM, TEM, scanning probe microscopy – STM, AFM.

**Cryo-electron microscopy**

Principle, instrumentation and applications, advantages and challenges, cryo-SEM, cryo-TEM, vitrification, cryo-electron microscopy of vitreous sections, ice contamination, cryo-negative staining, brief account of cryo-fixation methods, 2-D crystallization of membrane protein and cryo-preparation of 2-D crystal samples, brief discussion on cryo- electron tomography.

**UNIT-IV (15 Hrs.)**

**Nuclear Chemistry:**

Nuclear binding energy and stability, nuclear models (nuclear shell model and collective model). Nuclear reactions: types of reactions, nuclear cross-sections, Q-value. Natural and artificial radioactivity, radioactive decay and equilibrium, Nuclear fission-fission product and fission yields, Nuclear fusion.

**Radiochemical methods of analysis:**

Radioactive tracer techniques and its applications, isotope dilution analysis, neutron activation analysis, Counting techniques such as G.M. Ionization and proportional counters.

**Separation methods:**

Solvent extraction: Partition law and its limitations, distributionratio, separation factor, factor influencing extraction, multiple extractions.

**Recommended Text Books / Reference Books:**

1. A Douglas, Skoog and Donald M. West, F.J. Holler, ‘Fundamentals of Analytical Chemistry**’**, 8$^{th}$Edn., Harcourt College Publishers, **2004**.
2. Skoog, Holder, Nieman, ‘Principles of Instrumental Analysis**’**, 5$^{th}$Edn., Thomson Books, **1998**.
3. J. Mendham, R.C. Denney, J.D. Barnes, M. Thomas, ‘Vogel's Text Book of Quantitative Chemical Analysis’**,** 6$^{th}$Edn., Pearson Education, **2006**.
4. R. Gopalan, P.S. Subramaniam and K. Rengarajan, ‘Elements of Analytical Chemistry**’**, 3$^{rd}$Edn.,Sultan Chand and Sons,**2003**.
5. S. Usharani, ‘Analytical Chemistry’, Macmillan Publishers,**2000**.
6. A. Cavalier, D. Spehner, B.M. Humbel, ‘Handbook of Cryo-Preparation Methods for Electron Microscopy’, CRC Press, Taylor & Francis Group, **2009**.
7. B. C. Harvey, ‘Introduction to Nuclear Chemistry’,Prentice-Hall, **1969**.
8. G. Friedlander, J. W. Kennedy, E.S. Marcus, J.M. Miller, ‘Nuclear & Radiochemistry’, John Wiley & Sons, **1981**.
9. H.J. Arnikar, ‘Nuclear Chemistry’, Wiley Eastern Co., II Edition, **1987**.
10. A. Braithwaite and F.J. Smith, ‘Chromatographic Methods’**,**5$^{th}$ Ed., Blackie

Academic and Professional, London, **1996**.

## NATURAL PRODUCTS

**Subject Code: MCHMD1-221** **L T PC 4 0 0 4** **Duration: 60Hrs.**

**Course Objectives**

1. To acquire basic knowledge of isolation, purification, identification and standardization of natural products.
2. To discuss structure elucidation of alkaloids, terpenoids , steroids, vitamins and carotenoids.
3. To understand the qualitative and quantitative analysis of natural compounds.
4. To discuss the use and importance of natural products.

**Course Outcomes:**

The students will be able to:

1. Understand the procedures involved in Isolation, purification, identification and standardization of natural products.
2. Elucidate the structure of alkaloids, terpenoids , steroids, vitamins and carotenoids.
3. Analyze the natural products quantitatively and qualitatively
4. Appreciate the use and importance of natural products in day to day life.

### UNIT-I (15 Hrs.)

**1. Introduction & General Methods**

Isolation, purification, identification and standardization of natural products. Carbohydrates and metabolism: Introduction, stereoisomerism, mutarotation, configuration and ring structure of monosaccharides, disaccharides and polysaccharides. Glycolysis, alcoholic and lactic acid fermentation, citric acid cycle.

### UNIT-II (15 Hrs.)

Introduction, classification, isolation and purification of alkaloids and terpenoids. Structure elucidation of alkaloids (atropine, quinine, morphine) and terpenoids (camphor and menthol). Biosynthesis of alkaloids and terpenoids.

### UNIT-III (15Hrs.)

**2. Steroids**

General introduction, isolation, purification and structure elucidation stereochemistry of sterols with special reference to cholesterol. Vitamin D group and bile acids. Biosynthesis of sterols.

### UNIT-IV (15Hrs.)

**3. Carotenoids andVitamins**

Introduction to carotenoids and vitamins, Carotenes. Vitamin A, xanthophyll, vitamin B complex, vitamin K and vitamin E group.

**Recommended Books**

1. I.L. Finar, 'Organic Chemistry: Stereochemistry and The Chemistry Natural Products', Vol. II, 5th Edn., Longman Scientific & Technical, **1988**.
2. O.P. Agarwal, 'Chemistry of Organic Natural Products', Vol. I, 40thEdn., Krishna Prakashan

Media,**2010.**

**3.** O.P. Aggarwal, 'Organic Chemistry Natural Products', Vol. II, $38^{th}$ Edn.,Krishna Prakashan Media,**2010.**

## BIO-PHYSICALCHEMISTRY

**Subject Code: MCHMD1-222** **L T PC** **Duration: 60Hrs.**

**4 0 0 4**

**Course Objectives:**

1. To equip with basic knowledge of the physical principles that govern chemical systems.
2. To provide knowledge of various biological systems with emphasis on biochemical reactions.
3. To recall enzyme concepts, and their role in chemical and biological catalysis.
4. To understand various principles that govern cellular processes.

**Course Outcomes:**

The students will be able to

1. Understand the importance of enzymes in biological processes.
2. Appraise various interactions between biomolecules.
3. Conceptualise the thermodynamics in biological systems.
4. Connect chemistry with biological processes.

### UNIT I (15Hrs)

**Biological Cell and its Constituents:**

Biological cell, DNA and RNA in living systems. Basic consideration. Proximity effects and molecular adaptation.

**Enzymes:**

Introduction and historical perspective, chemical and biological catalysis, Remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshland's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michaelis-Menten and Line Weaver-Burk plots, reversible and irreversible inhibition.

### UNIT II (15Hrs)

**Kinds of Reactions Catalyzed by Enzymes:**

Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reaction, enolic intermediates in isomerization reactions, b-cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

**Co-Enzyme Chemistry:**
Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes. Structure and biological function of coenzyme A, thiamine pyrophosphate, Pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B12. Mechanism of reaction catalyzed by the above cofactors.

**UNIT III (15Hrs)**

**Biological Macromolecules:**

**The Nucleic Acids:**
Nucleotide, torsion angles in poly nucleotide chains, the helical structure of polynucleic acids, high order structure in polynucleotides.

**Interactions in Macromolecules:**
Basic principles of interaction between molecules, water structure and its interaction with biomolecules, dipole interactions, side chain interactions, electrostatic interactions, base pairing in nucleic acids, base stacking, hydration and the hydrophobic effect.

**Structural Transition in Bio-macromolecules:**
Coil – helix transitions in proteins, statistical methods for predicting protein secondary structures; melting and annealing of polynucleotide duplexes, helical transitions in double stranded DNA, super coil dependent DNA transitions predicting helical structures in genomic DNA.

**UNIT IV (15 Hrs)**

**Bioenergetics and ATP cycle**

Standard free energy change in biochemical reaction, exergonic, endergonic reactions. Hydrolysis of ATP, synthesis of ATP from ADP, metal complexes and transition of energy, chlorophylls, photo system I and photo system II in cleavage of water.

**Thermodynamics of Biopolymer Solutions**
Thermodynamics of biopolymers solutions, osmotic pressure, membrane equilibrium, muscular contraction and Energy generations in mechano-chemical system.

**Recommended Books:**

1. A.L. Lehninger, 'Principles of Biochemistry', WorthPublishers.
2. Voet; 'VoetBiochemistry', John Wiley,**1995**.
3. E.E. Conn, P.K. Stumpt, 'Outlines of Biochemistry', JohnWiley.
4. Hermann Dugas, C. Penny, 'Bioorganic Chemistry: Chemical Approach toEnzyme Action', Springer Verlag,**1982**.
5. M.I. Page, A. Williams, 'Enzyme Mechanisms, 'Royal Society ofChemistry'.
6. Richard B. Silverman, 'Organic Chemistry of Enzyme CatalysedReaction'.
7. I. Bertini, H.B. Gray, S.J. Lippard, J.S. Valentine, 'Bioinorganic Chemistry', UniversityScience Books.
8. William Jolley, 'BioinorganicChemistry'.
9. K.E. VanHolde, W.C. Johnson, P.S. Ho, 'Principles of Physical Biochemistry',Prentice Hall,**1998**.
10. L.Stryer, 'Biochemistry', W.H.Freeman.
11. J. DavidRawn, 'Biochemistry', NeilPatterson.
12. F. Wold, 'Macromolecules: Structure and Function', PrenticeHall.

13. C.R. Cantor, P.R. Schimmel, 'Biophysical Chemistry', Vol. 1-3, Freeman, **1980**.

## ASYMMETRIC SYNTHESIS

**Subject Code: MCHMD1-223**

| L | T | P | C |
|---|---|---|---|
| 4 | 0 | 0 | 4 |

**Duration: 60 (Hrs.)**

**Course Objectives:**

1. To learn basic principles behind chirality/asymmetric synthesis
2. To understand analytical methods/techniques used in asymmetric synthesis
3. To illustrate substrate controlled/chiral auxiliary controlled asymmetric reactions mechanistically
4. To describe chiral reagent controlled asymmetric reactions mechanistically

**Course Outcomes:**

After the completion of course students will be able to:

1. Outline basic principles behind chirality/asymmetric synthesis
2. Explain analytical methods/techniques used in asymmetric synthesis
3. Write mechanisms of substrate controlled/chiral auxiliary controlled asymmetric reactions
4. Sketch the mechanisms of chiral reagent controlled asymmetric reactions

**UNIT-I (18 Hrs.)**

**Basic Principles of Chirality and Asymmetric Synthesis:**

Phenomenon of chirality, Need for asymmetric synthesis, Selective synthesis of enantiomers, Enantiomeric purity of natural products, stereogenic unit and types of chiral compound , Centrally chiral compounds of carbon, Centrally chiral compounds of nitrogen and phosphorus, Centrally chiral compounds of sulphur, Axially chiral compounds, Chiral molecules with more than one stereo genic unit: diastereomers, The selective synthesis of diastereomers, Prochirality: enantotopic and diastereotopic groups. Definition: enantiotropic and diastereotropic groups and faces – Symmetry, substitution and addition criteria. Prochirality nomenclature: Pro – R, Pro – S, Re and Si. Selectivity in synthesis: Stereospecific reactions (substrate stereoselectivity), Stereoselective reaction (Product stereoselectivity), Enantioselectivity and diastereoselectivity. Chemoselectivity, Regioselectivity. Conditions of Stereoselectivity: Symmetry and transition state criteria, kinetic and thermodynamic control. Methods for inducing enantio- and diastereoselectivity.

**UNIT-II (12 Hrs.)**

**Analytical Methods:**

Determining % Enantiomeric excess, % Enantioselctivity, Optical Purity, % Diastereomeric excess and % diatereoselectivity. Resolving agents and resolution of recemic compounds having common functional groups e.g. alcohol, amine, acid. Techniques for determination of Enantioselectivity, Polarimetric methods, Gas chromatography methods, Liquid chromatographic methods. NMR spectroscopy-Chiral derivatising agents (CDAs), Chiral solvating agents (CSAs), Chiral lanthanide shift reagents (CLSRs).

**UNIT-III (18 Hrs.)**

**Classification of Asymmetric Reactions:**

i) Substrate controlled asymmetric synthesis: Nucleophilic addition to chiral carbonyl compounds, 1,2 –Asymmetric induction, Felkin-Anh model, Double stereo differentiation; matched pair and mismatched pair, Examples from aldol condensation and hydroborationreactions

ii) Chiral auxiliary controlled asymmetric synthesis: α-alkylation of chiral enolates, azaenolates, imines and hydrazones, chiral sulphoxides. 1,4-asymmetric induction and Prelog's rule, use of chiral auxiliary in Diels-Alder and Cope reactions

iii) Chiral reagent controlled asymmetric synthesis: Asymmetric reduction using BINAL-H. Asymmetric Michael addition to α, β-unsaturated carbonyl compounds, Chiral lithium amides- enantioselective deprotonation, applications of chiralorganoboranes.

**UNIT-IV (12 Hrs.)**

**Classification of Asymmetric Reactions (Continued Unit III):**

**iv)** Chiral catalyst controlled asymmetric synthesis: Sharpless, Jacobson and Shi asymmetric epoxidation, Sharpless asymmetric dihydroxylation and amino hydroxylation. Asymmetric hydrogenations using chiral Wilkinson biphosphine and Noyori catalyst. Chiral catalyst controlled Diels-Alder and Michael reactions, Jacobson Catalysts-Evans Catalyst- Aziridination, Enzyme mediated enantioselective synthesis.

**Recommended Text Books / Reference Books:**


1. R. A. Aitken, S. N. Kilenyi, Asymmetric Synthesis, Originally published by Chapman &Hall, **1992**.
2. Guo-Qiang Lin, Yue-Ming Li, Albert S. C. Chan, Princilpes and applications of Asymmetric Synthesis, Wiley Interscience, **2001**
3. J.D. Morrison and H.S. Moscher, 'Asymmetric Organic Reactions', Vol 1-5, Academic Press,**1983.**
4. E.N. Jacobsen, A. Pfaltz, H. Yamamoto, 'Comprehensive Asymmetric Catalysis', Eds. Springer,**2000.**
5. R.S. Ward, 'Stereoselectivity in Organic Molecules', Wiley, New York,**1999**.
6. E.L. Eliel, 'Stereochemistry of Carbon Compounds', Wiley,**1992**.
7. W. Carruthers, 'Some Modern Methods of Organic Synthesis', Cambridge University Press, 4$^{th}$ Edn.,**2012.**
8. I. Ojima, 'Catalytic Asymmetric Synthesis', VCH-NY,Pergamon.**1998.**
9. R.E. Gawley, J. Aube, 'Principles of Asymmetric Synthesis' (Tetrahedron Series in Organic Chemistry),Pergamon,**1996.**
10. H.B. Kagan, 'Asymmetric Synthesis', Edn., I, Thieme Medical Publishers,**2003**.
11. G. Proctor, 'Asymmetric Synthesis', Oxford University Press, USA,**1997**.

## INORGANIC CHEMISTRY LAB-II

**Subject Code: MCHMS1-205** **L T P C 0 0 4 2** **Duration – 60 Hrs.**

**Course Objectives**

1. To extend knowledge of use of standard laboratory equipment, modern instrumentation and classical techniques to carry out experiments.
2. To synthesize various inorganic complexes and their qualitative determination by UV,IR, NMR and ESR techniques.

**Course Outcomes:**

The students will acquire knowledge of

1. Volumetric and gravimetric analysis of cations and anions.
2. Understand electro analytical techniques.
3. Syntheses of various complexes and their structural analysis.
4. Use of various spectroscopic techniques like UV, IR, NMR for structural determination.

Note:
1. Students will have to perform atleast 10-12 experiments from the given syllabus.

2. Any other subject related experiment can also be included.

1. **Gravimetric Analysis of Cations and Anions:** Iodide, thiocyanate, Sulphate, oxalate chloride, nickel, copper cobalt, zinc and their mixture.
2. **Determination of Metal Ions Using Solvent Extraction**:
   a) Determination of copper as the diethydithiocarbamatecomplex
   b) Determination of iron as the 8hydroxyquinolate
   c) Determination of nickel as the dimethylglyoxime complex,
3. **Electro Analytical Techniques**
   pHmetric, Conductometric Titration: Representative acid/base and redox titrations.
4. **Colorimetry and Spectrophotometry**
   a) Determination of $\lambda$max the absorption curve and concentration of asubstance
   b) Determination of copper (II) with EDTA
   c) Determination of iron (III) with EDTA.

**Recommended Books:**


1. H. Denny, W. Roesky, 'Chemical Curiosites', WILEY VCH,**1996**.
2. G. Marr and B.W. Rocket, 'Practical Inorganic Chemistry', University ScienceBooks, **1999.**
3. G. Pass and H. Sutcliffe, 'Practical Inorganic Chemistry', Chapman and Hall,London, **1968**.
4. J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, 'Vogel's Textbook of Quantitative Analysis', Pearson Education,**2006.**
5. G. Svehla, 'Vogel's Textbook of Quantitative Analysis', PearsonEducation,**2006**.
6. Anil J. Elias, 'A Collection of Interesting General Chemistry Experiments', University Press,**2002.**


Note: The students are required to perform atleast 2 experiments from each section.

**Total Credits= 24**

| 3rd Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MCHMS1-301 | Molecular Spectroscopy-II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-302 | Quantum Chemistry | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-303 | Heterocyclic Chemistry | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-304 | Seminar – II | 0 | 0 | 2 | 100 | - | 100 | 1 |
| **Departmental Elective-IV (Choose any one)** | | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMD1-311 | Surface Chemistry & Catalysis | | | | | | | |
| MCHMD1-312 | Medicinal Chemistry | | | | | | | |
| MCHMD1-313 | Green Chemistry | | | | | | | |
| **Open Elective-II** | | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| MCHMS1-305 | Organic Chemistry Lab.-II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| MCHMS1-306 | Physical Chemistry Lab.-I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **-** | **-** | **-** | **420** | **380** | **800** | **24** |

**Total Credits= 20**

| 4th Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Code** | **Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MCHMS1-401 | Photochemistry and Pericyclic Reactions | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-402 | Bio-inorganic Chemistry | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MREM0-101 | Research Methodology | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MCHMS1-403 | Physical Chemistry Lab.-II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Optional* (Choose any one)** | | 0 | 0 | 8 | 60 | 40 | 100 | 4 |
| MCHMS1-404 | Dissertation | | | | | | | |
| MCHMS1-405 | Term Paper | | | | | | | |
| MCHMS1-406 | Advanced Lab | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **-** | **-** | **-** | **300** | **300** | **600** | **20** |

**Overall Marks / Credits**

| Semester | Marks | Credits |
|---|---|---|
| $1^{st}$ | 700 | 23 |
| $2^{nd}$ | 700 | 23 |
| $3^{rd}$ | 800 | 24 |
| $4^{th}$ | 600 | 20 |
| **Total** | **2800** | **90** |

**Departmental Elective**: Subject to the availability of teacher and minimum 10 students as per university guidelines.

**Open Elective**: Student must choose open elective subject offered by other department.

**Optional*:**

**Dissertation-** Maximum 20% of the sanctioned strength of the students will be allotted dissertation on the basis of their option and percentage of marks (Merit) in M.Sc. $I^{st}$year examination subject to the consent of the faculty in the Department. Maximum students guided by each faculty cannot be more than two.

**Term paper:** The students who have not been allotted dissertation, will be offered term paper.

## MOLECULAR SPECTROSCOPY-II

| Subject Code: MCHMS1-301 | L T P C | Duration: 60(Hrs.) |
|---|---|---|
| | 4 0 0 4 | |

**Course Objectives:**

1.To provide the fundamental knowledge of principles of NMR, Mass and ESR spectroscop
2. To understand the application of spectroscopic concepts.
3. To understand the explanation behind the observed features the spectra of compounds.
4. To give the knowledge of structure elucidation based on spectroscopic data.

.

**Course Outcomes:**

The students will be able to

1. Understand the basic and advanced concepts of NMR, ESR and mass spectroscopy.
2. Apply the concepts of spectroscopy to understand the explanation behind the observed features of spectra
3. Analyze and understand the spectra of compounds.
4. Elucidate the structure of molecules on the basis of given spectroscopic data.

### UNIT-I (15 Hours)

**Nuclear Magnetic Resonance Spectroscopy**

The nuclear spin, precessional motion. Larmor frequency, the NMR isotopes, population of nuclear spin levels, spin – spin and spin – lattice relaxation, measurement techniques, Solvents used, Chemical Shift, shielding constant, range of typical chemical shifts simple applications of chemical shift ring currents and aromaticity, shifts of $^1$H and $^{13}$C, inductive effect, ring current effect and anisotropy chemical bonds, intermolecular forces effecting the chemical shifts. Spin – spin interactions, low- and high-resolution NMR with various examples. Heteronuclear coupling of $^1$H to other nuclei such as nitrogen, phosphoros and fluorine oxygen and sulphur. spin – spin interaction. Interaction between two or more nuclei, splitting due to vicinal and germinal protons, Coupling constant- mechanism of coupling, one, two and three bond coupling, long range coupling. Karplus relationship

### UNIT-II (15 Hours)

**Nuclear Magnetic Resonance Spectroscopy (contd.)**

First order and second spectra, spin system notation, $A_2$, AB, AX, $AB_2$,$AX_2$, ABC, ABX, $A_2B_2$and $A_2X_2$systems, magnetic equivalence, shifts reagents. Effects of chemical exchange, fluxional molecules, Hindered rotation on NMR spectrum,. Nuclear magnetic double resonance, spin decoupling, Nuclear Overhauser Effect (NOE), Advanced NMR techniques- COSY, HETCOR, NOESY

**$^{13}$C-Nuclear Magnetic Resonance Spectroscopy**

$^{13}$C- $^1$H coupling, $^{13}$C chemical shift, $^{13}$C spectra- proton coupled and decoupled, Differences of $^{13}$C from $^1$H NMR, DEPT, Nuclear OverhauserEffect, Cross Polarization, Intensities of lines in $^{13}$C, Problems with integration in $^{13}$C spectra.

## UNIT-III (15 Hours)

**Mass Spectroscopy**

Introduction, methods of ionization EI & CI, Laser desorption, Fast Atom Bombardment (FAB). Secondary Ion Mass Spectrometry (SIMS), field desorption etc. Ion analysis methods (in brief), isotope abundance, Metastable ions, Electron Impact mass spectra, fragmentation patterns for aliphatic compounds, amines, aldehydes, ketones, esters, amides, nitriles, carboxylic acids ethers, aromatic compounds, general rules predicting the fragmentation patterns.

## UNIT-IV (15 Hours)

**Electron Spin Resonance Spectroscopy**

Introduction, Factors affecting g values, limitations of ESR, Comparison of ESR and NMR, Instrumentation, hyperfine structure- isotropic and anisotropic interactions, ESR spectra of Deuterium, Triplet states-zero field splitting and Kramer's degeneracy, McConnel relationship, Study of inorganic compounds by ESR

**Structure Elucidation**

Structure elucidation by combined application of UV, IR, NMR and mass spectra. Solving first 20 problems from reference book 6 and first 20 problems from reference book 8.

**Recommended Text Books / Reference Books:**


1. C.N. Banwell 'Fundamentals of Molecular Spectroscopy' 4$^{th}$Edn., TataMcGraw-Hill Education,**1994**.
2. William Kemp, 'Organic Spectroscopy', 3$^{rd}$Edn., W.H. Freeman,**1991**.
3. Dudley H. Williams & Ian Fleming, 'Spectroscopic Methods in Organic Chemistry', 6$^{th}$Edn., McGraw Hill, Science,**2008.**
4. Russell S. Drago, 'Physical Method for Chemistry', 2$^{nd}$Edn., SurfsideScientific Publishers,**1992.**
5. R.M. Silverstein, G.C. Bassler, T.C. Morrill, 'Spectrometric Identification of Organic Compounds', 3$^{rd}$Edn., Wiley,**1974**.
6. D.L. Pavia, G.M. Lampan and G.S. Kriz, 'Introduction to Spectroscopy' 4$^{th}$Edn., Cengage Learning, **2008**.
7. R.C. Banks, E.R. Matjeka, G. Mercer, 'Introductory Problems in Spectroscopy' Manlo Park, CA,**1980**
8. Jag Mohan, 'Organic Spectroscopy-principles and applications', 2nd Edn., Narosa Publishing house Pvt. Ltd., 2007

## QUANTUM CHEMISTRY

**Subject Code: MCHMS1-302** | **L T P C** 4 0 0 4 | **Duration: 60(Hrs.)**

**Course Objectives:**

1. Master fundamental quantum mechanical principles and problem-solving techniques.
2. To gain detailed understanding of quantum chemical description of chemical bonding, reactivity and angular momentum
3. Learn how quantum mechanics manifests itself in nature and experimental science.
4. Understand advantages and limitations of approximation methods for solving complex problem

**Course Outcomes:**

The students will be able to:

1. Understand quantum mechanical principles and problem-solving techniques.
2. understand working knowledge of terminology and tools used by quantum chemistry
3. Apply approximate methods in quantum chemistry
4. Develop working knowledge of terminology and tools used by quantum chemistry.

### UNIT-I (15Hrs.)

Quantum Mechanics: limitations of classical mechanics, Operators , Hermitian operators and their properties. Commutation relations. Wavefunctions and Eigenvalue Equations, Expectation Values. Postulates of quantum mechanics. Uncertainty Principle, Schrodinger wave equation. Discussion of solutions of the Schrodinger equation to some model systems viz., Particle in a box, The Harmonic Oscillator and tunneling.

### UNIT-II (15 Hrs.)

Discussion of solutions of the Schrodinger equation to some model systems : The Rigid Rotor, The Hydrogen atom.

Approximate Methods: The Variation Theorem, Linear Variation Principle, Perturbation Theory (first order and non-degenerate). Applications of Variation Method and Perturbation Theory to the Helium atom.

**UNIT-III (15 Hrs.)**

Angular Momentum: Ordinary angular momentum, Generalized angular momentum, Eigen functions for angular momentum, Eigen values of angular momentum, Operator using ladder operators, Addition of angular momentum, Spin, Antisymmetry and Pauli exclusion principle. Electronic Structure of Atoms: Electronic configuration, Russell-Saunders terms and Coupling Schemes, Slater-Condon parameters, Term Separation Energies of the $p^n$ Configuration, Term Separation Energies for the $d^n$ Configurations, Magnetic Effects: Spin-orbit Coupling and Zeeman Splitting, Introduction to the methods of Self-consistent field, The Virial Theorem.

**UNIT-IV (15 Hrs.)**

Born-Oppenheimer Approximation: Hydrogen molecule ion. LCAO-MO and VB treatments of the Hydrogen molecule; Electron Density, Forces and their role in Chemical Binding. Hybridization and valence MOs of $H_2O$, $NH_3$ and $CH_4$. Huckel Theory of Conjugated Systems, Bond Order and Charge Density Calculations, Applications to Ethylene, Butadiene, and Cyclobutadiene.

**Recommended Text Books / Reference Books:**


1. P.W. Atkins and R.S. Friedman, ‘Molecular Quantum Mechanics’, 4$^{th}$Edn., Oxford University Press,**2004**.
2. D. McQuarrie, ‘Quantum Chemistry’, ‘2$^{nd}$Edn., University Science Books’,**2008**.
3. I.N. Levine, ‘Quantum Chemistry’, 5$^{th}$Edn., Prentice Hall,**2006**.
4. F.L. Pilar, ‘Elementary Quantum Chemistry’, McGraw Hill,**1968**.
5. N.H. March, ‘Self-Consistent Fields in Atoms’, Pergamon Press,**1975**.
6. A.K. Chandra, ‘Introductory Quantum Chemistry’, Tata McGraw Hill,**1988**.
7. J.A. Popleand D.L. Beveridge, ‘Approximate Molecular-Orbital Theory’, McGraw Hill, NY,**1970**.
8. J.P. Lowe, ‘Quantum Chemistry’, AcademicPress,**1993**.

## HETEROCYCLIC CHEMISTRY

**Subject Code: MCHMS1-303** **L T PC 4 0 0 4** **Duration: 60Hrs.**

**Course Objectives**

1. To provide the fundamental knowledge of heterocyclic compounds.
2. To understand the concept of nomenclature of heterocyclic compounds.
3. To give the knowledge of applications of Heterocyclic compounds in pharmaceutical industries.

.

**Course Outcomes:**

After completion of the course the student will

1. acquire the skill of naming heterocyclic compounds
2. Providing theoretical understanding of heterocyclic chemistry which includes various methods for ring synthesis, properties and reactions.
3. Apply the knowledge of synthesise heterocyclic compounds in wide medicinal field.

### UNIT-I (15 Hrs).

**Nomenclature of Heterocycles**

Replacement and systematic nomenclature (Hantzsch Widman system) for monocyclic, fused and bridged heterocycles.

**Aromatic Heterocycles**

General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond length, ring current and chemical shifts in 1H NMR-spectra, empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltation). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.

### UNIT–II(15 Hrs).

**Non Aromatic Heterocycles**

Strain bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3 diaxial interaction. Stereo-electronic effects – anomeric and related effects. Attractive interactions – hydrogen bonding and intermolecular nucleophilic – electrophilic interactions.

### UNIT–III(15 Hrs).

**Heterocyclic Synthesis**

Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions.

**Small Ring Heterocycles**

Three membered and four membered heterocycles- synthesis and reactions of aziridines, oxiranes, thiiranes, azetidines, oxetanes and thietanes.

### UNIT –IV (15 Hrs.)

**Benzo-Fused Five-Membered Heterocycles**

Synthesis and reactions including medicinal applications of benzopyrroles, benzofurans, and benzothiophenes.

**Meso-Ionic Heterocycles**
General classification, chemistry, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.

**Recommended Books**


1. R.R. Gupta, M. Kumar and V. Gupta, 'Heterocyclic Chemistry: Principles, Three- and Four-Membered Heterocycles, Vol. 1', Springer Berlin Heidelberg,**1998.**
2. R.R. Gupta, M. Kumar and V. Gupta, 'Heterocyclic Chemistry: Five-Membered Heterocycles, Vol. 2', Springer Berlin Heidelberg,**1999.**
3. T. Eicher and S. Hauptmann, 'The Chemistry of Heterocycles', Georg Thieme,Stuttgart, **1995.**
4. J.A. Joule, K. Mills and G.F. Smith, 'Heterocyclic Chemistry', 5$^{th}$ Edn., John Wiley& Sons,**2010.**
5. T.L. Gilchrist, 'Heterocyclic Chemistry', 3$^{rd}$ Edn., Pearson Education India,**2007.**
6. G.R. Newkome and W.W. Paudler, 'Contemporary Heterocyclic Chemistry', Wiley-Inter Science, New York,**1982.**
7. R.M. Acheson, 'An Introduction to the Heterocyclic Compounds', John Wiley & Sons Ltd., New York, London,**1976.**
8. A.R. Katritzky and C.W. Rees, 'Comprehensive Heterocyclic Chemistry',Pergamon Press, Oxford,**1984.**

**SEMINAR – II**

**Subject Code: MCHMS1-304** **L T P C** **0 0 2 1** **Duration: 30 Hrs.**

## Course Objectives

1. To mentor the students for the selection of the topic of seminar.
2. To counsel the students for preparation of powerpoint presentation.
3. To make the students able to present a seminar and handle the questions of the audience.
4. To improve the soft skills of students.

### Course Outcomes

After the completion of this course, the students will be able to

1. Prepare a powerpoint presentation for the seminar to justify the contents of the presentation.
2. Present the seminar before the whole class. This will hone their soft skills.
3. Understand the selected topic thoroughly so as to handle the questions of the audience at the time of presentation.

1. In the beginning of the semester, a teacher will be allocated maximum 30 students. The teacher will guide/teach them how to prepare/present 15 minutes Power Point Presentation for the Seminar.

2. If there are more than 30 students in the class, then class will be divided into two group shaving equal students. Each group may be allocated to a different teacher.

3. Each student will be allotted a topic by the teacher at least one week in advance for the presentation. The topic for presentation may be from the syllabus or relevant to the syllabus of the program.

4. During the presentation being given by a student, all the other students of his/her groupwill attend the Seminar. The assessment/evaluation will be done by the teacher. However, Head of Department and other faculty members may also attend the Seminar, ask questions and give their suggestions.

5. This is a turn wise continuous process during the semester and a student will give minimum two presentations in a Semester.

6. For the evaluation, the following criteria will be adopted,
(a) Attendance in Seminar: 25 Marks
(b) Knowledge of Subject along with Questions handling during the Seminar: 25 Marks
(c) Presentation and Communication Skills: 25 Marks
(d) Contents of the Presentation: 25 Marks.

## SURFACE CHEMISTRY & CATALYSIS

**Subject Code: MCHMD1-311** | **L T P C 4 0 0 4** | **Duration: 60 Hrs.**

**Course objective:**

1. To provide the fundamental knowledge of surface Chemistry and catalyst.
2. To familiarize with surface phenomena.
3. To understand the concept of Organized Molecular Assemblies and their analytical applications.
4. To give the knowledge of industrial applications of catalyst.

Course Outcomes:

After completion of the course the students will acquire knowledge of

1. Fundamental principles of surface chemistry, and their applications in industries.
2. providing theoretical understanding of surface Chemistry .
3. Analyze the experimental techniques for different catalytic reactions.
4. Development of various catalyst and their applications in industry.

### UNIT-I (15 Hrs.)

**Structural Aspects of Organized Molecular Assemblies**

Surfactants, classification of surfactants, micelles, critical micellar concentration,different methods for determination of critical micellar concentration, thermodynamicsof micellization, aggregation number, shape & size and their determination, shapetransition, reverse micelles, emulsion, microemulsion (oil in water and water in oil),effect of cosurfactants, thermodynamics of microemulsion formation.

### UNIT-II (15 Hrs.)

**Analytical Applications of Organized Assemblies**

Application of micellar systems for UV-Visible/fluorescence spectroscopic detection ofions, micellar enhanced phosphorescence and fluorescence, micellar systems in liquid liquid extraction, surfactant aggregates in flame and plasma atomic spectrometry,micellar systems in chromatography, recent developments in micellar chromatography,application of surfactants in gel electrophoresis.

### UNIT-III (15 Hrs.)

**Catalysts**

Classification of catalysis to homogeneous and heterogeneous, Basic concepts in heterogeneous catalysis, catalyst preparation and catalyst characterization, Surface reactivity and kinetics of reaction on surfaces, poisoning and regeneration, enzymatic, phase transfer catalysis, influence of heat and mass transport on the rate of catalytic process. Evaluation of activity and selectivity of catalysts.

**UNIT-IV (15 Hrs.)**

**Industrial Applications of catalysts**

Industrially important catalysts and processes such as oxidation, processing of petroleum and hydrocarbons, synthesis gas and related processes, Environmental catalysis, Commercial catalytic reactors (fixed bed, fluidized bed, trickle-bed, slurry, etc.).

Heat and mass transfer and its role in heterogeneous catalysis. Calculations of effective diffusivity and thermal conductivity of porous catalysts. Reactor modeling. Emphasizes the chemistry processing of petroleum and hydrocarbons, synthesis gas and related processes, Environmental catalysis.

**Reference books:**

1. P.H. Emmet, Catalysis (Vol I and II), Reinhold, New York, 1954.
2. M. Schlosser, Organometallics in Synthesis, A manual, John Wiley, New York, 1996.
3. L.S. Hegedus, Transition Metals in the Synthesis of Complex Organic Molecules, University Science, Book, CA, 1999.
4. D.K. Chakrabarty and B. Viswanathan, Heterogeneous Catalysis, New Age, 2008.
5. B. Viswanathan, S. Kannan, R.C. Deka, Catalysts and Surfaces: Characterization Techniques, Narosa, New Delhi, 2010.
6. M. Kaneko, I. Okura, Photocatalysis: Science and Technology, Springer, 2003.
7. Text Book of Physical Chemistry Vol-1-4 by K.L. Kapoor
8. Physical Chemistry by D.N. Bajpai
9. Physical Chemistry by A.W. Atkins

## MEDICINALCHEMISTRY

**Subject Code: MCHMD1-312** **L T PC 4 0 0 4** **Duration: 60Hrs.**

**Course Objectives**

1. To understand types, classification, structural activity of various antibacterial, Antiviral and Antimalarialagent.
2. To know the synthetic procedures for Chloroquine, amodiaquine, mefloquine and sontoquine.
3. To familiarize with CNS depressant and CNSstimulants.
4. To know the synthetic procedure for thioridazine, haloperidol,diazepam.

**Course Outcomes:**

The students will be able to:

1. Understand the basics of drugs and drug receptor interactions
2. Learn the mechanism of action of drugs based on physicochemical factors and mode of synthesis of selected drugs..
3. Classify the drug molecules for clinical application based upon their mechanism of action.
4. Sketch the commercial synthetic routes and reaction mechanism of drugs under study

### UNIT-I (15 Hrs.)

**1. Antibacterial and Antiviral Agents**

History of antibacterial drugs, types, classifications, structural activity relationship, fluoroquinolones. Mechanism of action of antibacterial, ß-lactams, bacterial resistance against antibacterial drugs. Target for anti HIV drugs, anti HIV agents, HIV-protease inhibitors, amprenavir, foseprenavir, alazanavir etc., anti-HIV nucleosides: lamivudine, retrovir, videx, hivid, zlarit, viread, carbovir, delavirdine, ziduvidine, etavirenz, calanolide, capravine, nevirapine. DNA polymerase inhibitors: acyclovir, ganciclovir, penciclovir, famicilovir, valaciclovir, valomaciclovir, codofvir.

### UNIT-II(15 Hrs.)

**2. Anti-malarials**

Cinchona alkaloids, 4-aminoquinolines, 8-aminoquinolines, pyramidines and sulfones, 9-aminoacridines, biguanides, mefloquine, sulfonamides.

**3. Commercial Synthetic Routes to**

Chloroquine, pamaquine, primaquine, proguanil, amodiaquine, mefloquine, pyremethamine, sontoquine.

**UNIT-III (15 Hrs.)**

**4. CNS Active Drugs: CNS depressants: Hypnotics and Sedatives**

Barbiturates, non-barbiturates, amides and imides, glutethimide, benzodiazepines, aldehydes and derivatives, methaqualone and other miscellaneous agents.

**5. Anticonvulsants**

Barbiturates, hydanatoins, oxazolidinediones, succinimides, bezodiazepines, thenacemide, glutethimide.

**6. CNS-Stimulants & Psychoactive Drugs**

Analeptics, purines, psychomotor stimulants, sympathomimetics, monamine oxidase inhibitors, tricyclic antidepressants, miscellaneous psychomotor stimulants. Hallucinogens (psychedelics, psychometrics): Indolethylamines, R-phenylethylamines, butyrophenones and other miscellaneous drugs.

**7. Commercial Synthetic Routes to**

Thioridazine, haloperidol, chloropromazine, phenytoin, Phenobarital, Carbamazipinevalproic acid, methaquolane, nitrazepam, oxazepam, diazepam, cholridazepoxide.

**UNIT-IV (15 Hrs.)**

**8. Diuretics**

Osmotic agents, acidifying salts, mercurials, purines and related heterocycles, sulfonamides, benzothiadiazene and related compounds, chlorothiazides and analogs, sulfamoylebenzoic acid and analogs, endocrine antagonists, miscellaneous diuretics.

**9. Commercial Synthetic Routesto**

Furosemide, methalthiazidemethylchlothlazide: Chlorothiazide, triameterene, hydrochlothiazide, ameloride, chlorthalidone.

**Recommended Books**

1. Wilson and Gisvolds, 'Textbook of Organic Medicinal and Pharmaceuticals Chemistry', 8th Edn., edited by R.F. Deorge, J.B. Lippincott Company, Philadelphia,**1982**.
2. B.G. Reuben and H.A. Wittcoff, 'Pharmaceutical Chemicals in Perspective'**,** John Wiley & Sons, New York,**1989**.
3. W.O. Foye, T.L. Lamke, D.A. Williams, 'Principles of Medicinal Chemistry'**,** 5thEdn.Lippencott Williams and Wilkins,**2002**.

## GREEN CHEMISTRY

**Subject Code:MCHMD1-313** | **L T P C** 4 0 0 4 | **Duration: 60 (Hrs.)**

**Course Objectives:**

1. To understand the importance of ultrasound and microwaves in green synthesis
2. To learn the role of ionic liquids in green synthesis
3. To familiarize with phase transfer catalysis
4. To study the mechanistic aspect of aqueous phase reactions

**Course Outcomes:**

**After completion of the course, students will be able to:**

1. Understand the use of ultrasound/microwave in green reactions
2. Identify the role of utilization of ionic liquids in green syntheses
3. Explain the advantages of phase transfer catalysts

Write mechanistic aspects and use of selected aqueous phase reactions

**UNIT-I (15 Hours)**

**Use of Ultrasound in Organic Synthesis:**
Introduction, instrumentation, the phenomenon of cavitation, Sonochemical esterification, Saponification, Hydrolysis, Substitution Reactions, Addition Reactions, Alkylations, Oxidation, Reduction, Hydroboration, Coupling Reactions, Fridel-Crafts Reaction, Diels-Alder Reaction, Simon-Smith Reaction, Bouveault Reaction, Cannizaro Reaction, Strecker Synthesis, Reformatsky Reaction, Conversion of Ketones into Tertiary Alcohols, Synthesis of Chromenes.

**Use of Microwaves in Organic Synthesis-**Introduction, concept, reaction vessel and medium, advantages and limitations, Microwave Assisted Reactions in Water-Hofmann Elimination, Hydrolysis, Oxidation of Toluene, Oxidation of Alcohols. Microwave Assisted Reactions in Organic Solvents- Esterification, Fries Rearrangement, Diels Alder Reaction, Synthesis of Chalcones, Decarboxylation. Microwave Assisted Solvent Free Reactions (Solid State Reactions)- Alkylation of Reactive Methylene Compounds, Condensation of Active Methylene Compounds with Aldehydes, Synthesis of Nitriles from Aldehydes, Synthesis of Anhydrides from Dicarboxylic Acid, Reductions, Synthesis of Heterocyclic Compounds.

**UNIT-II (15 Hours)**

**Ionic-liquids:**
Introduction, structure, synthesis of some important ionic liquids, Applications of ionic liquids in Hydrogenations, Diel's-Alder Reaction, Heck Reaction, *O*-Alkylation and *N*-alkylation, Methylene Insertion Reactions, Miscellaneous Applications, Synthesis of Pharmaceutical Compounds.

**Polymer supported Reagents in Organic Synthesis:**
Introduction- properties of polymer support, advantages of polymer supported reagents Applications of Polymer Supported Reagents-Polymer Supported Peracids, Polymer Supported Chromic Acid, Polymeric Thioanisolyl Resin, Poly-*N*-Bromosuccinimide (PNBS), Polymeric Organotin Dihydride Reagent as a Reducing Agent, Polystyrene Carbodiimide, Polystyrene Anhydride, Sulfonazide Polymer, Polystyrene Wittig Reagent, Polymeric Phenylthiomethyl Lithium Reagent, Polymer Supported Peptide Coupling Agent. Polymer

Supported Catalysts-Polystyrene aluminium Chloride, Polymeric Super Acid Catalysts, Polystyrene-metalloporphyrins, Polymer Supported Photosensitizers.

**UNIT-III (18 Hours)**

**Phase transfer catalysis and Crown Ethers :**

**Phase Transfer Catalysis:** Introduction, definition, mechanism of phase transfer catalysis. Applications of PTC in Organic Synthesis- Nitriles from Alkyl or Acyl Halides, Alkyl Flurides from Alkyl Halides, Generation of Dihalocarbenes, Generation of Vinylidene Carbenes, Elimination Reactions, C-Alkylations, C-Alkylation of Activated Nitriles, C-Alkylation of Activated Ketones, C-Alkylation of Aldehydes, N-Alkylations, N-Alkylation of Aziridines, N-Alkylation of $\beta$-Lactams, S-Alkylation, Darzen's Reaction, Williamson's Ether Synthesis, Wittig Reaction, Sulphur Ylides.

**Crown ethers:** Introduction, nomenclature, features, nature of donor site. General synthesis of Crown ethers. Applications of crown ethers-Esterification, Saponification, Anhydride Formation, Potassium Permanganate Oxidation, Aromatic Substitution Reaction, Elimination Reaction, Displacement Reaction, Generation of Carbene, Superoxide Anion Reaction, Alkylation.

**UNIT-IV (12 Hours)**

**Aqueous Phase Reactions:**

Studies on the mechanistic aspects and use of the following reactions in organic synthesis: Diels-Alder Reaction, Claisen Rearrangement, Wittig-Homer Reaction, Michael Reaction, Aldol Condensation, Knoevenagel Reaction, Pinacol Coupling, Benzoin Condensation, Claisen-Schmidt Condensation, Heck Reaction, Strecker Synthesis, Wurtz Reaction, Expoxidation and Dihydroxylation, Oxidations and Reductions.

**Recommended Text Books / Reference Books:**


1. V.K. Ahluwalia and M. Kidwai, New trends in Green Chemistry, Anamaya Publishers, New Delhi, **2004**.
2. R. Sanghi and M.M. Srivastava, ‘Green Chemistry, Environment FriendlyAlternatives’, Narosa, New Delhi,**2003.**
3. ‘Green Chemistry-An Introduction Text’, Royal Society of Chemistry, UK,**2002**.
4. G.W. Gokel, ‘Crown Ethers & Cryptands’, Monograph, The Royal Society of Chemistry,**1991.**
5. G.W. Gokel, S.M. Korzeniowski, ‘Macrocyclic Polyether Chemistry’, Vol 1 to 3, Wiley, NY, **1978, 1981,1987**.
6. W.B. Weber, G.W. Gokel, ‘Phase Transfer Catalysis in Organic Synthesis’, Springer, Berlin, **1977**.
7. E.V. Dehmlov, S.S. Dehmlov, ‘Phase Transfer Catalysis’, 2$^{nd}$ Edn., VerlagChemie, Wienheim, **1983**.
8. N.K. Mathur, C.K. Narang and R.E. Williams, ‘Polymers as Aids in OrganicSynthesis’, Academic Press, NY,**1980**.

## ORGANIC REACTION AND MECHANISM Lab - II

| Subject Code: MCHMS1-305 | L T P C<br>0 0 4 2 | Duration: 60(Hrs.) |
|---|---|---|

**Note:**
1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

**Course Objectives:**

1. To understand the synthesis procedure of some of the known organic molecules.
2. To introduce the basic techniques and procedures in isolation and purification of organic compounds
3. To learn physical and chemical characterization of the synthesized compounds.

**Course Outcomes:**

The students will be able to:

1. Understand the preparation methods of organic molecules.
2. Get hold of the theoretical understanding and practical skill of isolation and purification methods of synthesized molecules.
3. Evaluate the properties of synthesized organic products and their derivatives through spectroscopic and analytical tools.

1. **BeckmanRearrangement**
   a) Benzene-Benzophenone Benzophenone Oxime Benzanilide
   b) Benzene AcetophenoneAcetophenoneOxime-Acetanilide.
   c) CyclohexanoneOxime-Caprolactam.
2. **Benzylic acidRearrangement**
   a) Benzoin-Benzil-Benzylic-acid.
   b) Benzoin-Benzil-Benzilmonohydrazone.
3. **Fischer IndoleSynthesis**
   a) N-Arylmaleinilic acid N-arylmaleimide.
   b) 1, 2, 3, 4-Tetrahydrocarbazole.
   c) 2-Phenylindole fromPhenylhydrazone.
4. **Other OrganicPreparations**
   a) Cinnamic acid by Perkinreaction.
   b) Chalcone by aldolcondensation.
   c) Ethylp-aminobenzoate(benzocaine).
   d) Preparation of Benzopinacolone by Pinacol-Pinacolonerearrangement.
   e) Synthesis ofN-phenylmaleimide.
   f) Preparation ofp-bromoaniline fromacetanilide.
   g) Preparation of phenacetin fromp-aminophenol.
   h) Preparation of eosin from phthalicanhydride.
   i) Preparation of p-chlorobenzoic acid fromp-toluidine.

**Recommended Text Books / Reference Books:**

1. 'Vogel's Text Book of Practical Organic Chemistry'**,** 5th Edn., Prentice Hall,**1996**.
2. Julius B. Cohen, 'Practical Organic Chemistry'**,1910**.
3. David T. Plummer, 'An Introduction to Practical Biochemistry', 3rdEdn., TataMcGraw Hills**,1998**.
4. A.I. Vogel, 'Text Book of Practical Organic Chemistry', 5th Edn., PearsonEducation, **2005**.
5. P.R. Singh, D.S. Gupta and K.S. Bajpai, 'Experimental Organic Chemistry', Vol 2, Tata McGraw Hill, **1981**.
6. G. Mann and B.C. Saunders, 'Practical Organic Chemistry', ELBS Edn.,**1989**.
7. N.K. Vishnoi, 'Advanced Practical Organic Chemisry', 2nd Edn., Vikas PublishingHouse Pvt. Ltd.,**1994**.

## PHYSICAL CHEMISTRY LAB – I

**Subject Code: MCHMS1-306**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**Duration: 60(Hrs.)**

**Course Objectives:**

1. To develop basic understanding of data analysis and reporting of results.
2. To calculate various physical parameters while performing experiments.
3. To learn the principles applicable to various experiments.
4. To introduce the handling of various instruments.

**Course Outcomes:**

The students will be able to

1. Report the result scientifically.
2. Prepare various solutions for quantitative analysis.
3. Understand the determination of various physical parameters.
4. Apply the concepts of physical phenomenon to chemical processes

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

**Experiments**

1. Determination of accuracy, precision, mean deviation, standard deviation, coefficient of variation, normal error curve and least square fitting of certain set of experimental data in an analysis. Composition of two sets of results in terms of significance (Precision and accuracy) by (i) student's t-test, (ii) F-test
2. Determination of ferrous ammonium sulfate potentiometrically with standard ceric sulfate solution (Direct and back titration).
3. To prepare a buffer solution of known ionic strength and to find its maximum buffer capacity.
4. Titrate a tribasic acid (phosphoric acid) against NaOH and $Ba(OH)_2$conductometrically.
5. To determine the equivalent weight of iron by the chemical displacement method. The equivalent weight of copper is 63.5.
6. Determination of partition coefficient of benzoic acid between benzene and water, and hence show that benzoic acid dimerises in benzene.
7. Determine the specific rate constant for the acid catalysed hydrolysis of methyl acetate by the Initial Rate Method.
8. Determination of surface tension of given liquid by drop no. method by stalagmometer.
9. Compare the strengths of hydrochloric acid and sulphuric acid by studying the rate of hydrolysis of methyl acetate.
10. To determine the composition of a mixture of two liquids by surface tension measurements.
11. Determine the equivalent conductance at infinite dilution for acetic acid by applying Kohlrausch's law (b) Determine the equivalent conductance, degree of dissociation and dissociation constant (Ka) of acetic acid.
12. To verify Freundlich and Langmuir Adsorption isotherms for adsorption of acetic acid on activated charcoal.
13. Study the conductometric titration of hydrochloric acid with sodium carbonate and determine the concentration of sodium carbonate in a commercial sample of soda ash.
14. Study the stepwise neutralization of a polybasic acid e.g. oxalic acid, citric acid, succinic acid by conductometric titration and explain the variation in the plots.
15. Titrate a moderately strong acid (salicylic/mandelic acid) by the (a) salt-line method (b) double alkali method.
16. Study the effect of dielectric constant ($\varepsilon$) on the nature of the conductometric titration between maleic acid and sodium methoxide using different mixtures of benzene and methanol as solvents.
17. Determine the dissociation constant of an indicator spectrophotometrically.
18. Verification of Beer's law and calculation of molar absorption coefficient using $CuSO_4$ and $KMnO_4$ solutions.
19. To determine the the equivalent conductance of a weak electrolyte at infinite dilution using Kohlraush law.
20. To study the current-potential characteristics of $Cd^{2+}$ ions using DC polarography, sampled DC, cyclic voltammetry and pulse polarographic technique

**Recommended Text Books / Reference Books:**

1. A.I. Vogel, 'Vogel's Qualitative Inorganic Analysis', 7th Edn., (revised by G. Svehla) Longmans, 1996.
2. A.I. Vogel, 'Vogel's Textbook of Quantitative Chemical Analysis', 5th Edn., Longman, 1989.
3. F. Daniels, J.W. Williams, P. Bender, R.A. Alberty, C.D. Conwell & J.E. Harriman, 'Experimental Physical Chemistry', McGraw Hill, A.I. Vogel, 'Vogel's Qualitative Inorganic Analysis', 7th Edn., (revised by G. Svehla) Longmans, 1996.

4. A.I. Vogel, 'Vogel's Textbook of Quantitative Chemical Analysis', 5th Edn., Longman, 1989.
5. F. Daniels, J.W. Williams, P. Bender, R.A. Alberty, C.D. Conwell & J.E. Harriman, 'Experimental Physical Chemistry', McGraw Hill, 1962.
6. R.C. Das & B. Behera, 'Experimental Physical Chemistry', Tata McGraw Hill, Publishing Co. Pvt. Ltd., 1993.
7. D.P. Shoemaker, C.W. Garland & J.W. Nibler, 'Experiments in Physical Chemistry', McGraw Hill, New York, 1996.
8. R.A. Day, Jr. & A.L. Underwood, 'Quantitative Analysis', 3rd Edn. Prentice-Hall India Pvt. Ltd., New Delhi, 1977.
9. D.T. Burns & E.M. Ratenbury, 'Introductory Practical Physical Chemistry', Pergamon Press, 1966.
10. D.T. Burns & E.M. Ratenbury, 'Introductory Practical Physical Chemistry', Pergamon Press, 1966.
11. D.C. Harris, 'Quantitative Chemical Analysis', 6th Edn., W.H. Freeman & Co., 2002.

## PHOTOCHEMISTRY AND PERICYCLIC REACTIONS

**Subject Code: MCHMS1-401** **L T PC 4 0 0 4** **Duration: 60Hrs.**

Course Objectives

1. To provide the fundamental knowledge of photochemistry and pericyclic reactions.
2. To understand the concept of mechanism of photochemistry and pericyclic reactions.
3. To study the mechanistic aspect of pericyclic reaction to solve the reaction based problems.
4. To give the knowledge of applications of photochemical and pericyclic reactions in Organic synthesis..

Course Outcomes:

After completion of the course the student will able to

1. Acquire fundamental knowledge of pericyclic reactions and their mechanism.
2. Apply the principles of pericyclic reactions to solve the reaction based problems.
3. Understand the concept of mechanism of photochemistry.
4. Apply photochemical reactions in Organic synthesis..

### UNIT-I (15 Hrs.)

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5- hexatriene, allylsystem, classification of pericyclic reactions, FMO approach. Woodward-Hoffmann correlation diagrams method and Perturbation of molecular orbital (PMO) approach for explanation ofpericyclic reactions under thermal and photo-chemical conditions.
Electrocyclic reactions – controtatory and disrotatory motions, 4n, 4n+2, allyl systems, Electrocyclic rearrangement of cyclobutenes and 1,3 cyclohexadienes.
Cycloadditions – antrafacial and suprafacial additions, notation of cylcoadditions (4n) and (4n+2) systems with a greater emphasis on (2+2) and (4+2) cycloaddition-stereochemicaleffects and effects of substituents on the rates of cycloadditions, 1,3-dipolar cyclo-additions.

### UNIT-II (15 Hrs.)

Sigmatropic Rearrangements-suprafacial and antrafacial shifts [1,2]- sigmatropic shifts involving carbon moieties retention and invertion of configuration, (3,3) and (5,5) sigma-tropic rearrangements, detailed treatment of Claisen and Cope rearrangements, fluxional tautomerism, aza-cope rearrangements, cheleotropic reactions, Ene and retro ene reactions, Ene and retro ene reactions, Coarctate reaction, simple problems on pericyclic reactions.

### UNIT-III (15 Hrs.)

Introduction to organic photochemistry: Laws of photochemistry, Jablonski diagram

Photochemistry of Carbonul compounds: Primary photochemical reactions of n, $\pi^*$ states. Electronic energy transfer. Detail analysis of primary photochemical process of α-cleavage. Detail analysis of primary photochemical process of α- cleavage. Detail analysis of primary photochemical process of hydrogen abstraction. Detail analysis of primary photochemical process of electron transfer reactions. Norrish type-I and Norrish type –II reaction, Paterno Buchi Reaction.

**UNIT-IV (15 Hrs.)**

Primary photochemical reactions of π, $\pi^*$states. Detail analysis of cis-trans isomerization. Study on di- π-methane rearrangement,Photochemistry of aromatic compounds, Photochemical reaction of azo compounds. Photochemical Oxygenations-Singlet Oxygen. Photochemistry of halogen containing compounds. Photoinduced electron transfer reactions. Factors influencing the course of photochemical reaction. Applications of photochemistry.

**Recommended Books**

1. J.C. Calvert and J.N. Pitts, Jr., 'Photochemistry', Wiley, New York,**1966**.
2. N.J. Turro, 'Modern Molecular Photochemistry', (MMP), University Press, Menlo Park, CA, **1978**.
3. A. Gilbert and J. Baggott, 'Essentials of Molecular Photochemistry', CRC Press,London, UK,**1991**.
4. J. Mattay and A. Griesbeck, eds., 'Photochemical Key Steps in Organic Synthesis', VCH, New York,**1994**.
5. J.D. Coyle, Edn., 'Photochemistry in Organic Synthesis', Royal Society ofChemistry, London,**1986**.
6. W.H. Horspool, Edn., 'Synthetic Organic Photochemistry', Plenum, New York,**1984**.
7. Bryce-Smith, et. al, eds. 'Specialist Reports of the Chemical Society: D. Photochemistry (Annual reports on all of photochemistry since1969)'.
8. I. Ninomiya and T. Naito, eds., 'Photochemical Synthesis', Academic Press,London, **1989**.
9. J.C. Scaiano, Edn., 'CRC Handbook of Organic Photochemistry', vol. 1 and 2, CRC Press, Boca Raton, Florida,**1989**.
10. JagdambaSingh and Jaya Singh, Photochemistry and pericyclic reaction New Age International Publication,**2019.**

## BIO-INORGANICCHEMISTRY

**Subject Code: MCHMS1-402** | **L T PC 4 0 0 4** | **Duration: 60 Hrs.**

### Course Objectives

1. To understand structures, processes and chemical interactions of enzymes with metalions in biological systems.
2. To understand the transport mechanisms of enzymes in physiologica lsystems.
3. To acquire knowledge of metal complexes with various nucleic acids.

### Course Outcomes:

After completion of the course the student be will able to:

1. Understand the fundamental concepts related to bio inorganic chemistry.
2. Relate the fundamental concepts with the reactions of biomolecules.
3. Understand the reaction mechanisms and transport mechanisms of biomolecules .
4. Understand the importance of metals in biological metabolism.

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### UNIT-I (15Hrs.)

Introduction, non-photosynthetic processes, structure of metallo-porphyrines, cytochromes, structure and function of haemoglobin, nature of heme-dioxygen binding, cooperativity in haemoglobin, Bohr effect and Heldane effect. physiology of myoglobin and haemoglobin, structure and function of myoglobin, comparision of haemoglobin and myoglobin.

### UNIT-II (15Hrs.)

Structure and function, inhibition and poisoning Vitamin B12 and B12 coenzymes, nitrogen fixation, in-vitro and in-vivo nitrogen fixation, Nitrogenases, Other iron- prophyrin biomolecules, Peroxidase and catalases, cytochrome P450 enzymes. other natural oxygen carriers: hemerythrins, hemocyanine. Electron transfer system: respiration and photosynthesis, ferridoxins, and subredonim carboxypeptidase, carbonic anhydrase.

### UNIT-III (15Hrs.)

Metal complexes of polynucleotides, nucleosides and nucleic acids (DNA & RNA). Template temperature, stability of DNA. Role of metal ions in replication and transcription process of nucleic acids. Biochemistry of calcium as hormonal messenger, muscle contraction blood clotting, neurotransmitter, calcification reclaiming of barren land.

### UNIT-IV (15Hrs.)

Biochemistry of iron, iron storage and transport, ferritin transferring, bacterial iron transport, Bio-inorganic chemistry of Mo, W, V, Cr and Ni (essential and trace elements in biological systems). Metals in the regulation of biochemical events. Transport and storage of metal ions *in vivo*. metallothioneins.

**Recommended Books**

1. J.E. Huheey, E.A. Keiter and R.L. Keiter, 'Inorganic Chemistry: Principles of Structure and Reactivity', 4$^{th}$Edn., HaperCollins.
2. B. Douglas, D. McDaniel and J. Alexander, 'Concepts and Models of Inorganic Chemistry', 3$^{rd}$Edn., John Wiley andSons.
3. F.A. Cotton and G. Wilkinson, 'Advanced Inorganic Chemistry: A Comprehensive Text', 5$^{TH}$ EDN., JOHNWILEY.
4. Ch. Elschenbroich and A. Salzer, 'Organometallics. A Concise Introduction', 2$^{nd}$Edn., VCH.
5. D.F. Shriver and P.W. Atkins, 'Inorganic Chemistry', 3$^{rd}$ Edn., Oxford UniversityPress.
6. J.A. Cowan, 'Inorganic Biochemistry', 2$^{nd}$ Edn.,Wiley-VCH.
7. G. Wulfsberg, 'Inorganic Chemistry', University ScienceBooks.
8. S.J. Lippard& J.M. Berg, 'Principles of Bioinorganic Chemistry',Univ. ScienceBooks, **1994**.
9. S.J. Lippard, 'Progress in Inorganic Chemistry', Vols. 18, 38, Wiley-Interscience,**1991**.

## RESEARCH METHODOLOGY

**Subject Code– MREM0-101** **L T PC** **Duration – 60 Hours**

**4 0 0 4**

### UNIT–I (15 Hrs.)

**Introduction to Research**: Meaning, Definition, Objective and Process

**Research Design**: Meaning, Types - Historical, Descriptive, Exploratory and Experimental
**Research Problem**: Necessity of Defined Problem, Problem Formulation, Understanding of Problem, Review of Literature

**Design of Experiment:** Basic Principal of Experimental Design, Randomized Block, Completely Randomized Block, Latin Square, FactorialDesign.

**Hypothesis:** Types, Formulation of Hypothesis, Feasibility, Preparation and Presentation of Research Proposal

### UNIT–II (15 Hrs)

**Sources of Data**: Primary and Secondary, Validation of Data

**Data Collection Methods**: Questionnaire Designing, Construction

**Sampling Design & Techniques** – Probability Sampling and Non Probability Sampling

**Scaling Techniques**: Meaning & Types

**Reliability:** Test – Retest Reliability, Alternative Form Reliability, Internal Comparison Reliability and Scorer Reliability

**Validity:** Content Validity, Criterion Related Validity and Construct Validity

### UNIT–III (15 Hrs.)

**Data Process Operations**: Editing, Sorting, Coding, Classification and Tabulation

**Analysis of Data**: Statistical Measure and Their Significance, Central Tendency, Dispersion, Correlation: Linear and Partial, Regression: Simple and Multiple Regression, Skewness, Time series Analysis, Index Number

**Testing of Hypothesis**: T-test, Z- test, Chi Square, F-test, ANOVA

### UNIT – IV (15 Hrs.)

**Multivariate Analysis:** Factor Analysis, Discriminant Analysis, Cluster Analysis, Conjoint Analysis, Multi Dimensional Scaling

**Report Writing:** Essentials of Report Writing, Report Format

**Statistical Software:** Application of Statistical Softwares like SPSS, MS Excel, Mini Tab or MATLAB Software in Data Analysis

**Each Student has to Prepare Mini Research Project on Topic/ Area of their Choice and Make Presentation. The Report Should Consists of Applications of Tests and Techniques Mentioned in The Above UNITs*

**Recommended Books**


1. R.I Levin and D.S. Rubin, ‘Statistics for Management’, 7$^{th}$Edn., Pearson Education New Delhi.
2. N.K. Malhotra, ‘Marketing Research–An Applied Orientation’, 4$^{th}$ Edn., Pearson Education NewDelhi.
3. Donald Cooper, ‘Business Research Methods’, Tata McGraw Hill, NewDelhi.
4. Sadhu Singh, ‘Research Methodology in Social Sciences’, HimalayaPublishers.
5. Darren George & Paul Mallery, ‘SPSS for Windows Step by Step’, Pearson Education New Delhi.
6. C.R.Kothari, ‘Research Methodology Methods & Techniques’, 2$^{nd}$Edn., New Age InternationalPublishers.

## PHYSICAL CHEMISTRY LAB – II

**Subject Code: MCHMS1-403**

| L | T | P | C |
|---|---|---|---|
| 0 | 0 | 4 | 2 |

**Duration: 60(Hrs.)**

**Course Objectives:**

1. To develop basic understanding of various lab practices including safety measures.
2. To calculate various physical parameters while performing experiments.
3. To learn the principles applicable to various experiments.
4. To introduce the handling of various instruments.

**Course Outcomes:**

The students will be able to

1. Understand the determination of various physical parameters.
2. Connect the physical phenomenon to chemical processes.
3. Analyze multi-component systems.
4. Handle pH meter and spectrophotometer.

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

**Experiments**

1. To determine the atomic parachor of C, H, Cl and Br by surface tension measurements.
2. Determination of heat of solution of a substance by solubility method.
3. To construct phase diagram of 3-component system ($CH_3COOH$ + $CHCl_3$ + $H_2O$).
4. To prepare arsenious sulphide/Ferric hydroxide Sols and study Hardy – Schulze's rule for it.
5. To determine the relative strength of acids by study kinetics of hydrolysis of an ester.
6. To determine the iodine value of given sample of oil (Linseed oil).
7. To determine the saponification value of given sample of oil (Ground nut oil).
8. To obtain the mutual solubility curve of phenol + $H_2O$, and hence the Upper Consolute Point.
9. To determine parachor of a mixture of two liquids.
10. To determine the coefficient of viscosity of given liquid by Ostwald's viscometer.
11. To compare cleansing powers of two samples of detergent.
12. To determine the C.M.C. of a soap (sodium or potassium lauryl sulphate) by surface tension measurements
13. To determine the distribution coefficient of $I_2$ between $CCl_4$ and $H_2O$.
14. To study the variation of viscosity with composition of the mixture of liquids.
15. Determination of pH of a mixture of $CH_3COOH$ and $CH_3COONa$, and hence to calculate dissociation constant of the acid.
16. To titrate Fe(II) with $KMnO_4$ spectrophotometrically.
17. To determine the composition of binary mixture containing $K_2Cr_2O_7$ and $KMnO_4$ using spectrophotometer.

18. To study the variation of solubility of $Ca(OH)_2$ in NaOH solution, and hence determine the solubility product.
19. Spectrophotometric determination (in ppm) of Fe (II) or Fe(III) using 1,10 Phenanthroline (or thiocyanate) as colorimetric reagent.
20. To investigate the autocatalytic reaction between potassium permanganate and oxalic acid.

**Recommended Text Books / Reference Books:**

1. 'Findlay's Practical PhysicalChemistry'.
2. J.B. Yadav, 'Advanced Practical PhysicalChemistry'.
3. L.V. Cock and C. van Rede, 'Laboratory Handbook for Oil & FatAnalysis'.
4. A.I. Vogel, 'Vogel's Textbook of Quantitative Chemical Analysis', 5th Edn., Longman, 1989.
5. F. Daniels, J.W. Williams, P. Bender, R.A. Alberty, C.D. Conwell & J.E. Harriman, 'Experimental Physical Chemistry', McGraw Hill, A.I. Vogel, 'Vogel's Qualitative Inorganic Analysis', 7th Edn., (revised by G. Svehla) Longmans, 1996.

## DISSERATION

**Subject Code: MCHMS1-404** **L T P C**
**0 0 8 4**

Course Objectives:

1. To familiarize the students with the modus operandi of literature survey.
2. To enable the students to choose the topic of the project.
3. To guide the students to carry out the project in the laboratory.
4. To compile the experimental work in the form of a dissertation.

Course Outcomes:

After completion of this course, students will

1. Know about different sections of a research article and learn the modus operandi of literature survey.

2. Be engaged in small research projects in pure / multidisciplinary areas of chemical sciences.

3. Acquire training for writing the project report and research article.

4. Be able to defend viva voce for their dissertation

M.Sc. 4th Semester will carry the dissertation work under the supervision of the assigned project guide as per following scheme:

**Format for writing dissertation work:** The students will write the report in Times New Roman, with font size 12 and 1.5 spacing.

| | |
|---|---|
| 1. Title of the M.Sc. Dissertation Work | 7. Introduction |
| 2. Self-Declaration Certificate of Original Work | 8. Methodology |

| | |
|---|---|
| 3. Acknowledgement | 9. Results and Discussion |
| 4. Content | 10. Conclusion |
| 5. List of Tables | 11. References |
| 6. List of Figures | 12. Student's Bio data |

**Evaluation Criteria**: The maximum marks allotted for the dissertation will be 100 which comprises of internal evaluation of 60 marks and external evaluation of 40 marks. The details of internal and external evaluation are given below:

**(A) Internal Evaluation:(MM: 60)**

The students will be evaluated based on regular performance, attendance and presentation. He/She should give power point presentation of their detail work during the mid-semester ($1^{st}$and $2^{nd}$) examinations.

**Final Submission Report:**

The student will submit the final report as hard bound copies (03) and soft copy on CD/DVD. The internal awards will be given to the students after final submission of the report by the dissertation supervisor.

**(B) External Evaluation: (MM:40)**

Evaluation will be done based on originality and quality of work, knowledge and presentation skills etc. The students should give presentation through power point slides in front of a internal panel of three examiners including dissertation Supervisor, Head/Nominee and other faculty member of the Department as constituted by Head of the Department.



## TERM PAPER

**Subject Code: MCHMS1-405** **L T P C**
**0 0 8 4**

Course Objectives:

1. To apprise the student with various components of a research article.
2. To familiarize the student with the modus operandi of literature survey.

3. To give the knowledge of review paper writing.

4. To write a small review paper on the selected topic.

Course Outcomes:

After completion of this course, students will:

1. Introduced to different sections of a research article

2. Learn the modus operandi of literature survey for a pre-defined topic.

3. Learn the art of writing a review paper.

4. Get training for defending viva voce for their term paper.

1. Evaluation of Term Paper will be internal and will be done by the three member Departmental Commttee constituted by HOD.

2. Four different heads have been classified for evaluation purpose and weightage is as follows:

(a) Literature survey 40%

(b) Writing of paper/format 20%.

(c) Presentation 20%

(d) Knowledge of subject 20%

3. Every student will submit hard copy of research papers reviewed by him/her for writing Term Paper.

4. Every teacher will give format of a particular journal to the student for writing the Term Paper.

5. A time slot will be provided in the time table to carry out literature survey for Term Paper. Permission can be sought from particular Institution to provide access to library facility, if needed by students.

6. The whole process of writing Term Paper will be a time bound activity and a time line will be framed with fixed dates and milestones.

## ADVANCED LAB

**Subject Code: MCHMS1-406** | **L T P C** **0 0 4 2** | **Duration: 60(Hrs.)**

**Course Objectives**

1. To extract organic compound from natural sources
2. To synthesize organic molecules under sensitive reaction conditions
3. To prepare products, based on *a*, *b*- unsaturated compounds
4. To characterize synthesized products

**After completion of the course, students will be able to:**

1. Extract and identify organic compound from natural sources
2. Synthesize small organic molecules under sensitive reaction conditions
3. Prepare products, based on *a*, *b*- unsaturated compounds
4. Prepare and characterize aldol dehydration products

**Note:**
1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included.

**EXPERIMENTS**

1. **Extraction of organic compounds from naturalsources**
   a) Isolation of caffeine from tealeaves
   b) Isolation of piperine from blackpepper
   c) Isolation of lycopene from tomatoes
2. **Preparations:**
   a) Synthesis of anthranilic acid fromphthalimide.
   b) Preparation of 2-phenylindole fromphenylhydrazine.
   c) Synthesis of 2-phenyl-1,3,4-oxadiazole frombenzhydrazide
   d) Synthesis and reactivity of benzalacetophenone

**3. Reactions of alkenesand *α*, *β*-unsaturated compounds**

a) Bromination& subsequent debromination
b) Epoxidation and ring opening with hydroxide ion
c) Michael addition reactions of $\alpha$, $\beta$-unsaturated compounds

**4.Preparation and characterization of the Aldol-dehydration products *via* following aldehydes and ketones**

a) Aldehydes:benzaldehyde, 4-methylbenzaldehyde, 4 methoxybenzaldehyde.

b) Ketones: acetone, cyclopentanons, cyclohexanone

**RECOMMENDED BOOKS**

1. L.M. Harwood and C.J. Moody, ‘Experimental Organic Chemistry’, 1st Edn., Blackwell Scientific Publishers,**1989**.
2. A.I. Vogel, ‘Textbook of Practical Organic Chemistry’, 6th Edn., ELBS, Longman Group Ltd.,**1978**.
3. F.G. Mann and B.C. Saunders, ‘Practical Organic Chemistry’, 4th Edn., New Impression, Orient Longman Pvt. Ltd.,**1975**.
4. A. Viswas and K.S. Tewari, ‘A Textbook of Organic Chemistry’, 3rd Edn.,Vikas Publishing House,**2009**.
5. J. Leonard and B. Lygo, ‘Advanced Practical Organic Chemistry’, Chapman andHall, **1995**.
6. W.L. Armarego and C. Chai, ‘Purification of Laboratory Chemicals’, Butterworth Heinemann,**2012**.
7. J.A. Young, ‘Improving Safety in the Chemical Laboratory: A Practical Guide’, 2nd Edn., Wiley Publishing,**1991**.

**Total Marks= 800/900** **Total Credits= 23/24**

| 1st Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject** | **L** | **T** | **P** | **Internal** | **External** | **Total** | |
| **BCHMS1-101** | Inorganic Chemistry-I | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-102** | Physical Chemistry-I | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-103** | Inorganic Chemistry-I **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-104** | Physical Chemistry-I **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BHSMC0-042** | Ability Enhancement Compulsory Course — English | 2 | - | - | 40 | 60 | 100 | 2 |
| **Generic Elective I (Select any two with lab/tutorial as applicable)[a,b]** | | | | | | | | |
| **BPHYS1-101** | Electricity and Magnetism | 4 | - | - | 40 | 60 | 100 | 4 |
| **BMCAS1 - 102** | Introduction to Information Technology | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BMATH5-101** | Mathematics I* | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BMATH5-102** | Basic Mathematics I* | | | | | | | |
| **BPHYS1-104** | Electricity and Magnetism **Lab** | | - | 2 | 60 | 40 | 100 | 1 |
| **BMCAS1-105** | Software Lab.-I (Based on BMCAS1-102) | | - | 2 | 60 | 40 | 100 | 1 |
| **Total#** | | | - | - | **380/440** | **420/460** | **800/900** | **23/24** |

Note: (a): Each student has to opt two papers with lab/tutorial from the category of generic electives in each semester starting from semester I till semester IV from any two disciplines (mathematics, Physics, Computer Science). The disciplines once opted will remain same throughout the course.

*Students from Medical stream will study Basic Mathematics – I and Students from Non-Medical stream will study Mathematics – I

# Depends on combination of electives selected by student.

**Total Marks= 800/900** **Total Credits= 23/24**

| 2nd Semester | | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject** | | **L** | **T** | **P** | **Internal** | **External** | **Total** | |
| **BCHMS1-201** | Organic Chemistry-I | | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-202** | Physical Chemistry-II | | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-203** | Organic Chemistry-I **Lab** | | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-204** | Physical Chemistry-II **Lab** | | - | - | 4 | 60 | 40 | 100 | 2 |
| **BHSMC0-041** | Ability Enhancement Compulsory Course | Environmental Sciences | 3 | - | - | 40 | 60 | 100 | 3 |
| **BMNCC0-041** | | Drug abuse: problem, management and prevention | 2 | 0 | 0 | 40 | 60 | 100 | 0 |
| **Generic Elective II (Select any two with lab/tutorial as applicable )[a,b]** | | | | | | | | | |
| **BPHYS1-201** | Thermal Physics | | 4 | - | - | 40 | 60 | 100 | 4 |
| **BMCAS1- 403** | Linux Operating System | | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BMATH5-201**<br>**BMATH5-202** | Mathematics II*<br>Basic Mathematics II* | | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BPHYS1-204** | Thermal Physics Lab | | - | - | 2 | 60 | 40 | 100 | 1 |
| **BMCAS1- 406** | Software Lab.-VIII (Based on BMCAS1-403) | | - | - | 2 | 60 | 40 | 100 | 1 |
| **Total#** | | | **-** | **-** | **-** | **420/480** | **480/520** | **900/ 1000** | **24/25** |

*Students from Medical stream will study Basic Mathematics – II and Students from Non Medical Stream will study Mathematics - II

**Total Marks= 800/900 Total Credits= 23/24**

| 3rd Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject** | **L** | **T** | **P** | **Internal** | **External** | **Total** | |
| **BCHMS1-301** | Organic Chemistry-II | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-302** | Physical Chemistry-III | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-303** | Organic Chemistry-II **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-304** | Physical Chemistry-III **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **Skill enhancement course (Select any one)** | | | | | | | | |
| **BCHMD1-311** | Chemistry of cosmetics and perfumes | 2 | - | - | 40 | 60 | 100 | 2 |
| **BCHMD1-312** | Green Methods in Chemistry | | | | | | | |
| **Generic Elective III(Select any two with lab/tutorial as applicable )[a,b]** | | | | | | | | |
| **BPHYS1-302** | Elements of Modern Physics | 4 | - | - | 40 | 60 | 100 | 4 |
| **BMCAS1-104** | Programming in C Language | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BMATH5-301** | Mathematics III | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BPHYS1-306** | Elements of Modern Physics Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **BMCAS1-106** | Software Lab.-II (Based on BMCAS1-104) | - | - | 2 | 60 | 40 | 100 | 1 |
| | **Total#** | - | - | - | **380/440** | **420/460** | **800/900** | **23/24** |

**Total Marks= 800/900 Total Credits= 23/24**

| 4th Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject** | **L** | **T** | **P** | **Internal** | **External** | **Total** | |
| **BCHMS1-401** | Inorganic Chemistry-II | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-402** | Organic Chemistry-III | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-403** | Inorganic Chemistry-II **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-404** | Organic Chemistry-III **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **Skill enhancement course (Select any one)** | | | | | | | | |
| **BCHMD1-411** | Fuel Chemistry | 2 | - | - | 40 | 60 | 100 | 2 |
| **BCHMD1-412** | Pharmaceutical Chemistry | | | | | | | |
| **Generic Elective IV (Select any two with lab/tutorial as applicable )[a,b]** | | | | | | | | |
| **BPHYS1-202** | Waves and Optics | 4 | - | - | 40 | 60 | 100 | 4 |
| **BMCAS1-204** | Object Oriented Programming Language in C++ | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BMATH5-401** | Mathematics IV | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **BPHYS1-205** | Waves and Optics Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **BMCAS1-207** | Software Lab.-IV (Based on BMCAS1-204) | - | - | 2 | 60 | 40 | 100 | 1 |
| **Total[#]** | | **-** | **-** | **-** | **380/440** | **420/460** | **800/900** | **23/24** |

**Total Marks= 1000 Total Credits= 26**

| 5th Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject** | **L** | **T** | **P** | **Internal** | **External** | **Total** | |
| **BCHMS1-501** | Inorganic Chemistry-III | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-502** | Organic Chemistry-IV | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-503** | Physical Chemistry-IV | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-504** | Inorganic Chemistry-III **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-505** | Organic Chemistry-IV **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-506** | Physical Chemistry-IV **Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **Discipline Specific Elective – I (Select any two with lab)** | | | | | | | | |
| **BCHMD1-511** | Applications of Computers in Chemistry | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **BCHMD1-512** | Instrumental methods of analysis | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **BCHMD1-513** | Novel Inorganic Solids | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **BCHMD1-514** | Applications of Computers in Chemistry **Lab** | - | - | 2 | 60 | 40 | 100 | 1 |
| **BCHMD1-515** | Instrumental methods of analysis **Lab** | - | - | 2 | 60 | 40 | 100 | 1 |
| **BCHMD1-516** | Novel Inorganic Solids **Lab** | - | - | 2 | 60 | 40 | 100 | 1 |
| **Total** | | **-** | **-** | **-** | **500** | **500** | **1000** | **26** |

**Total Marks= 1000 Total Credits= 26**

| 6th Semester | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject** | **L** | **T** | **P** | **Internal** | **External** | **Total** | |
| **BCHMS1-601** | Physical Chemistry – V | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-602** | Inorganic Chemistry – IV | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-603** | Organic Chemistry – V | 4 | - | - | 40 | 60 | 100 | 4 |
| **BCHMS1-604** | **Physical Chemistry – V Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-605** | **Inorganic Chemistry – IV Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **BCHMS1-606** | **Organic Chemistry V – Lab** | - | - | 4 | 60 | 40 | 100 | 2 |
| **Discipline Specific Elective – I (Select any two with lab)** | | | | | | | | |
| **BCHMD1-611** | Polymer Chemistry | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **BCHMD1-612** | Molecular modelling and drug design | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **BCHMD1-613** | Inorganic materials of Industrial Importance | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **BCHMD1-614** | Polymer Chemistry Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **BCHMD1-615** | **Molecular modelling and drug design lab** | - | - | 2 | 60 | 40 | 100 | 1 |
| **BCHMD1-616** | Inorganic materials of Industrial Importance Lab | - | - | 2 | 60 | 40 | 100 | 1 |
| **Total** | | **-** | **-** | **-** | **500** | **500** | **1000** | **26** |

| Semester | Marks | Credits |
|---|---|---|
| 1st | **900/ 1000** | **23/24** |
| 2nd | **800/ 900** | **23/24** |
| **3rd** | **800/ 900** | **23/24** |
| **4th** | **800/ 900** | **23/24** |
| **5th** | **1000** | **26** |
| **6th** | **1000** | **26** |
| **Total** | 5300/5700 | 144/148 |

## INORGANIC CHEMISTRY-I

**SUBJECT CODE–BCHMS1-101** **L T P C** **(60 Lectures)**
**3 1 0 4**

**Course Objectives**
1. To familiarize with atomic structure, quantum numbers and shapes of orbitals
2. To understand periodic table and periodicity of elements and their effect on various properties of elements
3. To understand the concept of various bonding theories
4. To understand importance of redox reactions

**Course Outcomes:** The completion of this course will make student to acquire the knowledge of:
1. Wave mechanics, atomic theories and shapes of orbitals
2. Periodic table and various periodic properties
3. Ionic bond, covalent bond, metallic bond and various weak chemical forces
4. Redox reactions and applications of redox reactions

**Unit I** **(14 Lectures)**

**Atomic Structure:**
Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: deBroglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of $\psi$ and $\psi^2$. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f*orbitals. Contour boundary and probability diagrams. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

**Unit II** **(16 Lectures)**

**Periodicity of Elements:**
*s*, *p*, *d*, *f* block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to *s* &*p*-block.
(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
(b) Atomic radii (van der Waals)
(c) Ionic and crystal radii.
(d) Covalent radii (octahedral and tetrahedral)
(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.
(f) Electron gain enthalpy, trends of electron gain enthalpy.
(g) Electronegativity, Pauling's/ Mulliken's/ Allred Rachow's/ and Mulliken-Jaffé's electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity. Sanderson's electron density ratio.

**Unit III** **(12 Lectures)**

**Chemical Bonding I:**
(i) *Weak Chemical Forces:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points.
(ii) *Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

**Unit IV** **(18 Lectures)**

**Chemical Bonding II:**

(i) *Covalent bond:* Lewis structure, Valence Bond theory (Heitler-London approach).Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules $N_2$, $O_2$, $C_2$, $B_2$, $F_2$, CO, NO, and their ions; HCl, $BeF_2$, $CO_2$, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding ($\sigma$ and $\pi$ bond approach) and bond lengths. Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ioniccharacter from dipole moment and electronegativity difference.

(ii) *Metallic Bond:* Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids.

**Oxidation-Reduction:**

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

**Reference Books:**

• Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.
• Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry,Oxford, 1970
• Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2006.
• Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.

## PHYSICAL CHEMISTRY I

**SUBJECT CODE–BCHMS1-102** **L T P C** **(60 Lectures)**
**3 1 0 4**

**Course Objectives**

1. To familiarize with the basic phenomenon/concepts of equation of state and properties of liquids and solids.

2. To understand the nature of solid state, crystal systems and defects in crystals.

3. To understand the concept of ionisation, pH and hydrolysis.

4. To familiarise with the role of equilibrium in electrolytic action.

**Unit I** **(8 Lectures)**

**Gaseous stateI**:

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation;collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

**Unit II** **(10 Lectures)**

**Gaseous stateII**:

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, *Z*, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. Van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dietrici); virial equation of state; van der Waals equation expressed in virial form and calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

**Unit III** **(6 Lectures)**

**Liquid state:**

Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water.

**Solid state:** **(16 Lectures)**

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law. Detailed discussion of defects in crystals. Glasses and liquid crystals.

**Unit IV** **(20 Lectures)**

**Ionic equilibria:**

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect; dissociation constants of mono-, di-and triprotic acids (exact treatment).

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.

Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations. Multistage equilibria in polyelectrolyte systems; hydrolysis and hydrolysis constants

**Course Outcomes:** On completion of this course students will be able to:

1. Comprehend the kinetic modular model of gases, behaviour of ideal and real gases.
2. Apply the concept of equilibrium to understand the behaviour of ions in solution.
3. Analyse a solid and its defects for their applications.
4. Relate different states of matter with their observable properties.

**Reference Books:**

• Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press13(2006).
• Ball, D. W. Physical Chemistry Thomson Press, India (2007).
• Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
• Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).

## INORGANIC CHEMISTRY LAB I

**SUBJECT CODE-BCHMS1-103** **L T P C** **(60 Lectures)**
**0 0 4 2**

**Course Objectives**

1. To develop basic understanding of various lab practices including safety measures.
2. To familiarize with solution preparation.
3. To understand acid-base and oxidation reduction titrimetry.

**EXPERIMENTS**

**(A) Titrimetric Analysis**

(i) Calibration and use of apparatus
(ii) Preparation of solutions of different Molarity/Normality of titrants

**(B) Acid-Base Titrations**

(i) Estimation of carbonate and hydroxide present together in mixture.
(ii) Estimation of carbonate and bicarbonate present together in a mixture.
(iii) Estimation of free alkali present in different soaps/detergents

**(C) Oxidation-Reduction Titrimetry**

(i) Estimation of Fe(II) and oxalic acid using standardized $KMnO_4$ solution.
(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.
(iii) Estimation of Fe(II) with $K_2Cr_2O_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

**Course Outcomes:** The students will acquire knowledge of:

1. Preparation of solutions
2. Estimation of carbonates, bicarbonates and free alkalis in solution with acid base titrations
3. Estimation of Fe(II) and oxalic acid with oxidation reduction titrimetry

**Reference text:**

1. Vogel, A.I. A Textbook of Quantitative Inorganic Analysis, ELBS.

## PHYSICAL CHEMISTRY LAB-I

**SUBJECT CODE-BCHMS1-104** **L T P C** **(60 Lectures)**
**0 0 4 2**

**Course Objectives**

1. To develop basic understanding of various lab practices including safety measures.
2. To familiarize with basics of the phenomenon of surface tension and viscosity.
3. To understand the principle of pH metric titrations.
4. To familiarize with preparation of buffer solutions of different pH values.

**1. Surface tension measurements.**
a. Determine the surface tension by (i) drop number (ii) drop weight method.
b. Study the variation of surface tension of detergent solutions with concentration.
2. **Viscosity measurement using Ostwald's viscometer**.
a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.
b. Study the variation of viscosity of sucrose solution with the concentration of solute.
**3. Indexing of a given powder diffraction pattern of a cubic crystalline system.**
**4. pH metry**
a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
b. Preparation of buffer solutions of different pH
i. Sodium acetate-acetic acid
ii. Ammonium chloride-ammonium hydroxide
c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
d. Determination of dissociation constant of a weak acid.
**Course Outcomes:** The students will be able to:

1. Carry out measurement of surface tension and viscosity of solutions.
2. Prepare buffer solutions of different pH values.
3. Handle pH meter.
4. Apply pH metric titrations for various determinations.

**Reference Books**

• Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
• Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed*.; McGraw-Hill: New York (2003).
• Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003

## ENGLISH

**SUBJECT CODE– BHSMC0-042** **L T P C** **(30 Lectures)**
**2 0 0 2**

**Course Objectives**

1. To remove the phobia of conversing in English.
2. To make the learners enable to express themselves among peers & teachers.
3. To enable learners, improve their vocabulary.
4. To introduce them with basic communicative skills in real life situations.
5. To enhance learner's writing ability.

### UNIT-I (8 Hours)

**Communication Skills**: Introduction, Definition, the Importance of Communication,
The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context
**Barriers to communication:** Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers

### UNIT-II (7 Hours)

**Perspectives in Communication:** Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.
**Elements of Communication:** Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

### UNIT-III (7 Hours)

**Communication Styles:** Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.
**Basic Listening Skills:** Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations

### UNIT-IV (8 Hours)

**Interview Skills:** Purpose of an interview, Do's and Don'ts of an interview
**Giving Presentations:** Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery
**Group Discussion:** Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

Course Outcomes:
The student will acquire mastery in English
including writing; formal writing, letters, e'Dcoumentation and Reading. Especially in Communication Skills through G.D's, Public speaking and Situational Dialogues.

Reference Books:
1. Ruther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education,2011.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press,2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson,2013.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life,2011.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquettefor Success', 5th Edition, Pearson, 2013.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1 st Edition, Universe of Learning LTD,2010.
7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI,2011.

8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press,2011.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., 2011.
10. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw HillEducation, 2011.
11. John A., 'Effective Communication', 4th Edition, Pan MacMillan, 2009.
12. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill,1999

## ELECTRICITY AND MAGNETISM

**Subject Code: BPHYS1-101** **L T P C** **4 0 0 4** **Duration: 60 Hrs.**

**Course Objective:**

To understand the basic concepts of electricity and magnetism.

To provide knowledge of Dielectric, Magnetic properties of matter and Electromagnetic induction and Electric circuits.

**Course Outcomes:**

1. Understanding the concepts of electric field, magnetic field, potentials, dielectric and magnetic properties of matter, electromagnetic induction and electric circuits.
2. Skill enhancement to solve numerical problems related with Electricity and Magnetism.
3. Apply knowledge of Electricity and Magnetism to go for higher studies in diverse fields.
4. To inculcate and develop the ability to think abstractly.

**UNIT-I (15 Hours)**

**Electric Field and Electric Potentials**

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor.

**UNIT-II (15 Hours)**

**Magnetic Field and Electric Potentials**

Magnetic force between current elements and definition of Magnetic Field B. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements.

**UNIT-III (15 Hours)**

**Dielectric and Magnetic Properties of Matter**

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D. Relations between E, P and D. Gauss' Law in dielectrics. Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis.

**UNIT-IV(15 Hours)**

**Electromagnetic induction and Electric circuits**

Electromagnetic Induction: Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current. Electrical Circuits: AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and Band Width. Parallel LCR Circuit. Network theorems: Ideal Constant-voltage and Constant-current Sources. Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem.

**Recommended Text Books / Reference Books:**

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, 2012, Tata McGraw.
2. Electricity and Magnetism, Edward M. Purcell, 1986 McGraw-Hill Education.
3. Introduction to Electrodynamics, D.J. Griffiths, 3rd Edn., 1998, Benjamin Cummings.
4. Feynman Lectures Vol.2, R.P.Feynman, R.B.Leighton, M. Sands, 2008, Pearson Education.
5. Elements of Electromagnetics, M.N.O. Sadiku, 2010, Oxford University Press.
6. Electricity and Magnetism, J.H.Fewkes & J.Yarwood. Vol. I, 1991, Oxford Univ. Press.

## INTRODUCTION TO INFORMATION TECHNOLOGY

**Subject Code: BMCAS1--102** **L T P C** **(60 Lectures)**
**3 1 0 4**

**Course Objectives:**

1. To understand the basics of Computer Languages,Computer Network and Communication.
2. To define the memory types,input/output devices,storage devices,computer generations.
3. To get familiar with Operating System,Word processing and number system
4. To understand the Internet Applications and Presentation Graphics Software

**Course Outcomes:** The completion of this course will make student to acquire the knowledge of:

1. Working on different software for word processing, powerpoint presentation, spreadsheets and communicate ideas electronically.
2. Designing page layouts for digital and electronic publications by combining different media elements.
3. Basic concepts and terminology of information technology.
4. Personal computers and their operations.

**UNIT- I** **(14 Lectures)**

**Computer Fundamentals**: Block structure of a computer, characteristics of computers, problem solving with computers, generations of computers, and classification of computers on the basis of capacity, purpose, and generation.

**Number System**: Bit, byte, binary, decimal, hexadecimal, and octal systems, conversion from one system to the other, representation of characters, integers and fractions.
**Binary Arithmetic**: Addition, subtraction and multiplication.

**UNIT-II** **(15 Lectures)**

**Memory Types**: Magnetic core, RAM, ROM, Secondary, Cache, Bubble Memory.
**Input and Output Units**: Keyboard, Mouse, Monitor (CRT and LCD): Light pen, joystick, Mouse, Touch screen; OCR, OMR, MICR
**Overview of storage devices**: Floppy disk, hard disk, compact disk, tape. Printers: Impact, non-impact, working mechanism of Drum printer, Dot Matrix printer, Inkjet printer and Laser printer.
**Computer Languages**: Machine language, assembly language, higher level language, 4GL. Introduction to Compiler, Interpreter, Assembler, Assembling, System Software, Application Software.

**UNIT- III** **(17 Lectures)**

**Operating System**: Batch, multi-programming, time sharing, network operating system, on-line and real time operating system, Distributed operating system, multi-processor, Multi-tasking.
**Graphical OS:** Fundamentals of windows, types of windows, anatomy of windows, windows explorer, customizing windows, control panel, taskbar setting, Network Neighborhood.
**Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge and equation editors.
**Spreadsheet:** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs.
**Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special

features, presenting slide shows.

**UNIT –IV** **(14 Lectures)**

**Computer Network and Communication**: Network types, network topologies, network communication devices, physical communication media.

**Internet and its Applications**: E-mail, TELNET, FTP, World Wide Web, Internet chatting; Intranet, Extranet, Gopher, Mosaic, WAIS.

**Recommended Books:**


1. D. H. Sanders, 'Computers Today', 4$^{th}$Edn.,McGraw Hill,**1988**.
2. V. Rajaraman, 'Fundamentals of Computers', 2$^{nd}$Edn.,Prentice Hall of India, New Delhi,**1996**.
3. Satish Jain, 'Information Technology', BPB, Paperback Edn.,**1999**.
4. David Cyganski, John A. Orr, 'Information Technology Inside and Outside', Pearson Education, Paperback Edn., **2002**.
5. B. Ram, 'Computer Fundamentals', 3$^{rd}$Edn.,Wiley,**1997**.
6. ChetanSrivastva, 'Fundamentals of Information Technology', 3$^{rd}$Edn.,KalayaniPublishers.
7. Larry long & Nancy long, 'Computers', 12$^{th}$Edn.,PrenticeHall, **1999**.

## MATHEMATICS-I

**SUBJECT CODE –BMATH5-101** **L T P C** **(60 Lectures)**
**31 0 4**

**Course Objective:**

Define and interpret the concepts of Matrices and Determinants
To learn Vector Calculus, Vector Differentiation, Vector Integration.

**Course Outcome**

Students will be able to assess:

1. To implement the idea of system of linear equations
2. Use vector and scalar product in terms of area and volume
3. To implement the idea of vector differentiation, divergence and curl of vector field
4. To implement the idea of vector integration with its theorems

**UNIT-I** **(15 Lectures)**

Algebra of matrices, Inverse and rank of a matrix, System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

**UNIT-II** **(14 Lectures)**

Vector Calculus: Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations, Vector product, Scalar triple product and their interpretation in terms of area and volume respectively, Scalar and Vector fields.

**UNIT-III** **(16 Lectures)**

Vector Differentiation: Directional derivatives and normal derivative, Gradient of a scalar field and its geometrical interpretation, Divergence and curl of a vector field, Del and Laplacian operators, Vector identities.

**UNIT-IV** **(15 Lectures)**

Vector Integration: Ordinary Integrals of Vectors, Multiple integrals, Notion of infinitesimal line, surface and volume elements, Line, surface and volume integrals of Vector fields, Flux of a vector field, Gauss' divergence theorem, Green's and Stokes Theorems (Without proofs) and their applications.

**References Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, 2008.
3. Murray R. Spiegel, Vector Analysis, Schaum publishing Company, New York.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
6. Peter Baxandall , Hans Liebeck , 'Vector Calculus', Dover Publications; 2008 edition.

## BASIC MATHEMATICS-I

**Subject Code: BMATH5-102** **L T P C** **(60 Lectures)**
**3 1 0 4**

**Course Objective:**

To explain the concepts of limit and continuity, function
To learn Maxima and Minima, Rules of Differentiability integration.

**Course Outcome:**

Students will be able to assess:

1. Get knowledge about the basic concept of limit continuity,Differentiability ,nth derivative of well-known functions
2. To determine Rolle's theorem, Mean Value Theorems and various type of Tracing of curves
3. Tracing of Cartesian curves, parametric and polar curves
4. Able to solve applications of definite integral

.

**UNIT-I** **(15 Lectures)**

Basic concept of limit and continuity, Properties of limit and classification of discontinuities, Properties of continuous functions, Differentiability and differentials, Successive differentiation and Leibnitz theorem, Derivatives of higher order, nth derivative of well-known functions.

**UNIT-II** **(13 Lectures)**

Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series, Maclaurin's series of sin x, cos x, $e^x$ , log(l+x), $(l+x)^m$, Maxima and Minima, Indeterminate forms, Curvature, Asymptotes, Singular points, Tracing of curves, tracing of curves in polar and Parametric forms.

**UNIT-III** **(16 Lectures)**

Integration: Introduction, Definition, Standard formulae, Rules of integration, Method of substitution, Method of Partial fractions, Integration by parts, properties of definite integral.

**UNIT-IV** **(16 Lectures)**

Applications of Definite Integrals, Plane Area, Arc Length, Areas between Curves, Centroids, Moments of Inertia, Volumes, Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic function and of their combinations.

**Course Outcome:**On successful completion of the course, students will be able to assess properties implied by the Properties of continuous functions, Differentiability and differentials, Tracing of curves, tracing of curves in polar and Parametric forms, Method of Partial fractions, Applications of Definite Integral.

**Books Recommended**

1. H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc., 2002.
2. G.B. Thomas and R.L. Finney, Calculus, Pearson Education, 2007.
3. Zafar Ahsan: Differential Equations and Their Applications, Second Edition, PrenticeHall of India Private Limited, New Delhi.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Erwin Kreyszig: Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

## ELECTRICITY AND MAGNETISM LAB

**ubject Code: BPHYS1-104** **L T P C** **Duration: 30 Hrs.**
**21**

**Course Objective:**

To learn practically the various concepts of electricity and magnetism.

The course will provide hands- on training to the students for handling various electrical instruments.

**Course Outcome:**

- Able to verify the concepts/laws of Electricity and Magnetism.
- To inculcate and develop scientific aptitude by performing the various experiments.
- Skill enhancement by solving experimental problems.
- To inculcate the spirit of team work.

**Note:**

1. Maximum 20% experiments could be performed virtually.
2. Any other subject related experiment can also be included.

**List of Experiments:-**

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the characteristics of a series RC Circuit.
3. To determine an unknown Low Resistance using Potentiometer.
4. To determine an unknown Low Resistance using Carey Foster's Bridge.
5. To compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. To verify the Thevenin and Norton theorems.

8. To verify the Superposition, and Maximum power transfer theorems.
9. To determine self inductance of a coil by Anderson's bridge.
10. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.
11. To study the response curve of a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
12. Determine a high resistance by leakage method using Ballistic Galvanometer.
13. To determine self-inductance of a coil by Rayleigh's method.
14. To determine the mutual inductance of two coils by Absolute method.

**Recommended Text Books / Reference Books:**


1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. Engineering Practical Physics, S.Panigrahi and B.Mallick, 2015, Cengage Learning.
5. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.


## SOFTWARE LAB-I (BASED ON BMCAS1--102)

**Subject Code: BMCAS1--105** **L T P C** **(30 Lectures)**
**0 0 2 1**

**Course Objectives:**

1. To introduce IT in a simple language to students.
2. To help students to pursue specialized programs leading to technical and professional careers and certifications in the IT industry
3. To introduce skills relating to IT basics, computer applications, programming, interactive medias and Internet basics
4. To understand the concept of Computer's Input/output devices, the concept of dynamic memory, data types, loops, functions, array, pointers, string, structures and files.

**Course Outcomes:**

After completion of the course students will be able to:

1. Understand basic concepts and terminology of information technology.
2. Understand the working of spreadsheets and create their own powerpoint presentations
3. Know about Ms-Word and its features.
4. Work with the latest tools of information technology.

## ORGANIC CHEMISTRY-I

**SUBJECT CODE -BCHMS1-201** **L T P C** **(60 Lectures)**
**31 0 4**

**Course Objectives**

1. To understand the concepts behind basics of organic chemistry
2. To familiarize with the general mechanisms of organic reactions and bonding between organic molecules
3. To comprehend the applicability of organic reactions and organic molecules
4. To make the students apprehend the recognition of organic compounds and organic reaction mechanism

**Unit I** **(6 Lectures)**

**Basics of Organic Chemistry**

*Organic Compounds:* Classification, and Nomenclature, Hybridization, Shapes of molecules, influence of hybridization on bond properties.

*Electronic Displacements:* Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

**Unit II** **(18 Lectures)**

**Stereochemistry:**

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules.

*Optical Isomerism:* Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers,Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemicmixture and resolution. Relative and absolute configuration: D/L and R/S designations.

**Unit III** **(16 Lectures)**

**Chemistry of Aliphatic Hydrocarbons**

**Carbon-Carbon sigma bonds**

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

**Carbon-Carbon pi bonds:**

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

*Reactions of alkenes:* Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

*Reactions of alkynes:* Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

**Unit IV** **(20 Lectures)**

**Cycloalkanes and Conformational Analysis**

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

**Aromatic Hydrocarbons**

*Aromaticity:* Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with theirmechanism. Directing effects of the groups.

Course Outcomes:

Students will be able to:

1. Understand the basics of organic chemistry
2. Analyze the general mechanisms of organic reactions and bonding between organic molecules
3. Comprehend the applicability of organic reactions and organic molecules
4. Recognise the type of organic compounds and organic reaction mechanism

**Reference Books:**

• Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
• Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
• Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
• Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
• Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

## PHYSICAL CHEMISTRY-II

**SUBJECT CODE–BCHMS1-202** **L T P C** **(60 Lectures)**
**3 1 0 4**

**Course Objectives**

To familiarize the student with the basic concepts of thermodynamics.
To elaborate the system of variable composition and their properties.
To understand the concept of chemical equilibrium.
To understand the concept of solutions and colligative properties.

**Unit I** **(18 Lectures)**

**Chemical Thermodynamics I:**
Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.
*First law:* Concept of heat, *q*, work, *w*, internal energy, *U*, and statement of first law; enthalpy, *H*, relation between heat capacities, calculations of *q*, *w*, *U* and *H* for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.
*Thermochemistry:* Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.

**Unit II** **(18 Lectures)**

**Chemical Thermodynamics II:**
*Second Law:* Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.
*Third Law:* Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.
*Free Energy Functions:* Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

**Unit III** **(16 Lectures)**

**Systems of Variable Composition:**
Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs- Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

**Chemical Equilibrium:**
Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants $K_p$, $K_c$ and $K_x$. Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.

**Unit IV** **(8 Lectures)**

**Solutions and Colligative Properties:**
Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions. Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

**Course Outcomes:** On completion of this course, students will be able to:
1. Identify and describe energy exchange processes.
2. Manipulate physical parameters to favour a particular process.
3. Compare the system properties with variation in composition.
4. Explain the behaviour of solutions.

**Reference Books**


• Peter, A. & Paula, J. de. *Physical Chemistry 9th Ed.*, Oxford University Press (2011).
• Castellan, G. W. *Physical Chemistry 4th Ed.*, Narosa (2004).
• Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).
• McQuarrie, D. A. & Simon, J. D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.: New Delhi (2004).
• Assael, M. J.; Goodwin, A. R. H.; Stamatoudis, M.; Wakeham, W. A. & Will, S. *Commonly Asked Questions in Thermodynamics.* CRC Press: NY (2011).
• Levine, I .N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010).
• Metz, C.R. *2000 solved problems in chemistry*, Schaum Series (2006)


## ORGANIC CHEMISTRY LAB I

**SUBJECT CODE-BCHMS1-203** **L T P C** **(60 Lectures)**
**0 0 4 2**

**Course Objectives**

1. To understand the concepts behind calibration and purification by crystallization method.
2. To familiarize with the procedures to determine the physicochemical properties and effect of impurities on these properties
3. To understand the basics of chromotagraphic methods of separation of mixtures.

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents:
a. Water
b. Alcohol
c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus)
4. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds
5. Determination of boiling point of liquid compounds. (Boiling point lower than and more than 100 °C by distillation and capillary method)
6. Chromatography
a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography
b. Separation of a mixture of two sugars by ascending paper chromatography
c. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC)

Course Outcomes:
After completion of course students will be able to:

1. Purify organic compounds using various solvent combinations and calibrate small instruments.
2. Determine melting and boiling points of various organic compound
3. Separate organic mixtures using chromatographic techniques

**Reference Books**

• Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry,* Pearson Education (2009)
• Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)

## PHYSICAL CHEMISTRY LAB II

**SUBJECT CODE-BCHMS1-204** **L T P C** **(60 Lectures)**
**0 0 4 2**

**Course Objectives**

1. To understand the determination of heat capacity.
2. To familiarize with the enthalpy of a reaction.
3. To understand the use of a calorimeter for determination of heat capacity.
4. To correlate physical phenomena with their heat exchange.

**Thermochemistry**

(a) Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
(b) Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
(c) Calculation of the enthalpy of ionization of ethanoic acid.
(d) Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
(e) Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.
(f) Determination of enthalpy of hydration of copper sulphate.
(g) Study of the solubility of benzoic acid in water and determination of $\Delta H$.

**Course Outcomes:** The students will be able to:

1. Handle calorimeter.
2. Determine the heat capacity.
3. Determine enthalpy of different processes.
4. Determine heat of neutralization of an acid with a base.

**Reference Books**

• Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
• Athawale, V. D. & Mathur, P. *Experimental Physical Chemistry* New Age International: New Delhi (2001).

## ENVIRONMENTAL SCIENCE

**Subject Code: BHSMC0-041** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To familiarize the student with the basic concept of Environmental and Environmental Chemistry.
2. To elaborate the ecosystem and their properties.
3. To understand the concept of Environmental Pollution and its diverse effect of pollution.
4. To understand the concept of sustainable and unsustainable development and its importance.

**Course Outcomes:** On completion of this course, students will be able to:

CO1: Understand the basics of Environment chemistry
CO2: Analyze the general concept of ecosystem and their components.
CO3: Comprehend the applicability of social issues and Environment.
CO4: Recognize the Environment Pollution and control measures of urban and industrial wastes.

**Unit-I (08 Hours)**

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

**Unit-II (15 Hours)**

Natural resources and associated problems: a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources; f) Land resources: Role of an individual in conservation of natural resources.

**Unit-III (12 Hours)**

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit- IV (10 Hours)**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

**Recommended Books:**

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India.
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clark R.S., Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment

## DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTION

**Subject Code: BMNCC0-041** **L T P C** **Duration: 30Hrs.**
**2 0 0 0**

### UNIT-I (6 Hours)

Meaning of Drug Abuse: Meaning: Drug abuse, Drug dependence and Drug addiction. Nature and extent of drug abuse in India and Punjab.

### UNIT-II (8 Hours)

Consequences of Drug Abuse: Individual: Education, Employment, Income. Family: Violence. Society: Crime. Nation: Law and Order problem.

### UNIT-III (8 Hours)

Prevention of Drug Abuse: Role of Family: Parent-child relationship, Family support, supervision, shipping values, active scrutiny. School: Counselling, Teacher as role-model, Parent-teacher-health professional coordination, Random testing on students.

### UNIT-IV (8 Hours)

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counselling, Behavioural and Cognitive therapy. Social Management: Family, Group therapy and Environmental intervention. Treatment: Medical, Psychological and Social Management. Control: Role of Media and Legislation.

**Recommended Books:**

1. Ram Ahuja, 'Social Problems in India', Rawat Publications, Jaipur, 2003.
2. 'Extent, Pattern and Trend of Drug Use in India', Ministry of Social Justice and Empowerment, Govt. of India, 2004.
3. J.A. Inciardi, 'The Drug Crime Connection', Sage Publications, Beverly Hills, 1981.
4. T. Kapoor, 'Drug Epidemic among Indian Youth', Mittal Publications, New Delhi, 1985.
5. Kessel, Neil and Henry Walton, 'Alcoholism, Harmond Worth', Penguin Books, 1982.
6. Ishwar Modi and Shalini Modi, 'Addiction and Prevention', Rawat Publications,Jaipur, 1997.
7. 'National Household Survey of Alcohol and Drug Abuse', Clinical Epidemiological Unit, All India Institute of Medical Sciences, New Delhi, 2003 &2004.
8. Ross Coomber and Others, 'Key Concept in Drugs and Society', Sage Publications, New Delhi,2013.
9. Bhim Sain, 'Drug Addiction Alcoholism, Smoking Obscenity', Mittal Publications, New Delhi,1991.
10. Ranvinder Singh Sandhu, 'Drug Addiction in Punjab: A Sociological Study', Guru Nanak Dev University, Amritsar, 2009.
11. Chandra Paul Singh, 'Alcohol and Dependence among Industrial Workers', Shipra,Delhi, 2000.
12. S.Sussman and S.L. Ames, 'Drug Abuse: Concepts, Prevention andCessation', Cambridge University Press, 2008.
13. P.S. Verma, 'Punjab's Drug Problem: Contours and Characteristics', Vol. LII, No. 3, P.P. 40-43, Economic and Political Weekly, 2017. 1
14. 'World Drug Report', United Nations Office of Drug and Crime, 2016.

'World Drug Report', United Nations Office of Drug and Crime,2017

## THERMAL PHYSICS

| | | |
|---|---|---|
| **Subject Code: BPHYS1-201** | **L T P C**<br>**4 0 0 4** | **Duration: 60 Hrs.** |

**Course Objective:**

To provide a detailed knowledge of laws of thermodynamics,

T understand the applications of laws of thermodynamics, and Maxwell's thermodynamic relations.

**Course Outcomes:**

To understand the concepts related to Thermal Physics and their applications.

Skill enhancement to solve numerical problems related with the laws of thermodynamics, entropy, and Maxwell's thermodynamic relations.

Apply knowledge of Thermal Physics to go for higher studies in diverse fields.

To inculcate and develop the ability to think abstractly.

### UNIT-I (15 Hours)

**Laws of Thermodynamics**

Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem.

### UNIT-II (15 Hours)

**Applications of laws of thermodynamics**

Applications of First Law: General Relation between $C_P$ and $C_V$, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient. Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.

### UNIT-III (15 Hours)

**Entropy**

Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.

### UNIT-IV (15 Hours)

**Thermodynamic Potentials and Maxwell's relations**

Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations Maxwell's Thermodynamic Relations: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv, (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations (6) Change of Temperature during Adiabatic Process.

**Reference Books:**


1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. Statistical Physics and Thermodynamics, V.S. Bhatia, 1990, Shoban Lal Nagin Chand.
3. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
4. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger. 1988, Narosa.
5. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford University.
6. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.


## LINUX OPERATING SYSTEM

**Subject Code: BMCAS1—403** **L T P C** **(60 Lectures)**
**3 1 0 4**

**Course Objectives:**

1. To teach principles of operating system including basic Linux commands.
2. To facilitate students in understanding Inter process communication.
3. To understand and make effective use of linux utilities and shell scripting language to solve problems
4. To Develop the skills the necessary for systems programming including file system programming,process and signal management .

**Course Outcomes:**

After completion of course students will be able to:

1. Understand the basic commands of linux operating system and can write shell scripts.
2. Create file systems and directories and operate them.
3. Create processes background and fore ground etc..by fork() system calls.
4. Create shared memory segements,pipes ,message queues and can exercise interprocess communication

**UNIT- I** **(14 Lectures)**

**Introduction to Operating Systems**: its needs and services, Simple batch Systems, Multi- programmed batched systems, Time sharing systems, Parallel systems, Distributed systems and Real-time systems. Introduction to process, Process States.

**Structure of LINUX:** Kernel, Shell. LINUX Directory system.

**UNIT- II** **(15 Lectures)**

**LINUX Commands:** User Access and User ID Commands, Directory commands, Editors Commands, File Manipulation Commands, Security and Protection Commands, Inter-User and Inter-Machine Communication, Process Management Commands, I/O Redirection and Piping Commands, Vi editor, File Handling commands, and Introduction to Regular Expressions and Grep.

**UNIT- III** **(17 Lectures)**

**Administering LINUX System:** Introduction to System Administration, Functional activities of System Administration - Starting up the system, Maintaining the Super User Login, shutting down the system, recovering from system crash, taking backups, managing disk space, Mounting and Un-mounting file system, Adding and removing users, Changing groups and password.

**UNIT- IV** **(14 Lectures)**

**Shell Programming:** Executing a shell program, Study of shell programming as a Language; Wild card characters, Type of statements and Reserved Words, Special Shell parameters. The AWK pattern scanning and processing language: Operators, Control Statements and arrays.

**Recommended Books:**

**1.** J. Goerzen," Linux Programming Bible", IDG Books, New Delhi**.**
2. N. Mathew&R. Stones,"Beginning Linux Programming", Wiley Publishing India.

## MATHEMATICS-II

**Subject Code: BMATH5-201** **L T P C** **(60 Lectures)**
**31 0 4**

**Course Objective:**
1. To provide the basic Knowledge of Probability spaces, Basic Statistics, Sequence and Series, Partial differentiation.

**UNIT-I** **(14Lectures)**

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables;

**UNIT-II** **(15Lectures)**

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

**UNIT-III** **(15Lectures)**

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe’s test, Logarithmic test, Cauchy’s root test, Cauchy’s Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

**UNIT-IV** **(16Lectures)**

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

**Course Outcome:** After the completion of the course, the students will able to :

1. Apply the concept and consequences of Probability and Measures of Central tendency:
2. Understand moments, skewness and Kurtosis Binomial, Poisson and Normal Probability

distributions also concepts of correlation

3. To demonstrate the idea convergence of sequence and series, tests for convergence,power series and to represent function as series.
4. Extend the knowledge of Partial derivatives of higher order for further exploration of the subject for going into higher education.

**Reference Books:**

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, 2002.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons,2006.
3. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
4. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, 2010.
5. S.C. Gupta and V.K. Kapoor ,Fundamentals of Applied Statistics,4th Edition, Sultan Chand & Sons, 2014.

## BASIC MATHEMATICS-II

**Subject Code: BMATH5-202** **L T P C** **(60 Lectures)**
**3 1 0 4**

**Course Objective:**

To define and interpret the concepts of Matrices and Determinants, Sequence and Series, Partial differentiation, Partial derivatives.

**UNIT-I** **(14Lectures)**

Matrices and Determinants: Algebra of matrices, Inverse and rank of a matrix, System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

**UNIT-II** **(15Lectures)**

Sequence and Series: Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Raabe's test, Logarithmic test, Cauchy's root test, Cauchy's Integral test, series of positive and negative terms); Power series, Taylor's series, series for exponential, trigonometric and logarithm functions.

**UNIT-III** **(16Lectures)**

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobians and its properties.

**UNIT-IV** **(15Lectures)**

Partial derivatives, directional derivatives, total derivative, Tangent plane and normal line, Maxima, minima and saddle points, Method of Lagrange multipliers.

**Course Outcome:** After the completion of the course, the students will be able

1. Understand the basic concepts of matrices and determinants in order to explore the advance study of theoretical problems of linear algebra.
2. To demonstrate the idea convergence of sequence and series, tests for convergence,power series and to represent function as series.
3. Extend the knowledge of Partial derivatives of higher order for further exploration of the subject for going into higher education.
4. Apply derivatives for the computation of directional derivative and Optimization.

**Reference Books:**

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, 2002.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons,2006.
3. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, 2008.
4. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
5. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, 2010.

## THERMAL PHYSICS LAB

**Subject Code: BPHYS1-204** **L T P C** **(30 Lectures)**

**0 0 2 1**

**Note:**

1. Maximum 20% experiments could be performed virtually.
2. Any other subject related experiment can also be included.

**Course Objective:**

To learn practically the various concepts of thermodynamics.

The course will provide hand on training to the students for handling various related instruments.

**Course Outcome:**

- Practical knowledge of concepts of Thermodynamics.
- To inculcate and develop scientific aptitude by performing the various experiments.

- Learn to draw conclusions from data and develop skills in experimental design.
- To inculcate the spirit of teamwork

**List of Experiments:-**

1. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
2. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-Emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using Null Method
8. To calibrate a thermocouple to measure temperature in a specified Range using Direct measurement using Op-Amp difference amplifier and to determine Neutral Temperature.

**Reference Books**

1 Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2 A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3 Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4 A Laboratory Manual of Physics for undergraduate classes,D.P.Khandelwal,1985, Vani Pub.

## SOFTWARE LAB VIII (BASED ON BMCAS1-403 LINUX OPERATING SYSTEM)

**Subject Code: BMCAS1--406** | **L T P C** **0 0 21** | **Duration: 30 Lectures**

**Course Objectives**

1. To describe the basic file system in Linux and its file attributes.
2. To Appraise different filters, process handling, regular expressions and network handling features using suitable commands.
3. To Summarize different Linux commands to write Shell Programs
4. To demonstrate use of system calls

**Course Outcomes:** After completion of course students will be able to:

1. Demonstrate installation of Linux operating system and understand the importance of Linux
2. Manage shell and processes using various commands.
3. Demonstrate Linux administration and its environment.
4. Write Shell scripts and C programs using vi editor

## ORGANIC CHEMISTRY-II

**SUBJECT CODE -BCHMS1-301** | **L T P C** **4 0 0 4** | **(60 Hrs.)**

**Course Objectives**

1. To understand the concepts behind basics of organic chemistry

2. To familiarize with concepts behind reaction intermediates
3. To understand the mechanism of various organic reactions
4. To describe concepts of preparation and properties of functional group derivatives

Course Outcomes:

After the completion of course, students will be able to:

1. Describe chemistry of functional groups

2.Use of reaction intermediates in organic reactions

3. Sketch mechanism of various organic reactions

4. Explain the concepts of preparation and properties of functional group derivatives

**Unit I** **(16 Hrs.)**

**Chemistry of Halogenated Hydrocarbons:**

*Alkyl halides:* Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and controlling factors, Comparison of nucleophilic substitution and elimination reactions.

*Aryl halides:* Preparation (including preparation from diazonium salts). Nucleophilic aromatic substitution; SNAr, Benzyne mechanism.

Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Organometallic compounds of Mg and Li – Use in synthesis of organic compounds.

**Unit II** **(16 Hrs.)**

**Alcohols, Phenols, Ethers and Epoxides:**

*Alcohols:* Preparation, properties and relative reactivity of 1°, 2°, 3°alcohols, Bouvaelt-Blanc Reduction; Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement.

*Phenols:* Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism.

*Ethers and Epoxides:* Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$

**Unit III** **(14 Hrs.)**

**Carbonyl Compounds:**

Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Claisan-Schmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α-substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, $LiAlH_4$, $NaBH_4$, MPV and PDC); Addition reactions of unsaturated carbonyl compounds: Michael addition.

Active methylene compounds: Keto-enol tautomerism. Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

**Unit IV** **(14 Hrs.)**

**Carboxylic Acids and their Derivatives:**

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic, phthalic, lactic, malic, tartaric, citric, maleic and fumaric acids; Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of nucleophilic sustitution at acyl group -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation,

Dieckmann and Reformatsky reactions, Hofmannbromamide degradation and Curtius rearrangement.

**Sulphur containing compounds:**
Preparation and reactions of thiols, thioethers and sulphonic acids.

**Reference Books:**

1. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (Pearson Education)2010.
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.(Pearson Education)2002.
3. Graham Solomons, T.W. *Organic Chemistry*, John Wiley & Sons, Inc.,2016.

## PHYSICAL CHEMISTRY-III

**SUBJECT CODE –BCHMS1-302** **L T P C** **(60 Hrs.)**
**4 0 0 4**

**Course Objectives**

1. To familiarize the student with the basic concepts of chemical kinetics.
2. To elaborate the concept of phases and phase equilibria.
3. To understand the concept of various surface phenomena and adsorption isotherms.
4. To understand various adsorption isotherms.

**Course Outcomes:** On completion of this course students will be able to:

1. Apply the knowledge of catalysis and its mechanism in reactions.
2. Predict and control the rate of formation of products/reactants based on concept of chemical kinetics.
3. Explain the reason for reaction rates on the basis of theories and mechanisms.
4. Identify and analyse uni/multicomponent systems.

**<u>Unit I</u>** **(12 Hrs.)**

**Phase Equilibria-I:**
Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systemswith applications.

**<u>Unit II</u>** **(14 Hrs.)**

**Phase Equilibria-II:**
Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent andincongruent melting points, solid solutions.
*Binary solutions:* Gibbs-Duhem-Margules equation, its derivation, azeotropes, partial miscibility of liquids, CST, miscible pairs, steam distillation.
Nernst distribution law: its derivation and applications.

**<u>Unit III</u>** **(20 Hrs.)**

**Chemical Kinetics :**
Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism.

**Unit IV** **(14 Hrs.)**

**Catalysis:**

Types of catalyst, specificity and selectivity, effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

**Surface chemistry:**

Physical adsorption, chemisorption, adsorption isotherms.

**Reference Books**

1. Peter, A. & Paula, J. de. *Physical Chemistry 9th Ed.*, Oxford University Press (2011).
2. Castellan, G. W. *Physical Chemistry 4th Ed.*, Narosa (2004).
3. Engel, T. & Reid, P. *Physical Chemistry 3rd Ed.*, Prentice-Hall (2012).

4. McQuarrie, D. A. & Simon, J. D. *Molecular Thermodynamics* Viva Books Pvt. Ltd. (2004).
5. Puri, B. R.; Sharma, L. R.&Pathania, M. S.; *Principles of Physical Chemistry*.Vishal Publishing (2011).
6. Levine, I .N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010).
7. Metz, C.R. *2000 solved problems in chemistry,* Schaum Series (2006)
8. Zundhal, S.S. *Chemistry concepts and applications* Cengage India (2011).
9. Ball, D. W. *Physical Chemistry* Cengage India (2012).
10. Mortimer, R. G. *Physical Chemistry 3rd Ed.,* Elsevier(2009).

## ORGANIC CHEMISTRY LAB II

**SUBJECT CODE-BCHMS1-303** **L T P C** **(60 Hrs.)**
**0 0 4 2**

**Course Objectives**

1. To understand synthesis of various organic compounds
2. To determine the melting points of organic compounds
3. To understand the use of thin layer chromatography
4. To understand chemistry involved in functional group determination

Course Outcomes:

After completion of course students will be able to:

1. Prepare prepare small organic compounds
2. Make use of melting point apparatus
3. Comparison of various organic compounds on thin layer chromatography
4. Analyze and detect organic functional groups

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included

**Experiments**

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
2. Organic preparations:

i. Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*-toluidinesand *o*-, *m*-, *p*-anisidine) and phenols (β-naphthol, vanillin, salicylicacid) by any one method:
a. Using conventional method.
b. Using green approach
ii Benzolyation of one of the following amines (aniline, *o*-, *m*-, *p*- toluidines and *o*-,*m*-, *p*-anisidine) and one of the following phenols (β-naphthol, resorcinol, p-cresol)by Schotten-Baumann reaction.
iii. Oxidation of ethanol/ isopropanol (Iodoform reaction).
iv. Bromination of any one of the following:
a. Acetanilide by conventional methods
b. Acetanilide using green approach (Bromate-bromide method)
v. Nitration of any one of the following:
a. Acetanilide/nitrobenzene by conventional method
b. Salicylic acid by green approach (using ceric ammonium nitrate).
vi. Selective reduction of *meta* dinitrobenzene to *m*-nitroaniline.

vii. Reduction of *p*-nitrobenzaldehyde by sodium borohydride.
viii. Hydrolysis of amides and esters.
ix. Semicarbazone of any one of the following compounds: acetone, ethyl methylketone, cyclohexanone, benzaldehyde.
x. *S*-Benzylisothiouronium salt of one each of water soluble and water insoluble acids(benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).

xi. Aldol condensation using either conventional or green method.

xii. Benzil-Benzilic acid rearrangement.
The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

**Reference Books**

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry,* Pearson Education(2009)
*2.* Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.,* Pearson (2012)
*3.* Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry:Preparation and* QuantitativeAnalysis, University Press (2000).
4. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: QualitativeAnalysis,* University Press (2000).

## PHYSICAL CHEMISTRY LAB III

**SUBJECT CODE-BCHMS1-304** **L T P C** **(60 Hrs.)**
**0 0 4 2**

1. **Course Objectives**
2. 1. To understand phase rule and phase diagram.
3. 2. To familiarize with various adsorption isotherms.
4. 3. To introduce the concept of critical solution temperature.
5. 4. To understand the kinetics of a reaction practically.

**Course Outcomes:** The students will be able to:
1. Construct the phase diagram and calculate various parameters associated with the phase concept.
2. Study kinetics of a reaction practically.
3. Apply adsorption isotherm to study adsorption phenomena.
4. Compare the strengths of acids.

Note:
1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2 Any other subject related experiment can also be included

**Experiments**
I. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.
II. Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:
a. simple eutectic and
b. congruently melting systems.
III. Distribution of acetic/ benzoic acid between water and cyclohexane.
IV. Study the equilibrium of at least one of the following reactions by the distribution method:
(i) $I_2(aq) + I^- \rightarrow I^{3-}(aq)$
(ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$
V. Study the kinetics of the following reactions.
1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
a. Acid hydrolysis of methyl acetate with hydrochloric acid.
b. Saponification of ethyl acetate.
3. Compare the strengths of HCl and $H_2SO_4$ by studying kinetics of hydrolysis of methylacetate.
VI. Adsorption
1. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid onactivated charcoal.

**Reference Books:**
1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003)

## CHEMISTRY OF COSMETICS AND PERFUMES

**Subject Code: BCHMD1-311** **L T P C** **(30 Hrs.)**
**2 0 0 2**

**Course Objectives**

1.To provide the significance of everyday usage of cosmetics and fundamental principles related to it..
2.3.To give an overview of cosmetic ingredients and different types of stability tests of finished products.
To familiarise the students with the chemical aspect of the cosmetics and safety measures required while applying the cosmetic product..

**Course Outcomes:** After completion of this course, the students will :

1.Know the significance and fundamentals of cosmetics of everyday use.
2.Have an overview of cosmetic ingredients, quality & stability testing of the finished product..
3.Understand the cosmetics from the chemical perspective and its safety measures.Students will be able to prepare some cosmetics on their own.

**Unit-I** **(7 Hrs.)**

Cosmetics through the Ages, Formulations of cosmetics for everyday use, A general studyincluding preparation and uses of hair care products: Hair dye, hair spray, shampoo, Skin preparations: creams (cold, vanishing and shaving creams).

**Unit-II** **(8 Hrs.)**

Colouring materials used in decorative cosmetics and colour matching, preparation and uses ofdecorative products: face powder, lipsticks, talcum powder, nail enamel.Sun damage and Sunscreen preparations.

**Unit-III** **(7 Hrs.)**

Quality, stability and safety assurance of cosmetics: analytical methods, efficacy testing of cosmetics, emulsion theory, microbiological control of cosmetics, hazard determination of ingredients, stability testing.

**Unit-IV** **(8 Hrs.)**

Perfumes**:** Essential oils and their importance in cosmetic industries with reference to Eugenol,Geraniol, sandalwood oil, eucalyptus, rose oil, 2-phenyl ethyl alcohol, Jasmone, Civetone, Muscone.

**Practicals (any two)**

1. Preparation of shampoo.
2. Preparation of nail polish and nail polish remover.
3. Preparation of cold creams.
4. Preparation of glycerine soap.

**Reference Books:**

1. *Handbook of Cosmetic Science and Technology* Edited by: Edited by André O. Barel, Marc Paye, Howard I. Maibach, 3rd edition
2. Stocchi, E. *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK (1990).
3. Jain, P.C. & Jain, M. *Engineering Chemistry* Dhanpat Rai & Sons, Delhi.
4. Sharma, B.K. & Gaur, H. *Industrial Chemistry,* Goel Publishing House, Meerut (1996).

## GREEN METHODS IN CHEMISTRY

**Subject Code: BCHMD1-312** **L T P C** **(30 Hrs.)**
**2 0 0 2**

**Course Objectives :**

1. To learn principles of green chemistry.
2. To familiarize with real world case studies related to green chemistry

**Course Outcomes:**

**After completion of the course, students will be able to:**

1. Explain principles of green chemistry
2. Define applications of green chemistry in industry

Tools of Green chemistry, Twelve principles of Green Chemistry, with examples.

**The following Real world Cases in Green Chemistry should be discussed:**
1 A green synthesis of ibuprofen which creates less waste and fewer by-products (Atomeconomy).
2 Surfactants for Carbon Dioxide – replacing smog producing and ozone depletingsolvents with $CO_2$ for precision cleaning and dry cleaning of garments.
3 Environmentally safe antifoulant.
4 $CO_2$ as an environmentally friendly blowing agent for the polystyrene foam sheetpackaging market.
5 Using a catalyst to improve the delignifying (bleaching) activity of hydrogenperoxide.
6 A new generation of environmentally advanced preservative: getting the chromiumand arsenic out of pressure treated wood.
7 Rightfit pigment: synthetic azopigments to replace toxic organic and inorganicpigments.
8 Development of a fully recyclable carpet: cradle to cradle carpeting.

**<u>Reference Books:</u>**

1. Manahan S.E. (2005) Environmental Chemistry, CRC Press
2. Miller, G.T. (2006) Environmental Science 11th edition. Brooks/Cole
3. Mishra, A. (2005) Environmental Studies. Selective and Scientific Books, New Delhi

## ELEMENTS OF MODERN PHYSICS

**Subject Code: BPHYS1-302** **L T P C** **(60 Hrs.)**
**4 0 0 4**

**Course Objective:**

1. To learn and understand basic concepts of Quantum Mechanics
2. To understand the concepts of Nuclear Physics, Laser and its Applications.

**Course Outcomes:**

- Understanding the basic concepts in the development of modern physics.
- To establish the basic foundation of students to study the advance level course like quantum physics, particle physics and high energy physics.
- Skill enhancement to solve numerical problems related with basic quantum, nuclear and particle physics.
- To provide the knowledge of the state-of-the-art of modern days lasers and their applications in daily life.

**UNIT-I(15 Hours)**

**Introduction to Quantum Mechanics**

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.

**UNIT-II (15 Hours)**

**Quantum Mechanical Uncertainty**

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction. Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence.

**UNIT-III (15 Hours)**

**Nuclear Physics**

Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, energy, charge. Binding energy, angular momentum, magnetic moment and electric quadruple moments of the nucleus, Wave mechanical properties of nucleus, average binding energy and its variation with mass numbers, Properties of nuclear forces, Non existence of electrons in the nucleus and neutron-proton model, Liquid drop model and semi empirical mass formula, Conditions of nuclear stability.Radioactivity. Modes of decay and successive radioactivity. Alpha emission. Electron emission, Positron emission. Electron capture, Gamma-ray emission, Internal conversion.

**UNIT-IV(15 Hours)**

**Laser and its Applications**

Introduction, Coherence, Spatial and temporal coherence,Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Einstein's A and B coefficients. Three-Level and Four-Level Lasers. Components of Laser, Types of Laser: Ruby Laser and He-Ne Laser, Semiconductor Laser and $CO_2$ Laser. Q-switching, Mode locking, Applications of lasers–a general outline. Basics of holography.

**Reference Books:**


1. Concepts of Modern Physics, Arthur Beiser, 2002, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill
3. Introduction to Quantum Mechanics, David J. Griffith, 2005, Pearson Education.
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, 2010, Cengage Learning.
5. Modern Physics, G.Kaur and G.R. Pickrell, 2014, McGraw Hill
6. Quantum Mechanics: Theory & Applications, A.K.Ghatak & S.Lokanathan, 2004, Macmillan


## PROGRAMMING IN C LANGUAGE

**Subject Code: BMCAS1-104** **L T P C** **(60 Hrs.)**
**3 1 04**

**Course Objectives:**

1. To help the students in finding solutions to various real life problems.
2. To convert the solutions into computer program using C language (structured programming).
3. To understand a functional hierarchical code organization.
4. To design and develop modular programming.

Course Objectives Outcomes:

1. Students will learn to write algorithm for solutions to various real- life problems.
2. Students will learn to convert the algorithms into computer programs using C language.
3. Students will implement different Operations on arrays, functions, pointers, structures, unions and files

**UNIT- I** **(14 Hrs.)**

**Algorithm and Programming Development**: Steps in development of a program, Flow charts, Algorithm Development, Program Debugging, Compilation and Execution.

**Fundamentals of 'C'**: I/O statements, Assignment Statements, Constants, Variables, Operators and Expressions, Standards and Formatted statements, Keywords, Data Types and Identifiers.

**UNIT- II** **(15 Hrs.)**

**Control Structures**: Introduction, Decision making with if – statement, if-else and Nested if, while and do-while, for loop. Jump statements: break, continue, goto, switch Statement

**Functions**: Introduction to Functions, Function Declaration, Function Categories, Standard Functions, Parameters and Parameter Passing, Call – by value/reference, Recursion, Global and Local Variables, Storage classes.

**UNIT- III** **(17 Hrs.)**

**Arrays**: Introduction to Arrays, Array Declaration, Single and Multidimensional Array, Memory Representation, Matrices, Strings, String handling functions.

**Structure and Union**: Declaration of structure, Accessing structure members, Structure Initialization, Arrays of structure, nested structures, Unions.

**UNIT- IV** **(14 Hrs.)**

**Pointers**: Introduction to Pointers, Address operator and pointers, Declaring and Initializing pointers, Assignment through pointers, Pointers and Arrays

**Files**: Introduction, creating a data file, opening and closing a data file, processing a data file.

**Preprocessor Directives**: Introduction and Use, Macros, Conditional Preprocessors, Header Files.

**Recommended Books:**

1. Yashvant P. Kanetkar, 'Let us C', 7th Edn., BPB Publications, NewDelhi, **2010**.
2. E. Balagurusami, 'Programming in ANSI C', 4th Edn., Tata McGrawHill, **2007**.
3. Byron S. Gottfried, 'Programming in C', 2nd Edn., McGrawHills, **1998**.
4. Kernighan & Richie, 'The C Programming Language', 2nd Edn., PHIPublication, **1988**.
5. R. Lafore, 'Object Oriented Programming', 3rd Edn., GalgotiaPublications, **1999**.
6. R.S. Salaria, 'Problem Solving and Programming in C', 2nd Edn, **2015**.

## MATHEMATICS-III

**Subject Code: BMATH5-301** **L T P C** **(60 Hrs.)**
**3 1 0 4**

**Course Objective**:

1. To introduce concept of ordinary and partial differential equations.

**Course Outcome:**

Students will be able to:

1. Apply various methods to Solve first and second order linear ordinary differential equations.
2. Solve the linear partial differential equations using various methods and apply these methods in solving some physical problems.
3. Understand the formation and solution of some significant PDEs like wave equation, heat equation and Laplace equation.
4. Apply differential equations to significant applied and theoretical problems.

**UNIT-I(14 Lectures)**

**First Order Ordinary Differential Equations:** Linear and Bernoulli's equations, exact equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

**UNIT-II(16 Lectures)**

**Ordinary Differential Equations of higher Orders:** Second order linear differential equations with variable coefficients, (complementary function, particular integral) method of variation of parameters, Cauchy-Euler equation.

**UNIT-III(15 Lectures)**

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method, Second-order linear equations and their classification.

**UNIT-IV(15 Lectures)**

Separation of variables in a PDE; wave and heat equations in one dimensional form, Elementary solutions of Laplace equations.

**Reference Books:**

1. G.B. Thomas and R.L. Finney, 'Calculus and Analytic Geometry', 9th Edn., Pearson, Reprint, 2002.
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', 9th Edn, John Wiley & Sons,2006.
3. T. Veerarajan, 'Engineering Mathematics for First Year', Tata McGraw Hill, New Delhi, 2008.
4. B.V. Ramana, 'Higher Engineering Mathematics', 11th Reprint, Tata McGraw Hill, New Delhi, 2010.
5. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, 2010.

## ELEMENTS OF MODERN PHYSICS LAB

**Subject Code: BPHYS1-306** **L T P C** **(30 Hrs.)**
**0 0 2 1**

**Note:**

1. Maximum 20% experiments could be performed virtually.
2. Any other subject related experiment can also be included.

**Course Objective:**

To understand practically the laws of Modern Physics.

The course will provide hand on training to the students for handling various related instruments.

**Course Outcomes:**

- Able to verify the concepts/laws of basic quantum, nuclear and particle physics.
- To inculcate and develop scientific aptitude by performing the various experiments.
- Skill enhancement by solving experimental problems.
- To inculcate the spirit of teamwork.

1. Measurement of Planck's constant using black body radiation and photo-detector
2. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light
3. To determine work function of material of filament of directly heated vacuum diode.
4. To determine the Planck's constant using LEDs of at least 4 different colours.
5. To determine the wavelength of H-alpha emission line of Hydrogen atom.
6. To determine the ionization potential of mercury.
7. To determine the absorption lines in the rotational spectrum of Iodine vapour.
8. To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet.
9. To setup the Millikan oil drop apparatus and determine the charge of an electron.
10. To show the tunneling effect in tunnel diode using I-V characteristics.
11. To determine the wavelength of laser source using diffraction of single slit.
12. To determine the wavelength of laser source using diffraction of double slits.
13. To determine (1) wavelength and (2) angular spread of He-Ne laser using plane diffraction grating

**Reference Books:**


1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

## SOFTWARE LAB II (BASED ON BMCAS1-104 PROGRAMMING IN C LANGUAGE)

**Subject Code: BMCAS1-106** **L T P C** **Duration (30 Hrs.)**
**0 0 2 1**

**Course Objectives:**

1. The objective of this course is to help the students in finding solutions to various real life problems
2. To convert the solutions into computer program using C language (structured programming).

**Course Outcomes:**

Students will learn to write programs for solving various real- life problems.

1. **Input-Output Statements:** formatted and non-formattedstatements.
2. **Decision Making:** switch, if-else, nested if, else-if ladder, break, continue, goto.
3. **Loops:** while, do-while, for.
4. **Functions:** definition, declaration, variable scope, parameterized functions, return statement, call by value, call by reference, recursivefunctions.
5. **Arrays:** Array declarations, Single and multi-dimensional, memory limits, strings and string functions.
6. **Files:** Creation and editing of various types of files, closing a file (using functions and without functions).

## INORGANIC CHEMISTRY-II

**SUBJECTCODE -BCHMS1-401** **L T PC 4 0 0 4** **(60 Hrs.)**

**Course Objectives**

1. To understand the principles of metallurgy
2. To familiarize with the concepts of acids and bases
3. To understand the concepts behind chemistry of s & p block elements
4. To learn the chemistry behind noble gases and inorganic polymers

Course Outcomes:

After the completion of course students will have:

1. Comprehend the metallurgy principles with various refining processes
2. understand chemistry of s and p block elements
3. have an overview of noble gases and inorganic polymers

**UnitI** **(14 Hrs.)**

**General Principles of Metallurgy:**

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagramsforreduction of metal oxides using carbon and carbon monoxide as reducing agent. ElectrolyticReduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Partingprocess, van Arkel-de Boer process and Mond’s process, Zone refining.

**Acids and Bases:**

Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids,types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification ofLewis acids, Hard and Soft Acids and Bases (HSAB), Application of HSAB principle.

**UnitII** **(13 Hrs.)**

**Chemistry of *s* and *p* Block Elements-I:**

Inert pair effect, Relative stability of different oxidation states, diagonal relationship andanomalous behavior of first member of each group. Allotropy and catenation. Complexformation tendency of *s* and *p* block elements.Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate andnitrate.

**UnitIII(17 Hrs.)**

**Chemistry of *s* and *p* Block Elements-II (Continued Unit II):**

Study of the following compounds with emphasis on structure, bonding, preparation,properties and uses. Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acidsof sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens.

**UnitIV** **(16 Hrs.)**

**Noble Gases:**

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation andproperties of $XeF_2$, $XeF_4$ and $XeF_6$; Nature of bonding in noble gas compounds (Valencebond treatment and MO treatment for $XeF_2$). Molecular shapes of noble gas compounds(VSEPR theory).

**Inorganic Polymers:**

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, andpolysulphates.

**Reference Books:**

1. Lee, J.D. *Concise Inorganic Chemistry*, ELBS, 1991.
2. Douglas, B.E; Mc Daniel, D.H. & Alexander, J.J. *Concepts & Models ofInorganic Chemistry 3$^{rd}$ Ed.*, John Wiley Sons, N.Y. 1994.
3. Greenwood, N.N. & Earnshaw. *Chemistry of the Elements*, Butterworth-Heinemann. 1997.
4. Cotton, F.A. & Wilkinson, G. *Advanced Inorganic Chemistry*, Wiley, VCH, 1999.
5. Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning IndiaEdition, 2002.
6. Miessler, G. L. & Donald, A. Tarr. *Inorganic Chemistry 4$^{th}$ Ed.*, Pearson, 2010.
7. Atkin, P. *Shriver & Atkins' Inorganic Chemistry 5$^{th}$ Ed*. Oxford University Press,2010.

## ORGANIC CHEMISTRY-III

**SUBJECTCODE -BCHMS1-402** **L T P C 4 0 0 4** **(60** Hrs.)

**Course Objectives:**

1. To provide the knowledge of Organic Chemistry and fundamental principles related to it..
2. To give an overview of reactivity and properties of various Organic compounds. .
3. To familiarise the students with the applications of the Organic compounds.

**Course Outcomes:** After completion of this course, the students will :

1. Know the significance and fundamentals of Organic compounds.
2. Have an overview of reactivity and properties of Organic copounds..
3. Understand the applications of Organic compounds in medicinal field.

**UnitI** **(18 Hrs.)**

**Nitrogen Containing Functional Groups:**

Preparation and important reactions of nitro and compounds, nitriles and isonitriles.Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive emethylation, Hofmann-elimination reaction; Distinction between 1°, 2°and 3°amines withHinsberg reagent and nitrous acid.Diazonium Salts: Preparation and their synthetic applications.

**UnitII** **(15 Hrs.)**

**Polynuclear Hydrocarbons:**

Reactions of naphthalene, phenanthrene and anthracene. Structure, Preparation and structureelucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.

**Heterocyclic Compounds-I:**

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered ringscontaining one heteroatom; Synthesis, reactions and mechanism of substitution reactions of:Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis),Thiophene,

**Unit III(15 Hrs.)**

**Heterocyclic Compounds-II (Continued Unit II):**

Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole,Fischer indole synthesis and Madelung synthesis), Structure elucidation of quinoline andisoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-FritschreactionDerivatives of furan: Furfural and furoic acid.

**UnitIV** **(12 Hrs.)**

**Alkaloids:**

Natural occurrence, General structural features, Isolation and their physiological actionHoffmann's exhaustive methylation, Emde's modification, Structure elucidation andsynthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine,Morphine, Cocaine, and Reserpine.

**Terpenes:**

Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral,Neral and α-terpineol.

**Reference Books:**


1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).
2. Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. *Organic Chemistry* (*Volume 2: Stereochemistry and the Chemistry of Natural Products*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Acheson, R.M. *Introduction to the Chemistry of Heterocyclic compounds*, John Welly & Sons, 1976.
5. Graham Solomons, T.W. *Organic Chemistry*, John Wiley & Sons, Inc.

6. McMurry, J.E. *Fundamentals of Organic Chemistry*, *7th Ed*. Cengage Learning India Edition, 2013.
7. Kalsi, P. S. *Textbook of Organic Chemistry 1st Ed.*, New Age International (P) Ltd. Pub.
8. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; *Organic Chemistry*, Oxford University Press
9. Singh, J.; Ali, S.M. & Singh, J. *Natural Product Chemistry*, Prajati Parakashan,2010.




## INORGANIC CHEMISTRY-II LAB

**SUBJECTCODE-BCHMS1-403** **L T PC** **(60 Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To learn the principles applicable to various experiments.

2. To understand the concepts behind Iodo/Iodimetric titrations
3. To synthesize various inorganic compounds

Course Outcomes:

After completion of course students will gain the knowledge of:

1. Obtaining precise results of Iodo/Iodimetric titrations
2. Preparation of transition metal based inorganic compounds

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included

**(A) Iodo/Iodimetric Titrations:**

(i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution(Iodimetrically).
(ii)Estimation of antimony in tartar-emetic iodimetrically
(iii) Estimation of available chlorine in bleaching powder iodometrically.
(iv) Calculation of percentage dehydration in copper sulphate crystals.
(v) Determination of percentage composition of mixture (copper sulphate and potassium sulphate).

**(B) Inorganic preparations:**

(i) Preparation of Cuprous Chloride, $Cu_2Cl_2$
(ii) Preparation of tristhioureacopper(I)chloride
(iii) Preparation of Aluminium potassium sulphate $KAl(SO_4)_2.12H_2O$ (Potash alum)
(iv) Preparation of Chrome alum $KCrS_2O_8$
(v) Cis-Trans diaquodioxalatochromate(II)

**Reference Books:**

1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009

## ORGANIC CHEMISTRY-III LAB

**SUBJECTCODE-BCHMS1-404** **L T PC** **(60 Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To understand the concepts behind detection of extra elements
2. To acquire knowledge of chemistry behind functional group tests
3. To study the quantitative analysis of organic compounds

**Course Outcomes:**

After completion of course students will acquire the knowledge of:

1. Detection techniques of extra elements
2. Concepts of functional groups detection
3. Quantitative analysis of organic molecules

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given syllabus.
2. Any other subject related experiment can also be included

**Experiments**

1. Detection of extra elements
2. Functional group tests for (a) nitro groups
   (b) amine groups
   (c) amide groups
3. Qualitative analysis of unknown organic compounds containing simple functionalGroups:
   (a) Alcohols
   (b) Carboxylic acids
   (c) Phenols
   (d) Other carbonyl compounds

**Reference Books**


1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education, 2009.
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical OrganicChemistry, 5th Ed.*,Pearson,2012.
3. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry:Preparation and Quantitative Analysis*, University Press, 2000.
4. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry:Qualitative Analysis*, University Press, 2000.

## FUEL CHEMISTRY

**SUBJECTCODE- BCHMD1-411** **L T PC** **(30 Hrs.)**
**2 0 0 2**

**Course Objectives**
1. To study the classification of fuels, uses and their calorific value
2. To understand the industrial uses of petroleum
3. To study the classification and properties of lubricants

Course Outcomes:

After completion of course students will attain the knowledge of:
1. Industrial applications of coal
2. Industrial uses and applications of petroleum
3. Properties and uses of lubricants

**UnitI** **(8 Hrs.)**

Review of energy sources (renewable and non-renewable). Classification of fuels and theircalorific value.

**Coal:**

Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization ofcoal. Coal gas, producer gas and water gas-composition and uses. Fractionation of coal tar,uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification(Hydro gasification and Catalytic gasification), Coal liquefaction and solvent refining.

**UnitII** **(7 Hrs.)**

**Petroleum and Petrochemical Industry***:*

Composition of crude petroleum, Refining anddifferent types of petroleum products and their applications.Fractional Distillation (Principle and process), Cracking (Thermal and catalytic cracking).

**UnitIII** **(8** Hrs.**)**

Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derivedfrom biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels.Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and itsderivatives Xylene.

**UnitIV** **(7 Hrs.)**

**Lubricants:**

Classification of lubricants, lubricating oils (conducting and non-conducting)Solid and semisolid lubricants, synthetic lubricants.Properties of lubricants (viscosity index, cloud point, pore point) and their determination.

**Reference Books:**

1. Stocchi, E. *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK, 1990.
2. Jain, P.C. & Jain, M. *Engineering Chemistry* Dhanpat Rai & Sons, Delhi
3. Sharma, B.K. & Gaur, H. *Industrial Chemistry*, Goel Publishing House, Meerut, 1996.

## PHARMACEUTICAL CHEMISTRY

**SUBJECTCODE-BCHMD1-412** **L T PC** **(30 Hrs.)**
**2 0 0 2**

**Course Objectives**

1. To understand the concepts of drug design and development
2. To acquire the knowledge of synthesis of drug molecules.
3. To study the concepts of aerobic and anaerobic fermentation for industrial applications

Course Outcomes:

After completion of course students will gain the knowledge of:

1. Synthetic methods used for the drug design and development
2. Aerobic and anaerobic fermentation and its importance in pharmaceutical industries.

**UNIT I (8 Hrs.)**

**Drugs & Pharmaceuticals-I:**
Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of therepresentative drugs of the following classes: analgesic agents, antipyretic agents, anti-inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol).

**UNIT II (8 Hrs.)**

**Drugs & Pharmaceuticals-II:**
Synthesis of the representative drugs:Antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide,Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital,Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS relateddrugs (AZT-Zidovudine).

**UnitIII (8 Hrs.)**

**Fermentation-I:**
Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii)Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin.

**UnitIV (6 Hrs.)**

**Fermentation-II (Continued Unit III):**
(iii) Lysine,Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

**Reference Books:**

1. Patrick, G. L. *Introduction to Medicinal Chemistry, Oxford University* Press, UK, 2013.
2. Singh, H. & Kapoor, V.K. *Medicinal and Pharmaceutical Chemistry*, Vallabh Prakashan, Pitampura, New Delhi, 2012.
3. Foye, W.O., Lemke, T.L. & William, D.A.: *Principles of Medicinal Chemistry*, 4th *Ed*., B.I. Waverly Pvt. Ltd. New Delhi

## WAVES AND OPTICS

**Subject Code: BPHYS1-202** **L T P C** **(60 Hrs.)**
**4 0 0 4**

**Course Objective:**
To understand the fundamentals of harmonic oscillations, wave motion,
To provide the knowledge of wave optics: diffraction, interferometer and holography.

**Course Outcomes:**

- Understanding the concepts of harmonic oscillations, wave motion, wave optics, interference and diffraction.
- Skill enhancement to solve numerical problems related with Waves and Optics.
- Apply knowledge of Waves and Optics to go for higher studies in diverse fields.
- To inculcate and develop the ability to think abstractly.

### UNIT-I (15 Hours)

**Harmonic oscillations and Superpositions**

Introduction to Harmonic oscillations, Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

### UNIT-II (15 Hours)

**Wave Motion**

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.

### UNIT-III (15 Hours)

**Wave Optics and Interference**

Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. Interference: Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. Interferometer: Michelson Interferometer-(1) Idea of form of fringes (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer.

### UNIT-IV (15 Hours)

**Diffraction**

Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only) Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone

Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

**Reference Books**


1 Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
2 Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
3 Optics, Ajoy Ghatak, 2008, Tata McGraw Hill.
4 The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
5 The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
6 Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.

## OBJECT ORIENTED PROGRAMMING LANGUAGE IN C++

**Subject Code: BMCAS1-204** **L T P C** **(60 Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To develop a greater understanding of the issues involved in programming language design and object oriented paradigms and its implementation.
2. To impart adequate knowledge on the need of object oriented programming languages.
3. To enhance problem solving and programming skills in C++ by implementing the object oriented concepts.
4. To understand the difference between the top-down and bottom-up approach.

**Course Objectives:After completion of this course students will be able to:**

1. Apply the concepts of object-oriented programming.
2. Illustrate the process of data file manipulations using C++.
3. Apply virtual and pure virtual function and complex programming situations.
4. Describe the object-oriented programming approach in connection with C++**.**

**UNIT-I** **(14 Hrs.)**

**Characteristics of Object Oriented Programming:** Abstraction, Encapsulation, Data hiding, Inheritance, Polymorphism, Code Extensibility and Reusability, User defined Data Types.Introduction to C++: Identifier, Keywords, Constants, And Operators: Arithmetic, relational, logical, And conditional and assignment. Size of operator, Operator precedence and associativity.

**UNIT-II** **(15 Hrs.)**

**Classes and Objects:** Class Declaration and Class Definition, defining member functions, making functions inline, nesting of member functions, Members access control. this pointer.Objects: Object as function arguments, array of objects, functions returning objects, Const member functions.
**Destructors:** Properties, Virtual destructors. Destroying objects. Rules for constructors and destructors. Array of objects. Dynamic memory allocation using new and delete operators, Nested and container classes.

**UNIT-III** **(17 Hrs.)**

**Static data members and Static member functions.** Friend functions and Friend classes.
**Constructors:** properties, types of constructors (Default, parameterized and copy), Dynamic constructors, multiple constructors in classes.
**Inheritance:** Defining derived classes,inheriting private members,single inheritance,types of derivation, function redefining, constructors in derived class.
**Types of Inheritance:** Single, Multiple, Multilevel and Hybrid. Types of base classes: Direct, Indirect, Virtual, Abstract. Code Reusability.

**UNIT-IV** **(14 Hrs.)**

**Polymorphism:** Methods of achieving polymorphic behavior.
**Operator overloading:** overloading binary operator, overloading unary operators, rules for operator overloading, operator overloading using friend function.
**Function overloading:** Early binding, Polymorphism with pointers, virtual functions,late binding, pure virtual functions and abstract base class. Introduction to File Handling.

**Recommended Books:**

1. E. Balagurusamy, 'Object Oriented Programming with C++', Tata McGrawHill, **2008**.
2. Deitel and Deitel, 'C++ How to Program', PearsonEducation, **2012**.
3. Herbert Schildt, 'The Complete Reference C++', Tata McGrawHill, **2003**.
4. Robert Lafore, 'Object Oriented Programming in C++', GalgotiaPublications, **2002**.
5. BjarneStrautrup, 'The C++ Programming Language', Addition-Wesley PublicationCo, **1986**.
6. Stanley B. Lippman, JoseeLajoie, 'C++ Primer', Pearson Education, **2002.**

## MATHEMATICS-IV

**Subject Code: BMATH5-401** **L T P C** **(60 Hrs.)**
**3 1 0 4**

**Course Objective:**

To learn about basics and properties of fourier series

To learn about Laplace transformation, inverse Laplace transformation and their uses to solve differential equations

**UNIT-I** **(14 Hrs.)**

Fourier series: Definition of Periodic functions, Euler's formula, Even and odd functions, half range expansions, Fourier series of different wave forms.

**UNIT-II** **(16 Hrs.)**

Fourier transform: Dirichlet's conditions, Fourier integral formula, properties of Fourier transform, inversion formula, convolution, Parseval's equality; Fourier transform of generalized functions, application of transforms to heat wave and Laplace equation.

**UNIT-III** **(15 Hrs.)**

Laplace Transforms: Laplace transforms of functions and its properties, inverse Laplace transforms, transform of derivatives and integrals.

**UNIT-IV** **(15 Hrs.)**

Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients and simultaneous differential equations.

**Course Outcome:** After the completion of the course ,Students will understand :

1. Basics of periodic functions and Fourier series representation.
2. The use of Fourier transforms and its applications in different fields.
3. Laplace and Inverse Laplace transform and their properties.
4. Methods for Laplace transformation and its applications for the solutions of Differential Equations.

**References Books:**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, 'Higher Engineering Mathematics', 36th Edn., Khanna Publishers, 2010.

3. Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957.
4. Advanced Engineering Mathematics, O'Neil, Cengage Learning.
5. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
6. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.

## WAVES AND OPTICS-LAB

**Subject Code: BPHYS1-205** **L T P C** **Duration: 30 Hrs.**
**0 0 2 1**

**Note:**
1. Maximum 20% experiments could be performed virtually.
2. Any other subject related experiment can also be included.

**Course Objective:**

1. To learn practically the various concepts of waves and optics.

2. The course will provide hand on training to the students for handling various related instruments.

**Course Outcome:**

- Able to verify the concepts/laws of Waves and Optics
- To inculcate and develop scientific aptitude by performing the various experiments.
- Skill enhancement by solving experimental problems.
- To inculcate the spirit of teamwork.

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify $\lambda^2$ –T law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster`s focusing; determination of angle of prism.
5. To determine refractive index of the Material of a prism using sodium source.
6. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
7. To determine the wavelength of sodium source using Michelson's interferometer.
8. To determine wavelength of sodium light using Fresnel Biprism.
9. To determine wavelength of sodium light using Newton's Rings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes roduced by a wedge-shaped Film.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. To determine dispersive power and resolving power of a plane diffraction grating.
13. To Simulation of interference fringes with different shapes using Fortran Programming
14. To Simulate the effect of coherence on interference fringes
15. To Simulate propagation of EM waves in free space and in an optical fiber

**Reference Books**


1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal.
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

## SOFTWARE LAB-IV (BASED ON BMCAS1-204)

**Subject Code: BMCAS1--207** **L T PC**
**0 0 2 1** **(30 Hrs.)**

This laboratory course will comprise as exercises to supplement what is learnt under paper BMCAS1-: 204 Object oriented Programming Usng C++.Students will be provided with Operational Knowledge and Implementation of numerical methods & statistical Techniques using C++ Language

## INORGANIC CHEMISTRY-III

**SUBJECT CODE -BCHMS1-501** **L T P C** **(60 Hrs.)**
**4 0 0 4**

**Course Objectives**

1. To understand the concepts behind the basics of coordination chemistry.
2. To understand the concept of chemistry of various transition elements.
3. To familiarize with the chemistry of lanthanoids and actinoids.
4. To introduce the fundamentals of bioinorganic chemistry.

**Course Outcomes:** After completion of this course, students will be able to:

1. Understand the fundamental concepts of Inorganic and Bioinorganic Chemistry.
2. know the application of Inorganic and Bioinorganic chemistry.
3. Interpret and analyze the facts on the basis of fundamentals of Inorganic and Bioinorganic Chemistry.
4. Differentiate the related concepts of Inorganic chemistry.

**Unit I** **(15 Hrs.)**

**Coordination Chemistry-I:**
Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of 10 Dq ($\Delta o$), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq ($\Delta o$, $\Delta t$). Octahedral vs. tetrahedral coordination,

**Unit II** **(15 Hrs.)**

**Coordination Chemistry-II:**
Tetragonal distortions from octahedral geometry, Jahn-Teller theorem, square planar geometry.Qualitative aspect of Ligand field and MO Theory. IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

**Unit III** **(15 Hrs.)**

**Transition Elements:**
General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer &Bsworth diagrams). Difference between the first, second and third transition series. Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excluding their metallurgy)

**Unit IV** **(15 Hrs.)**

**Lanthanoids and Actinoids:** Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

**Bioinorganic Chemistry**: Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

**Reference Books:**

1. Purcell, K.F &Kotz, J.C. Inorganic Chemistry W.B. Saunders Co, 1977. • Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
2. Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
3. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry. Wiley-VCH, 1999
4. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
5. Greenwood, N.N. & Earnshaw A., Chemistry of the Elements, ButterworthHeinemann,1997.

## ORGANIC CHEMISTRY-IV

**SUBJECT CODE –BCHMS1-502** **L T P C** **(60 Hrs.)**

**4 0 0 4**

**Course Objectives**

1. To familiarize the students with the basic concepts of nucleic acids.
2. To elaborate the concept of amino acids, peptides and proteins.
3. To understand the enzymes chemistry and their mechanism of action.
4. To understand the concept of energy in bio systems.

**Course Outcomes:** The completion of this course will make students to :

1. Understand the basic concepts of nucleic acids, amino acids, peptides and proteins
2. Classify and sketch the synthesis routes of nucleic acids, amino acids, peptides and proteins
3. Analyze enzymes chemistry and their mechanism of action

Outline the energy conversion pathways of bio systems

**Unit I** **(15 Hrs.)**

**Nucleic Acids:**

Components of nucleic acids, Nucleosides and nucleotides; Structure, synthesis and representative reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine. Structure of polynucleotides.

**Lipids:**Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

**Unit II** **(15 Hrs.)**

**Amino Acids, Peptides and Proteins:**

Amino acids, Peptides and their classification. α-Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis; Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting and C-protecting groups -Solid-phase synthesis.

**Unit III** **(15 Hrs.)**

**Enzymes:**

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereospecificity), enzyme inhibitors and their importance, phenomenon of inhibition (competitive, uncompetitive and non-competitive inhibition including allosteric inhibition).

**Unit IV** **(15 Hrs.)**

**Concept of Energy in Biosystems:**

How cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).

**ATP**: ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD+ , FAD.

**Conversion of food to energy**: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle. Overview of catabolic pathways of fat and protein.Interrelationship in the metabolic pathways of protein, fat and carbohydrate. Caloric value of food, standard caloric content of food types

**Pharmaceutical Compounds: Structure and Importance**

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis),Analgesics: Ibuprofen (with synthesis), Antimalarials : Chloroquine (with synthesis). Medicinal values of curcumin (haldi),

azadirachtin (neem), vitamin C and antacid (ranitidine).

**Reference Books:**

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VIth Edition. W.H. Freeman and Co.
2. Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009) Principles of Biochemistry. IV Edition. W.H. Freeman and Co.

3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009) Harper's Illustrated Biochemistry. XXVIII edition. Lange Medical Books/ McGraw-Hill. 32 CHEMISTRY PRACTICAL-C XI

## PHYSICAL CHEMISTRY-IV

**SUBJECT CODE-BCHMS1-503** **L T P C** **(60 Hrs.)**
**4 0 0 4**

**Course Objectives**

1. To familiarize with the concept of conductance and related theories.
2. To introduce basic concepts of electrochemistry.
3. To explain the applications of EMF measurements.
4. To introduce electrical & magnetic properties of atoms and molecules.

**Course Outcomes:** On completion of this course, students will be able to:

1. Apply the theories of conductance in various solutions.
2. Understand the role of EMF in determination of physical parameters like pH, entropy etc.
3. Calculate the various physical parameters based on conductance.
4. Predict the electrical & magnetic properties of atoms and molecules.

**Unit I** **(15 Hrs.)**

**Conductance:**

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity atinfinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules. Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods.

**Unit II** **(15 Hrs.)**

**Applications of conductance measurement**: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts and (iv) hydrolysis constants of salts.

**Electrochemistry-I:**

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry. Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation.

**Unit III** **(15 Hrs.)**

**Electrochemistry-II:**

Standard electrode (reduction) potential and its application to different kinds of half-cells.

Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone and glass electrodes. Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

**Unit IV** **(15 Hrs.)**

**Electrical & Magnetic Properties of Atoms and Molecules:**

Basic ideas of electrostatics, Electrostatics of dielectric media, Clausius-Mosotti equation, Lorenz-Laurentz equation, Dipole moment and molecular polarizabilities and their measurements. Diamagnetism, paramagnetism, magnetic susceptibility and its measurement.

**Reference Books:**

1. Atkins, P.W & Paula, J.D. Physical Chemistry, 9th Ed., Oxford University Press (2011).
2. Castellan, G. W. Physical Chemistry 4th Ed., Narosa (2004).
3. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier: NOIDA, UP (2009).
4. Barrow, G. M., Physical Chemistry 5th Ed., Tata McGraw Hill: New Delhi (2006).
5. Engel, T. & Reid, P. Physical Chemistry 3rd Ed., Prentice-Hall (2012).

6. Rogers, D. W. Concise Physical Chemistry Wiley (2010).
7. Silbey, R. J.; Alberty, R. A. &Bawendi, M. G. Physical Chemistry 4th Ed., John Wiley & Sons, Inc. (2005).

## INORGANIC CHEMISTRY –III LAB

**Subject Code: BCHMS1-504** **L T P C** **(60 Hrs.)**
**0 0 4 2**

**Course Objectives**

1. To develop basic understanding of gravimetric analysis and estimation of different metals using the concept.
2. To familiarize the students with inorganic preparation.
3. To make the students understand principles involved in chromatographic separations.

**Course Outcomes:** After the completion of this course, students will be able to:

1. Understand the fundamental concepts related to Gravimetric analysis, Inorganic complexes and chromatography.
2. Extend and associate the fundamental concepts to Gravimetric analysis, Inorganic complexes and chromatographic separation .
3. Perform the gravimetric & chromatographic analysis and prepare the Inorganic complexes in the laboratory.

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**EXPERIMENTS**

**Gravimetric Analysis:**

**i.** Estimation of nickel (II) using Dimethylglyoxime (DMG).
**ii.** Estimation of copper as CuSCN
**iii.** Estimation of iron as $Fe_2O_3$ by precipitating iron as $Fe(OH)_3$.
**iv.** Estimation of Al (III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminium oxinate).

**Inorganic Preparations:**

**i.** Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$
**ii.** Iron acetylacetonate
**iii.** Tetraamminecarbonatocobalt (III) ion
**iv.** Potassium tris(oxalate)ferrate(III)

**Chromatography of metal ions:**

**i.** Principles involved in chromatographic separations.
**ii.** Paper chromatographic separation of following metal ions:
  **i.** Ni (II) and Co (II)
  **ii.** Fe (III) and Al (III)

**Reference Book:**

1. Vogel, A.I. A text book of Quantitative Analysis, ELBS 1986.

## ORGANIC CHEMISTRY –IV LAB

**Subject Code: BCHMS1-505** **L T P C** **(60 Hrs.)**
**0 0 4 2**

**Course Objectives**

1. To develop basic understanding of estimation of amino acids and proteins
2. To study the action of salivary amylase and the effect of various parameters on its action.
3. To determine various physical parameters of oil and fat.
4. To make them familiar with the procedures for synthesis of drugs and peptides

**Course Outcomes:** The completion of this course will make students able to:

1. Estimate amino acids, proteins and other natural products by chemical methods
2. Study the action of salivary amylase and the effect of various parameters on its action.
3. Calculate the physical parameters of oil and fat.
4. Learn the procedures for synthesis of drugs and peptides and apply the methods to synthesize basic drug molecules

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**EXPERIMENTS**

1. Estimation of glycine by Sorenson's formalin method.
2. Study of the titration curve of glycine.
3. Estimation of proteins by Lowry's method.
4. Study of the action of salivary amylase on starch at optimum conditions.
5. Effect of temperature on the action of salivary amylase.
6. Saponification value of oil or a fat.
7. Determination of Iodine number of an oil/ fat.
8. Isolation and characterization of DNA from onion/ cauliflower/peas.
9. Synthesis of drugs: Paracetamol, Ibuprofen, Chloroquine, acetaminophen and Aspirin
10. Determination of $pK_a$ and isoelectric points of amino acids:Alanine, Cystine, Glutamic acid and Histidine
11. Synthesis of peptides using N-protecting, C-protecting groups and DCC.

**Reference Books:**

1. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.
2. Arthur, I. V. Quantitative Organic Analysis, Pearson.

## PHYSICAL CHEMISTRY –IV LAB

**Subject Code: BCHMS1-506** **L T P C** **(60 Hrs.)**
**0 0 4 2**

**Course Objectives**

1. To familiarise with the working of the conductivity meter.
2. To familiarise with determination of cell constant.
3. To introduce the principle of conductometric titrations.
4. To introduce the principle of potentiometric titrations.

**Course Outcomes:** On completion of this course, students will be able to:

1. Standardise the conductivity meter.
2. Handle various electrodes.
3. Apply conductometric titrations for various determinations.
4. Perform potentiometric titrations for various applications.

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**EXPERIMENTS**

**Conductometry:**

**i.** Determination of cell constant
**ii.** Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
**iii.** Perform the following conductometric titrations:
- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Mixture of strong acid and weak acid vs. strong base
- iv. Strong acid vs. weak base

**Potentiometry:**

**i.** Perform the following potentiometric titrations:
- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Dibasic acid vs. strong base
- iv. Potassium dichromate vs. Mohr's salt

**Reference Books:**

1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
3. Halpern, A. M. &McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).

## APPLICATIONS OF COMPUTERS IN CHEMISTRY

**Subject Code: BCHMD1-511** **L T P C** **(45 Hrs.)**
**3 0 0 3**

**Course Objectives**
1. To familiarize with the basics of computers.
2. To understand the roots of equations and differential calculus.
3. To understand basic concepts of simultaneous equations and molecular modelling

**Course Outcomes:** The completion of this course students will be able to:
1. Understand the basic concepts of computers
2. Solve the numerical problems based on concepts of roots of equations, differential calculus and simultaneous equations
3. Learn basic concepts of molecular modelling

**Unit I** **(11 Hrs.)**

**Basics:**
Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics.
Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis

**Unit II** **(11 Hrs.)**
**Numerical methods:**
Roots of equations:
Numerical methods for roots of equations:Quadratic formula, iterative method, Newton-Raphson method, Binary bisection and Regula-Falsi.
Differential calculus: Numerical differentiation.

**Unit III** **(11 Hrs.)**
**Integral calculus:**
Numerical integration (Trapezoidal and Simpson’s rule), probability distributions and mean values. Simultaneous equations:
Matrix manipulation: addition, multiplication. Gauss-Siedal method.

**Unit IV** **(12 Hrs.)**
**Interpolation, extrapolation and curve fitting**:
Handling of experimental data.
Conceptual background of molecular modelling:
Potential energy surfaces. Elementary ideas of molecular mechanics and practical MO methods.

**Reference Books:**
1. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.
2. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge Univ. Press (2001) 487 pages.
3. Noggle, J. H. Physical chemistry on a Microcomputer. Little Brown & Co. (1985).
4. Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996

## INSTRUMENTAL METHODS OF ANALYSIS

**Subject Code: BCHMD1-512** **L T P C** **(45 Hrs.)**
**30 0 3**

**Course Objectives**
1. To familiarize with qualitative and quantitative aspects of analysis.
2. To introduce optical methods of analysis.
3. To explain the concepts of thermal methods and electroanalytical methods.
4. To introduce the concept of separation techniques.

**Course Outcomes:** On completion of this course, students will be able to:
1. Apply qualitative and quantitative analysis for appropriate purposes.
2. Carry out analytical estimations scientifically using appropriate methods.
3. Understand the principle and instrumentation of various instruments used for analytical purpose.
4. Select and apply suitable separation techniques for separation in mixtures.

**Unit I** **(11 Hrs.)**

**Qualitative and quantitative aspects of analysis:**
Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution, if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

**Optical methods of analysis:**
Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.
**UV-Visible Spectrometry:**
Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument;

**Unit II** **(12 Hrs.)**

**Basic principles of quantitative analysis**:
Estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.
**Infrared Spectrometry:**
Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.

**Unit III** **(12 Hrs.)**

**Thermal methods of analysis**:
Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.
Electroanalytical methods:Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

**Unit IV** **(10 Hrs.)**

**Separation techniques:**
Solvent extraction: Classification, principle and efficiency of the technique.
Mechanism of extraction: extraction by solvation and chelation.
Technique of extraction: batch, continuous and counter current extractions.
Chromatography: Classification, principle and efficiency of the technique.
Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.
Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC. Stereoisomeric separation and analysis: Measurement of optical rotation, calculation of Enantiomeric excess (ee)/ diastereomeric excess (de) ratios and determination of enantiomeric composition using NMR, Chiral solvents and chiral shift reagents. Chiral chromatographic techniques using chiral columns (GC and HPLC).

**Reference Books:**

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed. The English Language Book Society of Longman .
2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd. Singapore.
7. Mikes, O. &Chalmes, R.A. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Ltd. London.
8. Ditts, R.V. Analytical Chemistry – Methods of separation.

## NOVEL INORGANIC SOLIDS

**Subject Code: BCHMD1-513** **L T P C** **(45 Hrs.)**
**30 0 3**

**Course Objectives**
1. To familiarize with synthesis and modification of inorganic solids.
2. To understand the concept of nanomaterials.
3. To understand engineering materials for mechanical construction.
4. To understand composite materials and polymers

**Course Outcomes:** The completion of this course will make students to acquire the knowledge of:
1. Basic concepts of synthesis and modification of inorganic solids
2. Concepts of nanomaterials
3. Basic concepts engineering materials for mechanical construction
4. Fundamentals of composite materials and polymers

**Unit I** **(12 Hrs.)**

**Synthesis and modification of inorganic solids**:
Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods.
**Inorganic solids of technological importance:**
Solid electrolytes – Cationic, anionic, mixed Inorganic pigments – coloured solids, white and black pigments.

**Unit II** **(11 Hrs.)**

**Nanomaterials:**
Overview of nanostructures and nanomaterials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture-one dimensional control. Carbon nanotubes and inorganic nanowires.

**Unit III** **(10 Hrs.)**

**Introduction to engineering materials for mechanical construction:**
Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminum and their alloys like duralumin, brasses and bronzes

**Unit IV** **(12 Hrs.)**

**Composite materials:**
Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, environmental effects on composites, applications of composites.
**Speciality polymers:**
Conducting polymers - Introduction, conduction mechanism, polyacetylene and polypyrole, applications of conducting polymers

**Reference Books:**

1. Shriver & Atkins. Inorganic Chemistry, Peter Alkins, Tina Overton, Jonathan Rourke, Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012)
2. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry.
3. Frank J. Ovens, Introduction to Nanotechnology

## APPLICATIONS OF COMPUTERS IN CHEMISTRY LAB

**Subject Code:BCHMD1-514** **L T P C** **(30 Hrs.)**
**0 0 2 1**

**Course Objectives**

1. To make the students develop programs to solve chemistry problems using computer programs based on numerical methods.
2. To understand the basic tools of computer science in relation with chemistry.
3. To differentiate between systematic errors and random errors and how to delete or reduce their effects.
4. To design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

**Course Outcomes:** The completion of this course will make student able to:

1. Understand the basic tools of computer science in relation with chemistry.
2. Develop programs to solve chemistry problems using computer programs based on numerical methods.
3. Differentiate between systematic errors and random errors and how to delete or reduce their effects.
4. Design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

**EXPERIMENTS**

**Computer programs based on numerical methods for:**

1. Roots of equations: (e.g. volume of Van der Waals gas and comparison with ideal gas, pH of a weak acid).
2. Numerical differentiation (e.g., change in pressure for small change in volume of a Van der Waals gas, potentiometric titrations).
3. Numerical integration (e.g. entropy/ enthalpy change from heat capacity data), probability distributions (gas kinetic theory) and mean values.
4. Matrix operations. Application of Gauss-Siedel method in colourimetry.
5. Simple exercises using molecular visualization software.

**Reference Books:**

1. McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).
2. Mortimer, R. Mathematics for Physical Chemistry. 3rd Ed. Elsevier (2005).
3. Steiner, E. The Chemical Maths Book Oxford University Press (1996).
4. Yates, P. Chemical Calculations. 2nd Ed. CRC Press (2007).
5. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.
6. Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge Univ. Press (2001) 487 pages.
7. Noggle, J. H. Physical Chemistry on a Microcomputer. Little Brown & Co. (1985).
8. Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996).

## INSTRUMENTAL METHODS OF ANALYSIS LAB

**Subject Code:BCHMD1-515** **L T P C** **(30 Hrs.)**
**0 0 2 1**

**Course Objectives**

1. To familiarize with preparation of TLC.
2. To familiarize with chromatographic separation of mixtures.
3. To introduce the basic concept of extractions techniques.
4. To familiarise with working of UV/VIS spectrophotometer.

**Course Outcomes:** On completion of this course, students will be able to:

1. Prepare and use TLC
2. Perform chromatographic separations.
3. Apply the concept of solvent extraction.
4. Apply spectrophotometric determination of various quantities.

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**EXPERIMENTS**

**Separation Techniques**
**Chromatography: Separation of mixtures**

- **i.** Paper chromatographic separation of $Fe^{3+}$, $Al^{3+}$, and $Cr^{3+}$.
- **ii.** Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
- **iii.** Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.
- **iv.** Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

**Solvent Extractions:**

- **i.** To separate a mixture of $Ni^{2+}$& $Fe^{2+}$ by complexation with DMG and extracting the $Ni^{2+}$- DMG complex in chloroform, and determine its concentration by spectrophotometry.
- **ii.** Solvent extraction of zirconium with amberliti LA-1, separation from a mixture of irons and gallium.
- **iii.** Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
- **iv.** Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.
- **v.** Analysis of soil: (i) Determination of pH of soil. (ii) Total soluble salt (iii) Estimation of calcium, magnesium, phosphate, nitrate
- **vi.** Ion exchange: (i) Determination of exchange capacity of cation exchange resins and anion exchange resins. (ii) Separation of metal ions from their binary mixture. (iii) Separation of amino acids from organic acids by ion exchange chromatography.

**Spectrophotometry:**

- **i.** Determination of pKa values of indicator using spectrophotometry.
- **ii.** Structural characterization of compounds by infrared spectroscopy.
- **iii.** Determination of dissolved oxygen in water.
- **iv.** Determination of chemical oxygen demand (COD).
- **v.** Determination of Biological oxygen demand (BOD).
- **vi.** Determine the composition of the Ferric-salicylate/ ferric-thiocyanate complex by Job's method.

**Reference Books:**

1. Vogel, Arthur I: A Test book of Quantitative Inorganic Analysis (Rev. by G.H. Jeffery and others) 5th Ed. The English Language Book Society of Longman .
2. Willard, Hobert H. et al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Harris, Daniel C: Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International Publisher, 2009.
6. Skoog, D.A. Holler F.J. and Nieman, T.A. Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd. Singapore.
7. Mikes, O. &Chalmes, R.A. Laboratory Hand Book of Chromatographic & Allied Methods, Elles Harwood Ltd. London. 45
8. Ditts, R.V. Analytical Chemistry – Methods of separation.

## NOVEL INORGANIC SOLIDS LAB

**Subject Code: BCHMD1-516** **L T P C** **(30 Hrs.)**
**0 0 2 1**

**Course Objectives**

1. To familiarize with determination of cation exchange method and total difference of solids
2. To understand the basic concept of synthesis of hydrogels and nanoparticals

**Course Outcomes:** The completion of this course will make students will be:

1. Able to understand basic concepts of determination of cation exchange method and total difference of solids
2. Familiarize with basic concept of synthesis of hydrogels and nanoparticals

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**EXPERIMENTS**

1. Determination of cation exchange capacity.
2. Determination of total difference of solids.
3. Synthesis of hydrogel by co-precipitation method.
4. Synthesis of Iron, Zinc and copper metal nanoparticles by any two methods.
5. Estimation of Aluminium in various alloys.
6. Estimation of copper in various alloys.
7. Synthesis of any two nanocomposites.

**Reference Book:**

1. Fahan, Materials Chemistry, Springer (2004).

## PHYSICAL CHEMISTRY V

**Subject Code: BCHMS1-601** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives**

1. To understand the concept of quantum mechanics, Schrödinger wave equation and its applications
2. To introduce the concept of spherical harmonics and quantum chemical description of chemical bonding
3. To familiarize with the basics of electronic, vibrational and nuclear magnetic resonance spectroscopy
4. To understand fundamentals of photochemistry including photochemical reactions in biochemical processes

Course Outcomes:

The students will be able to:

1. Understand the concept of quantum mechanics, molecular spectroscopy and photochemistry
2. Solve numerical problems based on the concept of quantum mechanics.
3. Analyze the spectroscopic transition.
4. Quantitative analysis of photochemical reactions

### UNIT I (15 Hrs.)

**Quantum Chemistry:**

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wavefunctions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wavefunctions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum: Commutation rules, quantization of square of total angular momentum and z-component.

### UNIT II (15 Hrs.)

Rigid rotator model of rotation of diatomic molecule. Schrödinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics. Discussion of solution. Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus. Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorm and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of $H_2^+$. Bonding and antibonding orbitals. Qualitative extension to $H_2$. Comparison of LCAO-MO and VB treatments of $H_2$ (only wavefunctions, detailed solution not required) and their limitations.

### UNIT III (16 Hrs.)

**Molecular Spectroscopy:**

Interaction of electromagnetic radiation with molecules and various types of spectra; Born-Oppenheimer approximation.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-

rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.
Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.
Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.
Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

**UNIT IV** **(14 Hrs.)**

**Photochemistry:**
Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes, photostationary states, chemiluminescence.

**Reference Books:**

1 Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006).
2 Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).
3 House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).
4 Lowe, J. P. & Peterson, K. Quantum Chemistry, Academic Press (2005).
5 Kakkar, R. Atomic & Molecular Spectroscopy, Cambridge University Press (2015).

## INORGANIC CHEMISTRY-IV

**Subject Code: BCHMS1-602** **L T P C** **4 0 0 4** **Duration: 60 Hrs.**

**Course Objectives**

1. To understand the basic principles involved in analysis of cations and anions
2. To familiarize with organometallic compounds, 18 electron rule, metal carbonyls and metal alkyls
3. To introduce inorganic reaction mechanisms, trans effect
4. To understand the concept of catalysis by organometallic compounds

Course Outcomes:

The students will be able to

**1** Understand solubility products, common ion effect. group reagents and interfering anions

**2** Familiarize with organometallic compounds, p acceptor ligands and metal alkyls 3 Understand the mechanism of substitution in square planar and octahedral complexes

4 Write mechanism of various catalytic processes including hydrogenation, Hydroformylation

5 Get knowledge of preparation methods and reactions of ferrocene

**UNIT I** **(13 Hrs.)**

**Theoretical Principles in Qualitative Analysis ($H_2S$ Scheme):**

Basic principles involved in analysis of cations and anions and solubility products, common ion effect. Principles involved in separation of cations into groups and choice of group reagents. Interfering anions (fluoride, borate, oxalate and phosphate) and need to remove them after Group II.

**UNIT II** **(18 Hrs.)**

**Organometallic Compounds:**

Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π-acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding. Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls.

**Metal Alkyls:** Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds. Role of triethylaluminium in polymerisation of ethene (Ziegler – Natta Catalyst). Species present in ether solution of Grignard reagent and their structures, Schlenk equilibrium.

**UNIT III** **(12 Hrs.)**

**Reaction Kinetics and Mechanism:**

Introduction to inorganic reaction mechanisms. Substitution reactions in square planar complexes, Trans- effect, theories of trans effect, Mechanism of nucleophilic substitution in square planar complexes, Thermodynamic and Kinetic stability, Kinetics of octahedral substitution, Ligand field effects and reaction rates, Mechanism of substitution in octahedral complexes.

**UNIT IV** **(17 Hrs.)**

**Catalysis by Organometallic Compounds:**

Study of the following industrial processes and their mechanism: Alkene hydrogenation (Wilkinsons Catalyst), Hydroformylation (Co salts), Wacker Process, Synthetic gasoline (Fischer Tropsch reaction), Synthesis gas by metal carbonyl complexes

**Ferrocene:** Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). Structure and aromaticity. Comparison of aromaticity and reactivity with that of benzene.

**Reference Books:**


1 Vogel, A.I. *Qualitative Inorganic Analysis*, Longman, 1972 36

2 Svehla, G. *Vogel's Qualitative Inorganic Analysis*, 7th Edition, Prentice Hall,1996-03- 07.

3 Cotton, F.A. G.; Wilkinson & Gaus, P.L. *Basic Inorganic Chemistry 3rd Ed.;*Wiley India,

*4* Huheey, J. E.; Keiter, E.A. & Keiter, R.L. *Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed.*, Harper Collins 1993, Pearson,2006.

5 Sharpe, A.G. *Inorganic Chemistry*, 4th Indian Reprint (Pearson Education) 2005

*6* Douglas, B. E.; McDaniel, D.H. & Alexander, J.J. *Concepts and Models in Inorganic Chemistry3rd Ed.,* John Wiley and Sons, NY, 1994.

7 Greenwood, N.N. & Earnshaw, A. *Chemistry of the Elements, Elsevier 2nd Ed*, 1997 (Ziegler Natta Catalyst and Equilibria in Grignard Solution).

8 Lee, J.D. *Concise Inorganic Chemistry 5th Ed.*, John Wiley and sons 2008.

9 Powell, P. *Principles of Organometallic Chemistry*, Chapman and Hall, 1988.

10 Shriver, D.D. & P. Atkins, *Inorganic Chemistry 2nd Ed.*, Oxford University Press, 1994.

*11* Basolo, F. & Person, R. *Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution 2nd Ed.*, John Wiley & Sons Inc; NY.

12 Purcell, K.F. & Kotz, J.C., *Inorganic Chemistry*, W.B. Saunders Co. 1977

13 Miessler, G. L. & Donald, A. Tarr, *Inorganic Chemistry 4th Ed.*, Pearson, 2010.

14 Collman, James P. et al. *Principles and Applications of Organotransition Metal Chemistry*. Mill Valley, CA: University Science Books, 1987.

15 Crabtree, Robert H. *The Organometallic Chemistry of the Transition Metals*. *J* New York, NY: John Wiley, 2000.

16 Spessard, Gary O., &Gary L. Miessler. *Organometallic Chemistry*. Upper Saddle River, NJ: Prentice-Hall, 1996.

## ORGANIC CHEMISTRY-V

**Subject Code: BCHMS1-603** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives**

1. To understand the basic principles of organic spectroscopy including UV, IR and NMR spectroscopy
2 To familiarize with mechanistic pathways of complex organic molecules
3. To familiarize with classification/biological significance/color/constitution of carbohydrates/dyes
4. To understand concepts of classification/chemistry of polymers and fabrics

Course Outcomes:

**After completion of the course, students will be able to:**

1. Achieve the fundamentals of UV/IR/NMR spectroscopy for organic molecules
2. Write mechanisms of various organic molecules (simple/complex molecules)
3. Explain concepts behind classification/biological significance/color/constitution of carbohydrates/dyes
4. Describe concepts of classification/chemistry of polymers and fabrics

### UNIT I (18 Hrs.)

**Organic Spectroscopy:** General principles Introduction to absorption and emission spectroscopy.
**UV Spectroscopy:** Types of electronic transitions, λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λmax for the following systems: α,β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

**IR Spectroscopy:** Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.
**NMR Spectroscopy:**Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpetation of NMR spectra of simple compounds.

### UNIT II (16 Hrs.)

**Carbohydrates:** Occurrence, classification and their biological importance.
**Monosaccharides:** Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Inter conversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides – Structure elucidation of maltose, lactose and sucrose.
**Polysaccharides:**Elementary treatment of starch, cellulose and glycogen.

### UNIT III (13 Hrs.)

**Dyes:**Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red (mechanism of Diazo Coupling); Triphenyl Methane Dyes -Malachite Green, Rosaniline and Crystal Violet; Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes –structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples.

**UNIT IV** **(13 Hrs.)**

**Polymers:** Introduction and classification including di-block, tri-block and amphiphilic polymers;
Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index.
**Polymerisation reactions**:Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermosoftening (PVC, polythene);
**Fabrics:** Natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Introduction to liquid crystal polymers; Biodegradable and conducting polymers with examples.

**Reference Books:**

1 Kalsi, P. S. *Textbook of Organic Chemistry 1st Ed.*, New Age International (P) Ltd. Pub.
2 Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3 Billmeyer, F. W. *Textbook of Polymer Science*, John Wiley & Sons, Inc.
4 Gowariker, V. R.; Viswanathan, N. V. & Sreedhar, J. *Polymer Science*, New Age International (P) Ltd. Pub.
5 Finar, I. L. *Organic Chemistry* (*Volume 2: Stereochemistry and the Chemistry of Natural Products*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6 Graham Solomons, T.W. *Organic Chemistry*, John Wiley & Sons, Inc.
7 Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; *Organic Chemistry*, OxfordUniversity Press.
8 Singh, J.; Ali, S.M. & Singh, J. *Natural Product Chemistry*, Prajati Prakashan(2010).
9 Kemp, W. *Organic Spectroscopy*, Palgrave

## PHYSICAL CHEMISTRY LAB-V

**Subject Code: BCHMS1-604** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objective:**

1. To acquaint the students with the basics absorption spectroscopy
2. To make the students learn to run the UV VIS Spectrophotometer and its various applications in chemical analysis
3. To learn colourimetry techniques for various analytical applications .

Course Outcomes:

The students will be able to:

1. Understand the basics absorption spectroscopy
2. Run the UV VIS Spectrophotometer and do various chemical analysis using the technique
3. Do chemical analysis using colourimetry techniques

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**UV/Visible spectroscopy**

I. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M $H_2SO_4$) and determine the λmax values. Calculate the energies of the two transitions in different units (J molecule$^{-1}$, kJ mol$^{-1}$, cm$^{-1}$, eV).

II. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.

III. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

**Colourimetry**

I. Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration.

II. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.

III. Study the kinetics of iodination of propanone in acidic medium.

IV. Determine the amount of iron present in a sample using 1,10-phenathroline.

*V.* Determine the dissociation constant of an indicator (phenolphthalein).

VI. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

VII. Analysis of the given vibration-rotation spectrum of HCl(g)

**Reference Books**

1 Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry,* R. Chand & Co.: New
2 'Findlay's Practical Physical Chemistry'.
3. J.B. Yadav, 'Advanced Practical Physical Chemistry'.

## INORGANIC CHEMISTRY LAB-IV

**Subject Code: BCHMS1-605** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objective:**

1 To understand qualitative semi micro analysis of mixtures containing 3 anions and 3 cations.
2 To provide knowledge of various methodologies for synthesis of target molecules

Course Outcomes:

The students will acquire knowledge of
1 Analysis of mixture for cations and anions 2 Syntheses of inorganic complexes

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**Experiments**

1 Qualitative semi micro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:
$CO_3^{2-}$, $NO_2^-$, $S^{2-}$, $SO_3^{2-}$,$S_2O_3^{2-}$, $CH_3COO^-$, $F^-$, $Cl^-$, $Br^-$, $I^-$, $NO_3^-$, $BO_3^{3-}$, $C_2O_4^{2-}$, $PO_4^{3-}$, $NH_4^+$, $K^+$,$Pb^{2+}$, $Cu^{2+}$, $Cd^{2+}$, $Bi^{3+}$, $Sn^{2+}$, $Sb^{3+}$, $Fe^{3+}$, $Al^{3+}$, $Cr^{3+}$, $Zn^{2+}$, $Mn^{2+}$, $Co^{2+}$, $Ni^{2+}$, $Ba^{2+}$,$Sr^{2+}$, $Ca^{2+}$,$Mg^{2+}$
Mixtures should preferably contain one interfering anion, **or** insoluble component ($BaSO_4$,$SrSO_4$, $PbSO_4$, $CaF_2$ or $Al_2O_3$)**or** combination of anions e.g. $CO_3^{2-}$and $SO_3^{2-}$, $NO_2^-$ and $NO_3^-$,$Cl^-$ and $Br^-$, $Cl^-$ and $I^-$, $Br^-$ and $I^-$, $NO_3^-$ and $Br^-$, $NO_3^-$ and $I^-$. Spot tests should be done whenever possible.
2. Measurement of 10 Dq by spectrophotometric method
3. Verification of spectrochemical series.
4. Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs thermodynamic factors.
5. Preparation of acetylacetanato complexes of $Cu^{2+}$/$Fe^{3+}$. Find the $\lambda$max of the complex.
6. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

**Reference Books:**


1 Vogel's *Qualitative Inorganic Analysis*, Revised by G. Svehla.
*2* Marr & Rockett *Inorganic Preparations.*

## ORGANIC CHEMISTRY LAB-V

**Subject Code: BCHMS1-606** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objective:**
1 To provide knowledge of extraction of organic compounds from natural sources. 2 To familiarize with syntheses of compounds
3 Analysis of unknown organic molecules
4. To identify organic compounds by applying IR//NMR spectroscopic concepts

Course Outcomes:

**After completion of the course, students will be able to:**

1. Extract caffeine from tea leaves
2. Carry out selected polymeric reactions/methyl orange
3. Detect various organic functional group
4. Identify organic compounds by applying IR//NMR spectroscopic concepts

**Note:**
1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**Experiments**
1. Extraction of caffeine from tea leaves.
2. Preparation of sodium polyacrylate.
3. Preparation of urea formaldehyde.
4. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
5. Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, for e.g. salicylic acid, cinnamic acid, nitrophenols etc.
6. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided).
7. Preparation of methyl orange.

**Reference Books:**

1 Vogel, A.I. *Quantitative Organic Analysis*, Part 3, Pearson (2012).
2 Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
*3* Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
4 Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press (2000).
*5* Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis,* University Press (2000).

## POLYMER CHEMISTRY

**Subject Code: BCHMD1-611** **L T P C** **3 0 0 3** **Duration: 45 Hrs.**

**Course Objectives**

1. To recall concepts involved in polymerization..
2. To introduce various mechanism and kinetics of polymer.
3. To introduce properties and factor affecting the properties of polymers
4. To familiarise with applications of polymer.

**Course Outcomes:**

The students will be able to

1. concept of polymers and polymer related termnology.
2. To familiarize with concept of kinetics of Polymerization, Morphology of crystalline polymers.
3. Apply the advanced polymer in various field of industries.
4. Analyze the crystal structure of polymer with advanced characterization techniques

**UNIT I** **(11 Hrs.)**

**Introduction and history of polymeric materials:** Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

**Functionality and its importance:** Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bifunctional systems, Poly-functional systems.

**UNIT II** **(11 Hrs.)**

**Kinetics of Polymerization:** Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

**Crystallization and Crystallinity:** Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

**Nature and structure of polymers:** Structure Property relationships.

**UNIT III** **(11 Hrs.)**

**Determination of molecular weight of polymers:**($M_n$, $M_w$, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

**Glass transition temperature (Tg) and determination of Tg**: Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).

**UNIT IV** **(12 Hrs.)**

**Polymer Solution:** Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

**Properties of Polymer**s (Physical, Thermal, Flow & Mechanical Properties): Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly(vinyl chloride) and related polymers, poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylene sulphide polypyrrole, polythiophene)].

**Reference Books:**

1 *Seymour's Polymer Chemistry,* Marcel Dekker, Inc.
2 G. Odian: Principles of Polymerization, John Wiley.
3 F.W. Billmeyer: Text Book of Polymer Science, John Wiley.
4 P. Ghosh: Polymer Science & Technology, Tata Mcgraw-Hill.
5 R.W. Lenz: Organic Chemistry of Synthetic High Polymers.

## MOLECULAR MODELLING AND DRUG DESIGN

**Subject Code: BCHMD1-612** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives**

1. To impart knowledge about concept of molecular modelling
2. To understand computer simulation methods
3. To familiarize molecular dynamics and monte carlo simulation methods
4. To understand structure prediction and drug design

Course Outcomes:

The students will be able to:

1. Understand the concept of molecular modelling
2. Learn computer simulation methods
3. Apply molecular dynamics and monte carlo simulation methods on different molecules
4. Predict structure and design new drug molecules

**UNIT I** **(11 Hrs.)**

**Introduction to Molecular Modelling:** Introduction. Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. Computer Hardware and Software. The Molecular Modelling Literature.

**Force Fields:** Fields. Bond Stretching. Angle Bending. Introduction to nonbonded interactions. Electrostatic interactions. van der Waals Interactions. Hydrogen bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

**UNIT II** **(11 Hrs.)**

**Energy Minimization and Computer Simulation:** Minimization and related methods for exploring the energy surface. Non-derivative method, First and second order minimization methods. Computer simulation methods. Simple thermodynamic properties and Phase Space. Boundaries. Analyzing the results of a simulation and estimating Errors.

**UNIT III** **(11 Hrs.)**

**Molecular Dynamics & Monte Carlo Simulation:** Molecular Dynamics Simulation Methods. Molecular Dynamics using simple models. Molecular Dynamics with continuous potentials. Molecular Dynamics at constant temperature and pressure. Metropolis method. Monte Carlo simulation of molecules. Models used in Monte Carlo simulations of polymers.

**UNIT IV** **(12 Hrs.)**

**Structure Prediction and Drug Design:** Structure prediction - Introduction to comparative Modeling. Sequence alignment. Constructing and evaluating a comparative model. Predicting protein structures by 'Threading', Molecular docking. Structure based de novo ligand design, Drug Discovery – Chemoinformatics – QSAR.

4 Molecular docking. Structure based de novo ligand design, Drug Discovery – Chemoinformatics

**Reference Books:**

1 A.R. Leach, Molecular Modelling Principles and Application, Longman, 2001.
2 J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
3 Satya Prakash Gupta, QSAR and Molecular Modeling, Springer – Anamaya Publishers, 2008.

## INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

**Subject Code: BCHMD1-613** **L T P C** **Duration: 45 Hrs.**
**3 0 0 3**

**Course Objectives**
1. To impart knowledge about manufacturing and properties of glasses, ceramics and cements
2. To understand manufacturing of different fertilizers and surface coating
3. To develop an understanding about primary and secondary batteries
4. To understand the mechanism of homogeneous catalysis

Course Outcomes:

The students will acquire knowledge of
1. Types, classification and manufacturing process of glass, ceramics and cement
2. Classification of surface coatings paints and pigment formulation
3. Different types of fertilizers and their manufacturing processes
4. Classification of alloys, properties of different types of steel
5. Homogeneous and hetrerogeneous catalyst and their industrial applications

### UNIT I (11 Hrs.)

**Silicate Industries** *Glass:* Glassy state and its properties, classification (silicate and non-silicate glasses).Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.
*Ceramics:* Important clays and feldspar, ceramic, their types and manufacture. High technology ceramics and their applications, superconducting and semiconducting oxides, fullerenes carbon nanotubes and carbon fibre.
*Cements:* Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

### UNIT II (11 Hrs.)

**Fertilizers:** Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.
**Surface Coatings:** Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing.

### UNIT III (12 Hrs.)

**Batteries:** Primary and secondary batteries, battery components and their role, Characteristics of Battery. Working of following batteries: Pb acid, Li-Battery, Solid state electrolyte battery. Fuel cells, Solar cell and polymer cell.
**Alloys:** Classification of alloys, ferrous and non-ferrous alloys, Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels.

**UNIT IV** **(11 Hrs.)**

**Catalysis:** General principles and properties of catalysts, homogenous catalysis (catalytic steps and examples) and heterogenous catalysis (catalytic steps and examples) and their industrial applications, Deactivation or regeneration of catalysts. Phase transfer catalysts, application of zeolites as catalysts.

**Chemical explosives:** Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX). Introduction to rocket propellants.

**Reference Books:**

1 E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2 R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3 W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics,* Wiley Publishers, New Delhi.
4 J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
5 P. C. Jain, M. Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
6 R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
7 B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

## POLYMER CHEMISTRY LAB

**Subject Code: BCHMD1-614** **L T P C** **Duration: 30 Hrs.**
**0 0 2 1**

**Course Objective:**

1. To familiarize with syntheses of different polymers
2. To understand characterization techniques for polymers
3 Analysis of polymers using different instrumental techniques and IR methods

Course Outcomes:

The students will acquire knowledge of
1 Synthesis of different polymers
2 Apply techniques for the determination of Molecular weight.
3. Analyze structure of polymer by instrumental methods such as IR spectrometer.

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

1. **Polymer synthesis**

1.Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA)/ Acrylic acid (AA).
a. Purification of monomer
b.Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN)
2. Preparation of nylon 66/6
3. Redox polymerization of acrylamide
4. Preparation of urea-formaldehyde resin
5. Preparations of novalac resin/resold resin.

**Polymer characterization**

1. Determination of molecular weight by viscometry:
(a) Polyacrylamide-aq.$NaNO_2$ solution
(b) Poly vinyl proplylidine (PVP) in water
(c) Polymethyl methacrylate (PMMA)
2. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).

**Polymer analysis**

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. Instrumental Techniques
3. IR studies of polymers

**Reference Books:**


1 Malcohm P. Stevens, Polymer Chemistry: An Introduction, 3rd Ed.
2 Harry R. Allcock, Frederick W. Lampe and James E. Mark, Contemporary Polymer Chemistry, 3rd ed. Prentice-Hall (2003)
3 Fred W. Billmeyer, Textbook of Polymer Science, 3rd ed. Wiley-Interscience (1984)
4 Joel R. Fried, Polymer Science and Technology, 2nd ed. Prentice-Hall (2003)
5 Petr Munk and Tejraj M. Aminabhavi, Introduction to Macromolecular Science, 2nd ed. John Wiley & Sons (2002)
6 L. H. Sperling, Introduction to Physical Polymer Science, 4th ed. John Wiley & Sons (2005)
7 Malcolm P.zq4 Stevens, Polymer Chemistry: An Introduction, 3rd ed. Oxford University Press (2005)
8 Seymour/ Carraher's Polymer Chemistry, 9th ed. by Charles E. Carraher, Jr. (2013).

## MOLECULAR MODELLING AND DRUG DESIGN LAB

**Subject Code: BCHMD1-615** **L T P C** **Duration: 30 Hrs.**
**0 0 2 1**

**Course Objective:**

1. To draw the chemical structure structure of the molecules using various drawing packages
2. To perform different modelling simulations methods for optimization of bond lengths and bond angles to obtain minimum strain energy structure of the molecule.
3. To run programs to calculate physico chemical properties and spectroscopic of molecules

Course Outcomes:

The students will be able to:

1. Draw the chemical structure structure of the molecules using various drawing packages
2. Perform different molecular modelling simulations for optimization of bond lengths and bond angles to obtain minimum strain energy structure of the molecule.
3. Run programs to calculate physico chemical properties and spectroscopic of molecules

**Note:**

**Note:**

1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**Experiments**

1 Compare the optimized C-C bond lengths in ethane, ethene, ethyne and benzene.
Visualize the molecular orbitals of the ethane σ bonds and ethene, ethyne, benzene and pyridine π bonds.
*2* (a) Perform a conformational analysis of butane. (b) Determine the enthalpy of isomerization of *cis* and *trans* 2-butene.
3 Visualize the electron density and electrostatic potential maps for LiH, HF, $N_2$, NO and CO and comment. Relate to the dipole moments. Animate the vibrations of these molecules.
4 (a) Relate the charge on the hydrogen atom in hydrogen halides with their acid character. (b) Compare the basicities of the nitrogen atoms in ammonia, methylamine, dimethylamine and trimethylamine.
5 (a) Compare the shapes of the molecules: 1-butanol, 2-butanol, 2-methyl-1-propanol, and 2-methyl-2-propanol. Note the dipole moment of each molecule. (b) Show how the shapes affect the trend in boiling points: (118 ºC, 100 ºC, 108 ºC, 82 ºC,respectively).
6 Build and minimize organic compounds of your choice containing the following functional groups. Note the dipole moment of each compound: (a) alkyl halide (b) aldehyde (c) ketone (d) amine (e) ether (f) nitrile (g) thiol (h) carboxylic acid (i) ester (j) amide.
7. (a) Determine the heat of hydration of ethylene. (b) Compute the resonance energy of benzene by comparison of its enthalpy of hydrogenation with that of cyclohexene.
8. Arrange 1-hexene, 2-methyl-2-pentene, (*E*)-3-methyl-2-pentene, (*Z*)-3-methyl-2- pentene, and 2,3-dimethyl-2-butene in order of increasing stability.
9 (a) Compare the optimized bond angles $H_2O$, $H_2S$, $H_2Se$. (b) Compare the HAH bond angles for the second row dihydrides and compare with the results from qualitative
MO theory.
*Note:* Software: ChemSketch, ArgusLab (www.planaria-software.com), TINKER 6.2 (dasher.wustl.edu/ffe), WebLab Viewer, Hyperchem, or any similar software.

**Reference Books:**

1 A.R. Leach, Molecular Modelling Principles and Application, Longman, 2001.
2 J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and

Sons, 1997.
3 Satya Prakash Gupta, QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008.

## INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE LAB

**Subject Code: BCHMD1-616** **L T P C** **Duration: 30 Hrs.**
**0 0 2 1**

**Course Objective:**
1. To impart knowledge and hand-on experiences of different analytical techniques for chemical analysis
2. To impart skills for preparation of buffer

Course Outcomes:
The students will acquire knowledge

1. Different analytical techniques for analysis different materials

2. Preparation of buffer solution

**<u>Note:</u>**
1. Students will have to perform atleast 10-12 experiments from the given list/topic.
2. Any other subject related experiment can also be included.

**Experiments**
1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Electroless metallic coatings on ceramic and plastic material.
5. Determination of composition of dolomite (by complexometric titration).
6. Analysis of (Cu, Ni); (Cu, Zn ) in alloy or synthetic samples.
7. Analysis of Cement.
8. Preparation of pigment (zinc oxide).
9 To study the saponification reaction for preparation of soap.
10 Preparation of buffers and measurement of their pH
11 Determination standard electrode potential of $Fe^{2+}/Fe^{3+}$ system by potentiometer using potassium permanganate solution.

**Reference Books:**

1 E. Stocchi: *Industrial Chemistry*, Vol-I, Ellis Horwood Ltd. UK.
2 R. M. Felder, R. W. Rousseau: *Elementary Principles of Chemical Processes*, Wiley Publishers, New Delhi.
3 W. D. Kingery, H. K. Bowen, D. R. Uhlmann: *Introduction to Ceramics*, Wiley Publishers, New Delhi.
4 J. A. Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
5 P. C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.
6 R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry*, Vikas Publications, New Delhi.
7 B. K. Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut

# Maharaja Ranjit Singh Punjab Technical University
# Bathinda-151001

**FACULTY OF SCIENCES**

**SYLLABUS**

**FOR**

**B.A. (COMPUTER SCIENCE)**

**2023 BATCH ONWARDS**

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**(ii) Subject to change in the syllabi at any time.**

**Please visit the University website time to time.**

| SEMESTER1st | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| **BACSS1-101** | General English - I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-102** | General Punjabi – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-103** | Introduction of Information Technology and Office Automation | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-104** | Introduction of Information Technology and Office Automation (Lab) | 0 | 0 | 4 | 40 | 60 | 100 | 2 |
| **Department Elective Subjects (Any Two)** | | | | | | | | |
| **BACSD1-111** | History – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-112** | Political Science – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-113** | Mathematics – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-114** | Physical Education – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-115** | Elective English – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-116** | Economics – I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-117** | Elective Punjabi - I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-118** | Sociology - 1 | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-119** | Web Designing - I | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **Total** | | **20** | **0** | **4** | **240** | **360** | **600** | **22** |

| SEMESTER 2nd | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BACSS1-201 | General English - II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BACSS1-202 | General Punjabi – II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BACSS1-203 | Trends in IT and Office automation | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| BACSS1-204 | Trends in IT and Office automation (Lab) | 0 | 0 | 4 | 40 | 60 | 100 | 2 |
| **Department Elective Subjects (Any Two)** | | | | | | | | |
| **BACSD1-211** | History – II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-212** | Political Science – II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-213** | Mathematics (Algebra) - II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-214** | Physical Education – II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-215** | Elective English – II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-216** | Economics – II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-217** | Elective Punjabi – II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-218** | Sociology - II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-219** | Web Designing - II | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **Total** | | **20** | **0** | **4** | **240** | **360** | **600** | **22** |

| SEMESTER 3rd | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| **BACSS1-301** | General English – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-302** | General Punjabi – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-303** | Computer Networks and Internet Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-304** | Computer Networks and Internet Applications (Lab) | 0 | 0 | 4 | 40 | 60 | 100 | 2 |
| **Department Elective Subjects (Any Two)** | | | | | | | | |
| **BACSD1-311** | History – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-312** | Political Science – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-313** | Mathematics (Calculus) - III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-314** | Physical Education – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-315** | Elective English – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-316** | Economics – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-317** | Elective Punjabi – III | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **Total** | | **20** | **0** | **4** | **240** | **360** | **600** | **22** |

| SEMESTER 4th | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| **BACSS1-401** | General English – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-402** | General Punjabi – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-403** | Multimedia & Its Applications | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-404** | Multimedia & Its Applications (Lab) | 0 | 0 | 4 | 40 | 60 | 100 | 2 |
| **Department Elective Subjects (Any Two)** | | | | | | | | |
| **BACSD1-411** | History – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-412** | Political Science – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-413** | Mathematics (Analytical Geometry) - IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-414** | Physical Education – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-415** | Elective English – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-416** | Economics – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-417** | Elective Punjabi – IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **Total** | | **20** | **0** | **4** | **240** | **360** | **600** | **22** |

| SEMESTER 5th | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| **BACSS1-501** | General English – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-502** | General Punjabi – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-503** | Software Engineering | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-504** | Software Engineering (Lab) | 0 | 0 | 4 | 40 | 60 | 100 | 2 |
| **Department Elective Subjects (Any Two)** | | | | | | | | |
| **BACSD1-511** | History – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-512** | Political Science – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-513** | Mathematics (Differential Geometry) - V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-514** | Physical Education – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-515** | Elective English – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-516** | Economics – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-517** | Elective Punjabi – V | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **Total** | | **20** | **0** | **4** | **240** | **360** | **600** | **22** |

| SEMESTER 6th | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| **BACSS1-601** | General English – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-602** | General Punjabi – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-603** | Introduction to Computer Network and Internet Programming | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSS1-604** | Introduction to Computer Network and Internet Programming (Lab) | 0 | 0 | 4 | 40 | 60 | 100 | 2 |
| **BACSS1-605** | Human Values and Professional Ethics | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **Department Elective Subjects (Any Two)** | | | | | | | | |
| **BACSD1-611** | History – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-612** | Political Science – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-613** | Mathematics (Analysis) - IV | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-614** | Physical Education – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-615** | Elective English – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-616** | Economics – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **BACSD1-617** | Elective Punjabi – VI | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| **Total** | | **23** | **0** | **4** | **280** | **420** | **700** | **25** |

| Semester | Marks | Credits |
|---|---|---|
| Semester – 1st | 600 | 22 |
| Semester – 2nd | 600 | 22 |
| Semester – 3rd | 600 | 22 |
| Semester – 4th | 600 | 22 |
| Semester – 5th | 600 | 22 |
| Semester – 6th | 700 | 25 |
| **Total** | **3700** | **135** |

**PROGRAM OUTCOMES (POS)**

PO 1. The program enables the students to acquire communication efficacy which would help them to communicate effectively with the community as well as society.

PO 2. The students acquire knowledge in the field of social sciences, literature and humanities

Which make them sensitive and sensible enough?

PO 3. The program also empowers the graduates to appear for various competitive examinations or choose the post graduate programme of their choice.

PO 4.The program enables the students to acquire the knowledge with human values.

PO 5. The students will be kindled enough to think and act over for the solution of various issues prevailed in the human life.

PO 6. Programme provides the base to be the responsible citizen.

# SEMESTER - I

## ਪੰਜਾਬੀ ਲਾਜਮੀ – I

**Subject Code:BACSS1-102** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Language Skills:** Enhance reading, writing, listening, and speaking skills in Punjabi | 3 | 1 | 2 | | | |
| CO2 | **Vocabulary and Grammar:** Learn essential Punjabi vocabulary and grammar rules | 3 | | 2 | | | |
| CO3 | **Writing Skills:** Learn to write short essays, paragraphs, and simple compositions in Punjabi | 3 | | 2 | | 1 | |
| CO4 | **Reading Comprehension:** Improve the ability to read and understand Punjabi Poems | 2 | | 1 | 2 | | |

### ਪਾਠਕ੍ਰਮ

1. ਅਧੁਨਿਕਪੰਜਾਬੀਕਵਿਤਾਦਾਅਧਿਐਨ
2. ਲੇਖਰਚਨਾ
3. ਵਿਆਕਰਨ: ਸਿਧਾਂਤਅਤੇਵਿਹਾਰ

**ਯੂਨਿਟ – I (15 Hrs)**

(ੳ) ਕਾਵਿਸੁਮੇਲਪੁਸਤਕਵਿਚੋਂਪ੍ਰਸੰਗਸਹਿਤਵਿਆਖਿਆ।

(ਅ) ਕਵਿਤਾਦਾਕੇਂਦਰੀਭਾਵ।

**ਯੂਨਿਟ – II (15 Hrs)**

ਲੇਖਰਚਨਾ) 500 ਸ਼ਬਦਾਵਿੱਚ (ਚਲੰਤਮਸਲਿਆਂਤੇ।

**ਯੂਨਿਟ – III (15 Hrs)**

ਵਿਆਕਰਨਦੀਪਰਿਭਾਸ਼ਾ, ਮਹੱਤਵ।

**ਯੂਨਿਟ – IV (15 Hrs)**

ਵਿਹਾਰਕਪ੍ਰਸ਼ਨ।

- **Recommended Books:-**

(i) ਕਾਵਿ ਸੁਮੇਲ (ਸੰਪਾਦਕ) ਡਾ. ਕਰਮਜੀਤਸਿੰਘ, ਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋ।

(ii) ਸਹਾਇਕਪੁਸਤਕਾਂ: ਬਰਾੜ, ਬੂਟਾਸਿੰਘ (ਡਾ.), ਪੰਜਾਬੀਵਿਆਕਰਨਸਿਧਾਂਤਅਤੇਵਿਹਾਰਚੇਤਨਾਪ੍ਰਕਾਸ਼ਨਲੁਧਿਆਣਾ 2008।

(iii) ਮਨਜੀਤਕੌਰ, ਪੰਜਾਬੀਭਾਸ਼ਾ: ਵਰਤੋਂਤੇਬਣਤਰ, ਲੋਕਗੀਤਪ੍ਰਕਾਸ਼ਨ, ਚੰਡੀਗੜ੍ਹ।

1. ਜੱਸਲਕੰਵਰਜੀਤ, ਪੰਜਾਬੀਵਿਆਕਰਨਦੇਕੁਝਪੱਖ, ਰਵੀਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨਹਾਲਬਜਾਰਅਮ੍ਰਿਤਸਰ 2012

## GENERAL ENGLISH- I

**Subject Code:BACSS1-101** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Language Proficiency:** Develop proficiency in the English Language | 3 | 2 | 2 | | 1 | |
| CO2 | **Vocabulary and Grammar:** Learn essential English vocabulary and grammar rules | 3 | | 2 | | | |
| CO3 | **Writing Skills:** Learn to write paragraphs in English | 3 | | 2 | | 1 | |
| CO4 | **Reading Comprehension:** Improve the ability to read and understand English Poetry and Prose | 2 | | 1 | 2 | | |

### UNIT-1 Peotry (15 Hrs.)

1. Song 36 from Gitanjali – Rabindernath Tagore.
2. Pippa's song - Robert Browning.
3. women's rights annie lennox walker.
4. The soul's prayer - Sarojini naidu.

### UNIT-2 Prose (15 Hrs.)

1. Spoken English and broken English – G.B shaw.
2. Garif – Antor Chekov.
3. Uncle podger hangs a picture -Jerome k Jerome.
4. The doll's house - Katherine Mansfield.

### UNIT-3 (15 Hrs.)

1. Paragraph writing –Discriptive & Narrative?
2. Comprehensiom of passage prose text.

### UNIT-4 (15 Hrs.)

i.) Grammer →voice,Determiner,modals,antonyms.
ii.) Translation→ from varnaculer to English (four out of six sentences)

Textbook:-

i.) The poetic palatte (orient blackswan, for-1/2Sem Second edition, 2016)
ii.) Prose parables (orient black swan,2013)
iii.) English at work (selection from poetry & prose Vijay kumar, B.T. Seetha, A.V Suresh Kumar, Y.L. Srinivas, New Delhi; Macmillan, India Ltd.2012 (Punjab University) revised edition.

## INTRODUCTION INFORMATION TECHNOLOGY AND OFFICE AUTOMATION

**Subject Code: BACSS1-103** **L T P C** **Duration: 60 Hrs.**
**4 00 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **IT Fundamentals:** Introduce students to the basic principles and concepts of information technology like hardware, software, networks, Input devices and output devices | | | 3 | | 2 | |
| CO2 | **Office Automation Tools:** Familiarize students with commonly used office automation tools such as word processors, spreadsheets and email applications | | | 2 | | 3 | |
| CO3 | **Internet and Web Browsing:** Acquaint students to internet usage and web browsing | 1 | | 3 | | 3 | |

### UNIT-I(15 Hrs.)

**Computer Fundamentals:** Block diagram of a Computer, Characteristics of Computers, Hardware, Software, Machine Language, Assembly Language and Assembler, High Level Language and Compiler v/s Interpreter.
**Computer software**: Types of software, application software and system software.
**Input Devices**: Keyboard, Mouse, Joystick, Track Ball, Touch Screen, Light Pen, Digitizer, Scanners, monitors, printers, plotters.
**Output Devices:** Monitors, Impact Printers - Dot matrix, Character and Line printer, non impact Printers – DeskJet and Laser printing, Plotter

ਕੰਪਿਊਟਰਬੁਨਿਆਦੀ:ਇੱਕਕੰਪਿਊਟਰਦਾਬਲਾਕਚਿੱਤਰ, ਕੰਪਿਊਟਰਦੀਆਂਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਹਾਰਡਵੇਅਰ, ਸੌਫਟਵੇਅਰ, ਮਸ਼ੀਨਭਾਸ਼ਾ, ਅਸੈਂਬਲੀਭਾਸ਼ਾਅਤੇਅਸੈਂਬਲਰ, ਉੱਚਪੱਧਰੀਭਾਸ਼ਾਅਤੇਕੰਪਾਈਲਰ v/s ਦੁਭਾਸ਼ੀਏ।
ਕੰਪਿਊਟਰਸਾਫਟਵੇਅਰ:ਸਾਫਟਵੇਅਰ, ਐਪਲੀਕੇਸ਼ਨਸਾਫਟਵੇਅਰਅਤੇਸਿਸਟਮਸਾਫਟਵੇਅਰਦੀਆਂਕਿਸਮਾਂ।
ਇਨਪੁਟਡਿਵਾਈਸ: ਕੀਬੋਰਡ, ਮਾਊਸ, ਜੋਇਸਟਿਕ, ਟ੍ਰੈਕਬਾਲ, ਟੱਚਸਕਰੀਨ, ਲਾਈਟਪੈੱਨ, ਡਿਜੀਟਾਈਜ਼ਰ, ਸਕੈਨਰ, ਮਾਨੀਟਰ, ਪ੍ਰਿੰਟਰ, ਪਲਾਟਰ।
ਆਉਟਪੁੱਟਉਪਕਰਣ:ਮਾਨੀਟਰ, ਪ੍ਰਭਾਵਪ੍ਰਿੰਟਰ - ਡਾਟਮੈਟ੍ਰਿਕਸ, ਅੱਖਰਅਤੇਲਾਈਨਪ੍ਰਿੰਟਰ, ਗੈਰਪ੍ਰਭਾਵੀਪ੍ਰਿੰਟਰ - ਡੈਸਕਜੈੱਟਅਤੇਲੇਜ਼ਰਪ੍ਰਿੰਟਿੰਗ, ਪਲਾਟਰ

### UNIT-II(15 Hrs.)

**Memories:** Memories: Main Memories - RAM ROM and Secondary Storage Devices - Hard Disk, Compact Disk and DVD.
**File Manipulation:** Creating, Deleting, coping, renaming file.
**Introduction to Internet**: Evolution of Internet, Internet Applications, WWW, E-mail, FTP, TELNET, Web Browsers.

ਯਾਦਾਂ:ਯਾਦਾਂ: ਮੁੱਖਯਾਦਾਂ - RAM ROM ਅਤੇਸੈਕੰਡਰੀਸਟੋਰੇਜਡਿਵਾਈਸ - ਹਾਰਡਡਿਸਕ, ਕੰਪੈਕਟਡਿਸਕਅਤੇ DVD।

ਫ਼ਾਈਲਹੇਰਾਫੇਰੀ:ਫ਼ਾਈਲਬਣਾਉਣਾ, ਮਿਟਾਉਣਾ, ਨਜਿੱਠਣਾ, ਨਾਮਬਦਲਣਾ।

ਇੰਟਰਨੈਟਦੀਜਾਣ-ਪਛਾਣ:ਇੰਟਰਨੈਟਦਾਵਿਕਾਸ, ਇੰਟਰਨੈਟਐਪਲੀਕੇਸ਼ਨ, ਡਬਲਯੂਡਬਲਯੂਡਬਲਯੂ, ਈ-ਮੇਲ, ਐਫਟੀਪੀ, ਟੇਲਨੈੱਟ, ਵੈੱਬਬ੍ਰਾਉਜ਼ਰ।

**UNIT-III(15 Hrs.)**

**Word Processing Tool:** Salient features of Word Processing, File, Edit, View, Insert, Format, Tools, Tables, Window, help options and all of their features, Options and Sub Options etc.,

**Windows:** Windows concept, Features, Desktop, Windows, And Accessories: Paint, Notepad, WordPad etc, Window Explorer, And Organization of data in Windows.

ਵਰਡਪ੍ਰੋਸੈਸਿੰਗਟੂਲ:ਵਰਡਪ੍ਰੋਸੈਸਿੰਗ, ਫਾਈਲ, ਐਡਿਟ, ਵਿਊ, ਇਨਸਰਟ, ਫਾਰਮੈਟ, ਟੂਲਸ, ਟੇਬਲ, ਵਿੰਡੋ, ਮਦਦਵਿਕਲਪਅਤੇਉਹਨਾਂਦੀਆਂਸਾਰੀਆਂਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਵਿਕਲਪਅਤੇਉਪਵਿਕਲਪਆਦਿਦੀਆਂਪ੍ਰਮੁੱਖਵਿਸ਼ੇਸ਼ਤਾਵਾਂ,

ਵਿੰਡੋਜ਼:ਵਿੰਡੋਜ਼ਸੰਕਲਪ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਡੈਸਕਟਾਪ, ਵਿੰਡੋਜ਼, ਅਤੇਸਹਾਇਕਉਪਕਰਣ: ਪੇਂਟ, ਨੋਟਪੈਡ, ਵਰਡਪੈਡਆਦਿ, ਵਿੰਡੋਐਕਸਪਲੋਰਰ, ਅਤੇਵਿੰਡੋਜ਼ਵਿੱਚਡੇਟਾਦਾਸੰਗਠਨ।

**UNIT-IV(15 Hrs.)**

**Presentation Tool:** Making Presentations, Inserting Objects, and Animations.

**Spreadsheet Tool:** Excel Worksheet, Data Entry, Editing, Cell Addressing ranges, Commands, Menus, Copying & Moving Cell Content, Inserting and Deleting Rows and Column, Column formats, Cell Protection, Printing, Creating, Displaying and Printing Graphs, Statistical Functions.

ਪੇਸ਼ਕਾਰੀਟੂਲ:ਪ੍ਰਸਤੁਤੀਆਂਬਣਾਉਣਾ, ਵਸਤੂਆਂਨੂੰਸ਼ਾਮਲਕਰਨਾ, ਅਤੇਐਨੀਮੇਸ਼ਨ।

ਸਪ੍ਰੈਡਸ਼ੀਟਟੂਲ: ਐਕਸਲਵਰਕਸ਼ੀਟ, ਡੇਟਾਐਂਟਰੀ, ਸੰਪਾਦਨ, ਸੈੱਲਐਡਰੈਸਿੰਗਰੇਂਜ, ਕਮਾਂਡਾਂ, ਮੀਨੂ, ਸੈੱਲਸਮੱਗਰੀਨੂੰਕਾਪੀਕਰਨਾਅਤੇਮੂਵਕਰਨਾ, ਕਤਾਰਾਂਅਤੇਕਾਲਮਨੂੰਸ਼ਾਮਲਕਰਨਾਅਤੇਮਿਟਾਉਣਾ, ਕਾਲਮਫਾਰਮੈਟ, ਸੈੱਲਪ੍ਰੋਟੈਕਸ਼ਨ, ਪ੍ਰਿੰਟਿੰਗ, ਬਣਾਉਣਾ, ਡਿਸਪਲੇਕਰਨਾਅਤੇਪ੍ਰਿੰਟਿੰਗਗ੍ਰਾਫ਼, ਅੰਕੜੇ।

**Recommended Books**:

1. V. Rajaraman, 'Fundamentals of Computers', 5th Edn., PHI, 2010.2. Satish Jain, 'Information Technology Concepts', ns, 4th Edn., BPB Publications, 2006.
3. Turban, Mclean and Wetherbe, 'Information Technology for Management', 4th Edn., John Wiley & Sons, 2006.4. G. Courter, 'Mastering MS Office 2000 Professional', 3rd Edn., BPB Publication, 2006.5. Steve Sagman, 'MS Office 2000 For Windows', 3rd Edn., Addison Wesley, 2008.

## HISTORY– I

**Subject Code: BACSD1-111** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Chronological Understanding:** Develop a chronological understanding of Ancient Indian History | | 2 | 3 | | 1 | |
| CO2 | **Civilizations and Empires:** Study the rise and fall of significant ancient civilizations and empires in India, such as the Indus Valley Civilization, Maurya Empire, Gupta Empire, etc. | | 1 | | 1 | 1 | |
| CO3 | **Cultural and Religious Heritage:** Explore contribution of different religions like Jainism and Buddhism | | | | 1 | 1 | 1 |

### UNIT– I (15 Hrs.)

Ancient Indian History and its Importance, Physical Features and Impact, Sources of Early Indian History.

ਪ੍ਰਾਚੀਨਭਾਰਤਦਾਇਤਿਹਾਸਅਤੇਮਹੱਤਵ, ਭਾਰਤਦੀਆਂਭੂਗੋਲਿਕਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਪ੍ਰਭਾਵ, ਪ੍ਰਾਚੀਨਭਾਰਤਦੇਸੋਮੇ।

### UNIT– II(15 Hrs.)

Indus Valley Civilizations or Harappa Culture, The Early Vedic Age, Later Vedic Age.

ਸਿੰਧੂਘਾਟੀਦੀਸਭਿਅਤਾਜਾਂਹੜੱਪਾਸੰਸਕ੍ਰਿਤੀ, ਮੁੱਢਲਾਵੈਦਿਕਕਾਲ, ਉੱਤਰਵੈਦਿਕਕਾਲ।

### UNIT– III(15 Hrs.)

Jainism and Buddhism, Alexander's Invasion of India, The Maurya Empire, The Kushana Empire, The Gupta Empire

ਜੈਨਧਰਮਅਤੇਬੁੱਧਧਰਮ, ਸਿੰਕਦਰਦਾਭਾਰਤਉੱਤੇਹਮਲਾ, ਮੌਰੀਆਸਾਮਰਾਜ, ਕੁਸ਼ਾਣਸਮਰਾਜ, ਗੁਪਤਸਮਰਾਜ।

### UNIT– IV(15 Hrs.)

Harsha Vardhana and His Time, Principal Dynasties of South India, Origin and Rise of the Rajputs.

ਹਰਸ਼ਵਰਧਨਅਤੇਉਸਦਾਸਮਾਂ, ਦੱਖਣੀਭਾਰਤਦੇਮਹੱਤਵਪੂਰਣਰਾਜਵੰਸ਼, ਰਾਜਪੂਤਾਂਦੀਉਤਪੱਤੀਅਤੇਉਥਾਨ।

**Books: -**

ਪ੍ਰਾਚੀਨਭਾਰਤਦਾਇਤਿਹਾਸ) Ancient History of India) Writer Dr. A.C. Arora
A.D. : - (Starting to 1200 CE)

## POLTICAL SCIENCE - I

**Subject Code: BACSD1-112** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Introduction:** Familiarize students with the discipline of political science, theories of origin of states | | 2 | 3 | | | 1 |
| CO2 | **Political Thinkers:** To acquaint students to the concepts of various political thinkers and philosophers | | 2 | 2 | 1 | | 1 |
| CO3 | **Political Theories and Ideologies:** Explore major political theories and ideologies | | | 3 | 1 | 1 | |

### UNIT – I(15 Hrs.)

- Political Theory – Ancient , Traditional and Modern - Distinction Between Political Theory and Political Science.
- Relationship of Poitiers Seine with Social Sciences.

### UNIT – II(15 Hrs.)

- The State : Meaning and Its Elements - destination Between State and society.
- Theories of the origin of State: - Social Contract theory and Historical Evolutionary Theory.

### UNIT – III(15 Hrs.)

- Liberal, Maxiom and Gandhian View of State function of state - Socialist Perspective
- Functions of state: Liberal Theory Welfare State : Concept and functions

### UNIT – IV(15 Hrs.)

- Sovereignty Meaning - Sovereignty and Its Monistic Theory, Austin theory of Sovereignty
- Pluralistic Theory of Sovereignty and Political Systems: Main Element of Political System, Main Structure of Political System.

Recommended Books:

1. Political Theory – J.S. Badyal, Raj Publications
2. Comparative Political System and International Politics – J.S. Badyal

## MATHEMATICS -I

**Subject Code: BACSD1-113** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| **CO1** | **Graphing and Functions:** Develop an understanding of graphing techniques and functions to visualize and analyze mathematical relationships | | | **3** | | **2** | |
| **CO2** | **Probability and Statistics:** Introduce students to probability theory and basic analysis and interpretation | | **1** | **2** | | **3** | |
| **CO3** | **Calculus Concepts:** Introduce fundamental concepts of calculus | | | **2** | | **2** | |

### UNIT-I (15 Hrs.)

Set Theory: Sets, Type of sets, set operations, Principle of Inclusion-Exclusion, Cartesian product of sets, Partitions.
Logic: Propositions, Implications, Precedence of logical operators, Truth table, Arguments and validity of arguments, equivalence and implication laws of logic, Principle of Mathematical induction.
Relations: Relations and diagraph, n-ary relations and their applications, properties of relations, representing relations, closure of relation, equivalence relation, operation on relations, partial ordering. Functions: Functions, One-to-one Functions, Onto Functions, Inverse and Composition of Functions, Floor Function, Ceiling Function.

### UNIT-II (15 Hrs.)

Integration by Partial fractions, integration of rational and irrational functions, Properties of definite integral, Reduction formulae for integrals of rational, trigonometric, exponential and logarithmic function and of their combinations.

### UNIT-III(15 Hrs.)

Graph Theory. Graphs: Introduction to Graph, Graph terminology, Representing graphs and Graph Isomorphism, Connectivity, Euler Paths and Circuits, Hamiltonian paths and circuits, Shortest Path Problems, Planar Graphs.
Trees: Trees, labeled trees, Tree Traversal, Undirected trees, Spanning Trees, Minimum spanning trees.

### UNIT–IV(15 Hrs.)

Probability: Definition, Addition law of Probability, Multiplication law, Binomial Distribution, Poisson Distribution, Normal Distribution
Statistics and Applications of Logarithms: Introduction to Statistics, Measures of Central Tendency- Mean, Median and Mode, Measures of Dispersion, Mean Deviation, Standard Deviation and Coefficient of Variation. Problems related to Compound Interest, Depreciation and Annuities.

## PHYSICAL EDUCATION - I

**Subject Code: BACSD1-114** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Physical Fitness:** Improve the understanding of Physical Fitness concepts and practice | | | 2 | | 3 | 1 |
| CO2 | **Motor Skills Development:** Enhance the students' motor skills like running, jumping, throwing, catching, kicking and other fundamental movement | | | 2 | | 2 | |
| CO3 | **Teamwork and Cooperation:** Promote teamwork, cooperation, and sportsmanship through various sports and group activities | 1 | | 2 | | 1 | 1 |
| CO4 | **Health Awareness:** Raise awareness about the importance of regular physical activity for maintaining overall health | | | 1 | | 3 | |
| CO5 | **Physical Education and Lifelong Activity:** Foster an understanding of the importance of lifelong | | 1 | | | 1 | 1 |

**(THEORY – 60 MARKS)**

### UNIT – I(15 Hrs.)

- **Physical Education**: Introduction, Objectives, Scope and Importance of Physical Education in the modern society.
- **Health Education**: Introduction, Aim & objectives, Principles and its Importance.
- **Olympic Games**: Introduction, Organization, Administration and Ceremonies of Ancient and Modern Olympic Games.
  **Asian & Commonwealth Games**: Introduction, Ceremonies, Venues.

### UNIT – II(15 Hrs.)

- **Growth and Development**: Introduction, Difference, Development Characteristics at Different stages of Development and factors affecting growth & Development.
- **Heredity and Environment**: Introduction, Effect of Heredity & Environment on Growth & development, Chronological age, Anatomical age and Physiological age.
- **Personal Hygiene**: Introduction, Personal Cleanliness, Rest, Relaxation and Sleep.

### UNIT – III(15 Hrs.)

- **Terminologies of Physical Education**: Kinesiology, Anatomy, Physiology Exercise Physiology, Bio Mechanics, Anthropometry and Sports Medicine.
- **Cell:** Structure, Parts and its Function.
- **Digestive System** : Introduction, Structure, Organs & Functions of Digestive System

### UNIT – IV(15 Hrs.)

- **Athletics**: Introduction, Classification of Events, General Rules of Track Events and Types of Start & Finish.
- **Football**: History, Laws of the Game, Major tournaments and Arjuna Awardees.
- **Volleyball**: History, Layout, General Rules and Regulation, Officials, Major Tournaments and Arjuna Awardees.

### PRACTICAL (40 MARKS)

**VOLLEYBALL, FOOTBALL AND SPRINTS (ATHLETICS)**

Evaluation will be based on skill test, Performance, Practical file and Viva Voce.

Recommended Books:

1. Dr. Nishan Singh Deol (1980): Text Book of Physical Education & Sports. (AP Publishiers, Jalandhar)
2. Singh Ajmer et al (2000): Modren Text book of Physical Edcation, Health and Sports, Kalyani Publishers, Ludhiana.

## ELECTIVE ENGLISH – I

**Subject Code: BACSD1-115** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Improving Language Proficiency:** Enhance overall language skills, including speaking, listening, reading, and writing, to communicate effectively in English | | | 2 | | 3 | 1 |
| CO2 | **Grammar and Vocabulary:** Develop a solid understanding of English grammar rules | | | 2 | | 2 | |
| CO3 | **Writing Skills:** Develop the ability to write clear, coherent, and organized letters | 1 | | 2 | | 1 | 1 |

### UNIT–I (15 Hrs.)

- Literary Terms: ballad ode, sonnet. Dramatic Monologue, Interior Monologue, Blank verse, free verse, Mock Epic. Metaphysical Conceit, Negative capability, Egotistical sublime, fancy, imagination, Irony, Paradox, Ambiguity ,Alliteration, Assonance, Imagery.

### UNIT–II (15 Hrs.)

- letter writing- official
- Applied Grammar - Voice, Direct Indirect

### UNIT–III (15 Hrs.)

- Transformation of Sentences- Simple compound complex,
- Articles, Proposition, conjunctions
- Vocabulary - Antonyms/Synonym,
- Uses of words Phrases in English.

### UNIT–IV (15 Hrs.)

- Text Prescribed from Fluency in English.
  (a) Inzy Lets things Flow over Him. - Kadamba Murali
  (b) Haroun and the sea of stories. : Salman Rushdil.
  (c) Sisters-Poem : Saleem Peeradina
  (d) Understanding Satire - A Ten Day Test: Harishanker Passai
  (e) Go, kiss the world- Subroto Bagachi
  (f) Amaltanti : Nirendranath Chakrabarti
  (g) Hitting Downy for a six- Kalpana Sharma
  *(h)* Chocolate : Manju Kapur
  *(i) Ref Book :*

*Fluency in English: Ed Promodini Verma, Mukti Sanyal, Tulika Prasad, New Delhi- Macmillan India, 2009 .*

## ECONOMICS -I

**Subject Code:BACSD1-116** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | To provide students with an overview of the economics concepts, theories and models related to micro economics | | 2 | 2 | | 3 | 1 |
| CO2 | To understand the fundamental principles of supply and demand and how they determine market prices and quantities | | 2 | 2 | 1 | 2 | |
| CO3 | To study firm behavior, production theory, cost analysis and how firms make production and pricing decisions in different market structures | | 2 | 2 | | 3 | 1 |

### UNIT – I (15 Hrs.)

Introduction: Definition, Meaning, Nature and scope of Economics.
Theory of Demand and Consumer Behaviour Utility Analysis & Indifference Curve Analysis, Law of Demand & Exceptions. Elasticity of Demand its Measurement consumer surplus & its measurement.

### UNIT – II (15 Hrs.)

Theory of production and costs: Concept, law of variable proportions & Law of Return to scale. Cost concept.
Market forms and Revenue: Behaviour of Average Revenue and Marginal Revenue under perfect competition. Relationship Between Average Revenue, Marginal Revenue.

### UNIT – III (15 Hrs.)

Price and Output Determination: Determination of the firm & industry under perfect competition, monopoly – In short and long seen.

### UNIT – IV (15 Hrs.)

Distribution: Marginal productivity and modern theories of wage determination.
Theory of interest ,risk and uncertainty theories of profit.

*Ref Books:*

*(a) Microeconomics – TR Jain ,Mukesh Trehan ,AS Sandhu*
*(b) Microeconomics- Chopra P.N ,Theory& welfare economics ,Kalyani Publishers ,New Delhi.*
*(c) Microeconomics- Chopra P.N ,Singh Joginder & Grewal ,PS ( Punjbai Medium) Latest edition Price Theory & Distribution ,Kalyani Publishers ,Ludhiana.*

## ਪੰਜਾਬੀਇਲੈਕਟਿਵ - I

**Subject Code: BACSD1-117** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Language Skills:** Enhance reading, writing, listening, and speaking skills in Punjabi | 3 | 1 | 2 | | | |
| CO2 | **Writing Skills:** Learn to write story in Punjabi | 3 | | 2 | | 1 | |
| CO3 | **Reading Comprehension:** Improve the ability to read and understand Punjabi text written by famous authors, poems by Punjabi poets | 2 | | 1 | 2 | | |

### ਪਾਠਕ੍ਰਮ

1. ਆਧੁਨਿਕਪੰਜਾਬੀਕਵਿਤਾਦਾਅਧਿਐਨ
2. ਭਾਸ਼ਾਤੇਪੰਜਾਬੀ (ਭਾਸ਼ਾ)
3. ਸਾਹਿਤਦੇਰੂਪ

### ਯਨਿਟ – I (15Hrs)

(ੳ) ,ਨਕਸ਼ਨੁਹਾਰ, ਪੁਸਤਕਵਿੱਚੋਂਪ੍ਰਸੰਗਸਹਿਤਵਿਆਖਿਆ।

(ਅ) ਕਾਵਿਸੰਗ੍ਰਹਿਵਿੱਚੋਂਕਿਸੇਇਕਕਵਿਤਾਦਾਵਿਸ਼ਾ_ਵਸਤੂ।

### ਯਨਿਟ – II (15Hrs)

ਭਾਸ਼ਾਅਤੇਪੰਜਾਬੀਭਾਸ਼ਾ : ਭਾਸ਼ਾਦੀਪਰਿਭਾਸ਼ਾ, ਮਹੱਤਵ

### ਯਨਿਟ – III (15Hrs)

ਸਾਹਿਤਦੇਰੂਪ : ਕਵਿਤਾ, ਗੀਤ, ਗਜਲ

### ਯਨਿਟ – IV (15Hrs)

ਇਕਾਂਗੀ, ਕਹਾਣੀ (ਸ਼ਾਹਿਤ ਦੇ ਰੂਪ), ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀਆਂ ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ।

- ਕੋਰਸ

,ਨਕਸ਼ਨੁਹਾਰ, (ਸੰਪਾਦਕ) ਡਾ. ਜਸਵਿੰਦਰਸਿੰਘਆਧੁਨਿਕਪੰਜਾਬੀਕਵਿਤਾ (1901 ਈ. ਤੋਂ 2000 ਈ. ਤੱਕ)।

ਸਹਾਇਕਪੁਸਤਕਾਂ: (ਨਿਰਧਾਰਿਤ ਕਵੀ: ਭਾਈ ਵੀਰ ਸਿੰਘ, ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ, ਧਨੀ ਰਾਮ ਚਤ੍ਰਿਕ, ਪ੍ਰੋ. ਮੋਹਨ ਸਿੰਘ, ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ, ਬਾਵਾ ਬਲਵੰਤ, ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ, ਡਾ. ਹਰਭਜਨ ਸਿੰਘ, ਡਾ. ਜਗਤਾਰ ।)

1. ਬਰਾੜ, ਬੂਟਾਸਿੰਘ (ਡਾ.) ਪੰਜਾਬੀਭਾਸ਼ਾਸ੍ਰੋਤਤੇਸਰੂਪਵਾਰਿਸ਼ਸ਼ਾਹਫਾਉਡੇਸ਼ਨ, ਅਮ੍ਰਿਤਸਰ 2012 ।
2. ਪਾਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ (ਆਧੁਨਿਕਕਾਲ) ਪੰਜਾਬੀਯੂਨੀਵਰਸਿਟੀਪਟਿਆਲਾ।

## ਵਿਸ਼ਾ: ਸਮਾਜ ਸ਼ਾਸਤਰ – I (Sociology –I)

**ਸਮੈਸਟਰ – ਪਹਿਲਾ**

**Subject Code:** BACSD1-119 **L T P C** **4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|
| CO1 | Articulate a sociological perspective. Apply sociological theories to understand social phenomena. | | 2 | 3 | | | 1 |
| CO2 | Critically evaluate explanations of human behavior and social phenomena. | | 2 | 2 | 1 | | 1 |
| CO3 | Use sociological knowledge to inform policy debates and promote public understanding. | | | 3 | 1 | 1 | |

### ਯੂਨਿਟ – I (15 Hrs.)

- Introduction to Sociology:- ਸਮਾਜ ਵਿਗਿਆਨ ਦੀ ਭੂਮਿਕਾ, ਸਮਾਜ ਵਿਗਿਆਨ ਦਾ ਜਨਮ ਤੇ ਵਿਕਾਸ
- ਸਮਾਜ ਵਿਗਿਆਨ ਦੀ ਪ੍ਰਕਿਰਤੀ, ਸਮਾਜ ਵਿਗਿਆਨ ਦੀ ਅਸਲ ਪ੍ਰਕਿਰਤੀ.

### ਯੂਨਿਟ – I I (15 Hrs.)

- ਮਨੁੱਖੀ ਸਮਾਜ, ਸਮਾਜ ਦਾ ਆਮ ਸਰੂਪ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਵਿਅਕਤੀ ਅਤੇ ਸਮਾਜ
- ਸਮਾਜਿਕ ਸਮੂਹ.

### ਯੂਨਿਟ – I I I (15 Hrs.)

- ਸੰਸਕ੍ਰਿਤੀ, ਅਰਥ, ਪਰਿਭਾਸ਼ਾ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਸੰਸਕ੍ਰਿਤੀ ਦੇ ਕਾਰਜ ਕਿਸਮਾਂ, ਸੰਸਕ੍ਰਿਤਕ ਪਛੜਾਪਨ, ਸੰਸਕ੍ਰਿਤੀ ਤੇ ਸੱਭਿਅਤਾ

### ਯੂਨਿਟ – I V (15 Hrs.)

- ਸਮਾਜੀਕਰਣ:- ਅਰਥ, ਪਰਿਭਾਸ਼ਾ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ ਤੇ ਸਾਧਨ
- ਸਮਾਜਿਕ ਨਿਯੰਤਰਣ:- ਅਰਥ ਪਰਿਭਾਸ਼ਾ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਲੋੜ, ਸਾਧਨ

Recommended Books:

1. ਸਮਾਜ ਵਿਗਿਆਨ ਨਾਲ ਜਾਣ-ਪਛਾਣ (ਡੇਜ਼ੀ ਔਜਲਾ)
2. ਸਮਾਜ ਸ਼ਾਸਤਰ ਦਾ ਪਾਠਕ ( ਮਧੁਰਿਮਾ)
3. ਸਮਾਜਿਕ ਸੰਸਥਾਵਾਂ (ਡਾ. ਸੁਕੌਨਿਆ ਦਾਸ)
4. Bhushan Vidya & Sachdeva D.D (2014) : An Introduction of Sociology Kilab Maal Allahabad

**Web Designing-I**

Subject Code: BACSD1-119 L T P C Duration: 60 Hrs

4 0 0 4

| COs | Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|
| CO1 | Understand, analyze and create web pages using HTML | | | 3 | | 2 | |
| CO2 | Understand, analyze and build interactive web applications | | | 2 | | 3 | |
| CO3 | Students should be able to design and implement a basic website. | 1 | | 3 | | 3 | |

## UNIT - I

**Basic Terminology:** Introduction to web programming, Website, Webpage, Static Website, Dynamic Website, Internet, Intranet, Extranet, WWW, URL, client server architecture, internet domains.

**Introduction to HTML:** Basics of HTML5, difference between HTML & HTML5,Structure of an HTML program, understanding document tags.

## UNIT - II

**HTML5 formatting:** Formatting tags e.g. font, Bold, italic, super script, subscript, delete, mark etc.

**Lists:** Unordered List, Ordered Lists, Definition lists.

**Adding Images:** Img element using Border, Width, Height, Align, ALT Attributes

## UNIT - III

**Introduction to LINK:** anchor element, internal linking and external linking, attribute of anchor tag.

**Tables:** Caption Tag, Width, Border, Cell padding, Cell spacing, BGCOLOR, COLSPAN and ROWSPAN Attribute

## UNIT - IV

**HTML Frames:** Introduction to frameset tag, frame tag, iframes and respective attributes.

**Forms:** Attributes of Form element, Input element: Text Element, Password, Button, Submit Button, Reset Button, The Checkbox, Radio, TextArea, Select and Option.

***Faculty members can take practical sessions during the lectures.***

**Recommended Books:**

1. Kogent Learning Solutions Inc.," HTML 5 in simple steps", Dreamtech Press.

2. Murray, Tom/Lynchburg," Creating a Web Page and Web Site",2002.

3. Steven M. Schafer," HTML, XHTML, and CSS Bible, 5ed", Wiley India.

# SEMESTER - II

## ਪੰਜਾਬੀਲਾਜਮੀ - II

**Subject Code: BACSS1-202** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Language Skills:** Enhance reading, writing, listening, and speaking skills in Punjabi | 3 | 1 | 2 | | | |
| CO2 | **Vocabulary and Grammar:** Learn essential Punjabi vocabulary and grammar rules | 3 | | 2 | | | |
| CO3 | **Writing Skills:** Learn to write Notices | 3 | | 2 | | 1 | |
| CO4 | **Reading Comprehension:** Improve the ability to read, understand and summarize Punjabi stories | 2 | | 1 | 2 | | |

### ਪਾਠਕ੍ਰਮ

1. ਪੰਜਾਬੀਕਹਾਣੀਆਦਾਅਧਿਐਨ
2. ਮੁਹਾਵਰੇ
3. ਸੂਚਨਾਹਿੱਤਨੋਟਿਸ

### ਯਨਿਟ – I (15 Hrs)

ਕਥਾਕਹਾਣੀਪੁਸਤਕਵਿੱਚੋਂਕਿਸੇਇੱਕਕਹਾਣੀਦਾਵਿਸ਼ਾਦੱਸਕੇਸਾਰਲਿਖਣਾ।

### ਯਨਿਟ – II (15 Hrs)

ਕਹਾਣੀਸੰਗ੍ਰਹਿਵਿਚੋਂਸੰਖੇਪਉੱਤਰਾਂਵਾਲੇਪ੍ਰਸ਼ਨ।

### ਯਨਿਟ – III (15 Hrs)

ਮੁਹਾਵਰੇ : ਅਰਥਦਸਕੇਵਾਕਬਣਾਉਣੇ।

### ਯਨਿਟ – IV (15 Hrs)

ਸੂਚਨਾਹਿੱਤਨੋਟਿਸ) ਸਾਹਿਤਕ, ਸੱਭਿਆਚਾਰਕਤੇਖੇਡਖੇਤਰਨਾਲਸੰਬੰਧਿਤ(।

- ਕੋਰਸ

ਕਥਾਕਹਾਣੀਪੁਸਤਕ (ਸੰਪਾਦਕ) ਡਾ. ਧਨਵੰਤਕੌਰ, ਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋ।

ਸਹਾਇਕ ਪੁਸਤਕਾਂ : 1. ਅਗਨੀਹੋਤਰੀ ਵੇਦ, ਪਰਿਚਾਇਕ ਭਾਸ਼ਾਵਿਗਿਆਨ, ਦੀਪਕਪਬਲਿਕੇਸ਼ਨਜਲੰਧਰ 1981।
2. ਜੱਸਲਕੰਵਲਜੀਤ, ਪੰਜਾਬੀਵਿਆਕਰਨਦੇਕੁੱਝਪੱਖ, ਰਵੀਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨਹਾਲ, ਬਾਜਾਰਅਮ੍ਰਿਤਸਰ 2012।

## GENERAL ENGLISH - II

**Subject Code: BACSS1-201** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Language Proficiency:** Develop proficiency in the English Language | 3 | 2 | 2 | | 1 | |
| CO2 | **Vocabulary and Grammar:** Learn essential English vocabulary and grammar rules | 3 | | 2 | | | |
| CO3 | **Writing Skills:** Learn and practice letter writing and unseen passage | 3 | | 2 | | 1 | |
| CO4 | **Reading Comprehension:** Improve the ability to read and understand English Poetry and Prose | 2 | | 1 | 2 | | |

### UNIT -1 (Poetry) (15 Hrs.)

i.) I know why the caged bird sings - Maya Angelou.
ii.) From homecoming – R.Parthasarathy.
iii.) Where the mind is without fear - Rabindranath tagore.
iv.) Goodbye party for Miss Pushpa T.S - Nissim Ezekiel.
v.)

### UNIT -2 (Prose) (15 Hrs.)

i.) Principles of good writing - L.A. Hill.
ii.) The doctor's word – R.K. Narayan.
iii.) The eyes are not here - Ruskin bond.
iv.) The conjurer's revenge - Stephen leacock.

### UNIT-3 (15 Hrs.)

i.) Letter writing (Pessonal only).
ii.) Comple hension of unseen Pessage.

### UNIT- 4 (15 Hrs.)

i.) Grammer →Narration,Preposotion,conjunction, synonyms.
ii.) Translation from hindi to English (four out of six sentences) Idiom Based.

Textbook:-
i.) The poetic palatte (orient blackswan, for-1/2Sem Second edition, 2016)
iv.) Prose parables (orient black swan,2013)
v.) English at work (selection from poetry & prose Vijay kumar, B.T. Seetha, A.V Suresh Kumar, Y.L. Srinivas, New Delhi; Macmillan, India Ltd.2012 (Punjab University) revised edition.

## TRENDS IN IT AND OFFICE AUTOMATION

**Subject Code: BACSS1-203** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **IT Trends:** Introduce students to recent trends of information technology like mobile internet, 4G, cloud technology and social media trends | | | 3 | | 2 | |
| CO2 | **Office Automation Tools:** Familiarize students with word processing software, editing and formatting text | | | 2 | | 3 | |
| CO3 | **Networking and Software:** Introduce the students to soft computing, software process models and IOT | 1 | | 3 | | 3 | |

### UNIT-I(15 Hrs.)

1. **Trends in IT:** Mobile Internet, GPS, 3G, 4G, Wi-Fi, Bluetooth, Cloud Technology, Virtual LAN Technology, Firewall, Nanotechnology, online shopping, Social media, You tube, Face book, Twitter, Goggle+ .

   IT ਵਿੱਚਰੁਝਾਨ: ਮੋਬਾਈਲਇੰਟਰਨੈਟ, GPS, 3G, 4G, Wi-Fi, ਬਲੂਟੁੱਥ, ਕਲਾਉਡਟੈਕਨਾਲੋਜੀ, ਵਰਚੁਅਲ LAN ਤਕਨਾਲੋਜੀ, ਫਾਇਰਵਾਲ, ਨੈਨੋਤਕਨਾਲੋਜੀ, ਔਨਲਾਈਨਖਰੀਦਦਾਰੀ, ਸੋਸ਼ਲਮੀਡੀਆ, ਯੂਟਿਊਬ, ਫੇਸਬੁੱਕ, ਟਵਿੱਟਰ, ਗੋਗਲ+।

### UNIT-II(15 Hrs.)

2. **E-mail:-** introduction, Advantages and disadvantages, Structure of an Email message, working of Email(Sending and receiving message, managing E-mail(creating new folder, deleting messages, forwarding messages, filtering messages), Telnet, HTTP, TCP/IP, HTML, DHTML.

3. **Mail merge:** Creating merged envelops, creating merged mailing labels

   ਈ-ਮੇਲ: -ਜਾਣ-ਪਛਾਣ, ਫਾਇਦੇਅਤੇਨੁਕਸਾਨ, ਈਮੇਲਸੰਦੇਸ਼ਦੀਬਣਤਰ, ਈਮੇਲਦਾਕੰਮ (ਸੁਨੇਹੇਭੇਜਣਾਅਤੇਪ੍ਰਾਪਤਕਰਨਾ, ਈ-ਮੇਲਦਾਪ੍ਰਬੰਧਨਕਰਨਾ (ਨਵਾਂਫੋਲਡਰਬਣਾਉਣਾ, ਸੰਦੇਸ਼ਾਂਨੂੰਮਿਟਾਉਣਾ, ਸੰਦੇਸ਼ਾਂਨੂੰਅੱਗੇਭੇਜਣਾ, ਸੁਨੇਹਿਆਂਨੂੰਫਿਲਟਰਕਰਨਾ), ਟੇਲਨੈੱਟ, HTTP, TCP /IP, HTML, DHTML।
   ਮੇਲਮਰਜ: ਵਿਲੀਨਲਿਫਾਫੇਬਣਾਉਣਾ, ਵਿਲੀਨਮੇਲਿੰਗਲੇਬਲਬਣਾਉਣਾ

### UNIT – III(15 Hrs.)

4. **Word Processing Software**: Basics of Word Processing: creating, opening, saving, and printing document, Menu Toolbars.

5. **Editing Text:** Copy, Paste, Delete, Move etc., Finding and Replacing Text, Spell Check, Autocorrect feature, language setting and thesaurus

6. **Formatting:** Character, Paragraph and Page formatting, working with indents, Bulleted and numbered lists, adding Headers and Footers, setting up Multiple Columns

ਵਰਡਪ੍ਰੋਸੈਸਿੰਗਸੌਫਟਵੇਅਰ: ਵਰਡਪ੍ਰੋਸੈਸਿੰਗਦੀਆਂਮੂਲਗੱਲਾਂ: ਦਸਤਾਵੇਜ਼ਬਣਾਉਣਾ, ਖੋਲ੍ਹਣਾ, ਸੇਵਕਰਨਾਅਤੇਪ੍ਰਿੰਟਿੰਗਕਰਨਾ, ਮੀਨੂਟੂਲਬਾਰ।

ਟੈਕਸਟਨੂੰਸੰਪਾਦਿਤਕਰਨਾ: ਕਾਪੀਕਰੋ, ਪੇਸਟਕਰੋ, ਮਿਟਾਓ, ਮੂਵਕਰੋਆਦਿ, ਟੈਕਸਟਲੱਭਣਾਅਤੇਬਦਲਣਾ, ਸਪੈਲਚੈੱਕ, ਸਵੈ-ਸੁਧਾਰਵਿਸ਼ੇਸ਼ਤਾ, ਭਾਸ਼ਾਸੈਟਿੰਗਅਤੇਥੀਸੌਰਸ

ਫਾਰਮੈਟਿੰਗ: ਅੱਖਰ, ਪੈਰਾਗ੍ਰਾਫਅਤੇਪੰਨਾਫਾਰਮੈਟਿੰਗ, ਇੰਡੈਂਟਸਦੇਨਾਲਕੰਮਕਰਨਾ, ਬੁਲੇਟਡਅਤੇਨੰਬਰਵਾਲੀਆਂਸੂਚੀਆਂ, ਸਿਰਲੇਖਅਤੇਫੁੱਟਰਜੋੜਨਾ, ਕਈਕਾਲਮਸਥਾਪਤਕਰਨਾ

**UNIT-IV(15 Hrs.)**

7. **Soft Computing:-**Introduction to Neural Network-intelligence, Neurons, artificial neural networks, application scope of neural network, brain Vs computer.
8. **Software Process Models:** Software Development Life Cycle, Waterfall Life Cycle Model, Prototype Model, Spiral Model, Introduction to Agile Models.
9. **IOT architecture: -** Topologies, edge routers, client-server architecture, P2P, M2M.

ਸਾਫਟਕੰਪਿਊਟਿੰਗ:- ਨਿਊਰਲਨੈੱਟਵਰਕ-ਇੰਟੈਲੀਜੈਂਸ, ਨਿਊਰੋਨਸ, ਆਰਟੀਫਿਸ਼ੀਅਲਨਿਊਰਲਨੈੱਟਵਰਕ, ਨਿਊਰਲਨੈੱਟਵਰਕਦਾਐਪਲੀਕੇਸ਼ਨਸਕੋਪ, ਦਿਮਾਗਬਨਾਮਕੰਪਿਊਟਰਦੀਜਾਣ-ਪਛਾਣ।

ਸਾਫਟਵੇਅਰਪ੍ਰੋਸੈਸਮਾਡਲ: ਸਾਫਟਵੇਅਰਡਿਵੈਲਪਮੈਂਟਲਾਈਫਸਾਈਕਲ, ਵਾਟਰਫਾਲਲਾਈਫਸਾਈਕਲਮਾਡਲ, ਪ੍ਰੋਟੋਟਾਈਪਮਾਡਲ, ਸਪਾਈਰਲਮਾਡਲ, ਐਗਾਇਲਮਾਡਲਾਂਦੀਜਾਣ-ਪਛਾਣ।

IOT ਆਰਕੀਟੈਕਚਰ: - ਟੋਪੋਲੋਜੀਜ਼, ਐਜਰਾਊਟਰ, ਕਲਾਇੰਟ-ਸਰਵਰਆਰਕੀਟੈਕਚਰ, P2P, M2M

**Recommended Books:**

1. Peter Nortorn's, 'Introduction to Computer', Tata McGraw Hill, 2004.
2. R.K. Taxali, 'Introduction to Software Package', Galgotia Publications.3. P.K. Sinha, 'Introduction to Computer

## HISTORY - II

**Subject Code:BACSD1-211** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Historical Timeline:** To provide students with a chronological overview of Sikh history | | 2 | 3 | | 1 | |
| CO2 | **Guru Tradition:** To explore the lives and teachings of Sikh Gurus and their contribution to shaping Sikhism's Principles and practices | | | 2 | 3 | 2 | 1 |
| CO3 | **Key Events and Turning Points:** To identify and analyze significant events and turning points in Sikh History, such as the establishment of the Khalsa, Sikh rulers, British rule and Freedom struggle | | | | 1 | 1 | 1 |

### UNIT – I(15 Hrs.)

Shri Guru Nanak Dev Ji, Expansion and consolidation of Sikhism, Shri Guru Arjun Dev Ji
ਸ੍ਰੀਗੁਰੂਨਾਨਕਦੇਵਜੀ, ਸਿੱਖਧਰਮਦਾਵਿਕਾਸ, ਸ੍ਰੀਗੁਰੂਅਰਜਨਦੇਵਜੀ

### UNIT – II(15 Hrs.)

Development of Sikhism, Creation of The Khasla, Banda Singh Bahadur
ਸਿੱਖਧਰਮਦਾਵਿਕਾਸ, ਖਾਲਸਾਦੀਸਿਰਜਨਾ, ਬੰਦਾਸਿੰਘਬਹਾਦਰ

### UNIT – III(15 Hrs.)

Punjab Under Maharaja Ranjit Singh, British Rule, Socio-Religious reform Movements
ਮਾਹਾਰਾਜਾਰਣਜੀਤਸਿੰਘਦੇਅਧੀਨਪੰਜਾਬ, ਅੰਗਰੇਜੀਰਾਜਸਮਾਜਿਕਅਤੇਧਾਰਮੀਕਸੁਧਾਰਅੰਦੋਲਨ

### UNIT – IV(15 Hrs.)

Phase of the Freedom Struggle, Development after Independence
ਸਵਤੰਤਰਤਾਸੰਗਰਾਮਦੀਅਵਸਥਾ, ਸਵਤੰਤਰਤਾਬਾਅਦਦਾਵਿਕਾਸ।

**Books: -**
History of Punjab M.S. Mann (1469-1966)

## POLTICAL SCIENCE - II

**Subject Code:BACSD1-212** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Introduction:** Familiarize students with the discipline of political science, theories of power and authority | | 2 | 3 | | | 1 |
| CO2 | **Rights and Duties:** Awareness about rights and duties | | 2 | 2 | 1 | | 1 |
| CO3 | **Political Concepts:** Study about concept of liberty, equality, legitimacy | | | 3 | 1 | 1 | |

### UNIT – I (15 Hrs.)

- Concept of Power: Meaning and Definition of Power, Characteristic of Power, Sources of formed. Different forms of Power Criticism the concept of Power.
- Concept of Authority - Meaning and Definitions of Authority, Characteristics of Authority kinds of Authority and Its Basis.

### UNIT – II (15 Hrs.)

- Concept of legitimacy: Meaning and its legitimacy, Characteristics of legitimacy kinds of legitimacy, Crisis of legitimacy. Importance of legitimacy.
- Political Culture :- Meaning and Definitions of Political, Characteristics of Political Culture components of Political Culture, kinds of Political culture.

### UNIT – III (15 Hrs.)

- Political Specialisation - Meaning and Its Definition, Characteristic of Political Socialisation Types of political Socialisation , Agents of Political specialisation, and Its Importance.
- Rights and Duties - Meaning and Definitions of Rights, Nature the characteristics of Rogues, Classification of Rights, duties & Classification. Relationship Between Rights and Duties.

### UNIT – IV (15 Hrs.)

- Liberty: - Meaning and Definition of Liberty and its Characteristics Different forms or kind of liberty, main supporters of this theory.
- Concept of Equality: Meaning and it's - Definitions characteristics of Equality. Various dimensions of Equality. Relationship Between Liberty and finality.

Recommended Books:

1. Political Theory – J.S. Badyal, Raj Publications
2. Comparative Political System and International Politics – J.S. Badyal

## MATHEMATICS (ALGEBRA) - II

**Subject Code: BACSD1-213** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Basic Operations:** To understand and apply the fundamental operations in algebra | | | 3 | | 2 | |
| CO2 | **Solving Equations:** To learn how to solve linear and quadric equations | | 1 | 2 | | 3 | |
| CO3 | **Systems of Equations:** To solve systems of linear equations using various methods | | | 2 | | 2 | |

### UNIT-I(15 Hrs.)

Matrices, Row and Column Space of Matrix, Row reduction and echelon forms, Rank, Systems of linear equations, Gaussian elimination, Determinants and their properties, Cramer's rule, Vector equations, The matrix equation AX = B, Solution sets of linear systems (Homogeneous & Non-homogeneous), Applications of linear systems.

### UNIT –II(15 Hrs.)

Eigen values, Eigenvectors, Characteristic polynomial, Minimal polynomial, Characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding the inverse of a matrix, Diagonalization, Linear transformations, Representation of linear transformations by matrices, Change of basis, Rank-nullity theorem, Minimal polynomial.

### UNIT-III(15 Hrs.)

Binary space, Definition of group, Ring and field, Vector space, Subspace, Linear combination, linear span, Dimension of vector space, direct sum of spaces, Quotient space, Homomorphism & Isomorphism of vector space.

### UNIT-IV(15 Hrs.)

Linear Transformation, Null space, Range space, Product of linear transformation, Singular and nonsingular transformation, Canonical forms, Jordan forms, Triangular forms, Rank-nullity theorem, Eigen value & Eigen vectors of linear transformation

## PHYSICAL EDUCATION - II

**Subject Code: BACSD1-214** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Physical Fitness:** Improve the understanding of Physical Fitness concepts and practice | | | 2 | | 3 | 1 |
| CO2 | **Motor Skills Development:** Enhance the students' motor skills like running, jumping, throwing, catching, kicking and other fundamental movement | | | 2 | | 2 | |
| CO3 | **Teamwork and Cooperation:** Promote teamwork, cooperation, and sportsmanship through various sports and group activities | 1 | | 2 | | 1 | 1 |
| CO4 | **Health Awareness:** Raise awareness about the importance of regular physical activity for maintaining overall health | | | 1 | | 3 | |
| CO5 | **Physical Education and Lifelong Activity:** Foster an understanding of the importance of lifelong | | 1 | | | 1 | 1 |

**(THEORY – 60)**

### UNIT – I(15 Hrs.)

- **Children and Sports**: Introduction, Stages of Motor Development in Children, Benefits of Exercise for Children, Weight Training and their Advantages or Disadvantages for Children.
- **Body Types**: Introduction, Sheldon and Kretschmer's Classification.
- **Communicable Diseases** : Introduction, Classification, Causes, Symptoms, Prevention and Control of Communicable Disease (Cholera, Typhoid, Tuberculosis, AIDS, Hepatitis A & B, Rabies and Malaria)

### UNIT – II(15 Hrs.)

- **Sports Terminologies**: Isometric, Isotonic, Isokinetic, Reflex Action, Over Load, Recovery and Motor Ability.
- **Skeleton System**: Introduction, Types, Functions and various Bones of Body.
- **Joints** : Introduction, Classification of various Joints of Human Body and Kinds of Joint Movements

### UNIT – III(15 Hrs.)

- **Description of the following**:
  (a) N.S.N.I.S. (Netaji Subhash National Institute of Sports)
  (b) S.A.I (Sports Authority of India)
  (c) I.O.A. (Indian Olympic Association)
  (d) I.A.A.F. (International Association of Athletic Federation)
- **Drugs**: Introduction, Causes, Symptoms, Harmful Effects and its Prevention.
  **Doping**: Introduction, Types, Prohibited Substances & Methods and its Effects.
- **Warming up and Cooling Down** : Introduction, Method type of Warm Up, Significance and Guidelines.

**UNIT – IV(15 Hrs.)**

- **Long Jump** : Introduction, Rules, Layout, Techniques and Arjuna Awardees.
- **Hockey & Basketball**: History, Layout, General Rules and Regulations, Officials, Major tournaments and Arjuna Awardees.
- **Sports Awards**:
  (a) Maharaja Ranjit Singh
  (b) Arjuna Award
  (c) Dronacharya Award
  (d) MAKA Trophy
  (e ) Rajiv Gandhi Khel Ratan Award

**PRACTICAL (40 MARKS)**
**BASKETBALL, HOCKEY AND LONG JUMP**

Evaluation will be based on skill test, Performance, Practical file and Viva Voce.

********END*******

*References:*

(a) *Dr. Nishan Singh Deol (1980) : Text book of Physical Education & Sports. ( AP Publishers, Jalandhar).*

(b) *Singh Ajmer et al (2000) : Modern Text Book of Physical Education, Health and Sports", Kalyani Publishers, Ludhiana*

## ELECTIVE ENGLISH - II

**Subject Code: BACSD1-215** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| **CO1** | **Improving Language Proficiency:** Enhance overall language skills, including speaking, listening, reading, and writing, to communicate effectively in English | | | **2** | | **3** | **1** |
| **CO2** | **Grammar and Vocabulary:** Develop a solid understanding of English grammar rules | | | **2** | | **2** | |
| **CO3** | **Writing Skills:** Develop the ability paragraph writing | **1** | | **2** | | **1** | **1** |

### UNIT – I (15 Hrs.)

- literary Terms : Prose, Essay, Expository Essay, Analytical essay, Lyrical essay, Descriptive Essay, Imaginative Essay, Philosophical Essay, short Story, Long story, Drama Dramatic plot, Character, Incident, setting, Structure Tragedy, Comedy, Tragi - comedy.

### UNIT – II (15 Hrs.)

- Paragraph writing. (based on outline, a situation a string of questions etc).
- Applied Grammar
  (a) Corrections.
  (b) Use of the same words as different Parts of speech.

### UNIT – III (15 Hrs.)

- Translation from vernacular into English
- Antonyms / Synonyms

### UNIT – IV (15 Hrs.)

A Collection of essays ,short stories & one acts plays : Ed RK Kaushik & SC Bhatia ,New Delhi ,OUP ,2006

## ECONOMICS - II

**Subject Code: BACSD1-216** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | To provide students with an overview of the economics concepts, theories and models related to macro economics | | 2 | 2 | | 3 | 1 |
| CO2 | To understand the fundamental principles of Money and Banking; income and employment | | 2 | 2 | 1 | 2 | |
| CO3 | To study inflation, theories of inflation, policies for stabilization of inflation | | 2 | 2 | | 3 | 1 |

### UNIT – I (15 Hrs.)

Introduction : Nature ,Meaning and Scope of Macro Economics.
Consumption Function: Average and Marginal Propensity to consume.
Investment Function: Types of Investment, Investment Demand Schedule and factors affecting investment decisions.

### UNIT – II (15 Hrs.)

Determination of income & employment: Classical & Keynesian theories of income output &employment ,says 's law of market.

### UNIT – III (15 Hrs.)

Money – Definition, function, role Quantity theory of money – fishers's equation Keynesian liquidity preference theory
Banking: Major function & meaning of commerce banks.

### UNIT – IV (15 Hrs.)

Inflation and macro economics polices : Cost push and demand pull theories of inflation.
Monetary & fiscal policies for stabilization.

*Reference Books:*

(a) *Macro Economics : Sharma ,OP (Punjabi Medium)*
(b) *Macro Economics – TR Jain, Ashok Gupta.*

## ਪੰਜਾਬੀਇਲੈਕਟਿਵ - II

**Subject Code: BACSD1-217** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 |
|---|---|---|---|---|---|---|---|
| CO1 | **Language Skills:** Enhance reading, writing, listening, and speaking skills in Punjabi | 3 | 1 | 2 | | | |
| CO2 | **Writing Skills:** Learn to write story in Punjabi | 3 | | 2 | | 1 | |
| CO3 | **Reading Comprehension:** Improve the ability to read and understand Punjabi text written by famous authors, poems by Punjabi poets | 2 | | 1 | 2 | | |

### ਪਾਠਕ੍ਰਮ

1. ਆਧੁਨਿਕਪੰਜਾਬੀਕਵਿਤਾਦਾਅਧਿਐਨ
2. ਭਾਰਤੀਕਾਵਿਸ਼ਾਸ਼ਤਰ
3. ਸਾਹਿਤਆਲੋਚਨਾ

### ਯੂਨਿਟ – I (Hrs)

)ੳ (ਨਕਸ਼ ਨੁਹਾਰਕਾਵਿਪੁਸਤਕਵਿੱਚੋਂਪ੍ਰਸੰਗਸਹਿਤਵਿਆਖਿਆ।

)ਅ (ਕਾਵਿਸੰਗ੍ਰਹਿਵਿੱਚੋਂਕਿਸੇਇਕਕਵਿਤਾਦਾਵਿਸ਼ਾ ਵਸਤੂ।

### ਯੂਨਿਟ – II (Hrs)

ਧੁਨੀ ਸੰਪਰਦਾਇ ।

### ਯੂਨਿਟ – III (Hrs)

ਅਲੰਕਾਰ ਸੰਪਰਦਾਇ) ਮੁੱਢਲੀਜਾਣਪਛਾਣ(।

### ਯੂਨਿਟ – IV (Hrs)

ਸਾਹਿਤਆਲੋਚਨਾ : ਸਾਹਿਤਦੀਪ੍ਰੀਭਾਸ਼ਾ, ਪ੍ਰਕ੍ਰਿਤੀਅਤੇਤੱਤ।

- ਕੋਰਸ

  .ਨਕਸ਼ਨੁਹਾਰ, (ਸੰਪਾਦਕ) ਡਾ. ਜਸਵਿੰਦਰਸਿੰਘਆਧੁਨਿਕਪੰਜਾਬੀਕਵਿਤਾ (1901 ਈ. ਤੋਂ 2000 ਈ. ਤੱਕ) ਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋ।

ਸਹਾਇਕਪੁਸਤਕਾਂ: (ਨਿਰਧਾਰਿਤ ਕਵੀ: ਪਾਸ਼, ਸੰਤ ਰਾਮ ਉਦਾਸੀ, ਸੁਰਜੀਤ ਪਾਤਰ, ਜਸਵੰਤ ਦੀਦ, ਨਵਤੇਜ ਭਾਰਤੀ, ਸੁਖਵਿੰਦਰ ਅੰਮ੍ਰਿਤ, ਦਰਸ਼ਨ ਬੁਲੰਦਵੀ, ਜਸਵਿੰਦਰ, ਸੁਖਪਾਲ) ।

1. ਜੱਗੀ, ਰਤਨਸਿੰਘ (ਡਾ.) ਸਾਹਿਤਦੇਰੂਪਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋ, ਪੰਜਾਬੀਯੂਨੀਵਰਸਿਟੀਪਟਿਆਲਾ।
2. ਪਾਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ (ਆਧੁਨਿਕਕਾਲ) ਭਾਸ਼ਾਵਿਭਾਗ, ਪਟਿਆਲਾ।

## ਵਿਸ਼ਾ: ਸਮਾਜ ਸ਼ਾਸਤਰ – II (Sociology –II)

**ਸਮੈਸਟਰ – ਦੂਜਾ**

**Subject Code: BACSD1-218** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

| COs | Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|
| CO1 | Articulate a sociological perspective. Apply sociological theories to understand social phenomena. | | 2 | 3 | | | 1 |
| CO2 | Critically evaluate explanations of human behavior and social phenomena. | | 2 | 2 | 1 | | 1 |
| CO3 | Use sociological knowledge to inform policy debates and promote public understanding. | | | 3 | 1 | 1 | |

### ਯੂਨਿਟ – I (15 Hrs.)

- ਸਮਾਜਿਕ ਸਤਰੀਕਰਣ : ਅਰਥ, ਪਰਿਭਾਸ਼ਾ, ਕਾਰਜ, ਆਧਾਰ
- ਸਮਾਜਿਕ ਅਸਮਾਨਤਾਵਾਂ : ਅਰਥ, ਪਰਿਭਾਸ਼ਾ, ਆਧਾਰ

### ਯੂਨਿਟ – II (15 Hrs.)

- ਕਾਰਲ ਮਾਰਕਸ : ਸੰਘਰਸ਼ ਦਾ ਸਿਧਾਂਤ
- ਮੈਕਸ ਵੈਬਰ : ਬਹੁ ਆਯਾਮੀ ਸਿਧਾਂਤ

### ਯੂਨਿਟ – III (15 Hrs.)

- ਜਾਤ : ਅਰਥ, ਪਰਿਭਾਸ਼ਾ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ
- ਜਮਾਤ : ਅਰਥ, ਪਰਿਭਾਸ਼ਾ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ

### ਯੂਨਿਟ – IV (15 Hrs.)

- ਸਮਾਜਿਕ ਗਤੀਸ਼ੀਲਤਾ : ਅਰਥ, ਕਾਰਨ, ਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਕਿਸਮਾਂ

Recommended Books:

1. Ghurya G.S. (1983) : Cast, Class and occupation, Bombay Popular Prakashan
2. Bendix, RS Lipset, SM (1974) : Class, Status, Power, Social Stratification in comparative perspective, London, Routledge & Kegan Paul

## Web Designing-II

Subject Code: BACSD1-219 L T P C Duration: 60 Hrs.

4 0 0 4

| COs | Course Outcomes | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 |
|---|---|---|---|---|---|---|---|
| **CO1** | Describe basic knowledge of DHTML and CSS | | | **3** | | **2** | |
| **CO2** | Analyze the utility of different tools in web designing for different applications | | | **2** | | **3** | |
| **CO3** | Students should be able to design and implement a basic website. | **1** | | **3** | | **3** | |

## UNIT - I

**Introduction to DHTML:** Basics of DHTML, difference between HTML & DHTML, Structure of an DHTML program, client-side script and server-side script.

## UNIT - II

**CSS:** introduction to CSS3, ways to Insert CSS in HTML document (External Style Sheet, Internal Style Sheet, Inline Styles), CSS id and class, div and span tag.

## UNIT - III

**CSS background**: background color, background image (repeat horizontally or vertically, set position and no-repeat)

**CSS Text:** text color, text alignment, text decoration

**CSS Font:** style, family, SizeCSS lists, CSS Links

## UNIT - IV

**CSS Tables:** Table borders, collapse borders, table width and height, table text alignment, table padding, table color.

**CSS border:** style, width, color

**CSS margin:** margin, padding

***Faculty members can take practical sessions during the lectures.***

**Recommended Books:**

1. Kogent Learning Solutions Inc.," HTML 5 in simple steps", Dreamtech Press.

2. Murray, Tom/Lynchburg," Creating a Web Page and Web Site",2002.

3. Steven M. Schafer," HTML, XHTML, and CSS Bible, 5ed", Wiley India.

# SEMESTER - III

**ਪੰਜਾਬੀਲਾਜਮੀ - III**

**Subject Code: BACSS1-302** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

**ਪਾਠਕ੍ਰਮ**

1. ਪੰਜਾਬੀਸੱਭਿਆਚਾਰਬਾਰੇਨਿਬੰਧਾਂਦਾਅਧਿਐਨ
2. ਚਿੱਠੀ-ਪੱਤਰ
3. ਵਿਆਕਰਨ : ਸਿਧਾਂਤਤੇਵਿਹਾਰ

**ਯਨਿਟਅਤੇਥੀਮ**

1. (ੳ) 'ਪੰਜ - ਆਬ' ਪੁਸਤਕਵਿੱਚੋਂਕਿਸੇਇਕਨਿਬੰਧਦਾਵਿਸ਼ਾਦੱਸਕੇਸਾਰਲਿਖਣਾ।
   (ਅ) 'ਪੰਜ - ਆਬ' ਪੁਸਤਕਵਿੱਚੋਂਸੰਖੇਪਉੱਤਰਾਂਵਾਲੇਪ੍ਰਸ਼ਨ।
2. ਚਿੱਠੀਪੱਤਰ (ਦਫ਼ਤਰੀ, ਵਪਾਰਕ, ਸਮਾਜਿਕ, ਸੱਭਿਆਚਾਰਕਮਸਲਿਆਂਬਾਰੇਸੰਪਾਦਕਨੂੰਪੱਤਰ)
3. ਵਿਆਕਰਨ : ਸਿਧਾਂਤਤੇਵਿਹਾਰ
   ਸ਼ਬਦਤੇਸ਼ਬਦਰਚਨਾ : ਪਰਿਭਾਸ਼ਾਤੇਵਰਗੀਕਰਨ
   ਭਾਵੰਸ਼ : ਬੰਦਤੇਖੁੱਲ੍ਹੇ

- ਕੋਰਸ

  'ਪੰਜ - ਆਬ' ਪੁਸਤਕ (ਸੰਪਾਦਕ) ਪ੍ਰੋ. ਭੁਪਿੰਦਰਸਿੰਘਖਹਿਰਾ।

ਸਹਾਇਕਪੁਸਤਕਾਂ : 1. ਹਰਕੀਤਰਸਿੰਘ (ਡਾ.) ਕਾਲਜਪੰਜਾਬਵਿਆਕਰਨ, ਪੰਜਾਬਸਟੇਟਯੂਨੀਵਰਸਿਟੀਟੈਕਸਟਬੁੱਕਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ 1999।

2. ਜੱਸਲਕੰਵਲਜੀਤ, ਪੰਜਾਬੀਵਿਆਕਰਨਦੇਕੁੱਝਪੱਖ, ਰਵੀਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨਹਾਲ, ਬਾਜਾਰਅਮ੍ਰਿਤਸਰ 2012।

## GENERAL ENGLISH - III

**Subject Code: BACSS1-301** | **L T P C 4 0 0 4** | **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:**To demonstrate awareness of English language and literature in various contexts.
**CO2:**To get basic knowledge of the English grammar when they acquire their degree.
**CO3:**To communicate and present the ideas and use of sources accurately and efficiently.
**CO4:**To acquaint the students with cultural and behavioral approaches for global competence.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

### UNIT- 1 (Poetry) (15 Hrs.)

i.) Ode to autumn - John keats.
ii.) The road not taken - Robert frost.
iii.) Money madness – D.H. Lawrence.
iv.) I, Too - langston hughes.

### UNIT -2 (prose) (15 Hrs.)

i.) On letter writing - A.G. Gardiner.
ii.) Not Just Oranges - Isai Tobolsky.
iii.) Film-making - Satyajit Ray.
iv.) Work brings solace – A.P.J. Abdul Kalam.

### UNIT-3(15 Hrs.)

i.) Note – making (one out of two is to attempted).
ii.) Do as dissected (based on transformation of sentences).

### UNIT- 4(15 Hrs.)

i.) Non- five verbs.
ii.) Punctuation (A short paragraph).

**Test prescribed for 3,4 Semester English for empowerment, eds, G.Damoda. D.Venkateshwarlu, M.Narendra,M.Sarat Babu, G.M.Sundera valli,Hydranad; orient black swan,2009.**

## COMPUTER NETWORKS AND INTERNET APPLICATIONS

**Subject Code: BACSS1-303** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** The ability to understand analyze and develop computer program in the areas related to algorithms , system software , multimedia web design, application program , database , graphics and networking for efficient design of computer based system of varying complexities.
**CO2:** To inculcate knowledge on graphics and multimedia concepts.
**CO3:** To get sufficient knowledge on various system resources.
**CO4:** To support automation and digitization in all walks of life.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | 3 | | | 2 | | | | | 2 | 2 |
| CO2 | | | | | | 2 | | | | | 3 | 2 |
| CO3 | | | 3 | | | 2 | | | | | | |
| CO4 | | | | | | 3 | | | | | 3 | |

### UNIT-I(15 Hrs.)

**Introduction:** Internet and its working, Business use of Internet, Services offered by Internet, Evaluation of Internet, Internet Service Provider (ISP), Windows environment for dial up networking (connecting to Internet), Audio on Internet, Internet Addressing (DNS) and IP addresses).

ਜਾਣ-ਪਛਾਣ:ਇੰਟਰਨੈਟਅਤੇਇਸਦਾਕੰਮਕਾਜ, ਇੰਟਰਨੈਟਦੀਵਪਾਰਕਵਰਤੋਂ, ਇੰਟਰਨੈਟਦੁਆਰਾਪੇਸ਼ਕੀਤੀਆਂਜਾਂਦੀਆਂਸੇਵਾਵਾਂ, ਇੰਟਰਨੈਟਦਾਮੁਲਾਂਕਣ, ਇੰਟਰਨੈਟਸੇਵਾਪ੍ਰਦਾਤਾ (ISP), ਡਾਇਲਅੱਪਨੈਟਵਰਕਿੰਗ (ਇੰਟਰਨੈੱਟਨਾਲਜੁੜਨਾ), ਇੰਟਰਨੈਟਤੇਆਡੀਓ, ਇੰਟਰਨੈਟਐਡਰੈਸਿੰਗ (DNS) ਅਤੇ IP ਪਤੇ)।

### UNIT-II(15 Hrs.)

**Introduction to Computer networks and applications:** Network Structure and Architecture, Network Hardware and Software (protocol hierarchies, design issues for layers, interfaces and services: connection oriented and connection less), Network structure and architecture-point to point, multicast, broadcast, Classification of networks on the basis of Geographical Span (PAN, LAN, MAN and WAN), LAN topologies (Bus, Ring, Star, Mesh, Tree and Hybrid). Network Connecting Devices: Repeaters, Hubs, Bridges, Routers, Gateways and Switches, Network Reference models: OSI model, TCP / IP model. Comparison between OSI and TCP/IP.

ਕੰਪਿਊਟਰਨੈੱਟਵਰਕਾਂਅਤੇਐਪਲੀਕੇਸ਼ਨਾਂਦੀਜਾਣ-ਪਛਾਣ:ਨੈੱਟਵਰਕਢਾਂਚਾਅਤੇਆਰਕੀਟੈਕਚਰ, ਨੈੱਟਵਰਕਹਾਰਡਵੇਅਰਅਤੇਸੌਫਟਵੇਅਰ (ਪ੍ਰੋਟੋਕੋਲਲੜੀ, ਲੇਅਰਾਂ, ਇੰਟਰਫੇਸਅਤੇਸੇਵਾਵਾਂਲਈਡਿਜ਼ਾਈਨਮੁੱਦੇ:

ਕੁਨੈਕਸ਼ਨਓਰੀਐਂਟਡਅਤੇਕੁਨੈਕਸ਼ਨਘੱਟ), ਨੈੱਟਵਰਕਬਣਤਰਅਤੇਆਰਕੀਟੈਕਚਰ-ਪੁਆਇੰਟਟੂਪੁਆਇੰਟ, ਮਲਟੀਕਾਸਟ, ਪ੍ਰਸਾਰਣ, ਵਰਗੀਕਰਨ।ਭੂਗੋਲਿਕਸਪੈਨ (PAN, LAN, MAN ਅਤੇ WAN), LAN ਟੌਪੋਲੋਜੀਜ਼ (ਬੱਸ, ਰਿੰਗ, ਸਟਾਰ, ਜਾਲ, ਰੁੱਖਅਤੇਹਾਈਬ੍ਰਿਡ) ਦੇਆਧਾਰ,ਤੇਨੈੱਟਵਰਕਾਂਦਾ।ਨੈੱਟਵਰਕਕਨੈਕਟਕਰਨਵਾਲੇਯੰਤਰ: ਰੀਪੀਟਰ, ਹੱਬ, ਬ੍ਰਿਜ, ਰਾਊਟਰ, ਗੇਟਵੇਅਤੇਸਵਿੱਚ, ਨੈੱਟਵਰਕਰੈਫਰੈਂਸਮਾਡਲ: OSI ਮਾਡਲ, TCP/IP ਮਾਡਲ। OSI ਅਤੇ TCP/IP ਵਿਚਕਾਰਤੁਲਨਾ।

**UNIT-III(15 Hrs.)**

**Internet Protocol** - Introduction, File transfer protocol (FTP), Gopher, Telnet, other protocols like HTTP and TCP/IP.

**Application Layer:** World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), Introduction to Network security.

ਇੰਟਰਨੈੱਟਪ੍ਰੋਟੋਕੋਲ - ਜਾਣ-ਪਛਾਣ, ਫਾਈਲਟ੍ਰਾਂਸਫਰਪ੍ਰੋਟੋਕੋਲ (FTP), ਗੋਫਰ, ਟੇਲਨੈੱਟ, HTTP ਅਤੇ TCP/IP ਵਰਗੇਹੋਰਪ੍ਰੋਟੋਕੋਲ।

ਐਪਲੀਕੇਸ਼ਨਲੇਅਰ: ਵਰਲਡਵਾਈਡਵੈੱਬ (WWW), ਡੋਮੇਨਨੇਮਸਿਸਟਮ (DNS), ਈ-ਮੇਲ, ਫਾਈਲਟ੍ਰਾਂਸਫਰਪ੍ਰੋਟੋਕੋਲ (FTP), ਨੈੱਟਵਰਕਸੁਰੱਖਿਆਦੀਜਾਣ-ਪਛਾਣ।

**UNIT-IV(15 Hrs.)**

**Search Engine:** About search engine, Component of search engine, working of search engine, Difference between search engine and web directory.

**Intranet and Extranet** - Introduction, Application of Intranet, Business value of Intranet, working of Intranet, Role of Extranet, working of Extranet, Difference between Intranet and Extranet.

ਖੋਜਇੰਜਣ: ਖੋਜਇੰਜਣਬਾਰੇ, ਖੋਜਇੰਜਣਦਾਹਿੱਸਾ, ਖੋਜਇੰਜਣਦਾਕੰਮ, ਖੋਜਇੰਜਣਅਤੇਵੈਬਡਾਇਰੈਕਟਰੀਵਿੱਚਅੰਤਰ।

ਇੰਟ੍ਰਾਨੈੱਟਅਤੇਐਕਸਟ੍ਰਾਨੈੱਟ - ਜਾਣ-ਪਛਾਣ, ਇੰਟ੍ਰਾਨੈੱਟਦੀਵਰਤੋਂ, ਇੰਟ੍ਰਾਨੈੱਟਦਾਵਪਾਰਕਮੁੱਲ, ਇੰਟ੍ਰਾਨੈੱਟਦਾਕੰਮਕਰਨਾ, ਐਕਸਟ੍ਰਾਨੈੱਟਦੀਭੂਮਿਕਾ, ਐਕਸਟ੍ਰਾਨੈੱਟਦਾਕੰਮਕਰਨਾ, ਇੰਟ੍ਰਾਨੈੱਟਅਤੇਐਕਸਟ੍ਰਾਨੈੱਟਵਿਚਕਾਰਅੰਤਰ।

## HISTORY - III

**Subject Code: BACSD1-311** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** To identify and analyze contemporary issues and concerns and find solutions.
**CO2:** To develop the ability of critical and logical thinking, select relevant facts , establish relationships and draw inferences and conclusions .
**CO3:** Acquaint with range of issues related to Indian history that span distinct eras.
**CO4:** Think and argue historically and critically in writing and discussion.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 3 | | 3 | 1 | 2 | | | |
| CO2 | | | | | | | 3 | 3 | 3 | | | |
| CO3 | | | | | | | | | 3 | | | |
| CO4 | 3 | | 3 | | | | | 2 | | | | |

### UNIT – I(15 Hrs.)

Foundation of Muslim Rule in India-Invention of Mehmud Ghaznavi and Mohammad Ghori, Establishment of Delhi Sutanate, Rise and Growth of The Khilji's, Tuqhlaq Dyansty, Vijay Nagar Empire.

ਭਾਰਤਵਿੱਚਮੁਸਲਿਮਸ਼ਾਸਨਦੀਸਥਾਪਨਾ, ਖਿਲਜੀਵੰਸ਼, ਤੁਗਲਕਵੰਸ਼, ਵਿਜੇਨਗਰਸਾਮਰਾਜ

### UNIT – II(15 Hrs.)

Babar (1526-30 A.D.), Humayun (1530-40), (1555-56 A.D.), Shershah Suri, (1540-45 A.D.) Akbar The Great, (1556-1605 A.D.) Mughal Government.

ਬਾਬਰ 1526-30 ਈ,. ਹੁਮਾਯੂੰ,1530-40 ,1555-56 ਈ,. ਸ਼ੇਰਸ਼ਾਹਸੂਰੀ) 1540-45 ਈ,(.ਅਕਬਰਮਹਾਨ )1556-45 A.D.), ਮੁਗਲਸ਼ਾਸਨਵਿਵਸਥਾ।

### UNIT – III(15 Hrs.)

Jahangir 1605-27 A.D., Shah Jahan 1627-58 A.D., Aurangazeb 1658-1707 A.D., Rise and Establishment of Maratha Power, Deccan Policy of Mughals.

ਜਹਾਂਗੀਰ 1605-27 ਈ, ਸ਼ਾਹਜਹਾਂ 1627-58 ਈ,. ਔਰੰਗਜੇਬ 1658-1707 ਈ,. ਮਰਾਠਾਸ਼ਕਤੀਦੀਸਥਾਪਨਾ, ਮੁਗਲਾਂਦੀਆਂਉੱਤਰ_ਪੱਛਮੀਸੀਮਾਂਨੀਤੀ।

### UNIT – IV(15 Hrs.)

Society and Economy in 16th and 17th CE Literature Art and Architecture under the Mughals, Bhakti Movement and Sufisim Rajputs and Religious Policies of the Mughals causes of decline of Mughal Empire.

16ਵੀ-17ਵੀਸਦੀਆਂਵਿੱਚਸਮਾਜਦੀਅਰਥਿਕਵਿਵਸਥਾਮੁਗਲਾਂਅਧੀਨਸਹਿਤਕਲਾਅਤੇਭਵਨਨਿਰਮਾਨਕਲਾ, ਭਾਰਤੀਅੰਦੋਲਨਅਤੇਸੂਫੀਮੱਤ, ਮੁਗਲਸਮਰਾਟਾਦੀਆਂਰਾਜਪੂਤਅਤੇਧਾਰਮਿਕਨੀਤੀਆਂ, ਮੁਗਲਸਾਮਰਾਜਦੇਪਤਨਦੇਕਾਰਨ।

**Books: -**

History of Medieval India (From 1000 A.D. to 1750 A.D.)

ਮੱਧਕਾਲੀਨਭਾਰਤਦਾਇਤਿਹਾਸ) 1000 ਈ.ਤੋਂ 1750 ਈ.)

## POLTICAL SCIENCE - III

**Subject Code: BACSD1-312** | **L T P C** **4 0 0 4** | **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** Get a comprehensive overview of polity and the various stages through which it evolved in the world.

**CO2:** Gain understanding of the intricacies of democratic system of the states and center level in India.

**CO3:** Get to know of the important notes and concepts of various political thinkers and philosophers of the world.

**CO4:** To observe and think critically of the politically events of the country and abroad.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | 2 | | | 2 | 1 | | | |
| CO2 | | | 3 | | 2 | | | 2 | | | | |
| CO3 | | | 3 | | 2 | | | 2 | | | | |
| CO4 | | | | | 2 | | | 2 | | | | |

### UNIT – I (15 Hrs.)

- United Notices which Human Rights Provisions, Native and Characteristics of Human Rights Preamble of the Human Rights.
- Philosophy of the Declaration of Human Rights: Philosophy of Human Rights, classification of the Rights Included in Declaration.

### UNIT – II (15 Hrs.)

- Environment - Meaning and Definition, forms of Environment, Types of Environment. Need of Environment Protection.
- Environment Protection is a Global Issue and Efforts Made at National level and efforts Made at International Level.

### UNIT – III (15 Hrs.)

- Theories of Negative and Positive Liberty. Supporters of liberty Theory. Included positive and Negative and criticism of Positive Theory of liberty.
- Safeguard of liberty : Relationship between Authority to leave and liberty.

### UNIT – IV (15 Hrs.)

- Meaning of Equality - Characteristics of Equality Definitions of Equality, Various Dimensions of Equality.
- Facts Responsible for the Growth of Negative Liberalism or Individualism - Main supporters of Negative liberalism. Criticisms of Negative liberalism,

## MATHEMATICS (CALCULUS) – III

**Subject Code: BACSD1-313** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Apply critical thinking skills to solve applied problems.

**CO2:** Use knowledge skill necessary for immediate employment and acceptance into a graduate program.

**CO3:** Apply mathematical concepts and principles to perform computation.

**CO4:** Maintain a core of mathematical and technical knowledge that is adoptable to changing technologies and provide a solid foundation for future learning.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | 2 | | | | 3 |
| CO2 | | | 2 | | | | | | | | | 3 |
| CO3 | | | 3 | | | | | | | | | 3 |
| CO4 | | | 2 | | | | | | | | | 3 |

### UNIT-I(15 Hrs.)

Basic concept of limit and continuity, Properties of limit and classification of discontinuities, Properties of continuous functions, Differentiability and differentials, Successive differentiation and Leibnitz theorem, Derivatives of higher order, nth derivative of well-known functions.

### UNIT-II(15 Hrs.)

Concavity, Convexity, Points of inflexion, Increasing and decreasing function, Asymptotes, Polar curves, Multiple points, Tracing of Cartesian curves, Idea of some well-known parametric and polar curves, Curvature of a curve at a point, Radius of curvature for Cartesian, Parametric, Polar forms, Centre of curvature.

### UNIT-III(15 Hrs.)

Partial differentiation –Function of two variables, Partial derivatives of higher order, Homogeneous functions, Euler's theorem and its extension (with proof), Composite functions, Total derivative, Differentiation of implicit functions and composite functions, Jacobins and its properties.

### UNIT IV(15 Hrs.)

Tangent plane and normal to a surface, Maxima and Minima of functions of two variables, working rule to find the extreme values of a function z= f (x, y), Lagrange's method of undetermined multipliers, Gradient, Curl and Divergence, Geometrical interpretation and basic properties, Directional Derivative

## PHYSICAL EDUCATION - III

**Subject Code: BACSD1-314** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** To study the behavior of India and world physical education.

**CO2:** Learning how to resist unfavorable and working conditions, decreasing fatigue during professional activities and raising the quality of results.

**CO3:** Fostering of motivational attitude to the physical education, healthy life style and regular exercising.

**CO4:** Learning the methods of self control while exercising.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | 3 | | 3 | 1 | | |
| CO2 | | | 3 | | 3 | | 3 | | | 1 | | |
| CO3 | | | 3 | | 3 | | 3 | 1 | | 3 | | |
| CO4 | | | 2 | | | | 3 | | | | | |

**(THEORY – 60)**

### UNIT – I(15 Hrs.)

- **Play** : Introduction, Theories and Importance.
- **Childhood Adolescence** : Growth and Development (Physical, Mental, Mental, Emotional & Social
- **Age and Sex Differences**: Introduction, Age & Sex differences, Structural difference Physiological differences and Gynecological differences.

### UNIT – II(15 Hrs.)

- **Yoga**: Introduction, Aim, Importance and Types of Yoga.
- **Pranayam**: Meaning, Types, Objectives and its Importance.
- **Shudhi Kriyas** : Introduction, Types, Objectives and its Effects.

### UNIT – III(15 Hrs.)

- **Physiology of Asanas** : Effective on various system of body.
- **Endocrine System**: Introduction, Glands, Location & Functions.
- **Excretory System**: Introduction, Organs, Structure and Functions.

### UNIT – IV(15 Hrs.)

- **Asanas** : Introduction, Importance, Types and Techniques of Padamasana, Vajrasana, Sukhasana, Shavasana, Makarasana, Halasna, Mayurasna and Chakrasna.
- **Kabaddi (National style)** : History, Layout, General Rules and Regulations, Officials, Major Tournaments and Arjuna Awardees.
- **Shot put** : Rules, Layout and Techniques.

### PRACTICAL (40 MARKS)

### KABADDI, YOGA AND SHOT PUT

Evaluation will be based on skill test, Performance, Practical file and Viva Voce.

## ELECTIVE ENGLISH - III

**Subject Code: BACSD1-315** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Students are encouraged and enabled to read various types of text on their own and discuss them among peers.
**CO2:** Students can develop their linguistic and pragmatic competence for learning.
**CO3:** Students are introduced to the grammatical properties in order to enable them to write and speak English consciously.
**CO4:** Students are introduced to appropriate literary strategies to read literature.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 2 | 2 | | | 2 | | | | | |
| CO3 | 3 | | 2 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 2 | 3 | | | 2 | | | | | |

### UNIT – I (15 Hrs.)

- Literally Terms :Drama, Myth of Dionysus, Liturgical Drama, Miracle plays Mystery Plays, Interlude, Mimesis catharsis, Tragic Hero, organic unity, Revenge Tragedy, Poetic Drama, Verse Drama, Myth & Drama, Ritual & Drama, Yaksyana Theory. Indian theory of Drama, Puppelty, Ardharishwara

### UNIT – II (15 Hrs.)

- . W. Shakespheare - The Merchant of Venice.

### UNIT – III (15 Hrs.)

- Grammar
  (a) Dialogue writing ( Based on a descriptive Passage of 300-400 words)
  (b) Identify figures of speech in Sentences (Unseen) Simite, Metaphor, Alliteration, Assonance.

### UNIT – IV (15 Hrs.)

- Grammar
  (a) Idioms and Pleases
  (b) One word substitution.
  (c) Comprehension. (un seen Passage)

## ECONOMICS - III

**Subject Code: BACSD1-316** | **L T P C 4 0 0 4** | **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** Developing the skill of data collection and use of sampling technique in research.
**CO2:** Developing the knowledge about theories of economic growth and development and issues of economic planning.
**CO3:** Understanding various issues of population, poverty, availability of resources and uses of Natural resources for sustainable development.
**CO4:** Developing research knowledge in economics.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | 2 | | | | 1 | 3 |
| CO2 | | | 3 | | | 1 | | | | | | |
| CO3 | | | | 1 | 3 | | | | 2 | | | |
| CO4 | | | 3 | | | | | | | | | |

### UNIT – I (15 Hrs.)

Introduction to public Finance: Nature, Scope, importance.
Public Expenditure: Meaning, Features, Importance Objectives, Principle of maximum social advantages, Wiseman peacock hypothesis causes for the recent growth of public expenditure in India.
Taxation: Meaning, Types of Tax, Classification of good Tax System.

### UNIT – II (15 Hrs.)

Incidence and Impact of Taxation: Demand & Supply Theory.
Taxable capacity: Absolute & Relative capacity, Determinates of taxable capacity.
Public Debt: Meaning Types, Role, Methods of its redemption.
Deficit Financing: Meaning, Objectives, Limitation.

### UNIT – III (15 Hrs.)

Pure Theory of International Trade: Classical Theories, the Theory of reciprocal Demand.
Trade: Concept, Meaning and Types.

### UNIT – IV (15 Hrs.)

Exchange Rates: Meaning & its Determination, fixed v/s flexible rate of exchange.
IMF and IBRD: Meaning ,objectives working ,achievements

*Reference Books:*

(a) *Sharma ,OP, Sarvjnik vit,Punajbi University Patiala.*
(b) *Bhatia H.L- Public finance, vikas publishing house Pvt Ltd.*
(c) *Public Finance & International Economics: TR Jain, Satpal Gupta.*

## ਪੰਜਾਬੀਇਲੈਕਟਿਵ - III

**Subject Code:** **BACSD1-317** | **L T P C** **4 0 0 4** | **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 1 | | | | 1 | | | | | |
| CO2 | | | 1 | 3 | | | 1 | | 3 | 3 | | |
| CO3 | 3 | | 2 | 3 | | | 1 | | 2 | 2 | | |
| CO4 | | | 2 | | | | | | 3 | 2 | | |

## ਪਾਠਕ੍ਰਮ

1. ਮੱਧਕਾਲਦੀਚੋਣਵੀਕਵਿਤਾ
2. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ : ਗੁਰਮਤਿਕਾਵਿ
3. ਭਾਸ਼ਾਵਿਗਿਆਨ

## ਯੂਨਿਟਅਤੇਥੀਮ

1. (ੳ) ਮੱਧਕਾਲੀਪੰਜਾਬੀਕਾਵਿਰੰਗਪੁਸਤਕਵਿੱਚੋਂਪ੍ਰਸੰਗਸਹਿਤਵਿਆਖਿਆ।
   (ਅ) ਕਾਵਿਪੁਸਤਕਵਿੱਚੋਂਦਾਵਿਸ਼ਾ- ਵਸਤੂ।ਭਾਰਤੀਕਾਵਿਸ਼ਾਸ਼ਤਰ।

2. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ (ਗੁਰਮਤਿਕਾਵਿ) ਸੰਖੇਪਉਤਰਾਂਵਾਲੇਪ੍ਰਸ਼ਨ।
3. ਭਾਸ਼ਾਵਿਗਿਆਨ : ਟਕਸ਼ਾਲੀਭਾਸ਼ਾ, ਵਿਅਕਤੀਭਾਸ਼ਾ, ਅਪਭਾਸ਼ਾਗੁਪਤ, ਗੁਪਤਭਾਸ਼ਾ।

- <u>ਕੋਰਸ</u>

  ਮੱਧਕਾਲੀਪੰਜਾਬੀਕਾਵਿ-ਰੰਗ (ਸੰਪਾਦਕ) ਡਾ. ਯੋਗਰਾਜਅੰਗਰਿਸ਼ਨਿਰਧਾਰਤਕਵੀ (ਗੁਰੂਨਾਨਕਦੇਵਜੀ, ਗੁਰੂਅਰਜਨਦੇਵਜੀ, ਗੁਰੂਤੇਗਬਹਾਦਰਜੀ, ਗੁਰੂਗੋਬਿੰਦਸਿੰਘਜੀ)

<u>ਸਹਾਇਕਪੁਸਤਕਾਂ</u>:

1. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ (1701-1900), ਪੰਜਾਬਯੂਨੀਵਰਸਿਟੀਚੰਡੀਗੜ੍ਹ।
2. ਉਹੀ, ‘ਸਿਧਾਂਤਕਭਾਸ਼ਾਵਿਗਿਆਨ, ਮਦਾਨਪਬਲੀਕੇਸ਼ਨਜ਼ਪਟਿਆਲਾ 2002।

# SEMESTER - IV

## ਪੰਜਾਬੀਲਾਜਮੀ - IV

**Subject Code: BACSS1-402** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

### <u>ਪਾਠਕ੍ਰਮ</u>

1 ਇਕਾਂਗੀ
2 ਪੰਜਾਬੀਦੀਆਂਉਪਭਾਸ਼ਾਵਾਂ
1. ਵਿਆਕਰਨ : ਸਿਧਾਂਤ

### <u>ਯਨਿਟਅਤੇਥੀਮ</u>

1. (ੳ) ‘ਛੇਛੱਲਾਂ’ ਇਕਾਂਗੀਸੰਗ੍ਰਹਿਦਾਵਿਸ਼ਾਸ਼ਾਰ।
   (ਅ) ‘ਛੇਛੱਲਾ’ ਵਿੱਚੋਂਪਾਤਰਚਿਤਰਨਕਰਨਾ।
2. ਇਕਾਂਗੀਸੰਗ੍ਰਹਿਵਿੱਚੋਂਪ੍ਰਸ਼ਨ _ ਉੱਤਰ
3. ਪੰਜਾਬੀਦੀਆਂਉਪ _ ਭਾਸ਼ਾਵਾਂ (ਮਾਝੀ, ਮਲਵਈ, ਦੁਆਬੀ)
4. ਵਿਆਕਰਨ : ਵਿਕਾਰੀਤੇਅਵਿਕਾਰੀਸ਼ਬਦ, ਸਧਾਰਨ, ਸਮਾਸੀ, ਮਿਸ਼ਰਤ, ਸ਼ਬਦਜੋੜਾਂਦੇਨਾਮ।

- <u>ਕੋਰਸ</u>

ਛੇਛੱਲਾ) ਸੰਪਾਦਕ (ਡਾ. ਆਤਮਜੀਤਸਿੰਘ, ਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋਇਕਾਂਗੀ।

<u>ਸਹਾਇਕਪੁਸਤਕਾਂ</u> : 1. ਹਰਕੀਤਰਸਿੰਘ) ਡਾ ,(. ਕਾਲਜਪੰਜਾਬੀਵਿਆਕਰਨ, ਪੰਜਾਬਸਟੇਟਯੂਨੀਵਰਸਿਟੀਟੈਕਸਟਬੁੱਕਬੋਰਡ, ਚੰਡੀਗੜ੍ਹ 1999।

2. ਬਰਾੜ, ਬੂਟਾਸਿੰਘ (ਡਾ.) ਸਿਧਾਂਤਕਭਾਸ਼ਾਵਿਗਿਆਨਅਤੇਵਿਹਾਰ, ਚੇਤਨਾਪ੍ਰਕਾਸ਼ਨਲੁਧਿਆਣਾ 2008।
3. ਜੱਸਲਕੰਵਲਜੀਤ, ਪੰਜਾਬੀਵਿਆਕਰਨਦੇਕੁੱਝਪੱਖ, ਰਵੀਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨਹਾਲ, ਬਾਜਾਰਅਮ੍ਰਿਤਸਰ 2012।

## GENERAL ENGLISH - IV

**Subject Code: BACSS1-401** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** To demonstrate awareness of English language and literature in various contexts.
**CO2:** To get basic knowledge of the English grammar when they acquire their degree.
**CO3:** To communicate and present the ideas and use of sources accurately and efficiently.
**CO4:** To acquaint the students with cultural and behavioral approaches for global competence.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

### UNIT- 1 (Poetry Section) (15 Hrs.)

i.) I will embrace only the sun - Tripuraneni srinivas.
ii.) Refugee mother and child - Chinua achebe.
iii.) This is a photograph of me - Margaret atwood.
iv.) I sit and look out - Walt Whitman.

### UNIT -2 (Prose Section) (15 Hrs.)

i.) On shaking hands – A.G. Gardiner.
ii.) Freedom of the press – Shashi tharoor.
iii.) No man is an island – Minoo Masani.
iv.) A service of love – O henry.

### UNIT- 3 (15 Hrs.)

i.) Repot writing.
ii.) Paragraph in 250 words.

### UNIT – 4 (15 Hrs.)

i.) Using nouns as verbs or vice versa.
ii.) Dialogue writing.

**Text prescribed: - English for empowerment.**

## MULTIMEDIA & ITS APPLICATIONS

**Subject Code: BACSS1-403** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** The ability to understand analyze and develop computer program in the areas related to algorithms , system software , multimedia web design, application program , database , graphics and networking for efficient design of computer based system of varying complexities.

**CO2:** To inculcate knowledge on graphics and multimedia concepts.

**CO3:** To get sufficient knowledge on various system resources.

**CO4:** To support automation and digitization in all walks of life.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | 3 | | | 2 | | | | | 2 | 2 |
| CO2 | | | | | | 2 | | | | | 3 | 2 |
| CO3 | | | 3 | | | 2 | | | | | | |
| CO4 | | | | | | 3 | | | | | 3 | |

### UNIT-I(15 Hrs.)

**Introduction:** Multimedia & its types, Hyper Media, Hyper Text, Multimedia system and its characteristics, challenges, desirable features, components and applications, Trends in Multimedia.

**ਜਾਣ-ਪਛਾਣ:** ਮਲਟੀਮੀਡੀਆਅਤੇਇਸਦੀਆਂਕਿਸਮਾਂ, ਹਾਈਪਰਮੀਡੀਆ, ਹਾਈਪਰਟੈਕਸਟ, ਮਲਟੀਮੀਡੀਆਸਿਸਟਮਅਤੇਇਸਦੀਆਂਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਚੁਣੌਤੀਆਂ, ਲੋੜੀਂਦੀਆਂਵਿਸ਼ੇਸ਼ਤਾਵਾਂ, ਭਾਗਅਤੇਐਪਲੀਕੇਸ਼ਨ, ਮਲਟੀਮੀਡੀਆਵਿੱਚਰੁਝਾਨ।

### UNIT-II(15 Hrs.)

**Multimedia Technology:** Multimedia systems technology, Multimedia Hardware devices, Multimedia Software devices, Multimedia Software development tools, Multimedia authoring tools, Multimedia standards for document architecture, Multimedia software for different media.

**ਮਲਟੀਮੀਡੀਆਟੈਕਨਾਲੋਜੀ:** ਮਲਟੀਮੀਡੀਆਸਿਸਟਮਤਕਨਾਲੋਜੀ, ਮਲਟੀਮੀਡੀਆਹਾਰਡਵੇਅਰਡਿਵਾਈਸ, ਮਲਟੀਮੀਡੀਆਸਾਫਟਵੇਅਰਡਿਵਾਈਸ, ਮਲਟੀਮੀਡੀਆਸਾਫਟਵੇਅਰਡਿਵੈਲਪਮੈਂਟਟੂਲ, ਮਲਟੀਮੀਡੀਆਆਥਰਿੰਗਟੂਲ, ਡੌਕੂਮੈਂਟਆਰਕੀਟੈਕਚਰਲਈਮਲਟੀਮੀਡੀਆਸਟੈਂਡਰਡ, ਵੱਖ-ਵੱਖਮੀਡੀਆਲਈਮਲਟੀਮੀਡੀਆਸਾਫਟਵੇਅਰ।

**UNIT-III(15 Hrs.)**

**Storage Media:** Magnetic and optical media RAID and RAID Levels, Compact Disks and DVDs and their standards, Multimedia servers.

**Audio:**Basics of Digital Audio, Applications of Digital Audio, Digitization of Sound, Sample Rates and bit size, Typical Audio Formats, Introduction to MIDI (Musical Instrument Digital Interface), Components of MIDI system, MIDI Hardware aspects, MIDI messages.

**ਸਟੋਰੇਜ਼ਮੀਡੀਆ**: ਚੁੰਬਕੀਅਤੇਆਪਟੀਕਲਮੀਡੀਆ RAID ਅਤੇ RAID ਪੱਧਰ, ਸੰਖੇਪਡਿਸਕਅਤੇ DVD ਅਤੇਉਹਨਾਂਦੇਮਿਆਰ, ਮਲਟੀਮੀਡੀਆਸਰਵਰ।

**ਆਡੀਓ:**ਡਿਜੀਟਲਆਡੀਓਦੀਆਂਮੂਲਗੱਲਾਂ, ਡਿਜੀਟਲਆਡੀਓਦੀਆਂਐਪਲੀਕੇਸ਼ਨਾਂ, ਧੁਨੀਦਾਡਿਜੀਟਾਈਜ਼ੇਸ਼ਨ, ਨਮੂਨਾਦਰਾਂਅਤੇਬਿੱਟਆਕਾਰ, ਆਮਆਡੀਓਫਾਰਮੈਟ, MIDI (ਸੰਗੀਤਸਾਧਨਡਿਜੀਟਲਇੰਟਰਫੇਸ) ਦੀਜਾਣ-ਪਛਾਣ, MIDI ਸਿਸਟਮਦੇਹਿੱਸੇ, MIDI ਹਾਰਡਵੇਅਰਪਹਿਲੂ, MIDI ਸੁਨੇਹੇ।

**UNIT-IV(15 Hrs.)**

**Image and Graphics Compression:**Color in Images, Types of Color Models, Graphic / Image File Format, TIFF, RIFF, BMP, PNG, PDF, Graphic / Image data, JPEG Compression, GIF Compression.

**ਚਿੱਤਰਅਤੇਗ੍ਰਾਫਿਕਸਕੰਪਰੈਸ਼ਨ**: ਚਿੱਤਰਾਂਵਿੱਚਰੰਗ, ਰੰਗਮਾਡਲਾਂਦੀਆਂਕਿਸਮਾਂ, ਗ੍ਰਾਫਿਕ / ਚਿੱਤਰਫਾਈਲਫਾਰਮੈਟ, TIFF, RIFF, BMP, PNG, PDF, ਗ੍ਰਾਫਿਕ / ਚਿੱਤਰਡੇਟਾ, JPEG ਕੰਪਰੈਸ਼ਨ, GIF ਕੰਪਰੈਸ਼ਨ।

## HISTORY - IV

**Subject Code: BACSD1-411** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To identify and analyze contemporary issues and concerns and find solutions.
**CO2:** To develop the ability of critical and logical thinking, select relevant facts , establish relationships and draw inferences and conclusions .
**CO3:** Acquaint with range of issues related to Indian history that span distinct eras.
**CO4:** Think and argue historically and critically in writing and discussion.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 3 | | 3 | 1 | 2 | | | |
| CO2 | | | | | | | 3 | 3 | 3 | | | |
| CO3 | | | | | | | | | 3 | | | |
| CO4 | 3 | | 3 | | | | | 2 | | | | |

### UNIT – I(15 Hrs.)

ਅਬਦੂਸਸਮਦਖਾਂ, ਜ਼ਕਰੀਆਂਖ਼ਾਂਅਤੇਮੀਰਮੰਨੂੰ, ਦਲਖ਼ਾਲਸਾਦਾਉੱਥਾਨਅਤੇਇਸਦੀਯੁੱਧਪ੍ਰਣਾਲੀ, ਮੁਗਲਾਂਅਧੀਨਪੰਜਾਬਦੀਸਮਾਜੀਕਅਤੇਆਰਥਿਕਅਵਸਥਾ।

Abdus Samad Khan, Zakariya Khan and Mir Mannu, Their relations with Sikhs, Rise of the Dal Khalsa and its mode of fighting social and economic conditions of the Punjab.

### UNIT – II(15 Hrs.)

ਅਹਿਮਦਸ਼ਾਹਅਬਦਾਲੀਦੇਹਮਲੇ, ਸਿੱਖਮਿਸਲਾਂ, ਮਹਾਰਾਜਾਰਣਜੀਤਸਿੰਘਦਾਜੀਵਨਅਤੇਜਿੱਤਾ।

Invasion of Ahmad Shah Abdali, The Sikh Misls, Maharaja Ranjit Singh's Career and consquests.

### UNIT – III(15 Hrs.)

ਐਂਗਲੋ_ਸਿੱਖਸੰਬੰਧ 1800-39 ਈ ,. ਰਣਜੀਤਸਿੰਘਦੇਅਫ਼ਗਾਨਿਸਤਾਨਨਾਲਸੰਬੰਧਅਤੇਉਸਦੀਉੱਤਰ_ਪੱਛਮੀਸੀਮਾਨੀਤੀ, ਮਹਾਰਾਜਾਰਣਜੀਤਸਿੰਘਦਾਸ਼ਾਸ਼ਨ।

Anglo-Sikh Relations 1800-39, Maharaja Ranjit Singh's Relations with Afghanistan and his N.W.F. Policy, Administration of Maharaja Ranjit Singh .

### UNIT – IV(15 Hrs.)

ਮਹਾਰਾਜਾਰਣਜੀਤਸਿੰਘਦਾਆਚਰਨਅਤੇਸ਼ਖਸੀਅਤ, ਪਹਿਲਾਐਂਗਲੋਯੂੱਧ, ਦੂਸਰਾਐਂਗਲੋਂਸਿੱਖਯੂੱਧ।

Character and Personality of Maharaja Ranjit Singh First and Second Anglo Sikh War.

**Books: -**
History of Punjab by Prof. Manjeet Singh Sodhi.

## POLTICAL SCIENCE - IV

**Subject Code: BACSD1-412** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** Get a comprehensive overview of polity and the various stages through which it evolved in the world.
**CO2:** Gain understanding of the intricacies of democratic system of the states and center level in India.
**CO3:** Get to know of the important notes and concepts of various political thinkers and philosophers of the world.
**CO4:** To observe and think critically of the politically events of the country and abroad.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | 2 | | | 2 | 1 | | | |
| CO2 | | | 3 | | 2 | | | 2 | | | | |
| CO3 | | | 3 | | 2 | | | 2 | | | | |
| CO4 | | | | | 2 | | | 2 | | | | |

### UNIT – I (15 Hrs.)

- **Social change :·** Meaning and definitions,characteristic of social change implication and modes of social change and ,factors of social change
- Theories of social change and hindrances of social change

### UNIT – II (15 Hrs.)

- **Democracy :·** Meaning, characteristics of democracy definitions and venous aspects of democracy kinds of democracy
- Merits and demerits of democracy

→ Necessary conditions for the success of democracy
→ Theory of democracy, liberal and elitist
→ Explanation of elitist theory of democracy

### UNIT – III (15 Hrs.)

- Marxist theory of democracy capitalist democracy, dictatorship of the proletariat socialist democracy
- Critical evaluation of the Marxian concept of the democracy.
- Difference between liberal democracy and Marxian democracy.

### UNIT – IV (15 Hrs.)

- Meaning of comparative government, meaning of comparative politics differences between comparative government comparative politics.
- Nature and politics characteristics of comparative government and politics, scope and utility of comparative government and politics.

## MATHEMATICS (ANALYTICAL GEOMETRY) - IV

**Subject Code: BACSD1-413** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Apply critical thinking skills to solve applied problems.
**CO2:** Use knowledge skill necessary for immediate employment and acceptance into a graduate program.
**CO3:** Apply mathematical concepts and principles to perform computation.
**CO4:** Maintain a core of mathematical and technical knowledge that is adoptable to changing technologies and provide a solid foundation for future learning.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | 2 | | | | 3 |
| CO2 | | | 2 | | | | | | | | | 3 |
| CO3 | | | 3 | | | | | | | | | 3 |
| CO4 | | | 2 | | | | | | | | | 3 |

### UNIT – I (15 Hrs.)

Transformation of axes, Shifting of origin, Rotation of axes, Reduction of the second degree equation into standard for ms by transformation of co -ordinates, Intersection of three planes, Condition for three planes to intersect in a point or along a line or to for m a prism.

### UNIT-II(15 Hrs.)

Co ne with a vertex at the origin as the graph of homogeneous equation of second degree in x, y, z, Cone as a surface generated by a line passing through a fixed curve and fixed point outside the plane of the curve, Right circular and elliptic cones.

### UNIT-III(15 Hrs.)

Cylinder as surface generated by a line moving parallel to a fixed line and through fixed curve. Different kinds of cylinders such as right circular, elliptic, hyperbolic and parabolic in standard forms.

### UNIT-IV(15 Hrs.)

Sphere, Section of a sphere b y a plane, Spheres of a given circle, Intersection of a line and a sphere, Tangent line, Tangent plane, Power of a point w.r.t. a sphere, Radical planes.

## PHYSICAL EDUCATION - IV

**Subject Code: BACSD1-414** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To study the behavior of India and world physical education.
**CO2:** Learning how to resist unfavorable and working conditions, decreasing fatigue during professional activities and raising the quality of results.
**CO3:** Fostering of motivational attitude to the physical education, healthy life style and regular exercising.
**CO4:** Learning the methods of self control while exercising.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | 3 | | 3 | 1 | | |
| CO2 | | | 3 | | 3 | | 3 | | | 1 | | |
| CO3 | | | 3 | | 3 | | 3 | 1 | | 3 | | |
| CO4 | | | 2 | | | | 3 | | | | | |

**(TEHEORY – 60 MARKS)**

**UNIT – I(15 Hrs.)**

- **Sports Psychology**: Introduction, Importance.
- **Learning:** Meaning, Laws of Learning and their Implication in Sports.
- **Transfer of Training** : Types and its application in Sports.

**UNIT – II(15 Hrs.)**

- **Motivation** : Introduction, Types, Methods of Motivation and its Importance in Physical Education and Sports
- **Personality** : Introduction, Types and Characteristics of Personality
- **First Aid** : Introduction, Principles, Qualities of First Aider, Process of Providing First Aid during different Calamity (Burns, Electric Shock, Heat Stroke, Drowning).

**UNIT – III(15 Hrs.)**

- **Muscles**: Structural and Function Classification of Muscles
- **Circulatory System** : Structure and Function of heart.
- **Sports Injuries** : Introduction, Causes, Symptoms, Treatment and Prevention of (Sprain, Strain, Contusion, Dislocation and Fracture).

**UNIT – IV(15 Hrs.)**

- **High Jump** : Rules and Regulations, Layout and Techniques.
- **Discus Throw** : Rules and Regulations, Layout and Techniques.
- **Kho- Kho** : History, Layout, General Rules and Regulation, Officials, Major Tournaments.

**PRACTICAL (40 MARKS)**

**KHO-KHO , HIGH JUMP AND DISCUS THROW**

Evaluation will be based on skill test, Performance, Practical file and Viva Voce.

*******END******

*References:*

*(c) Dr. Nishan Singh Deol (1980) : Text book of Physical Education & Sports. ( AP Publishers, Jalandhar).*

(d) *Singh Ajmer et al (2000) : Modern Text Book of Physical Education, Health and Sports", Kalyani Publishers, Ludhiana*

## ELECTIVE ENGLISH - IV

**Subject Code: BACSD1-415** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Students are encouraged and enabled to read various types of text on their own and discuss them among peers.
**CO2:** Students can develop their linguistic and pragmatic competence for learning.
**CO3:** Students are introduced to the grammatical properties in order to enable them to write and speak English consciously.
**CO4:** Students are introduced to appropriate literary strategies to read literature.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 2 | 2 | | | 2 | | | | | |
| CO3 | 3 | | 2 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 2 | 3 | | | 2 | | | | | |

### UNIT – I (15 Hrs.)

- Literary Terms :Allegory, Allusion, Epic, Epithet, Hyperbole, Internal Rhyme, Rhyme Royal, Terza Rima, Metaphor, Metonymy, Medias Res, oxymoron , Mood, Tone, Personification, Stanza ,Satire Free Paragraph.

### UNIT – II (15 Hrs.)

- Recommended test: An Anthology of English verse. Ed. Department of English; Deen Dyal Upadhayaya, Gorakhpur University ,New delhi : OUP 2004

Prescribed poems :

(a) John Donne : The Sun Rising
(b) Alexander Pope :From Essay on Man
(c) A Thing of Beauty : John keats
(d) Ring out, wild Bells : Alfred Tennyson.
(e) William Blake : The Tiger
(f) Tennyson : Ulysses.
(g) Browning : My Last Duchies.
(h) W.B Yeats : A Prayer from my daughter
(i) T.S Eliot. : Journey of the Magi
(j) William words worth – Tintern Abbey.

### UNIT – III (15 Hrs.)

- Précis Writing
- Identify figure of speech (Unseen) Metonmy, Epithet, Oxymoron, Epigram

### UNIT – IV (15 Hrs.)

- Choose the correct meaning of the word.

- Complete Incomplete sentences
- One word substitution.
- Comprehension (unseen Passage of 1000 words)

## ECONOMICS - IV

**Subject Code: BACSD1-416** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** Developing the skill of data collection and use of sampling technique in research.
**CO2:** Developing the knowledge about theories of economic growth and development and issues of economic planning.
**CO3:** Understanding various issues of population, poverty, availability of resources and uses of Natural resources for sustainable development.
**CO4:** Developing research knowledge in economics.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | 2 | | | | 1 | 3 |
| CO2 | | | 3 | | | 1 | | | | | | |
| CO3 | | | | 1 | 3 | | | | 2 | | | |
| CO4 | | | 3 | | | | | | | | | |

### UNIT – I (15 Hrs.)

Quantitative Methods:
Elementary Idea of sets & Function: Simple and partial derivatives, differentiation of simple function - Polynomial & Exponential.

### UNIT – II (15 Hrs.)

Matrices: Definition & Types, Operation – ( Sum ,Difference ,Product & Transpose) Adjoin & Inverse matrix ,grammar's rule.
Measures of central Tendency: Mean Median partition values, mode, and measures of dispersion skewness.

### UNIT – III (15 Hrs.)

Correlation: Karl Pearson's, Spearman's, Simple regression.
Interpolations: Meaning, Concept, Binomial, expansion method & Lagrange's method.

### UNIT – IV (15 Hrs.)

Index Number: Concepts, utility of index number problems in construction of index numbers, Simple & weighted index number lapser's &fishers index number only.
Analysis of Time Series: Components of time series, importance, methods – Least square and moving average method.

*Reference Books:*

(a) *Quantitative methods . Kalyani Publisher.*
(b) *Gupta S C – Fundamentals of statics Himalaya publishing house.*
(c) *Quantitative Techniques & Methods: TR Jain & SC Aggarwal.*

## ਪੰਜਾਬੀਇਲੈਕਟਿਵ - IV

**Subject Code: BACSD1-417** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 1 | | | | 1 | | | | | |
| CO2 | | | 1 | 3 | | | 1 | | 3 | 3 | | |
| CO3 | 3 | | 2 | 3 | | | 1 | | 2 | 2 | | |
| CO4 | | | 2 | | | | | | 3 | 2 | | |

**ਪਾਠਕ੍ਰਮ**

1. ਮੱਧਕਾਲਦੀਚੋਣਵੀਕਵਿਤਾ
2. ਕਹਾਣੀਸੰਗ੍ਰਹਿ
3. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ
4. ਉਪਭਾਸ਼ਾਵਿਗਿਆਨ

ਯਨਿਟਅਤੇਥੀਮ

1. (ੳ) ਮੱਧਕਾਲੀਪੰਜਾਬੀਕਾਵਿਰੰਗਪੁਸਤਕਵਿੱਚੋਂਪ੍ਰਸੰਗਸਹਿਤਵਿਆਖਿਆ।
2. (ੳ) ਕਥਾਪ੍ਰਵਾਹਪੁਸਤਕਵਿੱਚੋਂਘਟਨਾਵਾਂ, ਥੀਮ, ਪਾਤਰਚਿਤਰਨ
3. ਕਾਵਿਸੰਗ੍ਰਹਿਅਤੇਕਹਾਣੀਸੰਗ੍ਰਹਿਵਿਚੋਂਲਘੂਉਤਰਾਂਵਾਲੇਪ੍ਰਸ਼ਨ।
4. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ _ ਕਿੱਸਾਕਾਵਿ।
5. ਉਪਭਾਸ਼ਾਵਿਗਿਆਨ : ਉਪਭਾਸ਼ਾਦੀਪਰਿਭਾਸ਼ਾ, ਭਾਸ਼ਾਅਤੇਉਪਭਾਸ਼ਾ।

- ਕੋਰਸ
  1. ਮੱਧਕਾਲੀਪੰਜਾਬੀਕਾਵਿ_ਰੰਗ (ਸੰਪਾਦਕ) ਡਾ. ਯੋਗਰਾਜਅੰਗਰਿਸ਼।
  2. ਕਥਾ _ ਪ੍ਰਵਾਹ (ਸੰਪਾਦਕ) ਸੁਰਿੰਦਰਕੁਮਾਰਦਵੇਸ਼ਵਰ।

ਸਹਾਇਕਪੁਸਤਕਾਂ:

1. ਈਸ਼ਰਸਿੰਘਤਾਂਘ, ਪੱਛਮੀਸਮੀਖਿਆਦੇਸਿਧਾਂਤਦੀਪਪ੍ਰਕਾਸ਼ਨ, ਅੰਬਾਲਾਸ਼ਹਿਰ।

2. ਡਾ. ਸੁਰਿੰਦਰਸਿੰਘਕੋਹਲੀ, ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋਂ, ਪੰਜਾਬਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।

# SEMESTER - V

## ਪੰਜਾਬੀਲਾਜਮੀ - V

**Subject Code: BACSS1-502** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

### ਪਾਠਕ੍ਰਮ

1. ਮੱਧਕਾਲੀਨਪੰਜਾਬੀਕਾਵਿਦਾਅਧਿਐਨ
2. ਪੈਰਾਰਚਨਾ
3. ਲਿਪੀ

### ਯਨਿਟਅਤੇਥੀਮ

1. (ੳ) ਮੱਧਕਾਲੀਨਪੰਜਾਬੀਕਾਵਿ - ਸੁਰਾਂਪੁਸਤਕਵਿੱਚੋਂਕਵਿਤਾਦਾਸਾਰਤੇਕੇਂਦਰੀਭਾਵ।
   (ਅ) ਕਾਵਿਸੰਗ੍ਰਹੀਵਿੱਚੋਂਸੰਖੇਪਉੱਤਰਾਂਵਾਲੇਪ੍ਰਸ਼ਨ - ਉੱਤਰ।
2. ਪੈਰ੍ਹਾਰਚਨਾ (ਲਗਭਗ 250) ਸ਼ਬਦਾਵਿੱਚ।
3. ਲਿਪੀਦੀਮੁੱਢਲੀਜਾਣ - ਪਛਾਣ, ਲਿਪੀਦੀਪਰਿਭਾਸ਼ਾਜਨਮਤੇਵਿਕਾਸ।

- ਕੋਰਸ

ਮੱਧਕਾਲੀਪੰਜਾਬੀਕਾਵਿਸੁਰਾਂਪੁਸਤਕਡਾ. ਸੁਖਦੇਵਸਿਰਸਾਪਬਲਿਕੇਸ਼ਨਬਿਊਰੋਂ।

ਸਹਾਇਕਪੁਸਤਕਾਂ : 1. ਧਾਲੀਵਾਲ, ਪ੍ਰੇਮਸਿੰਘ) ਡਾ (. ਰੂਪਵਿਗਿਆਨਅਤੇਪੰਜਾਬੀਸ਼ਬਦਰਚਨਾ, ਮਦਾਨਪਬਲੀਕੇਸ਼ਨਜ਼ਪੰਜਾਬੀਯੂਨੀਵਰਸਿਟੀਪਟਿਆਲਾ 2002।

2. ਜੱਸਲਕੰਵਲਜੀਤ, ਪੰਜਾਬੀਵਿਆਕਰਨਦੇਕੁੱਝਪੱਖ, ਰਵੀਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨਹਾਲ, ਬਾਜਾਰਅਮ੍ਰਿਤਸਰ 2012।

## GENERAL ENGLISH - V

**Subject Code: BACSS1-501** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To demonstrate awareness of English language and literature in various contexts.
**CO2:** To get basic knowledge of the English grammar when they acquire their degree.
**CO3:** To communicate and present the ideas and use of sources accurately and efficiently.
**CO4:** To acquaint the students with cultural and behavioral approaches for global competence.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

### UNIT -1 (15 Hrs.)

I.) Arms and the man – G.B. Shaw.

### UNIT -2 (15 Hrs.)

i.) Freedom at midnight - Larry collins & Dominique lapierre.
ii.) Driving miss daisy - Alfred uhry.
iii.) Ulysses - Alfred lord Tennyson.

### UNIT -3 (15 Hrs.)

i.) Our urgent need for self esteem - Nathaniel branden.
ii.) Kalahandi - Junagarh Prasad das.
iii.) Corruption→causes, consequences and agenda for further research - Paolo Mauro.

### UNIT- 4 (Grammer) (15 Hrs.)

i.) Antonyms.
ii.) One word substitution.
iii.) Precis writing.

**Test prescribed for sem-5,6**
Insights a course in english literature and language - K. Elango.

## SOFTWARE ENGINEERING

**Subject Code: BACSS1-503** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** The ability to understand analyze and develop computer program in the areas related to algorithms , system software , multimedia web design, application program , database , graphics and networking for efficient design of computer based system of varying complexities.
**CO2:** To inculcate knowledge on graphics and multimedia concepts.
**CO3:** To get sufficient knowledge on various system resources.
**CO4:** To support automation and digitization in all walks of life.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | 3 | | | 2 | | | | | 2 | 2 |
| CO2 | | | | | | 2 | | | | | 3 | 2 |
| CO3 | | | 3 | | | 2 | | | | | | |
| CO4 | | | | | | 3 | | | | | 3 | |

### UNIT-I(15 Hrs.)

**Introduction:** Software crisis, Myths, Software Processes, Software Life Cycle Models: Waterfall, Prototype, Evolutionary, Spiral and Agile Models.
**ਜਾਣ-ਪਛਾਣ**: ਸਾਫਟਵੇਅਰਸੰਕਟ, ਮਿੱਥ, ਸਾਫਟਵੇਅਰਪ੍ਰਕਿਰਿਆਵਾਂ, ਸਾਫਟਵੇਅਰਲਾਈਫਸਾਈਕਲਮਾਡਲ: ਵਾਟਰਫਾਲ, ਪ੍ਰੋਟੋਟਾਈਪ, ਈਵੇਲੂਸ਼ਨਰੀ, ਸਪਿਰਲਅਤੇਐਗਾਇਲਮਾਡਲ।

### UNIT-II(15 Hrs.)

**Software Requirements Analysis & Specifications:** Requirement Engineering, Requirement Analysis using DFD, Data Dictionaries, Requirement Documentation, Nature of SRS, Characteristics and Organization of SRS.
**ਸੌਫਟਵੇਅਰਲੋੜਾਂਦਾਵਿਸ਼ਲੇਸ਼ਣਅਤੇਵਿਵਰਣ**: ਲੋੜਇੰਜੀਨੀਅਰਿੰਗ, DFD ਦੀਵਰਤੋਂਕਰਦੇਹੋਏਲੋੜਾਂਦਾਵਿਸ਼ਲੇਸ਼ਣ, ਡੇਟਾਡਿਕਸ਼ਨਰੀਆਂ, ਲੋੜਾਂਦੇਦਸਤਾਵੇਜ਼, SRS ਦੀਪ੍ਰਕਿਰਤੀ, SRS ਦੀਆਂਵਿਸ਼ੇਸ਼ਤਾਵਾਂਅਤੇਸੰਗਠਨ।

### UNIT-III(15 Hrs.)

**Software Testing:** Testing Process, **White Box Testing:** Basic Path, Control Structure, **Black Box Testing:** Graph Based Testing Models, Equivalence Partitioning Functional, Unit

Testing, Integration Testing and System Testing.
**ਸੋਫਟਵੇਅਰਟੈਸਟਿੰਗ**: ਟੈਸਟਿੰਗਪ੍ਰਕਿਰਿਆ, ਵ੍ਹਾਈਟਬਾਕਸਟੈਸਟਿੰਗ: ਬੇਸਿਕਪਾਥ, ਕੰਟਰੋਲਸਟ੍ਰਕਚਰ, ਬਲੈਕ**ਬਾਕਸਟੈਸਟਿੰਗ**: ਗ੍ਰਾਫਬੇਸਡਟੈਸਟਿੰਗਮਾਡਲ, ਸਮਾਨਤਾਵਿਭਾਗੀਕਰਨਫੰਕਸ਼ਨਲ, ਯੂਨਿਟਟੈਸਟਿੰਗ, ਏਕੀਕਰਣਟੈਸਟਿੰਗਅਤੇਸਿਸਟਮਟੈਸਟਿੰਗ।

**<u>UNIT-IV(15 Hrs.)</u>**

**<u>Software Maintenance :</u>**Management of Maintenance, Maintenance Process, Reverse Engineering, Software re-engineering, Configuration Management.
**ਸਾਫਟਵੇਅਰਮੇਨਟੇਨੈਂਸ**: ਮੇਨਟੇਨੈਂਸਦਾਪ੍ਰਬੰਧਨ, ਮੇਨਟੇਨੈਂਸਪ੍ਰਕਿਰਿਆ, ਰਿਵਰਸਇੰਜੀਨੀਅਰਿੰਗ, ਸਾਫਟਵੇਅਰਰੀ-ਇੰਜੀਨੀਅਰਿੰਗ, ਕੌਂਫਿਗਰੇਸ਼ਨਮੈਨੇਜਮੈਂਟ।

## HISTORY - V

**Subject Code: BACSD1-511** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:** To identify and analyze contemporary issues and concerns and find solutions.
**CO2:** To develop the ability of critical and logical thinking, select relevant facts , establish relationships and draw inferences and conclusions.
**CO3:** Acquaint with range of issues related to Indian history that span distinct eras.
**CO4:**Think and argue historically and critically in writing and discussion.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 3 | | 3 | 1 | 2 | | | |
| CO2 | | | | | | | 3 | 3 | 3 | | | |
| CO3 | | | | | | | | | 3 | | | |
| CO4 | 3 | | 3 | | | | | 2 | | | | |

### UNIT – I(15 Hrs.)

Foundation of British Rule in India Battles Clive, Warren Hastings, Wellesley & Dalhousie, Feforms of Conwallis, Bentinck and Dalhousie.

ਭਰਤਵਿੱਚਬ੍ਰਿਟਿਸ਼ਸ਼ਾਸ਼ਨਦੀਨੀਂਹਪਲਾਸੀਅਤੇਬਕਸਰਦਾਯੁੱਧ, ਬ੍ਰਿਟਿਸ਼ਸਾਮਰਾਜਦਾਵਿਸਤਾਰ, ਕਲਾਈਵ, ਵਾਰਨਹੇਸਟਿੰਗਜ਼, ਵੈਲਜ਼ਲੀਅਤੇਡਲਹੋਜ, ਕਾਰਨਵਾਲਿਸ਼, ਬੈਟਿੰਗਅਤੇਡਲਹੋਂਜੀਵਿੱਚਸੁਧਾਰ।

### UNIT – II(15 Hrs.)

The Great uprising of 1857, New Education system and Rise of Middle Class, Economic changes under the British Rule, Socio Cultural Movements.

1857 ਈ. ਦਾਮਹਾਨਵਿਦਰੋਹ, ਨਵੀਸਿਖਿਆਪ੍ਰਣਾਲੀਮ੍ਰੱਧਵਰਗਦਾਉੱਥਾ, ਬ੍ਰਿਟਿਸ਼ਸ਼ਾਸ਼ਨਦੇਅਧਿਨਆਰਥੀਕਪਰਿਵਰਤਨ, ਸਮਾਜਿਕਅਤੇਸੰਸਕ੍ਰਿਤੀਅਨਦੋਲਨ।

### UNIT – III(15 Hrs.)

Depressed Classes Movement, Constitutional Development, Rise of Political Consciousness and Indian National Congress, National Movement, 1906-19.

ਦਲਿਤਵਰਗਦਾਅੰਦੋਲਨ, ਸੰਵਿਧਾਨਿਕਵਿਕਾਸਭਾਰਤਵਿੱਚਰਾਜਨੀਤਿਕਚੇਤਨਾਦਾਉਥਾਨਅਤੇਇੰਡੀਅਨਨੋਸ਼ਨਲਕਾਂਗਰਸ, ਰਾਸ਼ਟਰੀਅੰਦੋਲਨ, 1906-19 ਈ।

### UNIT – IV(15 Hrs.)

Struggle for freedom, 1919-1947 A.D. Significant development after independence, salient features of the Indian Constitution, Problem of Rehabilitation after Independence.

**Books: -**
ਆਧੁਨਿਕਭਾਰਤਦਾਇਤਿਹਾਸ

History of Modern India (1707 A.D. to 1964 A.D.)
Writer:- S.P. Sabharwal

## POLTICAL SCIENCE - V

**Subject Code: BACSD1-512** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** Get a comprehensive overview of polity and the various stages through which it evolved in the world.

**CO2:** Gain understanding of the intricacies of democratic system of the states and center level in India.

**CO3:** Get to know of the important notes and concepts of various political thinkers and philosophers of the world.

**CO4:** To observe and think critically of the politically events of the country and abroad.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | 2 | | | 2 | 1 | | | |
| CO2 | | | 3 | | 2 | | | 2 | | | | |
| CO3 | | | 3 | | 2 | | | 2 | | | | |
| CO4 | | | | | 2 | | | 2 | | | | |

### UNIT – I (15 Hrs.)

- Development of comparative method in the study of politics; Meaning and definitions of comparative method, Operational aspect of comparative method. Unity or Importance of comparative method.
- Various Aspects of British Political Thought and Tradition; Main Provisions of magnacarta.

### UNIT – II (15 Hrs.)

1. Main sources of British constitution, salient features of British constitution
   - Rights of British Citizens.
   - The British Constitution is child of accident and Design.
   - Recent Constitutional Trends.

### UNIT – III (15 Hrs.)

1. Conventions of British constitutions: Meaning and definitions of conventions.
   - Differences between conventions and law.
   - Classifications of the conventions.
   - Sanctions behind conventions.
2. Monarchy: Role and Functions.
   - Royal Privilages and immunities.
   - Differences between the king and the crown.
   - Sources of the powers of the king or crown.

- Powers and Functions of the Monarch.

### UNIT – IV (15 Hrs.)

1. Parliamentary Government: (British Cabinet System)

- Meaning and Definition of Parliamentary Government.

- Salient features of the British Cabinet System.
- Origin and Development of British Cabinet.
- Appointment of Ministers.

2. Evolutions of American Political System:
    - Historical Evolutions of American Political System.
    - War of American Independence.
    - Causes Responsible for war.
    - Major Events of the war of American Independence.

- 

## MATHEMATICS (DIFFERENTIAL GEOMETRY) - V

**Subject Code: BACSD1-513** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Apply critical thinking skills to solve applied problems.
**CO2:** Use knowledge skill necessary for immediate employment and acceptance into a graduate program.
**CO3:** Apply mathematical concepts and principles to perform computation.
**CO4:** Maintain a core of mathematical and technical knowledge that is adoptable to changing technologies and provide a solid foundation for future learning.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | 2 | | | 2 | | | | **3** |
| **CO2** | | | 2 | | | | | | | | | **3** |
| **CO3** | | | 3 | | | | | | | | | **3** |
| **CO4** | | | 2 | | | | | | | | | **3** |

### UNIT-I(15 Hrs.)

Curves in Space: Space curves, Path, Arc length, Tangent line, Contact of nth order of a curve and surface, Plane of curvature, Tangent plane at any point of the surface f(x ,y , z)=0.The Principal nor mal and bi-norm al, Definitions of curvature, Torsion and screw-curvature, Serret -Fernet Formulae, To find curvature and torsion of curve, Helices.

### UNIT-II(15 Hrs.)

Intrinsic equations, Fundamental theorems for space curves, the circle of curvature, Osculating sphere, Behaviors of curve in the neighborhood of a point, Involute and Evolute.

### UNIT-III(15 Hrs.)

Concept of a Surface and Fundamental Forms: Concept and Definition of a surface, Curvilinear equations of the curve on the surface, Para metric curves, Tangent plane and nor mal, First and Second Fundamental For m, Derivatives of N, Weingarten equations, Angle between parametric curves, Direction coefficients, Angle between an y two intersecting curves on the surface.

### UNIT-IV(15 Hrs.)

Geodesics: Geodesics, Differential equation of geodesics, Normal property of geodesics, Geodesics curvature, Gauss bonnet theorem, Torsion of geodesics, Geodesics on Geodesics parallel.

## PHYSICAL EDUCATION - V

**Subject Code: BACSD1-514** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** To study the behavior of India and world physical education.
**CO2:** Learning how to resist unfavorable and working conditions, decreasing fatigue during professional activities and raising the quality of results.
**CO3:** Fostering of motivational attitude to the physical education, healthy life style and regular exercising..
**CO4:** Learning the methods of self control while exercising.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | 3 | | 3 | 1 | | |
| CO2 | | | 3 | | 3 | | 3 | | | 1 | | |
| CO3 | | | 3 | | 3 | | 3 | 1 | | 3 | | |
| CO4 | | | 2 | | | | 3 | | | | | |

**(THEORY – 60 MARKS)**

### UNIT – I(15 Hrs.)

- **Recreation**: Introduction, Aims, Objectives, Types, Principles, Importance and Agencies
  providing Recreation, Camping: Introduction, Objectives, Importance, Types, and Layout of Campsite and Organization of Camps.
  **Athletic Meet**: Introduction, Planning, Organization and Importance.
- **Leadership**: Introduction, Importance, Types, Qualities and Responsibilities of Leader

### UNIT – II(15 Hrs.)

- **Posture**: Introduction and Characteristics of Good Posture, Causes of Poor Posture corrections different postural positions (Walking, Standing, Sitting and Lying Postures)
- **Postural Deformities**: Introduction, Causes and Corrective Measures for Spinal
- **Deformities:** (Kyphosis, Lordosis and Scoliosis), Foot and Leg Deformities (Flat Foot, Knock Knee and Bow Legs).
- **Motion**: Introduction, Types, Laws of Motion and their application in i Sports & Games.

### UNIT – III(15 Hrs.)

- **Respiratory System**: Introduction, Structure & Functions of Respiratory System
- **Blood pressure & Pulse Rate**: Introduction, and Technique of Measurement.
- **Physical Education as Profession**: Qualities of Physical Education Teachers. Career opportunities in Physical Education profession, courses offered and institutions available for Physical Education in India

**UNIT – IV(15 Hrs.)**

- **Handball**: History, Layout, General Rules and Regulation, Officials, Major tournaments Arjuna Awardees.
- **Badminton**: History, Layout, General Rules and Regulation, Officials, Major tournaments, Arjuna Awardees.
- **Javelin throw**: Rules and Regulations, Layout and Technique, Arjuna Awardees.

**PRACTICAL (40 MARKS)**

**HANDBALL, BADMINTON AND JAVELIN THROW**

Evaluation will be based on skill test, Performance, Practical file and Viva Voce.

## ELECTIVE ENGLISH - V

**Subject Code: BACSD1-515** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Students are encouraged and enabled to read various types of text on their own and discuss them among peers.
**CO2:** Students can develop their linguistic and pragmatic competence for learning.
**CO3:** Students are introduced to the grammatical properties in order to enable them to write and speak English consciously.
**CO4:** Students are introduced to appropriate literary strategies to read literature.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 2 | 2 | | | 2 | | | | | |
| CO3 | 3 | | 2 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 2 | 3 | | | 2 | | | | | |

### UNIT – I (15 Hrs.)

- Literary Terms: Literatures Indian Languages, Colonialism Post. Colonial, Multicultural society
  Orientalism Hybridity, Ideology, Gender, Race, Class, Nation, Importance of Translation In India (Methods of translation).

### UNIT – II (15 Hrs.)

- Modern Indian Literature: Poems and Short stories Edited by the Dept of university of Delhi, OUP 2007, New Delhi.
- Jibanananda Das
  (a) Before Dying
  (b) Windy Night
  (c) I shall return to This Bengal.
- Sri-Sri.
  (a) Forward March
  (b) From some people Laugh, some people cry
- G.M. Mukti bodh
  (a) The void
  (b) So very far.

Short-stories

- Premchand : The Holy Panchayat
- RK Narayan : The MCC
- Sandat Hasan Manto : Toba Tek Singh
- Ambai - Squirrel

### UNIT – III (15 Hrs.)

- Note Making (A Passage of about 1000 hundreds to be given for this Purposes)
- Comprehension. with ten multiple choice question.

### UNIT – IV (15 Hrs.)

- One word substitution and then use it in sentences.

- Voice.

## ECONOMICS - V

**Subject Code: BACSD1-516** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Developing the skill of data collection and use of sampling technique in research.
**CO2:** Developing the knowledge about theories of economic growth and development and issues of economic planning.
**CO3:** Understanding various issues of population, poverty, availability of resources and uses of Natural resources for sustainable development.
**CO4:** Developing research knowledge in economics.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | 2 | | | | 1 | 3 |
| CO2 | | | 3 | | | 1 | | | | | | |
| CO3 | | | | 1 | 3 | | | | 2 | | | |
| CO4 | | | 3 | | | | | | | | | |

### UNIT – I (15 Hrs.)

Economic Growth & Development: Concept & Measurement main features of under developed economy.
Determinates of Economic Development:
Capital formation – Its source's Lewis Theory of Unlimited Supply of labour.

### UNIT – II (15 Hrs.)

Classical Model of growth: One sector Neo classical model of growth, Solow model of growth.

### UNIT – III (15 Hrs.)

Theory of big push: Strategic of economic development: Balanced vs UN Balanced growth, Rostov's Theory of stages of growth.

### UNIT – IV (15 Hrs.)

Theory of planning in developing countries: Meaning need objective .Strategies problems of planning
Emerging Strategic – Export promotion and Import Substitution strategy.

*Reference Books:*

(a) *Economics of development and planning – By R.C Agarwal*
(b) *TR Jain,Ashok Gupta & AS Sandhu.*

## ਪੰਜਾਬੀਇਲੈਕਟਿਵ - V

**Subject Code: BACSD1-517** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 1 | | | | 1 | | | | | |
| CO2 | | | 1 | 3 | | | 1 | | 3 | 3 | | |
| CO3 | 3 | | 2 | 3 | | | 1 | | 2 | 2 | | |
| CO4 | | | 2 | | | | | | 3 | 2 | | |

**ਪਾਠਕ੍ਰਮ**

1. ਪੁਰਾਤਨਪੰਜਾਬੀਕਾਵਿ
2. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ
3. ਭਾਰਤੀਕਾਵਿਸ਼ਾਸ਼ਤਰ
4. ਸਾਹਿਤਦੇਰੂਪ

**ਯਨਿਟਅਤੇਥੀਮ**

1. (ੳ) ਮੱਧਕਾਲਅਤੇਮੁੱਢਲੇਬਸਤੀਵਾਦੀਕਾਲਦੀਪੰਜਾਬੀਕਵਿਤਾਪੁਸਤਕਵਿੱਚੋਂਪ੍ਰਸੰਗਸਹਿਤਵਿਆਖਿਆ (ਦੋਵਿੱਚੋਇੱਕ)
   (ਅ) ਕਾਵਿ_ਪੁਸਤਕਵਿੱਚੋਂਕਵਿਤਾਦਾਵਿਸ਼ਾ_ਵਸਤੂ।
2. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ
   ਕਿਸਾਕਾਵਿਅਤੇਵਾਰਕਾਵਿਵਿੱਚੋਇਤਿਹਾਸਨਾਲਸੰਬੰਧਿਤ (ਸੰਖੇਪਉੱਤਰਾਂਵਾਲੇਪ੍ਰਸ਼ਨ)
3. ਭਾਰਤੀਕਾਵਿ _ ਸ਼ਾਸ਼ਤਰ _ ਰੀਤੀਸੰਪ੍ਰਦਾਇ
4. ਸਾਹਿਤਦੇਰੂਪ : ਜਨਮਸਾਖੀ, ਕਿੱਸਾ, ਵਾਰ

- ਕੋਰਸ

ਮੱਧਕਾਲੀਅਤੇਮੁੱਢਲੇਬਸਤੀਵਾਦੀਕਾਲਦੀਪੰਜਾਬੀਕਵਿਤਾ, ਡਾ. ਯੋਗਰਾਜਨਿਰਧਾਰਤਕਵੀ) ਵਾਰਿਸ਼ਸ਼ਾਹ, ਹਾਸ਼ਮਸ਼ਾਹ, ਅਹਮਦਯਾਰ, ਸ਼ਾਹਮੁਹੰਮਦ (

ਸਹਾਇਕਪੁਸਤਕਾਂ:

1. ਡਾ. ਗੋਪਾਲਸਿੰਘ, ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ, ਪਲਬੀਕੇਸ਼ਨਬਿਊਰੋ, ਪੰਜਾਬਯੂਨੀਵਰਸਿਟੀਚੰਡੀਗੜ੍ਹ।
2. ਬਰਾੜ, ਬੂਟਾਸਿੰਘ (ਡਾ.) ਪੰਜਾਬੀਭਾਸ਼ਾਸ੍ਰੋਤਤੇਸਰੂਪ, ਵਾਰਿਸ਼ਸ਼ਾਹਫਾਉਡੇਸ਼ਨ, ਅਮ੍ਰਿਤਸਰ 2012।

# SEMESTER - VI

## ਪੰਜਾਬੀਲਾਜਮੀ - VI

**Subject Code:** **BACSS1-602** **L T P C** **4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

**UNIT – I**

1. ਨਾਵਲਦਾਅਧਿਐਨ
2. ਅਖ਼ਬਾਰਲਈਪ੍ਰੈਸਨੋਟ
3. ਗੁਰਮੁੱਖੀਲਿਪੀ
4. ਵਿਆਕਰਨ

**UNIT – II**

(ii) (ੳ) ਅਨੂਪਕੌਰਨਾਵਲਵਿਚੋਂਪ੍ਰਸੰਗਸਾਹਿਤਵਿਆਖਿਆ।

(ਅ) ਨਾਵਲਦਾਵਿਸ਼ਾਤੇਪਾਤਰਚਿਤਰਨਤੇਪ੍ਰਸ਼ਨਉੱਤਰ।

(iii) ਅਖ਼ਬਾਰਲਈਪ੍ਰੈਸਨੋਟ, ਕਾਲਜਦੀਆਸਾਹਿਤਕਸੱਭਿਆਚਾਰਕਖੇਡਾਂਅਤੇਅਕਾਦਮਿਕਖੇਤਰਨਾਲਸੰਬੰਧਿਤਸਰਗਰਮੀਆਂਬਾਰੇ।ਲਗਭਗ 200 ਸ਼ਬਦਾਵਿੱਚ

(iv) ਗੁਰਮੁੱਖੀਲਿਪੀ : ਨਾਮਕਰਣ, ਗੁਰਮੁੱਖੀਲਿਪੀਦਾਪੰਜਾਬੀਭਾਸ਼ਾਲਈਅਨੁਕੂਲਤਾ।

(v) ਵਿਆਕਰਨ : ਵਾਕਤੇਉਪਵਾਕਦੀਪਰਿਭਾਸ਼ਾ, ਸਧਾਰਨ, ਸੰਯੁਕਤਤੇਮਿਸ਼ਰਤਵਾਕ

- ਕੋਰਸ

1. ਅਨੂਪਕੌਰ, ਹਰਨਾਮਦਾਸਸਹਿਰਾਈ, ਪੰਜਾਬਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨਅਮ੍ਰਿਤਸਰ।

- ਸਹਾਇਕਪੁਸਤਕਾਂਵਿਆਕਰਨਲਈ : ਬਰਾੜ, ਬੂਟਾਸਿੰਘ (ਡਾ.)

2. ਜੱਸਲਕੰਵਰਜੀਤ, ਪੰਜਾਬੀਵਿਆਕਰਨਦੇਕੁਝਪੱਖ, ਰਵੀਸਾਹਿਤਪ੍ਰਕਾਸ਼ਨਹਾਲਬਜਾਰਅਮ੍ਰਿਤਸਰ 2012

## GENERAL ENGLISH - VI

**Subject Code: BACSS1-601** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**
**CO1:**To demonstrate awareness of English language and literature in various contexts.
**CO2:**To get basic knowledge of the English grammar when they acquire their degree.
**CO3:**To communicate and present the ideas and use of sources accurately and efficiently.
**CO4:**To acquaint the students with cultural and behavioral approaches for global competence.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO3 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 3 | 3 | | | 2 | | 3 | 3 | | |

**UNIT-1 (Novel) (15 Hrs.)**

i.) The Guide – R.K. Narayan.

**UNIT-2 (15 Hrs.)**

i.) The diary of anne frank – Anne frank.
ii.) Because i couldn't stop for death - Emily Dickinson.
iii.) Swami and friends –R.K. Narayan.

**UNIT-3(15 Hrs.)**

i.) The sporting spirit – George orwell.
ii.) Building an internet culture – Philip agre.
iii.) Odds against us – Satyajit ray.

**UNIT– 4(15 Hrs.)**

i.) Writing business emails.
ii.) Comprehension of unseen passage.
iii.) Narration (direct to indirect ),voice (active passive ),transformation of sentences.

## INTRODUCTION TO COMPUTER NETWORK AND INTERNET PROGRAMMING

**Subject Code: BACSS1-603** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** The ability to understand analyze and develop computer program in the areas related to algorithms , system software , multimedia web design, application program , database , graphics and networking for efficient design of computer based system of varying complexities.

**CO2:** To inculcate knowledge on graphics and multimedia concepts.

**CO3:** To get sufficient knowledge on various system resources.

**CO4:** To support automation and digitization in all walks of life.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | 3 | | | 2 | | | | | 2 | 2 |
| CO2 | | | | | | 2 | | | | | 3 | 2 |
| CO3 | | | 3 | | | 2 | | | | | | |
| CO4 | | | | | | 3 | | | | | 3 | |

### UNIT–I(15 Hrs.)

**Computer Networks:** Hardware, Software, users, goals and applications of computer networks.

**Types of Network:** LAN, MAN, WAN and value added networks and their features.

**Transmission Media:** Magnetic Media, trusted pair, coaxial cables, fibre optics, radio transmission, microwave transmission, infrared waves and Line of sight transmission, cellular radio and communication satellites.

**ਕੰਪਿਊਟਰਨੈੱਟਵਰਕ**: ਹਾਰਡਵੇਅਰ, ਸਾਫਟਵੇਅਰ, ਉਪਭੋਗਤਾ, ਟੀਚੇਅਤੇਕੰਪਿਊਟਰਨੈੱਟਵਰਕਾਂਦੇਐਪਲੀਕੇਸ਼ਨ।

**ਨੈੱਟਵਰਕਦੀਆਂਕਿਸਮਾਂ**: LAN, MAN, WAN ਅਤੇਵੈਲਯੂਐਡਿਡਨੈੱਟਵਰਕਅਤੇਉਹਨਾਂਦੀਆਂਵਿਸ਼ੇਸ਼ਤਾਵਾਂ।

ਟਰਾਂਸਮਿਸ਼ਨਮੀਡੀਆ: ਮੈਗਨੈਟਿਕਮੀਡੀਆ, ਭਰੋਸੇਯੋਗਜੋੜਾ, ਕੋਐਕਸ਼ੀਅਲਕੇਬਲ, ਫਾਈਬਰਆਪਟਿਕਸ, ਰੇਡੀਓਟ੍ਰਾਂਸਮਿਸ਼ਨ, ਮਾਈਕ੍ਰੋਵੇਵਟ੍ਰਾਂਸਮਿਸ਼ਨ, ਇਨਫਰਾਰੈੱਡਤਰੰਗਾਂਅਤੇਦ੍ਰਿਸ਼ਟੀਪ੍ਰਸਾਰਣਦੀਲਾਈਨ, ਸੈਲੂਲਰਰੇਡੀਓਅਤੇਸੰਚਾਰਉਪਗ੍ਰਹਿ।

### UNIT–II(15 Hrs.)

**Internet:** Internet , its advantages and disadvantages, internet facilities through WWW and

HTML, Internet Protocols, TCP/IP, FTP, newsgroups, remote logins, chat groups etc.

**WWW:** The Client- side, the Server side, web browsers, web pages, locating information on the web.

**E-Mail:** Architecture, Various aspects, the user agent, message format, message transfer, E-Mail Privacy.

**Network Security:** Various threats, Preventions and solutions.

**ਇੰਟਰਨੈਟ:** ਇੰਟਰਨੈਟ, ਇਸਦੇਫਾਇਦੇਅਤੇਨੁਕਸਾਨ, WWW ਅਤੇ HTML ਦੁਆਰਾਇੰਟਰਨੈਟਸੁਵਿਧਾਵਾਂ, ਇੰਟਰਨੈਟਪ੍ਰੋਟੋਕੋਲ, TCP/IP, FTP, ਨਿਊਜ਼ਗਰੁੱਪ, ਰਿਮੋਟਲੌਗਿਨ, ਚੈਟਗਰੁੱਪਆਦਿ।

**WWW:** ਕਲਾਇੰਟ-ਸਾਈਡ, ਸਰਵਰਸਾਈਡ, ਵੈੱਬਬ੍ਰਾਊਜ਼ਰ, ਵੈਬਪੇਜ, ਵੈੱਬ,ਤੇਜਾਣਕਾਰੀਦਾਪਤਾਲਗਾਉਣਾ।

**ਈ-ਮੇਲ:** ਆਰਕੀਟੈਕਚਰ, ਕਈਪਹਿਲੂ, ਉਪਭੋਗਤਾਏਜੰਟ, ਸੁਨੇਹਾਫਾਰਮੈਟ, ਸੁਨੇਹਾਟ੍ਰਾਂਸਫਰ, ਈ-ਮੇਲਗੋਪਨੀਯਤਾ।

ਨੈੱਟਵਰਕਸੁਰੱਖਿਆ: ਕਈਖਤਰੇ, ਰੋਕਥਾਮਅਤੇਹੱਲ।

**UNIT–III(15 Hrs.)**

**HTML:** Intoduction to HTML, SGML, Internet and Web Structure of HTML document, starting an HTML document, Head element, body element, style element, Script element, Text formatting, Using lists to organize information.

**Organising Data with Tables:** Basic Table Structures, individual cells and headings vertical controls, database considerations, displaying real data with a table.

**Table Layout and Presentation:** Table syntax, two column layout, staggered body with an index, traditional newspaper layout.

**HTML:** HTML, SGML, HTML ਦਸਤਾਵੇਜ਼ਦੇਇੰਟਰਨੈਟਅਤੇਵੈੱਬਢਾਂਚੇਦੀਜਾਣ-ਪਛਾਣ, ਇੱਕ HTML ਦਸਤਾਵੇਜ਼ਸ਼ੁਰੂਕਰਨਾ, ਮੁੱਖਤੱਤ, ਸਰੀਰਤੱਤ, ਸ਼ੈਲੀਤੱਤ, ਸਕ੍ਰਿਪਟਤੱਤ, ਟੈਕਸਟਫਾਰਮੈਟਿੰਗ, ਜਾਣਕਾਰੀਨੂੰਸੰਗਠਿਤਕਰਨਲਈਸੂਚੀਆਂਦੀਵਰਤੋਂਕਰਨਾ।

**ਟੇਬਲਾਂਦੇਨਾਲਡੇਟਾਨੂੰਸੰਗਠਿਤਕਰਨਾ:** ਮੂਲਸਾਰਣੀਬਣਤਰ, ਵਿਅਕਤੀਗਤਸੈੱਲਅਤੇਸਿਰਲੇਖਲੰਬਕਾਰੀਨਿਯੰਤਰਣ, ਡੇਟਾਬੇਸਵਿਚਾਰ, ਇੱਕਸਾਰਣੀਦੇਨਾਲਅਸਲਡੇਟਾਪ੍ਰਦਰਸ਼ਿਤਕਰਨਾ।

**ਟੇਬਲਲੇਆਉਟਅਤੇਪ੍ਰਸਤੁਤੀ:** ਸਾਰਣੀਸੰਟੈਕਸ, ਦੋਕਾਲਮਲੇਆਉਟ, ਇੱਕਸੂਚਕਾਂਕਦੇਨਾਲਸਟਗਰਡਬਾਡੀ, ਰਵਾਇਤੀਅਖਬਾਰਲੇਆਉਟ।

**UNIT–IV(15 Hrs.)**

**URLs:** Absolute URLs, Relative URLs, fragment URLs, Types of URL schemes- HTTP, mailto, news, FTP, Telnet, File etc.

**Using Hyper Links and Anchors:** Uses to Hyper Links, Structure of Hyper links, links to specialised contents.

**URLs:**ਸੰਪੂਰਨ URL, ਸੰਬੰਧਿਤ URL, ਟੁਕੜੇ URL, URL ਸਕੀਮਾਂਦੀਆਂਕਿਸਮਾਂ- HTTP, mailto, ਖ਼ਬਰਾਂ, FTP, ਟੇਲਨੈੱਟ, ਫਾਈਲਆਦਿ।

**ਹਾਈਪਰਲਿੰਕਸਅਤੇਐਂਕਰਸਦੀਵਰਤੋਂਕਰਨਾ:**ਹਾਈਪਰਲਿੰਕਸਦੀਵਰਤੋਂ, ਹਾਈਪਰਲਿੰਕਸਦੀਬਣਤਰ, ਵਿਸ਼ੇਸ਼ਸਮੱਗਰੀਦੇਲਿੰਕ।

## HUMAN VALUES AND PROFESSIONAL ETHICS

| Subject Code: BACSS1-605 | L T P C<br>4 0 0 4 | Duration: 60 Hrs. |
|---|---|---|

**Course Outcomes:**

**CO1:** Indentify ethical concerns in research and intellectual contexts, including academic

integrity, use & citation of sources and the objective presentation of data.
**CO2:** Proving value educations to the students.
**CO3:** Indentify the multiple ethical interests at a state in a real world situation or practice.
**CO4:** Understanding practically the importance of trust, mutually satisfying human behavior & enriching interaction with nature.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | 2 | 2 | 3 | | | | | |
| CO2 | | | | | | | 3 | | 3 | | | |
| CO3 | | | | | 3 | | 2 | | | | | |
| CO4 | | 1 | | | | | 2 | | 3 | | | |

**UNIT-I(15 Hrs.)**

**CourseIntroduction-Need,BasicGuidelines,ContentandProcessforValueEducation**
Understandingtheneed,basicguidelines,contentandprocessforValueEducation.Self-Exploration-whatisit?-itscontentandprocess;“NaturalAcceptance”andExperientialValidation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A lookat basic Human Aspirations Right understanding, Relationship and Physical Facilities- the basicrequirements for fulfillment of aspirations of every human being with their correct priority,Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenarioMethod to fulfill the above human aspirations: understanding and living in harmony at variouslevels

**UNIT-II(15 Hrs.)**

**UnderstandingHarmonyin theHumanBeing -Harmonyin Myself!**
Understandinghumanbeingasa co-existenceofthesentient“I” and thematerial“Body”Understandingthe needsofSelf(“I”) and“Body” -*Sukh*and *Suvidha*
Understandingthe Bodyasaninstrument of“I” (Ibeingthedoer,seer andenjoyer)Understandingthe characteristics and activitiesof“I”and harmonyin “I”
UnderstandingtheharmonyofIwiththeBody:*Sanyam*and*Swasthya*;correctappraisalofPhysicalneeds, meaningofProsperityin detail, Programsto ensure*Sanyam*and *Swasthya*

UnderstandingHarmonyintheFamilyandSociety-HarmonyinHuman-HumanRelationship:
Understanding harmony in the Family- the basic unit of human interaction; Understanding valuesinhuman-humanrelationship;meaningof*Nyaya*andprogramforitsfulfillmenttoensure*Ubhay-tripti*; Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship;Understandingthemeaningof*Vishwas*;Differencebetweenintentionandcompetence Understanding the meaning of *Samman*, Difference between respect and differentiation; the othersalient valuesin relationship.

**UNIT-III(15 Hrs.)**

**Understanding the Harmony in the Society (Society Being an Extension of Family):***Samadhan,Samridhi,Abhay,Sah-astitva*ascomprehensiveHumanGoalsVisualizingauniversalharmonious order in society- Undivided Society (*AkhandSamaj),* Universal Order(*SarvabhaumVyawastha)*-from familyto world family!

**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence:**Understandingtheharmonyinthe Nature;Interconnectednessandmutualfulfillment amongthefourordersofnature-recyclabilityandself-regulationinnature;UnderstandingExistenceasCo-existence (*Sah-astitva*) ofmutuallyinteractingunitsinall-pervasive space;Holistic perceptionofharmonyat all levels ofexistence.

**UNIT-IV(15 Hrs.)**

**Implications of the above Holistic Understanding of Harmony on Professional Ethics:**NaturalacceptanceofhumanvaluesDefinitivenessofEthicalHumanConduct;Basisfor HumanisticEducation,HumanisticConstitutionandHumanisticUniversalOrder;Competence inprofessional ethics:

1. Abilitytoutilizetheprofessional competenceforaugmentinguniversal humanorder,
2. Abilitytoidentifythescopeandcharacteristicsofpeople-friendlyandeco-friendlyproductionsystems,
3. Abilitytoidentifyanddevelop appropriatetechnologiesandmanagementpatternsfor above
4. productionsystems;
5. Casestudiesoftypicalholistictechnologies,managementmodelsandproductionsystems;Strategyfortransition from thepresentstate to Universal Human Order:
6. Atthelevelofindividual:associallyandecologicallyresponsibleengineers,technologistsand managers
7. Atthelevel ofsociety: as mutuallyenrichinginstitutions andorganizations

RecommendedBooks:

**1.** R.R.Gaur,R.Sangal,G.P.Bagaria,'A FoundationCourseinValueEducation', **2009.**
2. IvanIllich,'Energy&Equity',TheTrinityPress,Worcester,andHarperCollins,USA, 1974.
**3.** E.F.Schumacher,'SmallisBeautiful:AStudyofEconomicsasifPeopleMattered',Blond& Briggs, Britain,**1973.**
**4.** A.Nagraj,'JeevanVidyaekParichay',DivyaPathSansthan,Amarkantak,**1998.**
**5.** SussanGeorge,'Howthe OtherHalfDie's,PenguinPress. Reprinted,**1986,1991.**
6. P.L.Dhar,R.R.Gaur,'ScienceandHumanism', CommonWealthPublishers,**1990**.
**7.** A.N.Tripathy,'Human Values',NewAgeInternationalPublishers,**2003.**
**8.** Subhas Palekar, 'How to Practice Natural Farming', Pracheen (Vaidik) Krishi Tantra Shodh,Amravati,**2000.**

## HISTORY - VI

**Subject Code: BACSD1-611** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** To identify and analyze contemporary issues and concerns and find solutions.
**CO2:** To develop the ability of critical and logical thinking, select relevant facts , establish relationships and draw inferences and conclusions .
**CO3:** Acquaint with range of issues related to Indian history that span distinct eras.
**CO4:** Think and argue historically and critically in writing and discussion.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 3 | | 3 | 1 | 2 | | | |
| CO2 | | | | | | | 3 | 3 | 3 | | | |
| CO3 | | | | | | | | | 3 | | | |
| CO4 | 3 | | 3 | | | | | 2 | | | | |

### UNIT – I(15 Hrs.)

ਸ਼੍ਰੀਗੁਰੂਨਾਨਕਦੇਵਜੀਅਤੇਸ਼੍ਰੀਗੁਰੂਅੰਗਦਦੇਵਜੀ।

Sri Guru Nanak Dev Ji and Sri Guru Angand Dev Ji

### UNIT – II(15 Hrs.)

ਸ਼੍ਰੀਗੁਰੂਅਮਰਦਾਸਜੀਅਤੇਸ਼੍ਰੀਗੁਰੂਰਾਮਦਾਸਜੀ।

Sri Guru Amar Das Ji and Sri Guru Ram Das Ji

### UNIT – III(15 Hrs.)

ਸ਼੍ਰੀਗੁਰੂਅਰਜਨਦੇਵਜੀ ,ਸ਼੍ਰੀਗੁਰੂਹਰਗੋਬਿੰਦਜੀਅਤੇਸ਼੍ਰੀਗੁਰੂਹਰਿਰਾਏਜੀ।

Sri Guru Arjan Dev Ji, Sri Guru Hargobind Ji and Sri Guru Har Rai ji

### UNIT – IV(15 Hrs.)

ਸ਼੍ਰੀਗੁਰੂਹਰਕ੍ਰਿਸ਼ਨਜੀ ,ਸ਼੍ਰੀਗੁਰੂਤੇਗਬਹਾਦਰਜੀਅਤੇਸ਼੍ਰੀਗੁਰੂਗੋਬਿੰਦਸਿੰਘਜੀ।

Sri Guru Har Krishan Ji, Sri Guru Tegbahadar Ji and Sri Guru Gobind Singh Ji

Books: -

ਸਿੱਖਗੁਰੂਆਂਦਾਇਤਿਹਾਸ

History of Sikh Guru

## POLTICAL SCIENCE - VI

**Subject Code: BACSD1-612** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** Get a comprehensive overview of polity and the various stages through which it evolved in the world.

**CO2:** Gain understanding of the intricacies of democratic system of the states and center level in India.

**CO3:** Get to know of the important notes and concepts of various political thinkers and philosophers of the world.

**CO4:** To observe and think critically of the politically events of the country and abroad.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 3 | | 2 | | | 2 | 1 | | | |
| CO2 | | | 3 | | 2 | | | 2 | | | | |
| CO3 | | | 3 | | 2 | | | 2 | | | | |
| CO4 | | | | | 2 | | | 2 | | | | |

### UNIT – I(15 Hrs.)

1. **International politics:·**
   →Meaning, nature and scope of international politics
   → Difference between international politics and international relations.
   →Nature and subject matter of international politics.
2. **International politics:·**
   →Realist and idealist approaches.
   → Nature of realist approach
   → Morgenthau realist theory Model.
   → Six principle ofmorgenthaus theory.
   → Criticism of morgenthau's theory

### UNIT – II (15 Hrs.)

1. **Inealism or idealist approach:·**
   → Basicassumptions idealist approach.
   → Basic characteristics of idealist approach.
   → Suggestions for sowing international problems.
   → Critical evaluation of idealist approach.
   → Difference between realist and idealist approach.

### UNIT – III(15 Hrs.)

1. **National Power:·**
   → Meaning and definition of power and national power.
   → Characteristics of national power.
   → Kids of forms of national power.
   → Methods of exerusing national power.
   → Components of national power.

**UNIT – IV(15 Hrs.)**

1. **Balance of power:·**
   → Meaning and definition of Balance of power.
   → **Natureof** balance of power.
   → Methods of balance of power.
   → Critical evaluation of balance of power.
2. **Collective security:·**
   → Definition of collective security.
   → Characteristics of collective security.
   → Collective security and Collective defense.
   → Similarity between collectivesecurity and balance of power.

## MATHEMATICS (ANALYSIS) - IV

**Subject Code: BACSD1-613** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** Apply critical thinking skills to solve applied problems.
**CO2:** Use knowledge skill necessary for immediate employment and acceptance into a graduate program.
**CO3:** Apply mathematical concepts and principles to perform computation.
**CO4:** Maintain a core of mathematical and technical knowledge that is adoptable to changing technologies and provide a solid foundation for future learning.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | 2 | | | | 3 |
| CO2 | | | 2 | | | | | | | | | 3 |
| CO3 | | | 3 | | | | | | | | | 3 |
| CO4 | | | 2 | | | | | | | | | 3 |

### UNIT-I(15 Hrs.)

Real Numbers Preliminaries: Sets and Functions, Mathematical induction, Finite and infinite sets. Algebraic and order properties of R, Absolute value and the real line, Completeness property of R, Applications of supermom property, Archie median property, Density of rational numbers in R, Intervals- Characterization theorem, Nested intervals, Nested interval property, The unaccountability of R, Binary and decimal representation of real numbers.

### UNIT-II(15 Hrs.)

Sequences of Real Numbers A sequence in R, The limit of a sequence, Convergence of a sequence, Uniqueness of limits, Limit theorems, Monotone sequence, Euler's number, Subsequence, Divergent criteria, Monotone subsequence theorem, Bolzano - Weierstrass theorem, Cauchy sequence, Cauchy convergence criterion, Properties of divergent sequences.

### UNIT-III(15 Hrs.)

Infinite Series Infinite Series, Convergence of infinite series, thither m test, Cauchy criterion for series, the harmonic series, P- series, Comparison test. Absolute convergence, Tests for absolute convergence - The root test, the ratio test, the integral test, The Rabbe's test, Logarithmic test, Gauss test, Alternating series, Leibnitz test, Dirichlettest, Abel's test.

### UNIT-IV(15 Hrs.)

Limits and Continuity of Functions Limits and Continuity of functions, Cluster point of a subset of R, Limit of a function at a cluster point of a set, Sequential criterion for the limits, Divergence criterion, Limit theorems, Squeeze theorem, Infinite limits. Continuous functions, Sequential criterion of continuity, Discontinuity criterion, Combinations of continuous functions- sum, Difference, Product and quotient and compositions. Continuous functions on intervals, Boundedness theorem, Maxi mu m-Mini mu m theorem, Bolzano's Inter mediate value theorem, Preservation of intervals theorem. Uniform continuity, Non-uniform continuity criteria, Uniform continuity theorem, Lipchitz functions, Continuous Extension theorem, Approximations of continuous functions by step functions and by piece wise linear functions, Weierstrass Approximation theorem.

## PHYSICAL EDUCATION - VI

**Subject Code: BACSD1-614** **L T P C 4 0 0 4** **Duration: 60 Hrs.**

**Course Outcomes:**

**CO1:** To study the behavior of India and world physical education.

**CO2:** Learning how to resist unfavorable and working conditions, decreasing fatigue during professional activities and raising the quality of results.

**CO3:** Fostering of motivational attitude to the physical education, healthy life style and regular exercising..

**CO4:** Learning the methods of self control while exercising.

**COURSE ARTICULATION MATRIX**

| Cos | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | 3 | | 3 | 1 | | |
| CO2 | | | 3 | | 3 | | 3 | | | 1 | | |
| CO3 | | | 3 | | 3 | | 3 | 1 | | 3 | | |
| CO4 | | | 2 | | | | 3 | | | | | |

**(THEORY – 60 MARKS)**

### UNIT – I(15 Hrs.)

- **Intramural and Extramural Tournaments**: Introduction, Importance and Organization.
- **Tournaments**: Introduction and various classifications: Elimination (Knock out), Round robin (League Cyclic, Tabular and Staircase Method), Combination & challenge
- **Life Sketch of Sports Personalities**: Major Dhyan Chand, S. Milkha Singh, Prof. Aimer Singh, P.T.Usha, Leander Paes and Abhinav Bindra.

### UNIT – II(15 Hrs.)

- **Balanced Diet & Nutrition**: Introduction, Components, Sources and Functions of each Component.
- **Obesity and Over Weight Management**: Introduction, Causes, General Problems Effects on Health, Preventive and Remedial Measures.
- **Physiological Terminologies**: Hemoglobin, Cardiac output, Stroke volume, Oxygen

### UNIT – III(15 Hrs.)

- **Sports Training**: Introduction, Aims & Objectives, Characteristics and Principles.
- **Physical Fitness**: Introduction, its Components and their Types (Speed, Strength, Endurance, Co-ordination and Flexibility), factors affecting physical fitness.
- **Training Method**: Circuit training, Interval training, Fartlek training, Weight training Plyometric training and Cross country.

### UNIT – IV(15 Hrs.)

- **Sports Performance**: Introduction, Causes of Deterioration of sports performance, Indian Performance at Olympics, Asian & Commonwealth Games, and Suggestions for improving Indian Sports Performance.

- **Relay Races**: Rules & Regulations, Layout and Technique.
- **Cricket**: History, Layout, General Rules & Regulation, Officials, Major Tournaments and Arjuna Awardees.

**PRACTICAL (40 MARKS)**
**RELAY RACES AND CRICKET**

Evaluation will be based on skill test, Performance, Practical file and Viva Voce.

- **Blood Pressure And Pulse Rate (Practical)**
  Operational techniques to measure blood pressure & pulse rate with different medical equipment.

********END*******

*References:*

(e) *Dr. Nishan Singh Deol (1980) : Text book of Physical Education & Sports. ( AP Publishers, Jalandhar).*

(f) *Singh Ajmer et al (2000) : Modern Text Book of Physical Education, Health and Sports", Kalyani Publishers, Ludhiana*

## ELECTIVE ENGLISH - VI

**Subject Code: BACSD1-615** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:**Students are encouraged and enabled to read various types of text on their own and discuss them among peers.
**CO2:** Students can develop their linguistic and pragmatic competence for learning.
**CO3:** Students are introduced to the grammatical properties in order to enable them to write and speak English consciously.
**CO4:** Students are introduced to appropriate literary strategies to read literature.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | 3 | | | 2 | | | | | |
| CO2 | 3 | | 2 | 2 | | | 2 | | | | | |
| CO3 | 3 | | 2 | 3 | | | 2 | | | | | |
| CO4 | 3 | | 2 | 3 | | | 2 | | | | | |

### UNIT – I(15 Hrs.)

- Literary Teams. :Fiction, Non-fiction, Narrative, Building Sroman, Picaresque Novel, Novel of sensibility, Historical Romance, Grothic novel, Realistic novel, Psychological naval, political novel, Regional novel, point of views, omniscient Author, first person Narrator, stream of consciousness, Protagonist/ Antagonist. Plot/story,Character, Structure..

### UNIT – II(15 Hrs.)

- R.K Narayal- Noval – The Guide

### UNIT – III(15 Hrs.)

- A Essay on one topic of International importance.
- Report waiting

### UNIT – IV(15 Hrs.)

- Translation from Punjabi to English
- Direct / Indirect

## ECONOMICS - VI

**Subject Code: BACSD1-616** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** Developing the skill of data collection and use of sampling technique in research.
**CO2:** Developing the knowledge about theories of economic growth and development and issues of economic planning.
**CO3:** Understanding various issues of population, poverty, availability of resources and uses of Natural resources for sustainable development.
**CO4:** Developing research knowledge in economics.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | 2 | | | | 1 | 3 |
| CO2 | | | 3 | | | 1 | | | | | | |
| CO3 | | | | 1 | 3 | | | | 2 | | | |
| CO4 | | | 3 | | | | | | | | | |

### UNIT – I(15 Hrs.)

- Features of Indian economy on the eve of independence
- Nature and characteristics of Indian economy.
- Agriculture in India – Importance & Productivity.
- New Agricultural district or area programme ( IADP- Features, Objectives, Achievements of IADP Criticism)
- Application of Technology in Indian Agriculture : Meaning and Types of Agriculture Technology)
- Main Inputs of Modern Techniques of agriculture .
- Green Revolution ( Features/ Causes/Factors)
- Land Reforms ( Features, Need or Role)

### UNIT – II(15 Hrs.)

Industry – Role and problems of industrial development in India, measures for industrial development or steps taken by the govt for industrial development.
Public Enterprises: Objectives of public enterprises role or significance of public enterprises. Causes of low profitability in public sector organisation of public sector enterprises.

- Role and Problems of small and large scale industries.
- Industrial Pollution ( Types of Steps taken by the govt to control industrial pollution )

### UNIT – III(15 Hrs.)

Foreign Trade: Direction and composition of exports and imports main features of foreign Trade.
India's Balance of Payments - Meaning, Trends of Balance of Payments of Current Account, Measures / suggestions to correct Disqualification in the Balance of Payments.
Export Promotion : Meaning/ Need, Importance of Export promotion in India
Measures of Export promotion: Multinational Corporations: Meaning / features Advantages Role & Disadvantages.

**UNIT – IV(15 Hrs.)**

Planning: Features, Objectives, Failures of plans, Critical evolution of the latest fire year plan.

Money supply and Inflation in India: Introduction and meaning of Money supply, factors Affecting money supply in India

Inflation - Definitions, Types, Effects. causes

Unemployment : meaning, Nature and Types, causes. Suggestions to serve Unemployment Problems.

Inequalities of Income and wealth in India :Meaning/Nature, causes.

Role of Banks in Economic Development :Bank Meaning/functions/features

Reference Books:

(a) *Indian Economy – By TR Jain,Dr Rajinder Uppal,Mukesh Trehan,Ranju Trehan.*

## ਪੰਜਾਬੀਇਲੈਕਟਿਵ - VI

**Subject Code: BACSD1-617** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Outcomes:**

**CO1:** To develop a bonding with the mother tongue of the student.
**CO2:** To gain knowledge and understanding of the rich folk and cultural heritage of Punjab.
**CO3:** Knowledge and understanding of the various intricacies of the grammar and literature of Punjabi.
**CO4:** The program connects the students to their roots.

**COURSE ARTICULATION MATRIX**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 1 | | | | 1 | | | | | |
| CO2 | | | 1 | 3 | | | 1 | | 3 | 3 | | |
| CO3 | 3 | | 2 | 3 | | | 1 | | 2 | 2 | | |
| CO4 | | | 2 | | | | | | 3 | 2 | | |

### ਪਾਠਕ੍ਰਮ

1. ਪ੍ਰਗਤਨਪੰਜਾਬੀਕਾਵਿ
2. ਪੰਜਾਬੀਨਿਬੰਧਾਂਦਾਅਧਿਐਨ
3. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ
4. ਭਾਸ਼ਾਵਿਗਿਆਨ

### ਯਨਿਟਅਤੇਥੀਮ

1. (ੳ) ਮੱਧਕਾਲਅਤੇਮੁੱਢਲੇਬਸਤੀਵਾਦੀਕਾਲਦੀਪੰਜਾਬੀਕਵਿਤਾਪੁਸਤਕਵਿੱਚੋਂਪ੍ਰਸੰਗਸਾਹਿਤਵਿਆਖਿਆ।
   (ਅ) ਕਾਵਿਪੁਸਤਕਵਿੱਚੋਂਕਵਿਤਾਦਾਵਿਸ਼ਾਵਸਤੂ।
2. (ੳ) ਨਿਬੰਧਦੀਸਾਹਿਤਕਪਰਖ।
   (ਅ) ਨਿਬੰਧਸੰਗ੍ਰਹਿਵਿਚੋਂਲਘੂਉਤਰਾਂਵਾਲੇਪ੍ਰਸ਼ਨ।
3. ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸ (ਸੂਫੀਕਾਵਿ, ਮੁੱਢਲੇਬਸਤੀਵਾਦਨਾਲਸੰਬੰਧਿਤਕਿੱਸਾਕਾਵਿ।
4. ਭਾਸ਼ਾਵਿਗਿਆਨ : ਭਾਸ਼ਾਵਿਗਿਆਨਦੀਪ੍ਰੀਭਾਸ਼ਾ
   ਖੇਤਰਤੇਹੋਰਵਿਗਿਆਨਾਂਨਾਲਸੰਬੰਧ (ਮਨੋਵਿਗਿਆਨਅਤੇਸਮਾਜਵਿਗਿਆਨ)

- ਕੋਰਸ

  (iv) ਮੱਧਕਾਲਅਤੇਮੁੱਢਲੇਬਸਤੀਵਾਦੀਕਾਲਦੀਪੰਜਾਬੀਕਵਿਤਾ, ਡਾ. ਯੋਗਰਾਜਅੰਗਰਿਸ।
  (v) ਨਿਬੰਧਪ੍ਰਕਾਸ਼, ਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋ, ਪੰਜਾਬਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।

ਸਹਾਇਕਪੁਸਤਕਾਂ: ਡਾ. ਸੁਰਿੰਦਰਸਿੰਘਕੋਹਲੀ, ਪੰਜਾਬੀਸਾਹਿਤਦਾਇਤਿਹਾਸਪਬਲੀਕੇਸ਼ਨਬਿਊਰੋ, ਪੰਜਾਬਯੂਨੀਵਰਸਿਟੀ, ਚੰਡੀਗੜ੍ਹ।

| Semester 2nd | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| **BGWDS1-201** | Fundamentals of Animation | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| **BGWDS1-202** | Web Development Using PHP & MySQL | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| **BGWDS1-203** | Object Oriented Programming using C++ | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| **BGWDS1-204** | Software Lab IV (Object Oriented Programming Using C++) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **BGWDS1-205** | Software Lab V (Animation Based Minor Project Using Tools such as Scratch etc.) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **BGWDS1-206** | Software Lab VI (Project based on PHP and MySQL) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| **BHSMC0-041** | Environmental Sciences | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **BGWDS1-207** | Mentoring and Professional Development | 0 | 0 | 1 | 25 | --** | 25 | 1 |
| **Total** | | **-** | **-** | **-** | **365** | **360** | **725** | **22** |

** The Mentoring and Professional Development course will have internal evaluation only. (See guidelines at the last page of this file)

## FUNDAMENTALS OF ANIMATION

**Subject Code- BGWDS1-201** **L T P C 3 1 0 4** **Total Hours: 60**

**Course Outcomes:**

1. Learn the different mediums of Drawing and its importance for animation.
2. Know about the different mediums and techniques of drawing pencils and painting brushes.
3. Draw landscape with proper sketching sense, draw trees, plants, buildings, sky and to create the animation backgrounds.
4. Learn about the light and shadow and surface and texture sketching.

### UNIT-I (14 Hrs.)

**Starting with the tools for drawing:**

**Types of pencils:-**(HB,B,2B,4B,6B,8B,10B,12B),Charcoal Pencil, Clutch Pencil.

**Sheets:-**Cartridge, Hand-Made, Ivory, Art-Card, duplex, News-Print, Mount board sheet etc.

**Colors:-**Poster color, water color, pastel color, pencil color, waterproof ink.

**Brushes:-**Round and Flat

**Object Drawing**: Principles of object drawing, draw common shapes, forms on a Two-Dimension(2D)surface with geometry-structure, surface and texture, perspective and points of view, Knowing about line and make effects that can build, definition of light and shadow on objects and an assignment.

### UNIT-II (15 Hrs.)

**Rendition:** Rendition of the effect of light on simple forms and objects mood changing, quality of surface, solidity, drama, and impact.

**View point Drawing:** Viewpoint Drawing. Theory of viewpoint, one point and two point perspective as applied to objects, furniture, interior and exteriors of the buildings, study of light and shade etc.

### Unit–III (14 Hrs.)

**Study of Living World:** Drawing from Nature, Location drawing and learning to represent trees, plants, bushes, shrubs, insects, birds, and animals with attention to structured morphology, proportion, volume, and behavior.

### UNIT-IV (17 Hrs.)

**Human Creativity:** Explanation to human figure drawing–Drawings from Mannequin, Sketching of person figures from outside as well as inside. To know and catch the signs of the human form, weight, balance, Rhythm and proportion.

**Making Storyboard:** What is storyboard, usage of storyboard, drawing on storyboard, understanding and drawing movements of camera in storyboard.

**Reference Books:**

**1.** Drawing for the Absolute and Utter Beginner, Watson-Guptill, 2018.

2. Sketching for Animation: Developing Ideas, Characters and Layouts in Your Sketchbook, Peter Parr, Fairchild Books, 2016.

## WEB DEVELOPMENT USING PHP & MYSQL

**Subject Code- BGWDS1-202** **L T P C** **Total Hours: 60**
**3 1 0 4**

**Course Outcomes:**

1. Learn about server side script and its environment. Further, compare and contrast it with respect to client side script.
2. Learn the use of control structures and numerous native data types with their methods.
3. Make database connectivity between front end and back end.
4. Develop dynamic websites that can interact with different kinds of Database Languages.

### UNIT-I (14 Hrs.)

**Introduction to PHP:** Evolution of PHP & its comparison Interfaces to External systems, Hardware and Software requirements, PHP Scripting. Basic PHP Development, Working of PHP scripts, Basic PHP syntax, PHP data types.

**Displaying type information:** Testing for a specific data type, changing type with Set type, Operators, Variable manipulation, Dynamic variables and Variables scope.

### UNIT-II (15 Hrs.)

**Control Statements:** if() and elseif() condition Statement, The switch statement, Using the while() Loop, The do while statement, Using the for() Loop**.**

**Functions:** Function definition, Creation, Returning values, Library Functions, User defined functions, Dynamic function, default arguments, passing arguments to a function by value.

**Array** Anatomy of an Array, Creating index based and Associative array, Looping array using each() and for each() loop.

### UNIT-III (17 Hrs.)

**Forms :** Working with Forms, Super global variables, Super global array, Importing user input, Accessing user input, Combine HTML and PHP code, Using hidden fields, Redirecting the user..

**Working with File and Directories:** Understanding file & directory, Opening and closing a file, Coping, renaming and deleting a file, working with directories, File Uploading & Downloading. Generating Images with PHP: Basics of Computer graphics, Creating Image.

### UNIT-IV (14 Hrs.)

**Database Connectivity with MySql:** Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select).

**Reference Books:**

1. PHP: The Complete Reference, “Steven Holzner”, Tata McGraw Hill.
2. Programming PHP, “Kevin Tetroi”, O' Reilly.
3. Robin Nixon, Learning PHP, MySQL, and JavaScript, Shroff/O'Reilly.

## OBJECT ORIENTED PROGRAMMING USING C++

**Subject Code- BGWDS1-203** **L T P C** **Total Hours: 60**
**3 1 0 4**

**Course Outcomes:**

1. To learn programming from real world examples.
2. To Understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
3. To create computer based solutions to various real-world problems using C++.
4. To learn various concepts of object oriented approach towards problem solving.

### Unit-I (14 hours)

**Principles of Object Oriented programming:** Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure Oriented Language (C) and Object Oriented Language

### Unit-II (15 hours)

**Classes and Objects:** Defining Classes, Defining Member Functions, Declaration of Objects To Class, Access to Member Variables from Objects, Different Forms of Member functions, Access specifiers (Private, public, protected), Array of Objects.

**Concept of Constructors:** Introduction To Constructors, Parameterized Constructor, Copy Constructor, Multiple Constructors in Class, Dynamic Initialization of Objects, Destructors.

### Unit-III (17 hours)

**Inheritance and Operator Overloading:** Introduction to Inheritance, Types Of Inheritance:- Single Inheritance, Multiple Inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance, Defining Operator Overloading, Overloading of Unary and Binary operators, Rules for overloading operators.

### Unit-IV (14 hours)

**Polymorphism and File Handling:** Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes. Opening and Closing File, Reading and Writing a file.

**Reference Books:**

1. Object Oriented Programming with C++, E. Balaguru Sami, Fourth Edition, Tata Mc-Graw Hill, 2009.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications, 2013.
3. The C++ Programming Language, Bjarne Stroustrup, Third Edition, Addison- Wesley Publishing Company, 2015.
4. Object Oriented Programming Using C++, Salaria, R.S, Fourth Edition, Khanna Book Publishing, 2017.

## OBJECT ORIENTED PROGRAMMING USING C++ (SOFTWARE LAB-IV)

**Subject Code: BGWDS1-204** **L T P C**
**0 0 4 2**

**Course Outcomes:**

1. To learn programming from real world examples.
2. To understand an object oriented approach for finding Solutions to various problems with the help of C++ language.
3. To create computer based solutions to various real-world problems using C++.
4. To learn various concepts of object oriented approach towards problem solving.

This laboratory course will comprise of following assignments and projects:

1. Write a program to enter mark of 6 different subjects and find out the total mark (Using cin and cout statement)
2. Write a function using reference variables as arguments to swap the values of pairs of integers.
3. Write a function to find the largest of three numbers.
4. Write a program to find the factorial of a number.
5. Define a class to represent a bank account which includes the following members as

**Data Members:**

a) Name of the depositor
b) Account Number
c) Withdrawal amount d) Balance amount in the account

**Member Functions:**

a) To assign initial values
b) To deposit an amount
c) To withdraw an amount after checking the balance
d) To display name and balance.

6. Write the above program for handling n number of account holders using an array of objects.
7. Write a C++ program to compute the area of right angle triangle, equilateral triangle, isosceles triangle using function overloading concept.
8. Consider an example of declaring the examination result. Design three classes: student, exam and result. The student has data members such as roll no, name. Create the class exam by inheriting the student class. The exam class adds data members representing the marks scored in 5 subjects. Derive the result from exam-
Class and it has its own data members like total, avg.
9. Write a program for overloading the Unary ++ operator.
10. Write a program for overloading of Binary + operator.
11. Write a program of Virtual Functions.
12. Write a program of Abstract Classes.
13. Write a program to read and write from a file.

**Reference Books:**

1. Object Oriented Programming with C++, E. Balaguru Sami, Fourth Edition, Tata Mc-Graw Hill, 2009.
2. To understand an object oriented approach for finding Solutions to various problems with the help of C++ language.
3. To create computer based solutions to various real-world problems using C++.
4. To learn various concepts of object oriented approach towards problem solving.

**ANIMATION BASED MINOR PROJECT (SOFTWARE LAB-V)**

**Subject Code: BGWDS1-205** **L T PC**
**0 0 4 2**

**Course Outcomes:**

1. Create basic shapes and forms on a two-dimensional surface using geometry.
2. Analyze how to draw various objects based on their attributes.
3. Learn how to visually observe, visualize, and experience content based on nature.
4. Study about human figures for character drawing.

This laboratory course will comprise as exercises with tools such as Scratch to supplement that is learnt under the subject code:

1 Assignment on sketching by using Drawing pencils:- (HB, B, 2B,4B, 6B,8B, 10B, 12B), Charcoal Pencil, Clutch Pencil.

2 Assignment on drawing scenery by using colors (poster color, Water Color, Pastel color, Pencil Color, waterproof ink).

3 Assignment on poster designs with shades by using sheets (Cartridge, Hand Made, Ivory, Art Card, Duplex, News Print, Mount board sheet etc.).

4 Assignment on Round and Flat brush painting.

5 Assignment on design based on geometry - structure, surface and texture.

6 Assignment on light and shadow on objects and an assignment.

7 Assignment on design based on objects mood changing, quality of surface, solidity, drama, and impact.

8 Assignment on one point and two point perspective.

9 Assignment on furniture, interior and exteriors of the buildings Designs.

10 Assignment on drawing Nature & Location scene.

11 Assignment on Design based on light and shade of the pencils and brushes.

12 Drawing assignments on Nature, Location drawing, trees, plants, bushes, shrubs, insects, birds, and animals.

13 Assignment on drawings from Mannequin, Sketching of person figures from outside as well as inside.

14 Assignment on drawing on storyboard, understand and draw movements of camera in storyboard.

**Reference Books:**

1. Sketching for Animation: Developing Ideas, Characters and Layouts in Your Sketchbook, Peter Parr, Fairchild Books, 2016.

## PROJECT BASED ON PHP AND MYSQL (SOFTWARE LAB VI)

**Subject Code: BGWDS1-206** **L T PC**
**0 0 4 2**

**Course Outcomes:**

1. Solve simple to advanced online problems of web pages.
2. Develop logics of various programming problems using numerous data types and control structures.
3. Client Server concepts, Static & Dynamic environment of the websites etc.
4. Design and implement the concept of Database connectivity.

This laboratory course will comprise of following assignments and projects:

1. Take values from the user and compute sum, subtraction, multiplication, division and exponent of value of the variables.
2. Write a program to find the area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3. Compute and print roots of quadratic equations.
4. Write a program to determine whether a triangle is isosceles or not?
5. Print multiplication table of a number input by the user.
6. Calculate sum of natural numbers from one to n number.
7. Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13 21…..n
8. Write a program to find the factorial of any number.
9. Determine prime numbers within a specific range.
10. Write a program to compute the Average and Grade of student's marks.
11. Compute addition, subtraction and multiplication of a matrix.
12. Count the total number of vowels in a word "Develop & Empower Individuals".
13. Determine whether a string is palindrome or not?
14. Display word after Sorting in alphabetical order.
15. Check whether a number is in a given range using functions.
16. Write a program that accepts a string and calculates the number of upper case letters and lower case letters available in that string.
17. Design a program to reverse a string word by word.
18. Write a program to create a login form. On submitting the form, the user should navigate to the profile page.
19. Design the front page of a college or department using a graphics method.
20. Write a program to upload and download files.

**Reference Books:**

PHP: The Complete Reference, "Steven Holzner", January 1, 2007. Tata McGraw- Hill Education.
Programming PHP, "Kevin Tetroi", O' Reilly. Published by Wiley Publishing, Inc. 10475 Cross point Boulevard Indianapolis, IN 46256

## ENVIRONMENTAL SCIENCES

**Subject Code: BHSMC0-041** **L T P C** **3 0 0 3** **Duration: 45 Hrs.**

**Unit-I** **(08 Hours)**

The Multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources

**Unit-II** **(15 Hours)**

Natural resources and associated problems
a) Forest resources; b) Water resources; c) Mineral resources; d) Food resources; e) Energy resources;
f) Land resources: Role of an individual in conservation of natural resources.

**Unit-III** **(12 Hours)**

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features of the ecosystems (a) Forest ecosystem (b) Grassland ecosystem (c)
(d) Desert ecosystem (e) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Unit- IV** **(10 Hours)**

Environmental Pollution: Air pollution; Water pollution; Soil pollution

**Recommended Books (Latest edition):**

1. Y.K. Sing, Environmental Science, New Age International Pvt, Publishers, Bangalore
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Pu blishing Pvt. Ltd., Ahmedabad – 380 013, India,
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd. 8. Down of Earth, Centre for Science and Environment

**** Guidelines regarding Mentoring and Professional Development**

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B Mentors/Faculty in charge shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

| Semester 3rd | | Contact Hours | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BGWDS1-301 | Data Structures | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BGWDS1-302 | Elements of Design | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BGWDS1-303 | Database Management Systems | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BGWDS1-304 | Image Editing & Photography | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BGWDS1-305 | Software Lab VII (Based on Data Structures) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BGWDS1-306 | Software Lab VIII ( Based on Elements of Design) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BGWDS1-307 | Software Lab IX (Based on Database Management Systems) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BGWDS1-308 | Software Lab X(Image Editing & Photography) | 0 | 0 | 2 | 20 | 30 | 50 | 1 |
| BGWDS1-309 | Mentoring and Professional Development | 0 | 0 | 1 | 25 | --** | 25 | 1 |
| **Total** | | **12** | **3** | **15** | **385** | **390** | **775** | **23** |

** The Mentoring and Professional Development course will have internal evaluation only. (See guidelines at the last page of this file)

| Semester 4th | | Contact Hours | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BGWDS1-401 | Programming in Python | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BGWDS1-402 | Digital Marketing | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BGWDS1-403 | Computer Graphics | 3 | 1 | 0 | 40 | 60 | 100 | 4 |
| BGWDS1-404 | Video Editing | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| BGWDS1-405 | Software Lab XI(Based on Programming in Python) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BGWDS1-406 | Software Lab XII(Based on Digital Marketing ) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BGWDS1-407 | Software Lab XIII(Based on Computer Graphics) | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| BGWDS1-408 | Software Lab XIV(Based on Video Editing) | 0 | 0 | 2 | 20 | 30 | 50 | 1 |
| BGWDS1-409 | Mentoring and Professional Development | 0 | 0 | 1 | 25 | --** | 25 | 1 |
| **Total** | | **12** | **3** | **15** | **385** | **390** | **775** | **23** |

** The Mentoring and Professional Development course will have internal evaluation only. (See guidelines at the last page of this file)

# 3RD SEMESTER

## Data Structures

**Subject Code- BGWDS1-301** **L T P C** **Total Hours: 60 hrs.**
**3 1 0 4**

**Course Outcomes**

1. Use appropriate data structures for problem solving and programming.
2. Understand basic data structures such as arrays, linked lists, stacks and queues and solve problems involving graphs, trees and heaps.
3. Apply appropriate searching and/or sorting techniques for application development.

### UNIT-I (14 Hrs.)

Introduction to Data Structures: Algorithms and flowcharts, basics analysis on algorithm, complexity of algorithm, introduction and definition of data structure, classification of data, arrays, various types of data structure, static and dynamic memory allocation, function and recursion.

Arrays, Pointers and Strings: Introduction to arrays- definition, one dimensional array and multidimensional arrays, pointer, pointer to structure, array and pointer, strings- introduction to strings, definition, library functions of strings.

### UNIT-II (15 Hrs.)

Stack: Introduction to stack, definition, stack implementation, operations of stack, applications of stack, multiple stacks- implementation of multiple stacks.

Queue: Introduction to queue, definition, queue implementation operations of queue, circular queue, de-queue and priority queue.

### UNIT-III (17 Hrs.)

Linked List: Introduction, representation and operations of linked lists, singly linked list, doubly linked list, circular linked list, and circular doubly linked list.

Tree: Introduction to tree, tree terminology binary tree, binary search tree, strictly binary tree, complete binary tree, tree traversal, threaded binary tree, avl tree b tree, b+ tree.

### UNIT-IV (14 Hrs.)

Graphs: Introduction, representation to graphs, graph traversals, shortest path algorithms.

Searching and Sorting: Searching, types of searching, sorting, types of sorting like quick sort, bubble sort, merge sort, selection sort.

Hashing: Hash function, types of hash functions, collision, collision resolution technique (CRT) and perfect hashing.

**Reference Books:**

1. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.
2. Tenenbaum, Y. Lanhghsam and A. J. Augenstein, “Data Structures Using C and C++", Prentice Hall of India.
3. Seymour Lipschutz “Theory & Practice of Data Structures”, McGraw Hill..

## Elements of Design

**Subject Code: BGWDS1-302** **L T P C** **3 1 0 4** **Total Hours: 60 hrs.**

**Course outcomes:**

1. Learn about the components of Design..
2. Learn methods & means to create images using the elements of design – space, depth, overlaps, transparency, plane, volume etc.
3. Gain the knowledge of formal systems of visual representation.

### UNIT-I (15 Hrs.)

Introduction: Visual perception and design: introduction of art and ideas - visual & critical thinking and analysis of 2 dimensional (2d) art through history, theoretical introduction to the perception, phenomenology, definition of design –different applications of design.

Design Elements: Elements of design: The concepts of design space and concepts of design, visual elements - line and shape, form, value, texture, color - measure, type, direction, character visual elements.

### UNIT-II (17 Hrs.)

Principles of Design: Composition in contrast: Black and white, positive and negatives, tessellation, units and their shapes, transformations, alteration, unity and variety / element of interest, contrast, elaboration, dominance, expressive content, color and composition – balance, harmony and rhythm.

### UNIT-III (14 Hrs.)

Composition: Three principles- unity, balance, center of interest, achieving emphasis- light shade, details, contrasts, balance- asymmetrical balance, informal balance, radial balance.

Text: Type; text and meaning, typography as text and as image, typography as text and as image combined with pictorial representation.

### UNIT-IV (14 Hrs.)

Color Wheel: Mixing of primary, secondary and tertiary colors, tint, shades, hues, tones, warm colors and cool colors, different color schemes (complimentary, split complementary, analogous, triadic etc.).

**Reference books:**

1. The Elements of Graphic Design, Alex W. White, Second Edition, Allworth Publications, 2011.

# Database Management Systems

**Subject Code: BGWDS1-303** **L T P C** **Total Hours: 60 hrs.**
**3 1 0 4**

**Course outcomes:**

1. Understand the basic concepts of DBMS.
2. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
3. Understand the concept of Transaction and Query processing in DBMS.

## UNIT-I (14 Hrs.)

Introduction: Introduction of DBMS, data modeling for a database, three level architecture of DBMS, components of a DBMS.

Data Models: Hierarchical, network and relational model, comparison of network, hierarchical and relational model, entity relationship model.

## UNIT-II (15 Hrs.)

Relational Database: Relational algebra and calculus, SQL fundamentals, DDL, DML, DCL, PL/SQL concepts, cursors, stored procedures, stored functions, database triggers.

## UNIT-III (17 Hrs.)

Introduction to Normalization: First, second, third normal forms, dependency preservation, Boyce-Codd normal form, multi-valued dependencies and fourth normal form, join dependencies and fifth normal form, domain-key normal form (DKNF).

## UNIT-IV (14 Hrs.)

Database Recovery: Concurrency management, database security, integrity and control, structure of a distributed database, design of distributed databases.

**Reference Books:**

1. "SQL, PL/SQL The Programming Language of Oracle", Ivan Bayross, BPB Publications, 4th Revised Edition (2009)
2. "An Introduction to Database Systems", C. J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, (2006).

## Image Editing & Photography

**Subject Code: BGWDS1-304** **L T P C** **Total Hours: 45 hrs.**
**3 0 0 3**

**Course outcomes:**

1. Know about the basic functions and features of digital camera
2. Understanding of describing image quality and being able to enhance it.
3. Learn the various formats of camera and functioning of SLR camera and its controls.

### UNIT-I (11 Hrs.)

Camera Controls: Introduction of camera: its parts and types. Menu items and shooting modes (Auto vs. Scene vs. Priority).

Exposure, Black and White Conversion, Intro to Lighting: Black and White photographs angle and their conceptual editing - Black &White conversion practice Exposure compensation. Concept of high- and low key Studio session.

### UNIT-II (13 Hrs.)

The Portrait: Introduction of Portrait Image and its types. Discussion of portrait genres and lighting techniques (studio, natural) Review aperture, shutter speed, ISO. Practice, editing and cropping.

Composition tips, and Shooting: Composition tips and photography shooting methods. Night/Day photography and low light shooting and their differences.

### UNIT-III (11 Hrs.)

Conceptual Photography and Contemporary Art: Photography Methods for conceptual click. Contemporary art shoot and editing techniques.

Creating a Body of Work: Sequence editing Trouble shooting with editing.

### UNIT-IV (10 Hrs.)

Basics of Editing: Introduction to Editing, fixing blemishes, color correcting and selective edits.

Output: Ready images for final output. Web vs. print. Color space conversion.

**Reference Books:**

1. Tate - The Photography Ideas Book, Lorna Yabsley, 2019.

## Software Lab VII (Based on Data Structures)

| Subject Code: BGWDS1-305 | L T P C | Total Hours: 60 hrs. |
| --- | --- | --- |
| | 0 0 4 2 | |

This laboratory course will comprise of following assignments and projects:

1. Program for implementing selection sort.
2. Program for implementing insertion sort.
3. Program for implementing quick sort.
4. Program for implementing merge sort.
5. Program for implementing Stack using array.
6. Program for converting infix to postfix form.
7. Program for implementing Queue using array.
8. Program for implementing Binary Search Tree.
9. Program for implementing Singly Linked list.
10. Program for Breadth First Search (BFS) for graph traversal.
11. Program for Depth First Search (DFS) for graph traversal.

## Software Lab VIII (Based on Elements of Design)

| Subject Code: BGWDS1-306 | L T P C | Total Hours: 60 hrs. |
|---|---|---|
| | 0 0 4 2 | |

This laboratory course will comprise of following assignments and projects:

1. Assignment on pattern design by sketching
2. Assignment on creating cartoon character design.
3. Assignment on visual logo designing
4. Assignment on designing 5 different types of conceptual Branding creative.
5. Assignment on magazine covers design by using typography.
6. Assignment on line and shape design
7. Assignment on creating character visual elements design
8. Assignment on Masking and Manipulation of pictures
9. Assignment on to develop one creative by Radial Balance.
10. Assignment on creating design by mixing Primary, Secondary and Tertiary Colors.
11. Assignment on text and as image combined with pictorial representation.
12. Assignment on creating Background design by using Warm Colors and Cool Colors.
13. Assignment on design & Print any five most important activities of your college in a collage.
14. Assignment on designing & Printing any brochure.

## Software Lab IX (Based on Database Management Systems)

**Subject Code: BGWDS1-307** **L T P C** **Total Hours: 60 hrs.**
**0 0 4 2**

This laboratory course will comprise of following assignments and projects:

1. Use of CREATE, ALTER, RENAME and DROP statement in the database tables (relations)
2. Use of INSERT INTO, DELETE and UPDATE statement in the database tables (relations)
3. Use of simple select statements.
4. Use of select query on two relations
5. Use of nesting of queries.
6. Use of aggregate functions.
7. Use of substring comparison.
8. Use of order by statement.
9. Count the customers with grades above Amritsar's average.
10. Find the name and numbers of all salesmen who had more than one customer.
11. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)
12. Create a view that finds the salesman who has the customer with the highest order of a day.
13. Demonstrate the DELETE operation by removing salesmen with id 1000. All his orders must also be deleted.
14. Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time.
15. Write a PL/SQL code to find sum of first 10 natural numbers using while and for loop.

## Software Lab X (Image Editing & Photography)

| Subject Code: BGWDS1-308 | L T P C | Total Hours: 30hrs. |
|---|---|---|
| | 0 0 2 1 | |

This laboratory course will comprise of following assignments and projects:

1. Assignment on lighting techniques for product photography and portrait photography.
2. Assignment on photo shoots (Exposure, Role of different focal lengths, Visual Composition).
3. Assignment on clicking the photos from different genres.
4. Assignment on digital workflow (Editing the image in the software).
5. Assignment on working with strobe lights & on-camera Flash.
6. Assignment on detailed understanding of exposure metering.
7. Assignment on digital workflow (Digital black and white photography).
8. Assignment on High Dynamic Range (HDR Photography).
9. Assignment on studio photography techniques (post shoot processing of photographs).
10. Assignment on the submission of Theme/Project based campaign.

# 4TH SEMESTER

## Programming in Python

**Subject Code- BGWDS1-401** **L T P C** **Total Hours: 60 hrs.**
**3 1 0 4**

**Course Outcomes:**

1. Familiar with Python environment, data types, operators used in Python and Learn the use of control structures and numerous native data types
2. Design user defined functions, modules, and packages and exception handling methods.
3. Create and handle files in Python and learn Object Oriented Programming Concepts

**UNIT-I (17 Hrs.)**

Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up path and environment variables, Running Python, First Python Program, Python interactive help feature, Python differences from other languages.

Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Understanding Data Type, Python Input and Output Functions, Import command.

Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.

**UNIT-II (14 Hrs.)**

Control Structures: Decision making statements, Python loops, Python control statements.

Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, strings.

**UNIT-III (15 Hrs.)**

Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables.

Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path searching of a module, module reloading, Standard Modules, Python Packages.

**UNIT-IV (14 Hrs.)**

Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.

File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read () & write () methods, tell() & seek() methods, renaming & deleting files in Python.

Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.

**Reference Books:**

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.

2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

## Digital Marketing

**Subject Code- BGWDS1-402** **L T P C** **Total Hours: 60 hrs.**
**3 1 0 4**

**Course Outcomes:**

1. Learn how to use new media such as mobile, search and social networking.
2. Understand how and why to use digital marketing for multiple goals within a larger
3. Marketing and/or media strategy.
4. Understand the major digital marketing channels - online advertising: Digital display,
5. Video, mobile, search engine, and social media.

### UNIT-I (14 Hrs.)

Introduction to Digital Marketing: Difference between Traditional Marketing and Digital Marketing, Benefits of using Digital Media, Inbound and Outbound Marketing, Online marketing POEM: (Paid, Owned, and Earned Media), Components of Online Marketing (Email, Forum, Social network, Banner, Blog), Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing.

Email Marketing: Email newsletters, Digests, Dedicated Emails, Lead Nurturing, Sponsorship Emails and Transactional Emails, Drawbacks of Email Marketing.

Social Media Marketing (SMM): Different types of Social Media Marketing like Facebook, LinkedIn, Twitter, Video, Instagram etc.

### UNIT-II (17 Hrs.)

Search Engine Optimization (SEO): About SEO, Need of an SEO friendly website, Importance of Internet and Search Engines; Role of Keywords in SEO.

On-Page Optimization (Onsite): Basics of Website Designing / Development; HTML Basics for SEO; Onsite Optimization Basics; Website Structure and Navigation Menu Optimization; SEO Content Writing. Keywords Research and Analysis (eg. SWOT analysis of website, finding appropriate keywords).

Off Page Optimization: Introduction; Local marketing of websites depending on locations; Promoting Subsequent pages of the website. Introduction to organic SEO vs non-organic SEO; Social Media Optimization Techniques and Page Rank Technology.

### UNIT–III (15 Hrs.)

Website Planning & Creation Content Marketing Strategy: Goals and concepts, Strategic building blocks Content creation & channel distribution, Tools of the trade, Advantages and challenges.

Keywords Research and Analysis: Introduction to Keyword Research; Business Analysis; Types of Keywords; Keywords Analysis Tools.

Web Presence: How to increase online presence and drive more traffic for a website, Search result visibility in search engines for chosen keyword and phrases, Using e-mail marketing to drive traffic for a website, Posting social media content for lead generation, Tools to create and manage content, Use of Blogging as content strategy.

Creating content: Writing and posting content on the web and in social networks, blog and video; Create, manage and implement a content marketing strategy; Monitoring and recording results to improve content marketing campaigns; Successful content marketing strategies and case studies.

**UNIT-IV (14 Hrs.)**

Online Advertising, Mobile Marketing and Web analytics: Introduction to Online Advertising and its advantages, Paid versus Organic, Pay Per Click (PPC) Model. Basic concepts Cost per Click (CPC), CPM, CTR, CR etc. About Mobile Marketing, Objectives of Mobile Advertising, Creating a Mobile Marketing Strategy, Introduction to SMS Marketing. About Web.

**Reference Books:**

1. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
2. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
3. Venkataramana Rolla, “Digital Marketing Practice guide for SMB: SEO, SEM and SMM”, CreateSpace Independent Publishing Platform, First edition.
4. Enge, E., Spencer, S., Stricchiola, J., & Fishkin, R. (2012). The art of SEO. "O'Reilly Media, Inc.".

## Computer Graphics

**Subject Code- BGWDS1-403** **L T P C** **Total Hours: 60 hrs.**
**3 1 0 4**

**Course Outcomes:**

1. Let students understand the basics of Computer Graphics, Input/output primitive and basic transformations, which can be applied to objects of graphics.
2. To Develop The Logical And Reasoning Skills Of The Students.
3. Learn Graphical primitives and their algorithms.

### UNIT-I (17 Hrs.)

Introduction to Computer Graphics: Applications of Computer Graphics. Graphs and Types of Graphs.
Input Devices: Light Pens, Graphic Tablets, Joysticks, Track Ball, Data Glove, Digitizers, Image Scanner.
Video Display Devices: Refresh Cathode Ray Tube, Raster Scan Displays, Random Scan Displays, Color CRT-monitors and Color generating techniques (Shadow Mask, Beam Penetration), Flat-Panel Displays; 3-DViewing Devices, Graphics Monitors And Workstations, Color Models(RGB and CMY), Lookup Table.
Introduction Virtual Reality & Environments: Applications in Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.

### UNIT-II (14 Hrs.)

Scan-conversions: Process and need of Scan Conversion, Scan conversion algorithms for Line, Circle and Ellipse using direct method, Bresenham's algorithms for line & circle and Midpoint Ellipse Algorithm along with their derivations, Area Filling Techniques, Flood Fill Techniques, Character Generation.

### UNIT-III (15 Hrs.)

2–Dimensional Graphics: Cartesian and need of Homogeneous coordinate system, Geometric Transformations (Translation, Scaling, Rotation, Reflection, Shearing),Viewing transformation and clipping (line, polygon and text) using Cohen-Sutherland, Sutherland Hodgeman and Liang Barsky algorithm for clipping

### UNIT-IV (14 Hrs.)

3–Dimensional Graphics: Introduction to 3-dimensional Graphics: Geometric Transformations (Translation, Scaling, and Rotation), Mathematics of Projections (Parallel & Perspective).Color Shading. Introduction to Morphing Techniques.

**Reference Books:**

1. D. Hearn and M.P. Baker, Computer Graphics, PHI New Delhi.
2. J.D. Foley, A.V. Dam, S.K. Feiner, J.F. Hughes, R.L Phillips, Computer Graphics Principles & Practices, Second Edition, Pearson Education,2007.
3. R.A. Plastock and G. Kalley, Computer Graphic, McGraw Hill, 1986.

## Video Editing

**Subject Code- BGWDS1-404** **L T P C** **Total Hours:-45 hrs.**
**3 0 0 3**

**Course Outcomes:**

1. Create different modes using various sounds, which will further help them integrate the same into their film projects.
2. Know about editing basics, tools and broadcast systems.
3. Knowledge of working with footages in an editing software.

**UNIT-I (11 Hrs.)**

Sound: Introduction to Audio, interrelationship between sound, culture and media theory. Ear Training, Critical listening, Role of sound in film, Storytelling through sound, Sound editing, working with Dialogue.

**UNIT-II (10 Hrs.)**

Mixing: The mixing process, Monitoring basics of mixing, Basic Mixing Rules and techniques, Equalizing, Audio equipment, Studio Production Techniques, Effects introduction, overview, compression.

**UNIT –III (11 Hrs.)**

Audio Formats - Digital and Analogue practical assignments and practice, Mastering -Introduction to mastering - Mastering setups – Monitoring (The whole practice will be done practically).

**UNIT-IV (13 Hrs.)**

Voiceover-The art of voiceover, how to lend voice to a short film, Voice modulation, voice sync. Submission-Design a soundtrack for a short film.

**Reference Books:**

1. Editing Digital Video (Digital Video and Audio Series, Robert Goodman & Patrick McGrath, McGraw-Hill Education, 2002.

## Software Lab XI (Based on Programming in Python)

**Subject Code: BGWDS1-405** **L T P C** **Total Hours: 60 hrs.**
**0 0 4 2**

This laboratory course will comprise exercises to supplement that is learnt under the Subject.

1. Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2. Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and Parallelogram.
3. Compute volume of following 3D shapes: cube, cylinder, cone and sphere.
4. Compute and print roots of quadratic equation ax 2 +bx+c=0, where the values of a, b, and c are input by the user.
5. Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,….
6. Write a program to determine whether a triangle is isosceles or not?
7. Print multiplication table of a number input by the user.
8. Compute sum of natural numbers from one to n number.
9. Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13…..n
10. Compute the factorial of a given number.
11. Count occurrence of a digit 5 in a given integer number input by the user.
12. Print Geometric and Harmonic means of a series input by the user.

## Software Lab XII (Based on Digital marketing)

**Subject Code: BGWDS1-406** **L T PC** **Total Hours: 60 hrs.**
**0 0 4 2**

This laboratory course will comprise exercises to supplement that is learnt under the Subject.

1. Explore Facebook, LinkedIn, Twitter, Video, Instagram, blog etc.
2. Explore Online Display Advertising, Ecommerce Marketing, Mobile Web and Content marketing.
3. Explore Email Marketing; Google AdWords and Google Analytics.
4. How to increase online presence and drive more traffic for a website.
5. Search result visibility in Google for chosen keywords and phrases.
6. Using e-mail marketing to drive traffic for a website.
7. Posting social media content for lead generation.
8. Tools to create and manage content.
9. Use of Blogging as a content strategy.
10. Show results for Search Engine Algorithms & Pagerank Technology
11. How to promote home page, SWOT Analysis of Website & finding right appropriate keywords.

## Software Lab XIII (Based on Computer Graphics)

| Subject Code: BGWDS1-407 | L T P C<br>0 0 4 2 | Total Hours: 60 hrs. |
|---|---|---|

This laboratory course will comprise exercises to supplement that is learnt under the Subject.

1. Use of basic functions of graphic available like circle, rectangle, arc, ellipse, flood fill, set color etc.
2. Design a logo/poster using primitive functions.
3. Draw a 3D object using palettes.
4. Line Drawing Algorithm: Direct method and DDA.
5. Bresenham's Line Drawing Algorithm
6. Bresenham's Circle Generating Algorithm.
7. Draw an ellipse using the Midpoint Algorithm.
8. Translation transformation on a polygon.
9. Scaling transformation on a polygon.
10. Rotation transformation on a polygon.
11. Shearing transformation on a polygon.
12. Minor project (eg Game/ Animation etc.)

## Software Lab XIV (Based on Video Editing)

| | | |
|---|---|---|
| **Subject Code: BGWDS1-408** | **L T P C**<br>**0 0 2 1** | **Total Hours: 30 hrs.** |

This laboratory course will comprise exercises to supplement that is learnt under the Subject.

1. Assignment on creating one short video footage by using basic functions of the software
2. Assignment on designing a background, text and colors editing in video.
3. Assignment on editing a video by using a time in frames.
4. Assignment based on the mixing of 2 or more videos.
5. Assignment based on Audio equipment, Studio Production Techniques.
6. Assignment based on effects introduction, overview, compression.
7. Assignment based on Audio Formats- Digital and Analogue practical assignments and practice.
8. Assignment based on mastering setups – Monitoring the sound, background.
9. Assignment based on video editing by adding Voiceover.
10. Assignment based on voice modulation, voice synchronization.
11. Assignment based on design a soundtrack for a short film

# Maharaja Ranjit Singh Punjab Technical University

## Bathinda-151001



## FACULTY OF SCIENCES

# SYLLABUS

## FOR

## B.Sc. (FOOD SCIENCE AND TECHNOLOGY) /

## BACHELOR OF FOOD SCIENCE AND TECHNOLOGY (Hons.)

## 2021 BATCH ONWARDS

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**(ii) Subject to change in the syllabi at any time.**

**Please visit the University website time to time.**

# SCHEME

| Semester-I | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BFOTS1-101 | General Microbiology | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-106 | Introduction to Food Technology-I | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-103 | *Mathematics | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-104 | Computer Science and Applications | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-105 | General Microbiology Lab I | - | - | 4 | 60 | 40 | 100 | 2 |
| BPHAR0-002 | **Life Sciences | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BHUMA0-001 | Communicative English | 3 | - | - | 40 | 60 | 100 | 3 |
| **Total** | | **18** | **5** | **4** | **300** | **400** | **700** | **25** |

*Mathematics for Medical Students
** Life Sciences for Non-Medical students.

| Semester-II | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BFOTS1-201 | Introduction to Food Technology II | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-202 | Principles of Food Preservation | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-203 | Environmental Studies | 3 | - | - | 40 | 60 | 100 | 3 |
| BFOTS1-204 | Food Chemistry | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-205 | Introduction to Food Technology II Lab-II | - | - | 4 | 60 | 40 | 100 | 2 |
| BFOTS1-206 | Principles of Food Preservation Lab-III | - | - | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **12** | **3** | **8** | **280** | **320** | **600** | **19** |

| Semester-III | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BFOTS1-301 | Dairy Technology | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-302 | Technology of Fruits & Vegetables | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-303 | Food Microbiology and Food Safety | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-304 | Dairy Technology Lab IV | - | - | 4 | 60 | 40 | 100 | 2 |
| BFOTS1-305 | Technology of Fruits & Vegetables Lab V | - | - | 4 | 60 | 40 | 100 | 2 |
| BFOTS1-306 | Food Microbiology and Food Safety Lab VI | - | - | 4 | 60 | 40 | 100 | 2 |
| **Departmental Elective -I (Select any one)** | | | | | | | | |
| BFOTD1-311 | Entrepreneurship Development | 3 | - | - | 40 | 60 | 100 | 3 |
| BFOTD1-312 | Food Fermentation Technology | | | | | | | |
| BFOTD1-313 | Food Additives | | | | | | | |
| BMNCC0-004 | Drug Abuse | 2 | - | - | 100 | - | 100 | 0 |
| **Total** | | **14** | **3** | **12** | **440** | **360** | **800** | **21** |

| Semester-IV | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BFOTS1-401 | Technology of Cereals, Pulses and Oilseeds | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-402 | Egg, Poultry & Meat Technology | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-403 | Food Plant Hygiene and Sanitation | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-404 | Technology of Cereals, Pulses and Oil Seeds Lab VII | - | - | 4 | 60 | 40 | 100 | 2 |
| BFOTS1-405 | Egg, Poultry & Meat Technology Lab VIII | - | - | 4 | 60 | 40 | 100 | 2 |
| BFOTS1-406 | Food Plant Hygiene and Sanitation Lab IX | - | - | 4 | 60 | 40 | 100 | 2 |

| Departmental Elective-II | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BFOTD1-411 | Nutraceutical and Functional Foods | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-412 | Nutraceutical and Functional Foods Lab X | - | - | 4 | 60 | 40 | 100 | 2 |
| **OR** | | | | | | | | |
| BFOTD1-413 | Bakery Technology | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-414 | Bakery Technology Lab XI | - | - | 4 | 60 | 40 | 100 | 2 |
| **Total** | | **13** | **3** | **16** | **400** | **400** | **800** | **24** |

**Note:** All the students are required to undergo 'In Plant Training' for 4 weeks in a Food Processing unit after final examinations of 4th semester. Final degree to the students will be awarded subject to their successfully completion of 'In Plant Training' as per university norms.

| **Semester-V** | | **Contact Hrs.** | | | **Marks** | | | **Credits** |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BFOTS1-501 | Unit Operations in Food Engineering | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-502 | Food Packaging | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-503 | Sugar & Confectionary Technology | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTS1-504 | Food Packaging Lab XII | - | - | 4 | 60 | 40 | 100 | 2 |
| BFOTS1-505 | Sugar & Confectionary Technology Lab XIII | - | - | 4 | 60 | 40 | 100 | 2 |
| **Departmental Elective-III** | | | | | | | | |
| BFOTD1-511 | Spices and Flavour Technology | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-512 | Spices and Flavour Technology Lab XIV | - | - | 4 | 60 | 40 | 100 | 2 |
| **OR** | | | | | | | | |
| BFOTD1-513 | Technology of Oils and Fats | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-514 | Technology of Oils and Fats Lab XV | - | - | 4 | 60 | 40 | 100 | 2 |
| **TOTAL** | | **14** | **2** | **12** | **340** | **360** | **700** | **22** |

Note: In Semester-V students have to choose either between:
BFOTD1-511, BFOTD1-512 or BFOTD1-513, BFOTD1-514

| Semester-VI | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BFOTS1-601 | Food Engineering | 3 | 1 | - | 40 | 60 | 100 | 4 |
| BFOTS1-602 | Food and Nutrition | 3 | 1 | - | 40 | 60 | 100 | 4 |
| **Departmental Elective-IV** | | | | | | | | |
| BFOTD1-611 | Sensory Evaluation of Food | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-612 | Sensory Evaluation of Food Lab XVI | - | - | 4 | 60 | 40 | 100 | 2 |
| **OR** | | | | | | | | |
| BFOTD1-613 | Food Plant Layout | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-614 | Food Plant Layout Lab XVII | - | - | 4 | 60 | 40 | 100 | 2 |
| **Departmental Elective-V** | | | | | | | | |
| BFOTD1-621 | Food Safety | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-622 | Food Safety Lab XVIII | - | - | 4 | 60 | 40 | 100 | 2 |
| **OR** | | | | | | | | |
| BFOTD1-623 | Food Quality Management | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTD1-624 | Food Quality Management Lab XIX | - | - | 4 | 60 | 40 | 100 | 2 |
| **TOTAL** | | **14** | **2** | **8** | **280** | **320** | **600** | **20** |

Note: In Semester-VI students have to choose between:
BFOTD1-611, BFOTD1-612 or BFOTD1-613, BFOTD1-614
BFOTD1-621, BFOTD1-622 or BFOTD1-623, BFOTD1-624

| Semester-VII | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| BFOTS1-701 | Food Storage Engineering | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTS1-702 | Food Biotechnology | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTS1-703 | Technology of Beverages | 4 | - | - | 40 | 60 | 100 | 4 |
| BFOTS1-704 | Snacks and Extrusion Technology | 4 | - | 0 | 40 | 60 | 100 | 4 |
| BFOTS1-705 | Technology of Beverages Lab XX | - | - | 4 | 60 | 40 | 100 | 2 |
| BFOTS1-706 | Snacks and Extrusion Technology Lab XXI | - | - | 4 | 60 | 40 | 100 | 2 |
| **TOTAL** | | **16** | **-** | **8** | **280** | **320** | **600** | **20** |

| Semester-VIII | | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|---|
| Subject Code | Subject name | | L | T | P | Int. | Ext. | Total | |
| BFOTS1-801 | PROJECT WORK | *Monthly Progress Report | - | - | - | 100 | - | 100 | 4 |
| | | Seminar | - | - | - | 100 | 100 | 200 | 8 |
| | | Viva-voice | - | - | - | 100 | 100 | 200 | 8 |
| **TOTAL** | | | - | - | - | **300** | **200** | **500** | **20** |

**Overall Marks / Credits:**

| Semester | Marks | Credits |
|---|---|---|
| I | 700 | 25 |
| II | 600 | 19 |
| III | 800 | 21 |
| IV | 800 | 24 |
| V | 700 | 22 |
| VI | 600 | 20 |
| VII | 600 | 20 |
| VIII | 500 | 20 |
| **Total** | **5300** | **171** |

# SEMESTER FIRST

## GENERAL MICROBIOLOGY

**Subject Code: BFOTS1-101** **L T P C** **Duration: 60Hrs.**
**3 1 0 4**

**Course Objectives:**

1. To understand theories related to growth of micro-organisms and their disease causing abilities.
2. To memorize the general characteristics of micro-organisms in relation to their effect on plant and human health.
3. To identify suitable tools, equipments and environmental conditions for the growth of micro-organisms.
4. To analyze the appropriate techniques for the control of microbial spoilage in foods.
5. To evaluate the various environmental factors affecting microbial growth.

**Course Outcomes:**

1. Understanding the various theories related to growth of micro-organisms and their disease causing abilities
2. Remembering the general characteristics of micro-organisms in relation to their effect on plant and human health.
3. Selection of suitable tools, equipments and environmental conditions for the growth of micro-organisms.
4. Identifying the appropriate method for the control of micro-organisms that result in food preservation.
5. Evaluation of various environmental factors affecting microbial growth.

### UNIT-I (15Hrs.)

Introduction: Discovery of microbial world, theory of spontaneous generation, Germ theory of disease, Koch’s postulates, Pure culture concept, Nature and properties of prokaryotic and eukaryotic micro-organisms.

### UNIT-II (15Hrs.)

General characteristics and Nutritional requirements: General characteristics of bacteria, yeast, mold, viruses, algae. Types of bacteria, nutritional classification of bacteria.
Reproduction of micro-organisms: Brief account of bacteria, yeast and mold reproduction.

### UNIT-III (15Hrs.)

Microbial Growth: Definition of growth, growth cycle, growth rate, generation time, measurement of growth, effect of environmental factors such as temperature, oxygen, moisture, salt, pH, oxidation-reduction potential and radiations on growth.

### UNIT-IV (15Hrs.)

Cultivation of micro-organisms: Pour plate method, spread plate method and streak plate Control of Micro-organisms: Control of micro-organisms by physical, chemical and biological methods.

**Recommended Books:**

1. Pelczar M. J., Chan E.C.S. and Krieg N.R., ‘Microbiology’, 5th Edition., McGraw Hill Co, Singapore,1987.
2. Stanier R.Y., Graham J.L., Wheelies M.L. and Painter P.R., ‘General Microbiology’, 5thEdition., The Macmillan Press Ltd.,London,1993.
3. Cappuccino J.G. and Sherman N., ‘Microbiology: A Laboratory Manual’, Benjamine- Cummings Publishing Co., USA,2004.
4. Gunase K. P., ‘Laboratory Manual in Microbiology’, New Age International (P) Ltd. New Delhi,1996

## INTRODUCTION TO FOOD TECHNOLOGY-I

**Subject code: BFOTS1-106** **L T P C** **Duration: 60Hrs.**
**3 1 0 4**

**Course Objectives:**
1. To impart knowledge regarding various disciplines of food science and technology and their applications in food production and preservation.
2. To understand the selection of appropriate techniques for the production of nutrient dense foods2.
3. To acquire knowledge about compositional and nutritional properties of different cereal grains that aid in the production of different food products.
4. To summarize degradation of fats and oils and its prevention.
5. To analyze the effects of various physico-chemical changes occur during processing of foods.

**Course Outcomes:**
1. Creating awareness about various disciplines of food science and technology and their applications in food production and preservation.
2. Understanding about selection of appropriate techniques for the production of nutrient dense foods.
3. Acquire knowledge about compositional and nutritional properties of different cereal grains that aids in the production of different food products.
4. Identifying problems related to the degradation of fats and their solutions that results in preservation.
5. Imparting knowledge about various physical and chemical changes occur during processing.

### UNIT-I (11Hrs.)

Introduction to Food Science and Technology, its scope and importance.

### UNIT-II (18Hrs.)

Compositional, Nutritional and Technological aspects of Plant foods
Wheat: structure and composition, types (hard, soft/strong, weak) Diagrammatic representation of structure of wheat grain.
Rice: Structure and composition, parboiling of rice- advantages and disadvantages. Malting, gelatinization of starch, types of browning- Maillard & caramelization.
Corn: Structure and composition, Dry and wet milling.
Millets: Types of millets and its nutritional properties.

### UNIT-III (15Hrs.)

Pulses: Structure and composition of pulses, toxic constituents in pulses, processing of pulses: soaking, germination, decortication, cooking and fermentation.

### UNIT-IV (16Hrs.)

Fats and Oils: Classification of lipids, types of fatty acids - saturated fatty acids, unsaturated fatty acids, essential fatty acids, trans fatty acids. Rancidity –Types- hydrolytic and oxidative rancidity and its prevention.

**Recommended Books**
1. Manay, S. and Shadaksharaswami, M., ‘Foods: Facts and Principles’, New Age Publishers, 2004.
2. Srilakshmi B., ‘Food science’, New Age Publishers,2002.
3. Meyer L. H., ‘Food Chemistry’, New Age,2004
4. Kenneth F. et al, edited-Vol-1, 2, ‘The Cambridge World History of Food, Cambridge’, Univ. Press,2000.
5. Eastwood M., ‘Principles of Human Nutrition’, 2nd Edition, Blackwell Publishing,2003.

## MATHEMATICS

**Subject Code: BFOTS1-103** **L T PC 3 1 0 4** **Duration: 60Hrs.**

**Course Objectives:**

1. To impart knowledge about basics of algebra and geometry.
2. To understand the numerical part and its application in solving problems related to processing and preservation.
3. To summarize the link between mathematics and Food Science.
4. To select appropriate techniques and methodologies for application in food engineering.
5. To develop an ability of cost analysis involved during construction and designing of food processing plants.

**Course Outcomes:**

1. Imparting knowledge about basics of algebra and geometry.
2. Understanding the numericals and their application in solving problems related to processing and preservation.
3. Summarizing the link between mathematics and Food Science.
4. Selection of appropriate techniques and methodologies for application in food engineering.
5. Developing an ability of cost analysis involved during construction and designing of food processing plants.

**UNIT-I (17Hrs.)**

Mensuration: Mensuration of rectangles, easy examples of garden paths, cost of planting trees and fencing gardens. Area of right angled triangles area and height of isosceles and equilateral triangles, area of triangles in terms of sides, rent of field. Area of parallelograms, rhombus, quadrilateral and trapezoid. Regular polygons with emphasis on hexagon and octagon. Simple cases of similar figures. Circumference and area of circles. Circular rings. Cost of fencing circular fields and paths.

**UNIT-II (14Hrs.)**

Mensuration: Volumes of cubes and rectangular solids. Cubic contents of tanks and cisterns, Volumes of triangular & rectangular prisms, right circular cylinders and segments of cylinders (Easy numerical examples based on Science only to be set Proofs of formulae).

**UNIT-III (15Hrs.)**

Algebra: Solution of quadratic equations and of those reducible to quadratic equation (One variable). Relation between roots and co-efficients.nth term and sum to n terms of an A. P. and
G.P. nth term of an H. P.(excluding means and problems on numbers). Permutation and combinations: simple problems only. (Proofs of formulae not required).

**UNIT-IV (14Hrs.)**

Matrix and Determinant: Introduction matrices, Types of matrices, Operation of matrices, Transpose of matrix, Matrix multiplication, Determinants, Properties of determinants, Products of determinants, Minors and co-factors, Adjoint of a square matrix, Singular and non singular matrices, Inverse of Matrices.

**Recommended Books**

1. Algebra by Kapoor D. C. and SinghG.
2. Algebra by Nagpal T. N. and GuptaK.K.
3. Comprehensive Calculus by Dehiya R.S.
4. New Style Calculus for T. D.C

## COMPUTER SCIENCE & APPLICATIONS

**Subject Code: BFOTS1-104** **L T PC 3 1 0 4** **Duration: 60Hrs.**

**Course Objectives:**

1. To understand the basics of computers and terminologies used.
2. To identify problems related to security against computer viruses along with their preventive measures.
3. To provide knowledge about collection, storage and analysis of data with least human errors.
4. To create an ability to prepare effective presentations and communicate with target audience.
5. To develop managerial skills by imparting knowledge about applications of computers in different fields.

**Course Outcomes:**

1. Understanding the basics of computers and terminologies used.
2. Identifying the problems related to security against computer viruses along with their preventive measures.
3. Providing knowledge about collection, storage and analysis of data with least human errors.
4. Creating an ability to prepare effective presentations and communicating with target audience.
5. Developing managerial skills by imparting knowledge about applications of computers in different fields.

### UNIT-I (16Hrs.)

Computer Fundamentals Introduction to Computers: Characteristics of computers, Historical perspectives of computers, Computer generations, types of computers and uses, Software, Hardware, Basic architecture and functions of CPU and its parts, Important I/O devices like Keyboard, Mouse, Printers, Video Monitors. Memory Storage: Memory Cells, Semiconductor and Magnetic core memory, ROM (its types), RAM, Cache and Virtual memory, Secondary storage devices and their organization (Hard disk, Floppy disk, CD, DVD).

### UNIT-II (16Hrs.)

Operating Systems: Definitions, Need, Organization, Functions, Types of Operating Systems, DOS, Windows, Handling Drives, Directories and files, Commands (Internal & External), Icons, Clipboard, Folders, Major differences between DOS & Windows.
Communication Networks: Hardware and software components, seven layers of OSI architecture, Network Topologies (Ring, Star, Fully Connected and Bus), LAN and WAN, Bounded and unbounded communication media, Internet, World Wide Web and I.T., Browsers, Important terminology regarding Internet applications.

### UNIT-III (14Hrs.)

Computer Applications Word Processing: Techniques, File manipulation, Formatting, Printing setups Table handling, Mail merge, etc. using MS-Word.
Spreadsheet Package: Worksheets, formatting sheets, Calculations and graphing using formulae and functions, Import and export of data using MS-Excel.

**UNIT- IV (14Hrs.)**

Computer Applications Graphics: Objectives and types of graphics, Presentation packages, Slides designing, Diagrams and graphs, Import & Export data using MS-Power Point.

Data Security against Viruses: Definition of computer viruses, detection, prevention and cure against viruses using anti-virus software packages.

**Recommended. Books**

1. Rajaraman, 'Fundamentals of Computers', Prentice Hall ofIndia.
2. N.K. Tiwari, 'Computer Fundamental with Pharmacy Applications', 1st Edition, Pharm. MedPress,2008.
3. Stultz, 'Learn MS-Office 2000', BPBPublications.
4. Ivens, 'Using Microsoft Windows', Prentice Hall of India,1998.
5. Stultz, 'Learn DOS in a day', BPBPublication

## GENERAL MICROBIOLOGY LAB-I

**Subject Code: BFOTS1-105** **L T P C** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To understand working of different equipments used in microbiology and their applications in food production and preservation.
2. To impart knowledge about practical handling of microbiological tools.
3. To determine the microbial load of different food products with suitable techniques and interpret the factors associated with them.
4. To identify the methods for cultivation, isolation and storage of micro-organisms that can be beneficial for human health and environment.
5. To develop an ability to work effectively both individually and as a team member during the collection of samples from different sources.

**Course Outcomes:**

1. Understanding about working of different equipment's of microbiology and their applications in food production and preservation.
2. Imparting knowledge about practical handling of microbiological tools that ensures safety of food products.
3. Determination of microbial load of different food products with suitable techniques and interpret the factors associated with them.
4. Identification of suitable methods for the cultivation, isolation and storage of micro-organisms that can be beneficial for human health and environment.
5. Creating ability to work effectively both individually and as a team during the collection of samples from different sources.

**Practical**

1. To study different parts of amicroscope.
2. Study of instruments (Autoclave, Hot air oven, Incubator, Laminar flow, pH meter, and spectrophotometer) of microbiology laboratory.
3. Preparation of nutrient agar and Mac Conkey's Agar plates, slants and broth.
4. To study the serial dilution method.
5. To perform pour plate, spread plate and streak plate methods for isolation and enumeration of micro-organisms.
6. To perform Simple staining.
7. To stain the given bacteria by Gram's staining method.
8. To perform negative staining.
9. To determine the number of micro-organisms with a Haemocytometer.
10. To determine the motility of bacteria by hanging drop method.

## LIFE SCIENCES

**Subject code: BPHAR0-002** **L T PC 3 1 0 4** **Duration: 60 Hrs.**

**Course Objectives**

1. To understand the basics of cell and molecular biology.
2. To impart knowledge regarding physiology and anatomy of human body.
3. To identify the micro-organisms responsible for infectious and contagious diseases along with their preventive measures.
4. To create an ability to develop vaccines and antibiotics for societal benefits.
5. To apply basics of genetic engineering in food and human health that can support agro-food industries.

**Course outcome:**

1. Understanding the basics of cell and molecular biology.
2. Imparting knowledge regarding physiology and anatomy of human body.
3. Identification of micro-organisms responsible for infectious and contagious diseases along with their preventive measures.
4. Creating an ability to develop vaccines and antibiotics for societal benefits.
5. Application of basics of genetic engineering in food and human health that can support agro-food industries.

**UNIT-I (15Hrs.)**

Cell & Molecular Biology: Cell theory, Prokaryotic cell, eukaryotic cell, cell wall, cell membrane, cytoskeleton, nucleus, chloroplast, mitochondria, endoplasmic reticulum, golgi bodies, ribosomes, lysosomes, vacuoles and centrosomes.

**UNIT- II (15Hrs.)**

Cell cycle & division, amitosis, mitosis and meiosis. Study of genetic material, structure of DNA and RNA, replication, transcription, genetic code, translation & DNA repair.

Human physiology: Digestion and absorption, breathing and respiration, circulation, excretory system, nervous system, skeletal and muscular systems.

**UNIT-III (12Hrs.)**

Human health and diseases: Pathogens, Parasites causing human disease (malaria, dengue, chickenguinea, typhoid, pneumonia, common cold, ringworm) and their control. Basic concepts of immunology, vaccines, antibiotics, cancer, HIV and AIDS.

**UNIT-IV (18Hrs.)**

Biotechnology and its applications: Recombinant DNA technology, applications in health, agriculture and industries, genetically modified organisms; Plant breeding, tissue culture, single cell protein, Transgenic plants and transgenic animals.

**Recommended books:**

1. Lehninger A. L., David L. N. and Michael M. C., ‘Principles of Biochemistry’, Worth Publishers, 1993.
2. Singh B.D., ‘Biotechnology’, KalyaniPublishers.
3. Harvey L., Arnold B., Chris A. K., Paul M., Monty K., Jems D. and Mathew P. S., ‘Molecular Cell Biology’, W.H. Freeman,2004.

## COMMUNICATIVE ENGLISH

| Subject Code: BHUMA0-001 | L T P C<br>3 0 0 3 | Duration: 45 Hrs. |
|---|---|---|

**Course Objectives:**

1. To understand the concept of effective communication, its components, and importance for life-long learning.
2. To impart knowledge regarding different communication styles and their matrix.
3. To engage students in team work by organizing group discussions on different topics.
4. To improve interview skills of students and applying those to crack future interviews.
5. To develop the art of being an effective presenter using specific presentation and communication skills.

**Course Outcomes:**

1. Understanding the concept of effective communication, its components, and importance for life-long learning.
2. Imparting knowledge regarding different communication styles and their matrix.
3. Engaging students in team work by organizing group discussions on different topics.
4. Improving interview skills of students and applying those to crack future interviews.
5. Developing the art of being an effective presenter using specific presentation and communication skills.

### UNIT-I (12 Hrs.)

Communication Skills: Introduction, Definition, the Importance of Communication, The Communication Process – Source, Message, Encoding, Channel, Decoding, Receiver, Feedback, Context.
Barriers to communication: Physiological Barriers, Physical Barriers, Cultural Barriers, Language Barriers, Gender Barriers, Interpersonal Barriers, Psychological Barriers, Emotional barriers.

### UNIT-II (11Hrs.)

Perspectives in Communication: Introduction, Visual Perception, Language, Other factors affecting our perspective - Past Experiences, Prejudices, Feelings, Environment.
Elements of Communication: Introduction, Face to Face Communication - Tone of Voice, Body Language (Non-verbal communication), Verbal Communication, Physical Communication.

### UNIT-III (12Hrs.)

Communication Styles: Introduction, The Communication Styles Matrix with example for each Direct Communication Style, Spirited Communication Style, Systematic Communication Style, Considerate Communication Style.
Basic Listening Skills: Introduction, Self-Awareness, Active Listening, becoming an Active Listener, Listening in Difficult Situations.

### UNIT-IV (10Hrs.)

Interview Skills: Purpose of an interview, Do's and Don'ts of an interview
Giving Presentations: Dealing with Fears, Planning your Presentation, Structuring Your Presentation, Delivering Your Presentation, Techniques of Delivery

Group Discussion: Introduction, Communication skills in group discussion, Do's and Don'ts of group discussion.

**Recommended Books**

1. Ruther Ford A. J., 'Basic Communication Skills for Technology', 2nd Edition, Pearson Education,2011.
2. Kumar S. and Pushplata, 'Communication Skills', 1st Edition, Oxford Press,2011.
3. Stephen P. Robbins, 'Organizational Behaviour', 1st Edition, Pearson,2013.
4. Gill H., 'Brilliant-Communication Skills', 1st Edition, Pearson Life,2011.
5. Gopalawamy R., 'The Ace of Soft Skills: Attitude, Communication and Etiquettefor Success', 5th Edition, Pearson,2013.
6. Dalley D., Burton L. and Margaret G., 'Developing your Influencing Skills', Green Hall, 1st Edition, Universe of Learning LTD,2010.
7. Konarnira, 'Communication Skills for Professionals', 2nd Edition, PHI,2011.
8. Mitra B. K., 'Personality Development and Soft Skills', 1st Edition, Oxford Press,2011.
9. 'Soft Skill for Everyone', Butter Field, 1stEdition, Cengage Learning India Pvt. Ltd., 2011.
10. Francis Peters S.J., 'Soft Skills and Professional Communication', 1st Edition, McGraw HillEducation, 2011.
11. John A., 'Effective Communication', 4th Edition, Pan MacMillan, 2009.
12. Aubrey D., 'Bringing out the Best in People', 2nd Edition, McGraw Hill,1999.

# SEMESTER SECOND

## INTRODUCTION TO FOOD TECHNOLOGY–II

**Subject Code: BFOTS1-201** | **L T P C** | **Duration: 60Hrs.**
**3 1 0 4**

**Course Objectives:**

1. To understand the physiological-, physical-, chemical-, and pathological changes during storage of fruits and vegetables.
2. To impart knowledge regarding compositional and nutritional aspects of fruits and vegetables, useful in the development of value-added products.
3. To apply ethics during the handling, processing and preservation of animal products.
4. To summarize the general processing methods of Indian spices and their therapeutic uses.
5. To identify appropriate techniques for the quality evaluation of plant and animal based food products.

**Course Outcomes:**

1. Understanding the physiological-, physical-, chemical-, and pathological changes during storage of fruits and vegetables.
2. Imparting knowledge regarding compositional and nutritional aspects of fruits and vegetables, useful in the development of value-added products.
3. Applying ethics during the handling, processing and preservation of animal products.
4. Summarizing the general processing methods of Indian spices and their therapeutic uses.
5. Identification of appropriate techniques for the quality evaluation of plant and animal based food products.

### UNIT-I (16Hrs.)

Fruits and Vegetables: Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments, Dietary fibre.
Postharvest changes in fruits and vegetables: Climacteric rise, horticultural maturity, physiological maturity, physiological changes, physical changes, chemical changes, pathological changes during the storage of fruits and vegetables.

### UNIT-II (17Hrs.)

Compositional, Nutritional and Technological aspects of Animal foods Flesh Foods - Meat, Fish, Poultry
Meat- Definition of carcass, concept of red meat and white meat, composition of meat, marbling, post-mortem changes in meat- rigor mortis, tenderization of meat, ageing of meat.

Fish- Classification of fish (fresh water and marine), aquaculture, composition of fish, characteristics of fresh fish, spoilage of fish- microbiological, physiological, biochemical.

Poultry- Structure of hen's egg, composition and nutritive value, egg proteins, characteristics of fresh egg, deterioration of egg quality, difference between broiler and layers.

### UNIT-III (12Hrs.)

Milk and Milk Products: Definition of milk, chemical composition of milk, its constituents, processing of milk, pasteurization, homogenization. An overview of types of market milk & milk products.

**UNIT-IV (15Hrs.)**

Food Spices and Condiments: Types and uses of spices and condiments, Chemical composition, Extraction, General processing, uses and special attributes of important Indian spices like pepper, cinnamon, clove, ginger, turmeric, cardamom, fenugreek and fennel, seasonings and condiments blend.

**Recommended Books**

1. ManayS.andShadaksharaswamiM.,‘Foods:FactsandPrinciples’,NewAgePublishers,
2. 2004.
3. Srilakshmi B., ‘Food Science’, New Age Publishers,2002.
4. Meyer L. H., ‘Food Chemistry’, New Age,2004
5. Kenneth F. et.al, edited-Vol-1, 2, ‘ The Cambridge World History of Food’, Cambridge Univ.Press, 2000.
6. Eastwood M., ‘Principles of Human Nutrition’, 2nd Edition Blackwell publishing,2003.

## PRINCIPLES OF FOOD PRESERVATION

**Subject Code: BFOTS1-202** **L T P C** **Duration: 60Hrs**
**3 1 0 4**

**Course Objectives:**

1. To impart knowledge regarding various methods of preservation of food and their effect on physiochemical properties of food.
2. To identify appropriate equipments for preservation of different food products aiming at minimal degradation of nutrients.
3. To understand the problems associated with food spoilage and selection of suitable methods of their preservation.
4. To analyze and interpret freezing and drying curves of different food products.
5. To create awareness regarding the effect of chemical and physical preservation techniques on health and nutritional components of food.

**Course Outcomes:**

1. Imparting knowledge regarding various methods of preservation of food and their effect on physiochemical properties of food.
2. Identification of appropriate equipments for preservation of different food products aiming at minimal degradation of nutrients.
3. Understanding the problems associated with food spoilage and selection of suitable methods of their preservation.
4. Analyzing and interpreting freezing and drying curves of different food products.
5. Creating awareness regarding the effect of chemical and physical preservation techniques on health and nutritional components of food.

**UNIT-I (11Hrs.)**

Introduction: Historical developments of food preservation. Principles of Food preservation, Scope & its benefits. Chemical preservation: Class I and Class II preservatives.

**UNIT-II (16Hrs.)**

Preservation by low temperature: Introduction, Freezing and Refrigeration, cold storage and freezing, freezing curve, changes during freezing, types of freezing; slow freezing, quick freezing, thawing, changes during thawing and its effects on food.

**UNIT-III (16Hrs.)**

Preservation by high temperature: Thermal processing, Sterilization, commercial sterilization, pasteurization, and blanching. boiling, canning, aseptic processing, thermal death time.

**UNIT-IV (17Hrs.)**

Preservation by Drying: Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e. mechanical drying), factors affecting rate of drying, normal drying curve, Various types of driers used in food industry.

Irradiation: Units of radiation, Ultraviolet and ionizing irradiations, their effect on microorganisms & uses in food processing.

**Recommended Books**

1. Desrosier N. W. and Desrosier J. N., ‘The Technology of Food Preservation’, CBS Publication, New Delhi,1998.
2. Paine F.A. and Paine H.Y., ‘Handbook of Food Packaging’, Thomson Press India Pvt Ltd, New Delhi,1992.
3. Potter N.H., ‘Food Science’, CBS Publication, New Delhi,1998.
4. RamaswamyHandMarcottM.,‘FoodProcessingPrinciplesandApplications’,CRCPress,
5. 2006.
6. Rao P.G., ‘Fundamentals of Food Engineering’, PHI Learning Pvt Ltd, New Delhi,2010.
7. Toledo R. T, ‘Fundamentals of Food Process Engineering’, Aspen Publishers,1999.

## ENVIRONMENTAL STUDIES

**Subject Code: BFOTS1-203** **L T P C** **Duration: 45Hrs.**
**3 0 0 3**

**Course Objectives:**

1. To understand the concept of renewable and non-renewable resources of environment.
2. To identify the problems associated with different environmental resources.
3. To impart knowledge regarding different types of ecosystems and their characteristic features.
4. To analyze the causes of water, soil and air pollution and implementing some effective measures to save them for societal benefits.
5. To create awareness regarding role of an individual in conservation of natural resources and communicating it to society.

**Course Outcomes:**

1. Understanding the concept of renewable and non-renewable resources of environment.
2. Identifying the problems associated with different environmental resources.
3. Imparting knowledge regarding different types of ecosystems and their characteristic features.
4. Analyzing the causes of water, soil and air pollution and implementing some effective measures to save them for societal benefits.
5. Creating awareness regarding role of an individual in conservation of natural resources and communicating it to society.

### UNIT-I (11Hrs.)

The multidisciplinary nature of environmental studies, Natural Resources, Renewable and non- renewable resources: Natural resources and associated problems.

### UNIT-II (12Hrs.)

Forest Resources, Water Resources, Mineral Resources, Food resources, Energy resources, Land resources, Role of an individual in conservation of naturalresources.

### UNIT-III (12Hrs.)

Ecosystems, Concept of an ecosystem, Structure and function of an ecosystem, Introduction, types, characteristic features, Forest ecosystem; Grassland ecosystem; Desert ecosystem; Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

### UNIT- IV (10Hrs.)

Environmental Pollution: Air pollution; Water pollution; Soil pollution.

**Recommended Books**

1. Sing Y.K., 'Environmental Science', New Age International Pvt, Publishers,Bangalore.
2. Agarwal K.C., 'Environmental Biology', Nidi Publ. Ltd. Bikaner,2001.
3. Erach B., 'The Biodiversity of India,' Mapin Publishing Pvt.Ltd.
4. Brunner R.C., 'Hazardous Waste Incineration', McGraw HillInc.
5. Clark R.S., 'Marine Pollution', Clanderson PressOxford.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 'Environmental Encyclopedia',Jaico Publ. House, Mumbai, 1196p,2001.
7. De A.K., 'Environmental Chemistry', Wiley EasternLtd.
8. Down of Earth, Centre for Science and Environment.https://www.downtoearth.org.in/

## FOOD CHEMISTRY

**Subject Code: BFOTS1-204** **L T PC**
**3 1 0 4** **Duration: 60Hrs.**

**Course Objectives:**
1. To understand the compositional aspects of different categories of foods.
2. To impart knowledge regarding role of water activity in extending the shelf life of food products and selection of appropriate packaging material.
3. To summarize various deteriorative changes of fats and oils.
4. To analyze physico-chemical-, and functional properties of proteins and carbohydrates and development of various food products.
5. To create awareness regarding different types of food flavors and importance of water- and fat soluble vitamins.

**Course Outcomes:**
1. Understanding the compositional aspects of different categories of foods.
2. Imparting knowledge regarding role of water activity in extending the shelf life of food products and selection of appropriate packaging material.
3. Summarizing various deteriorative changes of fats and oils.
4. Analyzing physico-chemical-, and functional properties of proteins and carbohydrates and development of various food products.
5. Creating awareness regarding different types of food flavors and importance of water- and fat soluble vitamins.

### UNIT-I (12Hrs.)

Introduction to Food: Definition and Composition.
Water: Structure of water and ice, Types of water, Sorption phenomenon, Water activity and packaging.

### UNIT-II (16Hrs.)

Lipids: Classification, Physical properties-melting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point. Chemical properties- reichertmeissel value, polenske value, iodine value, peroxide value, saponificationvalue.
Changes in fats and oils: rancidity, lipolysis, flavor reversion, Fat Mimetics.

### UNIT-III (17Hrs.)

Proteins: Protein classification and structure, Nature of food proteins (plant and animal proteins). Properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation),
Functional properties of proteins, organoleptic, solubility, viscosity, binding gelation/ texturization, emulsification, foaming.
Carbohydrates: Classification and Functions (monosaccharides, oligosaccharides and polysaccharides), Modified celluloses and starches.

### UNIT-IV (15Hrs.)

Vitamin: Importance and Stability, Water soluble &Fat soluble vitamins.
Flavour: Definition and basic tastes, Description of food flavours, Flavour enhancers.

**Recommended Books**

1. Fennema O. R, ‘Food Chemistry’, 3rd Edition, Marcell Dekker, NewYork,1996.
2. Whitehurst R. J. and Law B. A., ‘Enzymes in Food Technology’, CRC Press,Canada,2002.
3. Wong Dominic W. S., ‘Food Enzyme, Chapman and Hall, New York,1995.
4. Potter N.N. and Hotchkiss J. H, Food Science’, 5thEdition., Chapman &Hall,1995.
5. DeMan J.M., ‘Principles of Food Chemistry’, AVI, NewYork,1980.

## INTRODUCTION TO FOOD TECHNOLOGY-II LAB II

**Subject Code: BFOTS1-205** | **L T P C 0 0 4 2** | **Duration: 60Hrs.**

**Course Objectives**

1. To impart knowledge regarding basic instruments used in the food industries for analysis of food components.
2. To familiarize the students with methodologies used for determination of various quality attributes, adhering to legal specifications.
3. To conduct qualitative tests for major food components.
4. To determine chemical components of food products quantitatively.
5. To analyze and interpret data for various quality attributes and using this information for product improvement.

**Course Outcomes:**

1. Imparting knowledge regarding basic instruments used in the food industries for analysis of food components.
2. Familiarizing the students with methodologies used for determination of various quality attributes, adhering to legal specifications.
3. Conducting qualitative tests for major food components.
4. Determination of chemical components of food products quantitatively.
5. Analysis and interpretation of data for various quality attributes and using this information for product improvement.

**PRACTICALS**

1. Demonstration of the instruments used in food technology.
2. Determination of moisture content in different food samples.
3. Determination of ash content of different food samples.
4. Determination of TSS of ketchup by refractometer.
5. Determination of acidity of milk and juices.
6. To study the effect of blanching on vegetables.
7. Determination of specific gravity of oil and milk.
8. Determination of pH of food samples by pH meter.
9. Determination of saponification value and acid value.
10. Qualitative test for starch and protein.

## PRINCIPLES OF FOOD PRESERVATION LAB III

**Subject Code: BFOTS1-206** **LT P C** **Duration: 60Hrs**
**0 0 4 2**

**Course Objectives:**

1. To prepare value added products from fruits and vegetables.
2. To understand the effects of hydrothermal processes on different vegetables.
3. To analyze quality attributes of packaged food products.
4. To apply different food preservation techniques for preservation of food products.
5. To gain practical knowledge of various instruments used in food processing industries.

**Course Outcomes:**

1. Preparation of value added products from fruits and vegetables.
2. Understand the effects of hydrothermal processes on different vegetables.
3. Analysis of quality attributes of packaged food products.
4. Application of different food preservation techniques for preservation of food products.
5. Gaining practical knowledge of various instruments used in food processing industries.

**Practical's**

1. Cut out analysis of canned foods.
2. Preservation of fruits and vegetables by syruping and salting.
3. Preservation by paraffining.
4. Preparation of sauerkraut.
5. To determine the adequacy of blanching on vegetables.
6. To enhance the shelf life of eggs by oiling and pickling.
7. To study the curing of meat.
8. Preservative effect of honey and different concentrations.
9. Preservation of fruits and vegetables by salt, oil and vinegar.
10. Visit to food industry

# SEMESTER THIRD

## DAIRY TECHNOLOGY

**Subject Code: BFOTS1-301** | **L T P C** **3 1 0 4** | **Duration: 60 (Hrs.)**

**Course Objectives:**

1. To understand physico-chemical properties, microbiology, and nutritive value of milk.
2. To impart knowledge regarding various steps involved in the production of market milk as per specified legal standards.
3. To summarize process of manufacturing of cream, ghee, butter, milk powders, ice cream, and cheese and identify associated defects.
4. To develop fermented milk and other indigenous milk products.
5. To create awareness regarding selection of equipment's for the processing and quality assessment of milk and milk products.

**Course Outcomes:**

1. Understanding the physico-chemical properties, microbiology, and nutritive value of milk.
2. Imparting knowledge regarding various steps involved in the production of market milk as per specified legal standards.
3. Summarizing the process of manufacturing of cream, ghee, butter, milk powders, ice cream, and cheese and identifying the associated defects.
4. Development of fermented milk and other indigenous milk products.
5. Creating awareness regarding selection of equipment's for the processing and quality assessment of milk and milk products.

### UNIT-I (15 Hours)

Definition of milk, Market milk, Composition, Physicochemical properties and nutritive value of milk, microbiology of milk, Factors affecting composition of milk.

### UNIT-II (15 Hours)

Liquid milk processing: Collection of milk, Reception, Platform testing.
Various stages of processing: Filtration, Clarification, Homogenization and Pasteurization.
Description and working of clarifier, cream separator, homogenizer and plate heat exchanger.

### UNIT-III 15 Hours)

Cream: Types, manufacturing and defects.
Butter: Types, preparation, theories of churning, defects.
Preparation and defects of Ghee, flavored milk, condensed milk and milk powder.

### UNIT-IV (15 Hours)

Manufacturing and defects of Ice-cream and cheese.
Fermented milk and milk products: Yoghurt, dahi and shrikhand.
Indigenous milk products.

**Recommended Text Books / Reference Books:**

1. De Sukumar, Outlines of Dairy Technology, Oxford University Press, Oxford, UK, 2007.
2. Webb and Johnson, Fundamentals of Dairy Chemistry, 3rd ed., CBS Publishers, New Delhi, 1988.
3. Eckles, Combs, Henery C, and Willes C, Milk & Milk Products, Tata McGraw Hill Publishers, USA, 1997.

## TECHNOLOGY OF FRUITS AND VEGETABLES

**Subject Code: BFOTS1-302** **L T P C** **Duration: 60 (Hrs.)**
**3 1 0 4**

**Course Objectives:**
1. To understand nutritional profile, methods of preservations and indices of fruits and vegetables maturity.
2. To impart knowledge regarding process of canning of fruits and vegetables.
3. To summarize various quality characteristics of fruits and vegetables involved in their processing.
4. To develop value added products from fruits and vegetables using appropriate processing techniques and equipments.
5. To create awareness regarding utilization of fruits and vegetable industry wastes.

**Course Outcomes:**
1. Understanding nutritional profile, methods of preservations and indices of fruits and vegetables maturity.
2. Imparting knowledge regarding process of canning of fruits and vegetables.
3. Summarizing various quality characteristics of fruits and vegetables involved in their processing.
4. Developing value added products from fruits and vegetables using appropriate processing techniques and equipments.
5. Creating awareness regarding utilization of fruits and vegetable industry wastes.

### UNIT-I (10 Hours)

Classification and nutritive value of fruits and vegetables, methods of preservation (short & long term), Physical and chemical indices of fruit maturity.

### UNIT-II (10 Hours)

Quality characteristics of fruits and vegetables for processing.
Canning of fruits and vegetables: Selection of fruits and vegetables, process of canning, factors affecting the process- time and temperature, syrups and brines for canning.

### UNIT-III (20 Hours)

Squashes, cordials, nectars, RTS, Syrups and blending of juices.
Jam: Constituents, selection of fruits, processing & technology, defects.
Jelly: Essential Constituents, Role of pectin, Theory of jelly formation, Processing & technology, defects.

### UNIT-IV (20 Hours)

Pickles and sauces: Processing, Types, Causes of spoilage in pickling.
Processing of Tomato puree, paste, ketchup and sauce.
Dehydration of fruits and vegetables: Sun drying & mechanical dehydration.
Refrigeration of fruits and vegetable (Air blast freezing, immersion freezing, plate freezing, cryogenic freezing and IQF).
Utilization of fruits and vegetable industry wastes.

**Recommended Text Books / Reference Books:**

1. Khurdia DS, Preservation of fruits and vegetables. Indian Council of Agriculture Research, New Delhi 1995.
2. Potter N, Hotchkiss JH, Food Science. CBS Publishers, Delhi 2006.
3. Siddhapa GS, Lal G and Tandon, Preservation of fruits and vegetables, Indian Council of Agriculture Research, New Delhi, 1986.
4. Srivastava RS, Kumar S. Fruit and Vegetable Preservation; Principles and Practices, International Book Distributing Company, Lucknow, 2005.
5. Srivastava SS, Phal Parirakshan, Kitab Mahal, Lucknow, 2006.
6. Subbalakshmi G, Udipi SA, Food Processing and Preservation, New Age International Publishers, Delhi, 2007.

## FOOD MICROBIOLOGY AND FOOD SAFETY

**Subject Code: BFOTS1-303** **L T P C** **Duration: 60 (Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To understand the morphology of micro-organisms and their importance in foods.
2. To identify enumeration techniques involved in qualitative and quantitative determination of micro-organisms in food products.
3. To impart knowledge regarding different methods of preservation to prevent microbial spoilage of food products.
4. To differentiate between food infection and food intoxication and understand the microbiology of different raw and processed foods.
5. Creating awareness regarding types of hazards, food safety and management tools.

**Course Outcomes:**

1. Understanding the morphology of micro-organisms and their importance in foods.
2. Identification of enumeration techniques involved in qualitative and quantitative determination of micro-organisms in food products.
3. Imparting knowledge regarding different methods of preservation to prevent microbial spoilage of food products.
4. Differentiating between food infection and food intoxication and understand the microbiology of different raw and processed foods.
5. Creating awareness regarding types of hazards, food safety and management tools.

### UNIT-I (15 Hours)

Types of Microorganisms in Food, Classification, Morphology and Structure of microorganisms, Importance in food (bacteria, fungi and viruses ), Significance of spores.

### UNIT-II (15 Hours)

Enumeration techniques & control of microorganisms in foods, Qualitative and quantitative methods-conventional as well as rapid, Principles and methods of preservation (thermal and non-thermal), Introduction to Hurdle Technology.

### UNIT-III (15 Hours)

Microbiology of raw, processed and spoiled foods: Fruits and vegetables, Meat and meat products, milk and milk products, eggs, canned foods, cereals and cereal products. Food infection and Food intoxication.

### UNIT-IV (15 Hours)

Introduction to Food Safety, Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting food safety. Sources of contamination, Control methods using physical and chemical agents, waste disposal, pest and rodent control, personnel hygiene. Food Safety Management Tools: HACCP, ISO series, TQM and Risk Analysis.

**Recommended Text Books / Reference Books:**

1. Frazier William C and Westhoff, Dennis C, Food Microbiology, TMH, New Delhi, 2004.
2. Jay, James M., Modern Food Microbiology, CBS Publication, New Delhi, 2000.
3. Garbutt, John., Essentials of Food Microbiology, Arnold, London,1997.
4. Pelczar MJ, Chan E.C.S and Krieg, Noel R , Microbiology, TMH, New Delhi, 1993.
5. Lawley, R., Curtis L. and Davis,J. , The Food Safety Hazard Guidebook , RSC Publication, 2004.
6. De Vries, Food Safety and Toxicity, CRC, New York, 1997.
7. Marriott, Norman G., Principles of Food Sanitation, AVI, New York, 1985.
8. Forsythe, S J., Microbiology of Safe Food, Blackwell Science, Oxford, USA, 1987.

## DAIRY TECHNOLOGY LAB-IV

**Subject Code: BFOTS1-304** **L T P C** **Duration: 60 (Hrs.)**

**0 0 4 2**

**Course Objectives:**

1. To understand procedures and significance of platform tests in milk.
2. To determine different components of milk affecting its quality.
3. To impart knowledge regarding various equipments used in milk industry.
4. To develop various milk based products in compliance with legal specifications.
5. To create awareness regarding adulteration of milk and detection methods.

**Course Outcomes:**

1. Understanding procedures and significance of platform tests in milk.
2. Determination of different components of milk affecting its quality.
3. Imparting knowledge regarding various equipments used in milk industry.
4. Development of various milk based products in compliance with legal specifications.
5. Creating awareness regarding adulteration of milk and detection methods.

**Practical's:**

1. To perform platform tests in milk (Alcohol-Alizarin test, COB, MBRT, specific gravity).
2. To estimate milk fat by Gerber method.
3. Determination of titrable acidity and pH of milk.
4. To determine adulteration of milk.
5. Preparation of pasteurized milk.
6. Preparation of flavoured milk.
7. Preparation of Paneer.
8. To perform neutralization of cream.
9. To study the working of cream separator.
10. Preparation of butter and determination of overrun in butter.
11. Preparation of Ice-cream.
12. Preparation of shrikhand.
13. Preparation of ghee.
14. Visit to milk processing plant.

## TECHNOLOGY OF FRUITS AND VEGETABLES LAB-V

| Subject Code: BFOTS1-305 | L T P C | Duration: 60 (Hrs.) |
| --- | --- | --- |
| | 0 0 4 2 | |

**Course Objectives:**

1. To understand the processing techniques involved in production of various value added products from fruits and vegetables meeting the specified needs of society.
2. To impart knowledge regarding quality parameters of products to meet legal specifications.
3. To analyze quality attributes of packaged food product.
4. To utilize by-products of fruits and vegetables industry for societal benefits and reducing environmental stress.
5. To create an ability to communicate the related issues during industrial visits.

**Course Outcomes:**

1. Understanding the processing techniques involved in production of various value-added products from fruits and vegetables meeting the specified needs of society.
2. Imparting knowledge regarding quality parameters of products to meet legal specifications.
3. Analyzing quality attributes of packaged food product.
4. Utilization of by-products of fruits and vegetables industry for societal benefits and reducing environmental stress.
5. Creating an ability to communicate the related issues during industrial visits.

**Practical's:**

1. Estimation of total soluble solids (TSS).
2. Estimation of brix: acid ratio.
3. Preparation of pickles.
4. Preparation of tomato paste.
5. Preparation of tomato ketchup and sauce.
6. Preparation of Jam and marmalades.
7. Preparation of Jelly.
8. Cut out analysis of canned food products.
9. Preparation of fruit preserve from Amla, Apple and carrot.
10. Preparation of Mango Leather.
11. Determination of dehydration and rehydration ratio of dehydrated vegetables.
12. Preparation of candied peels, glazed fruits and reformed fruits.
13. Visit to fruits and vegetable processing industry.

## FOOD MICROBIOLOGY AND FOOD SAFETY LAB-VI

| Subject Code: BFOTS1-306 | L T P C | Duration: 60 (Hrs.) |
|---|---|---|
| | 0 0 4 2 | |

**Course Objectives:**

1. To understand the application of various equipments used in microbiology.
2. To summarize methodologies and techniques involved in microbial analysis of different food commodities.
3. To describe the effect of various preservation methods on microbial load of different food products.
4. To analyze various food samples in terms of their pathogenic counts to ensure their safety for consumption.
5. To develop various fermented food products meeting the specified needs of population.

**Course Outcomes:**

1. Understanding the application of various equipments used in microbiology.
2. Summarizing the methodologies and techniques involved in microbial analysis of different food commodities.
3. Describing the effect of various preservation methods on microbial load of different food products.
4. Analyzing various food samples in terms of their pathogenic counts to ensure their safety for consumption.
5. Developing various fermented food products meeting the specified needs of population.

**Practical's:**

1. Sterilization and disinfection of equipment used in food microbiology laboratory.
2. Study of different types of microorganism colony shapes on agar plates.
3. Effect of extrinsic factors on growth of micro-organisms.
4. Effect of preservation methods on microbial load of different food samples.
5. Detection of food borne pathogens in a given food sample.
6. Isolation of fungi from food materials.
7. Study of incubation test of heated canned foods.
8. Study of Dye reduction test of milk.
9. Microbiological analysis of egg, cereal product and fruit product.
10. Spawn preparation of different mushrooms.
11. Production of red and white wine.
12. Production of vinegar.
13. Effect of sanitizers on microbial load.

## ENTREPRENEURSHIP DEVELOPMENT

**Subject Code: BFOTD1-311** **L T P C** **Duration: 45 (Hrs.)**

**3 0 0 3**

**Course Objectives:**

1. To understand the basics of Entrepreneur, Entrepreneurship and Enterprise for future prospectives.
2. To summarize entrepreneurial skills, techniques to develop, and assessment tests.
3. To interpret case studies of successful entrepreneurs in order to deal with different situations arising during Entrepreneurship.
4. To create an ability to identify opportunities in business and generation of unique business ideas.
5. To apply SWOT Analysis for business and for competitors.

**Course Outcomes:**

1. Understanding the basics of Entrepreneur, Entrepreneurship and Enterprise for future prospectives.
2. Summarizing entrepreneurial skills, techniques to develop, and assessment tests.
3. Interpreting case studies of successful entrepreneurs in order to deal with different situations arising during Entrepreneurship.
4. Creating an ability to identify opportunities in business and generation of unique business ideas.
5. Application of SWOT Analysis for business and for competitors.

### UNIT-I (9 Hours)

Entrepreneur, Entrepreneurship and Enterprise: Concept and role in development, characteristics of entrepreneurs, developing entrepreneurial competencies, types of enterprise and ownership, charms of becoming an entrepreneur, reinforcing entrepreneurial motivation and competencies.

### UNIT-II (12 Hours)

Entrepreneurial development

Case studies of successful entrepreneurs.

Exercises on ways of sensing opportunities – sources of idea, creating efforts, SWOT analysis.

Entrepreneurial skill assessment test.

Techniques of development of entrepreneurial skills, positive self-image and locus of control

### UNIT-III (12 Hours)

Food business management
Case studies of Food processing business and its aspects.

Business opportunity identification and assessment techniques.

Business idea generation and evaluation exercise.

Market assessment study and analysis of competitive situation.

### UNIT-IV (12 Hours)

SWOT Analysis for business and for competitors.

Preparation of business plan.

Preparation of project report.

Methods of arrangement of inputs–finance and material.

**Recommended Text Books / Reference Books:**

1. Vasant Desai, Fundamentals of Entrepreneurship and Small Business Management, Himalya Publishing House Pvt. Ltd., Mumbai, 2012.
2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management, Himalya Publishing House Pvt. Ltd., Mumbai, 2011.
3. D. David and S Erickson, Principles of Agri Business Management, Mc Graw Hill Book Co., New Delhi, 1987.
4. Acharya S S and Agarwal N L, Agricultural Marketing in India, Oxford & ISH Publishing Co., New Delhi, 1987.
5. David H. Holt, Entrepreneurship – Anew Venture Creation, Prentice Hall of India, New Delhi, 2002.
6. Phill Kottler, Marketing Management, Prentice Hall of India Private Limited, New Delhi, 1994.
7. Chandra, Prasanna, Projects, Planning, Analysis, Selection, Implementation and Review, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1996.

## FOOD FERMENTATION TECHNOLOGY

| Subject Code: BFOTD1-312 | L T P C | Duration: 45 (Hrs.) |
|---|---|---|
| | 3 0 0 3 | |

**Course Objectives:**
1. To understand the basics of food fermentation.
2. To impart knowledge regarding design and operation of a bio-fermenter.
3. To identify types of starters useful for food industries.
4. To summarize the techniques involved in production of organic acids, vitamins, and yeast.
5. To create an ability to develop different types of fermented foods for desired health benefits.

**Course Outcomes:**
1. Understanding the basics of food fermentation.
2. Imparting knowledge regarding design and operation of a bio-fermenter.
3. Identification of different types of starters useful for food industries.
4. Summarizing the techniques involved in production of organic acids, vitamins, and yeast.
5. Creating an ability to develop different types of fermented foods for desired health benefits.

### UNIT-I (10 Hours)
Introduction to fermentation technology, Principles of food fermentation, Types of fermentation (Continuous fermentation, Batch fermentation, Submerged fermentation and solid state fermentation), Microbial culture selection for fermentation.

### UNIT-II (11 Hours)
Study of a Bio fermenter – its design and operation, Down Stream Processing and Product recovery.
Raw material availability, quality, processes and pre-treatments of raw materials. Major alcoholic raw materials.

### UNIT-III (12 Hours)
Starter cultures, Types of starters used in Food Industry.
Fermented foods: methods of manufacture for vinegar, sauerkraut, Yoghurt, soya sauce, wine and traditional Indian foods, Fermented milk and products such as cheese, Fermented pickles.

### UNIT-IV (12 Hours)
Production of organic acids (citric acid, lactic acid, gluconic acid and acetic acid), production of vitamins (Vitamin B2) and yeast (SCP).

**Recommended Text Books / Reference Books:**
1. Adams M & Moss, M., Food Microbiology. 2nd Edition, RSC Publishing, 2008.
2. Joshi V. K. & Pandey, A., Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology. Volume 2, Sanjanya Books, 1999.
3. John Garbutt, Essentials of Food Microbiology, Arnold International Students, 1997.
4. Brian J. Wood. Elsiever, Microbiology of Fermented Foods. Volume II and I, Applied Science Publication, 1997.
5. Stanbury, P.F., Whitekar A. and Hall, Principles of Fermentation Technology, Pergaman. McNeul and Harvey. (AC) NEW, 1995.

## FOOD ADDITIVES

**Subject Code: BFOTD1-313** **L T P C** **Duration: 45 (Hrs.)**
**3 0 0 3**

**Course Objectives:**

1. To understand the types, applications, and legal specifications of different food additives.
2. To impart knowledge regarding types, mode of action, and applications of different types of preservatives and flavoring agents.
3. To summarize the properties and applications of different types of sweeteners and emulsifiers used in food industries.
4. To create awareness regarding chemical composition, extraction procedures, and uses of different spices and condiments.
5. To differentiate between natural-, and synthetic food colors and their applications.

**Course Outcomes:**

1. Understanding the types, applications, and legal specifications of different food additives.
2. Imparting knowledge regarding types, mode of action, and applications of different types of preservatives and flavoring agents.
3. Summarizing the properties and applications of different types of sweeteners and emulsifiers used in food industries.
4. Creating awareness regarding chemical composition, extraction procedures, and uses of different spices and condiments.
5. Differentiating between natural-, and synthetic food colors and their applications.

### UNIT-I (10 Hours)

Introduction to food additives: General Classification, types (On basis of their origin, natural and synthetic), uses, functions, legal aspects, risks and benefits

### UNIT-II (11 Hours)

Preservatives: Antimicrobial agents, antioxidants and anti-browning agents (Types, mode of action and their applications in different food products)
Flavouring agents: Flavours (Natural and artificial), flavour enhancers, flavour stabilisation and flavour encapsulation.

### UNIT-III (12 Hours)

Sweetners: Natural and artificial sweetners, Nutritive and non-nutritive sweetners, properties and uses of saccharin, aspartame, acesulfame-K, corn sweetners, invert sugar and sugar alcohols.
Emulsifiers: Types, selection of emulsifier, emulsion stability, functions and mechanism of action.

Stabilizers: Types, uses and functions

### UNIT-IV (12 Hours)

Food Spices and condiments: Types and uses of spices and condiments, Chemical composition, Extraction and processing of Indian spices like pepper, cinnamon, cardamom, clove, ginger, turmeric, fenugreek and fennel, Seasonings and condiment blends.
Food Colors: Introduction, natural (biocolors) and synthetic food colors.

**Recommended Books**

1. A.L. Branen, 'Food Additives', Marcel Dekker Inc., New York, U.S.A.
2. J.W. Purseglove 'Spices' Longman Publishers, London, England.

3. D.R. Tainter and A.T. Grenis, 'Spices and Seasonings- A Food Technology Handbook', VCH Publishers, Inc., Hoboken, U.S.A.

4. J. Merory, 'Food Flavorings, Composition, Manufacture and Use', AVI Publishing Inc., Westport, U.S.A.

5. K.T. Farrell 'Spices, Condiments and Seasonings', Springer, U.S.A.

## DRUG ABUSE

**Subject Code: BMNCC0-004** **L T P C** **Duration: 30 (Hrs.)**
**2 0 0 0**

**Course Objectives:**

1. To understand the basics of drug abuse, drug dependence and drug addiction, and drug tolerance.
2. To identify nature of problem, sign, and symptoms associated with drug abuse.
3. To impart basic knowledge regarding causes and consequences of drug abuse.
4. To create awareness regarding prevention of drug abuse.
5. To analyze short term, long term effects and withdrawal symptoms of drug abuse.

**Course Outcomes:**

1. Understanding the basics of drug abuse, drug dependence and drug addiction, and drug tolerance.
2. Identification of nature of problem, sign, and symptoms associated with drug abuse.
3. Imparting basic knowledge regarding causes and consequences of drug abuse.
4. Creating awareness regarding prevention of drug abuse.
5. Analyzing short term, long term effects and withdrawal symptoms of drug abuse.

**UNIT-I (10 Hours)**

Problem of Drug Abuse: Concept and Overview; Types of Drug Often Abused
Concept and Overview
What are drugs and what constitutes Drug Abuse?
Prevalence of menace of Drug Abuse
How drug Abuse is different from Drug Dependence and Drug Addiction?
Physical and psychological dependence- concepts of drug tolerance
Introduction to drugs of abuse: Short Term, Long term effects & withdrawal symptoms
Stimulants: Amphetamines, Cocaine, Nicotine
Depressants: Alcohol, Barbiturates- Nembutal, Seconal, Phenobarbital Benzodiazepines –Diazepam, Alprazolam, Flunitrazepam
Narcotics: Opium, morphine, heroin
Hallucinogens: Cannabis & derivatives (marijuana, hashish, hash oil), Steroids and inhalants

**UNIT-II (8 Hours)**

Nature of the Problem
Vulnerable Age Groups

Signs and symptoms of Drug Abuse

(a)- Physical indicators

(b)- Academic indicators

(c)- Behavioural and Psychological indicators

**UNIT-III (6 Hours)**

Causes and Consequences of Drug Abuse
Causes
Physiological

Psychological
Sociological
Consequences of Drug Abuse
For individuals
For families
For society & Nation

**UNIT-IV (6 Hours)**

Management & Prevention of Drug Abuse
Management of Drug Abuse
Prevention of Drug Abuse
Role of Family, School, Media, Legislation & Deaddiction Centres

**Recommended Text Books / Reference Books:**

1. Kapoor. T., Drug Epidemic among Indian Youth, Mittal Pub, New Delhi, 1985.
2. Modi, Ishwar and Modi, Shalini, Drugs: Addiction and Prevention, Rawat Publication, Jaipur, 1997.
3. Ahuja, Ram, Social Problems in India, Rawat Publications, Jaipur, 2003.
4. National Household Survey of Alcohol and Drug Abuse. New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
5. World Drug Report , United Nations Office of Drug and Crime,2011
6. World Drug Report, United nations Office of Drug and Crime, 2010.
7. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
8. The Narcotic Drugs and Psychotropic Substances Act, 1985, New Delhi: Universal, 2012.

# SEMESTER FOURTH

## TECHNOLOGY OF CEREALS, PULSES AND OIL SEEDS

**Subject Code: BFOTS1-401** **L T P C** **Duration: 60 (Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To understand the structure, composition, and physico-chemical properties of cereals, pulses and oilseeds.
2. To impart knowledge regarding milling of cereals and pulses.
3. To familiarize students with extraction and processing of fats and oils.
4. To develop value added products from cereals, pulses and oilseeds.
5. To create awareness regarding advantages and disadvantages of steps involved in processing of cereals, pulses and oilseeds.

**Course Outcomes:**

1. Understanding the structure, composition, and physico-chemical properties of cereals, pulses and oilseeds.
2. Imparting knowledge regarding milling of cereals and pulses.
3. Familiarizing students with extraction and processing of fats and oils.
4. Development of value added products from cereals, pulses and oilseeds.
5. Creating awareness regarding advantages and disadvantages of steps involved in processing of cereals, pulses and oilseeds.

### UNIT-I (15 Hours)

Wheat-Structure and chemical composition of wheat grain, Types, milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, bread, biscuit, cake manufacturing.

### UNIT-II (15 Hours)

Rice – Structure and chemical composition of rice grain, physicochemical properties, milling, parboiling of rice, changes during parboiling, Advantages and disadvantages of parboiling, ageing of rice

### UNIT-III (15 Hours)

Corn – Milling (wet & dry), cornflakes, corn starch and corn sweeteners.
Barley- Milling, Malting of barley: steeping, Germination and drying.
Sorghum and millets – Milling and uses.

### UNIT-IV (15 Hours)

Milling of pulses: Dry milling, wet milling, improved milling methods
Technology of oil seeds
Extraction of oil and refining.
Preparation of defatted flour, protein concentrates, isolates, Uses.

**Recommended Text Books / Reference Books:**

1. Kent, N.L., Technology of Cereal, 5th Ed., Pergamon Press, 2003.
2. Chakraverty, Post Harvest Technology of Cereals, Pulses and Oilseeds, revised Ed., Oxford & IBH Publishing Co. Pvt Ltd., 1988.
3. Marshall, Rice Science and Technology, Wadsworth, New York, 1994.
4. Manay, S. and Sharaswamy, M., Food Facts and Principles, Wiley Eastern Limited, 1994.

## EGG, POULTRY AND MEAT TECHNOLOGY

| Subject Code: BFOTS1-402 | L T P C | Duration: 60 (Hrs.) |
|---|---|---|
| | 3 1 0 4 | |

**Course Objectives:**

1. To understand the chemical composition and nutritive value of egg, meat and poultry.
2. To impart knowledge regarding packaging, spoilage and preservation of egg, meat and poultry.
3. To apply ethical principles during handling of animal and their conversion into meat and other products.
4. To analyze quality parameters of eggs, meat and poultry.
5. To create awareness regarding by product utilization of meat industry.

**Course Outcomes:**

1. Understanding the chemical composition and nutritive value of egg, meat and poultry.
2. Imparting knowledge regarding packaging, spoilage and preservation of egg, meat and poultry.
3. Application of ethical principles during handling of animal and their conversion into meat and other products.
4. Analysis of quality parameters of eggs, meat and poultry.
5. Creating awareness regarding by product utilization of meat industry.

### UNIT-I (15 Hours)

Egg: Structure and composition, Nutritive value and functional properties. Quality of egg: Interior quality evaluation, candling, grading, handling, packaging, storage, transportation. Egg powder. Liquid egg preservation. Packaging and transportation of eggs.

### UNIT-II (15 Hours)

Poultry: Types, chemical and nutritive value of poultry meat.
Poultry dressing and slaughtering methods.
Preservation, grading and packaging of poultry meat.

### UNIT-III (15 Hours)

Status and scope of meat industry in India. Ante-mortem and post-mortem examination of meat animal, their slaughtering and dressing. Structure and physico-chemical properties of muscle. Post-mortem changes in meat. Ageing of meat, meat tenderization-natural and artificial methods. Quality Parameters: Meat color, water holding capacity, Marbling, Firmness and factors affecting it.

### UNIT-IV (15 Hours)

Restructured meat products, meat analogs.
Preservation and spoilage of meat.
Meat industry by products: Importance and utilization.

**Recommended Text Books / Reference Books:**

1. Lawrie R A, Lawrie's, Meat Science, 5th Ed, Woodhead Publisher, England, 1998.
2. Parkhurst & Mountney, Poultry Meat and Egg Production, CBS Publication, New Delhi, 1997.
3. Pearson & Gillet Processed Meats, 3rd Ed, CBS Publication, New Delhi, 1997.
4. Shai Barbut, Poultry Products Processing, CRC Press, 2005.
5. Stadelman WJ, Owen J Cotterill Egg Science and Technology, 4th Ed. CBS Publication New Delhi, 2002.
6. Romans. JR and Costllo WJ, Carlson WC, Greaser, ML and Jones KW, The Meat we eat, Interstate Publishers, USA, 2004.

## FOOD PLANT HYGIENE AND SANITATION

**Subject Code: BFOTS1-403** **L T P C** **Duration: 60 (Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To understand the concept and importance of personal hygiene and its role in food safety.
2. To impart knowledge regarding principles and methods of cleaning and sanitation.
3. To design layout of ETP plants keeping in view all the requirements of food processing industry.
4. To develop value added products from wastes of food industry.
5. To create awareness regarding disposal and treatment of waste.

**Course Outcomes:**

1. Understanding the concept and importance of personal hygiene and its role in food safety.
2. Imparting knowledge regarding principles and methods of cleaning and sanitation.
3. Designing the layout of ETP plants keeping in view all the requirements of food processing industry.
4. Development of value added products from wastes of food industry.
5. Creating awareness regarding disposal and treatment of waste.

### UNIT-I (15 Hours)

Introduction:
Importance of personal hygiene of food handler-habits, clothes, illness, education of handler in

Handling and service.

### UNIT-II (15 Hours)

Industrial Hygiene:
Cleaning methods – sterilization, disinfection, heat & chemicals, chemical tests for sanitizer strength. Cleaning agents and disinfectants.

Food sanitation-Principles & methods, control, inspection. Sanitation in fruits & vegetables industry, cereals industry, dairy industry, meat, egg & poultry units.

### UNIT-III (15 Hours)

Waste disposal, Control methods using physical and chemical agents, Pest and rodent control, ETP design and layout. Food storage sanitation, transport sanitation and water sanitation.

### UNIT-IV (15 Hours)

By-products utilization obtained from dairy plant, egg & poultry processing industry and meat industry. Wastewater and solid waste treatment: Waste-types-solid and liquid waste characterization, physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary (advanced) treatments.

**Recommended Text Books / Reference Books:**

1. Norman G. Marriott and Robert B. Gravani, Principles of Food Sanitation, 5th edition, 2006.
2. Rao, D. G., Fundamentals of Food Engineering, PHI learning Private Ltd., 2010.
3. Fellows P., Food Processing Technology, 2nd Edition. Woodhead Publishing Limited and CRC Press LLC, 2000.
4. James A, The supply chain handbook, distribution group, 2013.
5. FAO, US, Design and operations of cold store in developing, 1984.

## TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS LAB-VII

**Subject Code: BFOTS1-404** **L T P C** **Duration: 60 (Hrs.)**

**0 0 4 2**

**Course Objectives:**

1. To impart knowledge regarding proximate composition of flour and its analysis.
2. To familiarize students with processing of cereals, pulses and oilseeds.
3. To develop value added products from cereals, pulses and oilseeds.
4. To analyze physico-chemical characteristics of grains and flour relating to product quality.
5. To create awareness regarding adulteration of fats and oils and detection techniques.

**Course Outcomes:**

1. Imparting knowledge regarding proximate composition of flour and its analysis.
2. Familiarizing the students with processing of cereals, pulses and oilseeds.
3. Development of value added products from cereals, pulses and oilseeds.
4. Analysis of physico-chemical characteristics of grains and flour relating to product quality.
5. Creating awareness regarding adulteration of fats and oils and detection techniques.

**PRACTICALS:**

1. Physical characteristics of cereal grains.
2. Proximate analysis of wheat flour (moisture, ash, fat, protein and crude fiber content).
3. Estimation of gluten content of flour.
4. Estimation of Polenske value of flour.
5. Estimation of alkaline water retention capacity of flour.
6. Determination of sedimentation value of flour
7. Cooking characteristics of rice.
8. Experimental parboiling of rice by different methods.
9. Determination of soaking and hydration capacity of pulses.
10. Preparation of full fat and defatted soya flour.
11. Extraction of oil from groundnuts.
12. Determination of saponification value.
13. Detection of adulteration of cotton seed oil and ground nut oil.
14. Visit to cereal and oilseed processing industry.

## EGG, POULTRY AND MEAT TECHNOLOGY LAB-VIII

**Subject Code: BFOTS1-405** | **L T P C** 0 0 4 2 | **Duration: 60 (Hrs.)**

**Course Objectives:**

1. To determine the proportion of different constituents present in eggs
2. To impart knowledge regarding techniques involved in grading and quality evaluation of eggs, poultry and meat products.
3. To familiarize students about ethical principles of slaughtering and dressing for the conversion of muscles into meat.
4. To formulate value added products from eggs, poultry, and meat to meet needs of society.
5. To create awareness regarding various methods used to preserve eggs, poultry, and meat.

**Course Outcomes:**

1. Determination of different constituents present in eggs
2. Imparting knowledge regarding techniques involved in grading and quality evaluation of eggs, poultry and meat products.
3. Familiarizing students about ethical principles of slaughtering and dressing for the conversion of muscles into meat.
4. Formulating value added products from eggs, poultry, and meat to meet needs of society.
5. Creating awareness regarding various methods used to preserve eggs, poultry, and meat.

**Practical's:**

1. Determination of moisture and ash contents of egg components.
2. Determination of percentage of various egg constituents
3. Grading and Quality evaluation of eggs.
4. Preservation of shell eggs by various methods.
5. Candling of eggs.
6. Determination of time temperature condition on formation of iron sulphide in egg.
7. Preparation of egg products: boiled, fried, poached, scrambled, poached.
8. Preparation of egg pickle
9. Slaughtering and dressing of poultry.
10. Post mortem examination of poultry meat and identifying different parts of poultry.
11. Preservation of meat by pickling method.
12. Preparation of different meat products.
13. Evaluation of meat quality.
14. Visit to poultry and meat industry.

## FOOD PLANT HYGIENE AND SANITATION LAB-IX

| Subject Code: BFOTS1-406 | L T P C | Duration: 60 (Hrs.) |
|---|---|---|
| | 0 0 4 2 | |

**Course Objectives:**

1. To understand the importance of sterilization of equipments and different ways to achieve the same.
2. To impart knowledge regarding methodology and significance of BOD and COD.
3. To familiarize the students with importance of cleaning and sanitation of equipments in the plant and methods to ensure the same.
4. To analyze microbial load of air, workplace, and equipments.
5. To create awareness regarding evaluation of different quality parameters of water.

**Course Outcomes:**

1. Understanding the importance of sterilization of equipments and different ways to achieve the same.
2. Imparting knowledge regarding methodology and significance of BOD and COD.
3. Familiarizing the students with importance of cleaning and sanitation of equipments in the plant and methods to ensure the same.
4. Analysis of microbial load of air, workplace, and equipments.
5. Creating awareness regarding evaluation of different quality parameters of water.

**Practical's:**

1. Sterilization of equipments used in the laboratory by using heat and chemicals.
2. Determination of B.O.D
3. Determination of C.O.D
4. Determination of sanitary status of plant equipment.
5. Measurement of Chlorine content in water.
6. Measurement of hardness of water.
7. Measurement of quality parameters and chemical analysis of water.
8. Determination of microbial load of air.
9. Determination of microbial load of workplace.
10. Determination of microbial load of equipments using swab test.

## NUTRACEUTICAL AND FUNCTIONAL FOODS

**Subject Code: BFOTD1-411** **L T P C** **Duration: 60 (Hrs.)**
**4 0 0 4**

**Course Objectives:**

1. To understand the basics of nutraceuticals, their types and importance.
2. To impart knowledge regarding different food commodities with potential to be used as functional foods.
3. To familiarize students with fermented foods and their role in addressing specific needs of society.
4. To develop an ability to differentiate between nutraceuticals and functional foods.
5. To create awareness regarding nutraceuticals and functional foodsand their potential role in human health.

**Course Outcomes:**

1. Understanding the basics of nutraceuticals, their types and importance.
2. Imparting knowledge regarding different food commodities with potential to be used as functional foods.
3. Familiarizing students with fermented foods and their role in addressing specific needs of society.
4. Developing an ability to differentiate between nutraceuticals and functional foods.
5. Creating awareness regarding nutraceuticals and functional foods and their potential role in human health.

### UNIT-I (15 Hours)

Introduction

Background, definitions, difference between nutraceuticals and functional foods, types of nutraceutical compounds and their health benefits, current scenario.

### UNIT-II (15 Hours)

Nutraceuticals

Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch).

Prebiotics, probiotics and synbiotics.

Lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health.

### UNIT-III (15 Hours)

Functional Foods

Cereal and cereal products, milk and milk products, egg, oils, meat and products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc)

### UNIT-IV (15 Hours)

Fermented foods – their health benefits and role in conditions like cardiovascular diseases, hypertension, diabetes etc. Future prospects of functional foods and nutraceuticals and their potential for use in improving health.

**Recommended Text Books / Reference Books:**

1. Wildman REC, Handbook of Nutraceutical and Functional Foods, CRC Press, 2001.
2. Ghosh D et al, Innovations in Healthy and Functional Foods, CRC Press, 2012.
3. Pathak YV, Handbook of nutraceuticals Volume 2, CRC Press, 2011.

## NUTRACEUTICAL AND FUNCTIONAL FOODS LAB X

**Subject Code: BFOTD1-412** **L T P C** **Duration: 60 (Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To identify various Nutraceuticals and functional foods available in the market.
2. To impart knowledge regarding compounds responsible for imparting nutraceutical and functional properties to the food product.
3. To develop various functional foods adhering to legal specifications.
4. To analyze different food components which may act as nutraceuticals and functional foods.
5. To create awareness regarding health benefits of Nutraceuticals and functional foods.

**Course Outcomes:**

1. Identification of various nutraceuticals and functional foods available in the market.
2. Imparting knowledge regarding compounds responsible for imparting nutraceutical and functional properties to the food product.
3. Development of various functional foods adhering to legal specifications.
4. Analysis of different food components which may act as nutraceuticals and functional foods.
5. Creating awareness regarding health benefits of nutraceuticals and functional foods.

**PRACTICALS**

1. Identification of various nutraceuticals and functional foods available in the market
2. Estimation of chlorophyll content of green vegetable
3. Determination of lycopene in fruit/vegetable
4. Determination of total pectin in plant material
5. Estimation of crude fibre/dietary fibre content in cereals and their products
6. Estimation of anthocyanins in food sample
7. Determination of Vitamin C content of sample
8. Preparation and evaluation of probiotic/prebiotic foods
9. Determination of antioxidant activity in food.
10. Determination of total phenolic content in foods
11. Determination of total flavonoids content in foods
12. Development of functional foods.

## BAKERY TECHNOLOGY

**Subject Code: BFOTD1-413** **L T P C** **Duration: 60 (Hrs.)**
**4 0 0 4**

**Course Objectives:**

1. To familiarize the students with current scenario and economic importance of Bakery industry in India.
2. To understand the role of different ingredients used in the formulation of different bakery products.
3. To impart knowledge regarding processing techniques involved in manufacturing of various baked products.
4. To create awareness regarding quality attributes of different bakery products.
5. To develop modified bakery products addressing specific needs of society.

**Course Outcomes:**

1. Familiarizing the students with current scenario and economic importance of Bakery industry in India.
2. Understanding the role of different ingredients used in the formulation of different bakery products.
3. Imparting knowledge regarding processing techniques involved in manufacturing of various baked products.
4. Creating awareness regarding quality attributes of different bakery products.
5. Development of modified bakery products addressing specific needs of society.

### UNIT-I (15 Hours)

Bakery industry: Current status, growth rate, and economic importance of Bakery Industry in India. Product types, nutritional quality.

### UNIT-III (15 Hours)

Bread: Ingredients, bread making process, faults and corrective measures
Cakes: Ingredients, cake making process, different types of icings.

### UNIT-III (15 Hours)

Biscuits, cookies & crackers
Technology of biscuit, cookies and cracker manufacturing. Baking powders as leavening agents in bakery industry.
Modified bakery products
Modification of bakery products for people with special nutritional requirements e.g. high fiber, low sugar, low fat, gluten free bakery products.

### UNIT-IV (15 Hours)

Breakfast cereals, macaroni products and malt
Production and quality of breakfast cereals, macaroni products and malt.

**Recommended Text Books / Reference Books:**

1. Dubey, S.C., Basic Baking 5th Ed., Chanakya Mudrak Pvt. Ltd., 2007.
2. Raina et.al., Basic Food Preparation-A complete Manual. 3rd Ed., Orient Longman Pvt. Ltd., 2003.
3. Manay, S. & Shadaksharaswami, M., Foods: Facts and Principles, New Age Publishers, 2004.
4. Barndt R. L., Fat & Calorie – Modified Bakery Products, Springer US, 1993.
5. Samuel A. Matz, Bakery Technology and Engineering, PAN-TECH International Incorporated, 1999.
6. Faridi Faubion , Dough Rheology and Baked Product Texture, CBS Publications, 1997.
7. Samuel A. Matz, Cookies & Cracker Technology, Van Nostrand Reinhold, 1992.

## BAKERY TECHNOLOGY LAB XI

**Subject Code: BFOTD1-414** **L T P C** **Duration: 60 (Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To impart knowledge regarding selection of ingredients for the development of various baked products and ensuring their safety to the allergic persons.
2. To familiarize students with methodologies of sensory evaluation of baked products.
3. To determine various quality attributes of baked products.
4. To develop various baked products adhering to legal standards.
5. To create awareness regarding ingredients falling under category of allergens as per legal standards.

**Course Outcomes:**

1. Imparting knowledge regarding selection of ingredients for the development of various baked products and ensuring their safety to the allergic persons.
2. Familiarizing students with methodologies of sensory evaluation of baked products.
3. Determination of various quality attributes of baked products.
4. Development of various baked products adhering to legal standards.
5. Creating awareness regarding ingredients falling under category of allergens as per legal standards.

**Practical's:**

1. Preparation of bread and assessment of its quality
2. Estimation of fermentation power of yeast.
3. Preparation of buns and assessment of quality
4. Preparation of cake and assessment of its quality.
5. Icing of cake.
6. Preparation of cookies and assessment of quality.
7. Preparation of biscuits and assessment of quality.
8. Sensory evaluation of bakery products.
9. Preparation of gluten free biscuits from pseudo cereals.
10. Preparation of low calorie biscuits and cakes.
11. Preparation of high fiber biscuits and cakes.
12. Preparation of pasta and evaluation of its quality.
13. Visit to local bakery.

# SEMESTER FIFTH

## UNIT OPERATIONS IN FOOD ENGINEERING

**Subject Code: BFOTS1-501** **L T P C** **Duration: 60(Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To understand the basics of unit operations.
2. To impart knowledge regarding methods of cleaning, sorting, grading, and size reduction.
3. To familiarize students with low-temperature, and high-temperature unit operations and their applications in food industry.
4. To formulate and analyze the problems related to unit operations used in food engineering.
5. To create awareness regarding selection and application of appropriate tools and techniques used in food industry.

**Course Outcomes:**

1. Understanding the basics of unit operations.
2. Imparting knowledge regarding methods of cleaning, sorting, grading, and size reduction.
3. Familiarizing students with low-temperature, and high-temperature unit operations and their applications in food industry.
4. Formulating and analyzing the problems related to unit operations used in food engineering.
5. Creating awareness regarding selection and application of appropriate tools and techniques used in food industry.

### UNIT I (12 Hrs.)

Introduction: Concept of unit operations
Preliminary Unit Operations: Material handling; Conveyors and elevators, types of conveyors and elevators.

### UNIT II (17 Hrs.)

Cleaning: Dry-cleaning; screening, aspiration and magnetic cleaning, wet cleaning; soaking, spray washing, ultrasonic washing, sorting and grading: methods, advantages of sorting and grading
Size reduction: Benefits, criteria for size reduction, size reduction of solid, fibrous and liquid foods.

### UNIT III (16 Hrs.)

Refrigeration and Freezing: Refrigeration, components of refrigeration system, compressors, condensers and expansion valve, selection of refrigerant, cooling load, coefficient of performance, refrigerant flow rate.
Direct contact and indirect freezing systems.

### UNIT IV (15 Hrs.)

High temperature operations: Pasteurization, pasteurizer and its functioning.
Evaporation: Single effect evaporators and multiple effect evaporators, natural and forced circulations, falling and rising film evaporators.

**Recommended Readings**

1. Rao D. G., 'Fundamentals of Food Engineering', PHI learning private ltd.,2010.
2. Singh R. P. and Heldman D. R., 'Introduction to Food Engineering', Academic press 2nd, 3rd and 4th Edition, 1993, 2003,2009.
3. Rao C.G., 'Essentials of Food Process Engineering', B.S. publications,2006.
4. Fellow P., Food Processing Technology,1988.

## FOOD PACKAGING

**Subject Code: BFOTS1-502** **L T P C** **Duration: 60(Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To understand the basics of food packaging.
2. To impart knowledge regarding different types of packaging materials and their suitability for packaging of different food products.
3. To familiarize students with various types of packaging machinery and systems.
4. To develop eco-friendly packaging and addressing environmental concerns.
5. To create awareness regarding novel methods of food packaging and communicating its benefits to consumers.

**Course Outcomes:**

1. Understanding the basics of food packaging.
2. Imparting knowledge regarding different types of packaging materials and their suitability for packaging of different food products.
3. Familiarizing students with various types of packaging machinery and systems.
4. Development of eco-friendly packaging and addressing environmental concerns.
5. Creating awareness regarding novel methods of food packaging and communicating its benefits to consumers.

### UNIT I (15 Hrs.)

Introduction to Food Packaging
Packaging Functions and Requirements, Printing of packages, Barcodes & other marking, Labelling Laws

### UNIT II (16 Hrs.)

Food Packaging Materials: Paper and paper-based materials, corrugated fiber board (CFB). Plastics, formation- Injection molding, Blow molding, Types of plastics, Lamination, Biodegradable plastics, Edible packaging and Bio-composites. Environmental Concerns recycling and disposal of plastic waste.

### UNIT III (14 Hrs.)

Metal packaging- Metals: Tinplate, tinning process, components of tinplate, tin free can (TFC) types of can, metallic films, lacquers
Glass: Composition, Properties, Methods of bottle making, Types of closures.

### UNIT IV (15 Hrs.)

Packaging Machinery and Systems: Bottling machines, Cartoning systems, Seal and Shrink packaging machine; Form, Fill and Sealing machine(FFS).
Vacuum, Controlled and Modified atmosphere packaging systems; Aseptic packaging systems; Retort packaging, Active and Intelligent packaging systems

**Recommended Readings:**

1. Robertson G. L., ‘Food Packaging – Principles and Practice’, CRC Press Taylor and Francis Group,2012.
2. Paine F.A. and Paine H.Y., ‘A Handbook of Food Packaging’, Blackie Academic and Professional,1992.
3. Coles R., McDowell D. and Kirwan M. J., ‘Food Packaging Technology’, Blackwell, 2003.

## SUGAR AND CONFECTIONARY TECHNOLOGY

**Subject Code: BFOTS1-503** **L T P C** **Duration: 60(Hrs.)**
**4 0 0 4**

**Course Objectives:**

1. To understand the manufacturing process and deterioration of sugar.
2. To impart knowledge regarding different types of icings and toppings.
3. To familiarize students with different types of confectionary products. .
4. To develop various value added products from cocoa and understand associated defects.
5. To create awareness regarding by-products of sugar industry and their utilization in an eco-friendly manner and for societal benefits.

**Course Outcomes:**

1. Understanding the manufacturing process and deterioration of sugar.
2. Imparting knowledge regarding different types of icings and toppings.
3. Familiarizing students with different types of confectionary products. .
4. Development of various value added products from cocoa and understand associated defects.
5. Creating awareness regarding by-products of sugar industry and their utilization in an eco-friendly manner and for societal benefits.

### UNIT-I (15 Hrs.)

Composition and characteristics of cane juice, Cane juice extraction. Manufacturing of sugar. Deterioration of sugars during storage & transportation and its prevention, By-products of sugar industry and their utilization.

### UNIT-II (15 Hrs.)

Icings and Toppings: Fondant, American frosting, Butter cream icing, royal icing, gum paste, glace icing, marshmallow, almond paste and fudge.

### UNIT III (15 Hrs.)

Chocolates: Cocoa processing, Cocoa liquor, Cocoa butter. Cocoa powder and chocolate manufacturing Chocolate tempering and lipid crystallization, Chocolate enrobing and chocolate defects.

### UNIT-IV (15Hrs.)

Classification of confectionary: Hard and soft boiled sugar confectionary; fondant, fudge, caramel, toffee butterscotch, Sugar panning, hard boiled candy.

**Recommended Books:**

1. Minife B.W, 'Chocolate, Cocoa and Confectionary: Science & Technology', AVI Publishing Co., New York, 1997.
2. Mathur R.B.L., 'Handbook of Cane Sugar Technology', Oxford & IBH Publishing Co., New Delhi,1986.
3. Faridi H., 'The Science of Cookie & Cracker Production', Chapman & Hall, UK,1994.

## FOOD PACKAGING LAB XII

**Subject Code: BFOTS1-504** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To impart knowledge regarding testing of physico-mechanical parameters of packaging materials.
2. To familiarize students regarding different types of packaging machinery.
3. To analyze various quality parameters of different packaging materials and packaged food products.
4. To develop edible packaging for food products.
5. To create awareness regarding effect of packaging on shelf life of food products.

**Course Outcomes:**

1. Imparting knowledge regarding testing of physico-mechanical parameters of packaging materials.
2. Familiarizing students regarding different types of packaging machinery.
3. Analysis of various quality parameters of different packaging materials and packaged food products.
4. Development of edible packaging for food products.
5. Creating awareness regarding effect of packaging on shelf life of food products.

**PRACTICALS**

1. Testing of physical/mechanical properties of food packaging materials.
2. Testing of thermal shock resistance of glass.
3. Gas/Vacuum packaging of foods
4. To Study the effect of packaging on shelf life of food products.
5. Determination of Water Vapor Transmission Rate of Packaging Material.
6. Edible packaging of Food Samples.
7. Study of Sorption Isotherm for Food Package Design.
8. Packaged food cut-out analysis.
9. To study the operation of FFS machine.

**Recommended Readings:**

1. Robertson G.L., 'Food Packaging – Principles and Practice', CRC Press Taylor and Francis Group, 2012.
2. Paine F.A. and Paine H.Y., A Handbook of Food Packaging, Blackie Academic and Professional, 1992.
3. Coles R., McDowell D. and Kirwan M. J., 'Food Packaging Technology', Blackwell, 2003.

## SUGAR AND CONFECTIONARY TECHNOLOGY LAB XIII

**Subject Code: BFOTS1-505** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objective:**

1. To understand the effect of different processing conditions on sugar.
2. To impart knowledge regarding instruments used for the analysis of various quality parameters of confectionary products.
3. To familiarize students with different types of packaging used for confectionary products.
4. To develop the ability to prepare various types of sugar and confectionary products.
5. To analyze sensorial attributes of various confectionary products.

**Course Outcomes:**

1. Understanding the effect of different processing conditions on sugar.
2. Imparting knowledge regarding instruments used for the analysis of various quality parameters of confectionary products.
3. Familiarizing students with different types of packaging used for confectionary products.
4. Developing ability to prepare various types of sugar and confectionary products.
5. Analysis of sensorial attributes of various confectionary products.

**PRACTICAL**

1. Determine the effect of heat on sugar solution and perform the thread and cold water test.
2. To study the process of inversion, melting and caramelization in sucrose.
3. Preparation of fondant, fudge and brittles.
4. Preparation of Shakarpara and Chhanamurki.
5. Preparation of candy and toffee and to perform quality assessment tests.
6. Preparation of cake decorations.
7. Collection of various types of confectionary packages.
8. Determination of sugar in confectionary product by saccharometer.
9. Determination of refractive index of sugar – solutions of different consistencies.
10. Organoleptic testing of different confectionary products.
11. Visit to sugar and confectionary industry.

**Recommended Readings:**

1. Raina et.al., ‘Basic Food Preparation-A complete Manual’, 3rd Edition, Orient Longman Pvt. Ltd., 2003.
2. Manay, S. and Shadaksharaswami, M., ‘Foods: Facts and Principles’, New Age Publishers, 2004.
3. Beckette S.T., ‘Industrial Chocolate Manufacture’, Blackwell Publishing Ltd., 2009. 4.Minifie B.W. , ‘Chocolate, Cocoa and Confectionary’, Aspen Publications,1999.
4. Mohini S. and Eram R., ‘Food science- Experiments and applications’, 2nd Edition., CBS publishers & Distributors Pvt. Ltd.2011.

## SPICES AND FLAVOUR TECHNOLOGY

**Subject Code: BFOTD1-511** **L T P C** **Duration: 60(Hrs.)**
**4 0 0 4**

**Course Objectives:**

1. To understand types, chemical composition, processing, and applications of different spices.
2. To impart knowledge regarding processing of spices.
3. To familiarize students with packaging of spices and spice products.
4. To summarize about different flavoring compounds and their stability during processing.
5. To create awareness regarding microbial contamination and insect infestation in spices and its control.

**Course Outcomes:**

1. Understanding types, chemical composition, processing, and applications of different spices.
2. Imparting knowledge regarding processing of spices.
3. Familiarizing students with packaging of spices and spice products.
4. Summarizing about different flavoring compounds and their stability during processing.
5. Creating awareness regarding microbial contamination and insect infestation in spices and its control.

**UNIT I (15 Hrs.)**

Classification & use of spices, Chemical constituents of spices, Processing of white pepper. Dehydration products of onion, garlic.

**UNIT-II (15 Hrs.)**

Cryomilling of spices. Spice oleoresins and spice emulsion. Packaging of spices and spice products. Microbial contamination and insect infestation in spices and its control.

**UNIT-III (16 Hrs.)**

Classification of flavouring compounds. Stability of flavourings. Flavor encapsulation Processing of Cocoa and Coffee.

**UNIT IV (14 Hrs.)**

Processing of white pepper, cardamom, cinnamon, cloves, turmeric, ginger, fenugreek and fennel.

**Recommended Books:**

1. Peter K.V., ‘Handbook of Spices’, Woodhead Publishers, UK, 2001.
2. Pruthi, J. S., ‘Spices and Condiments’, NBT India, 1976.
3. Spice Statistics by Spices Board, GOI, Cochin, 2007.

## SPICES AND FLAVOUR TECHNOLOGY LAB XIV

**Subject Code: BFOTD1-512** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objective:**

1. To impart knowledge regarding proximate composition of spices.
2. To familiarize students regarding organoleptic evaluation of flavoring compounds and their role in different food products.
3. To understand the methods used to assess quality of spices.
4. To analyze microbiological quality of spices in order to ensure their safety for human consumption.
5. To create awareness regarding adulteration of spices and their detection methods.

**Course Outcomes:**

1. Imparting knowledge regarding proximate composition of spices.
2. Familiarizing students regarding organoleptic evaluation of flavoring compounds and their role in different food products.
3. Understanding the methods used to assess quality of spices.
4. Analysis of microbiological quality of spices in order to ensure their safety for human consumption.
5. Creating awareness regarding adulteration of spices and their detection methods

**PRACTICAL**

1. Determination of moisture in ground spices.
2. Determination of total ash in spices.
3. Determination of extraneous matter in spices.
4. Determination of pungency rating (Scoville method) in Red Pepper.
5. Adulteration tests for different spices.
6. Organoleptic evaluation of flavours.
7. Identification of Saffron by sulphuric – diphenylamine test.
8. To evaluate microbiological quality of spices.

**Recommended Books:**

1. Peter K.V., 'Handbook of Spices', Woodhead Publishers, UK,2001.
2. Pruthi, J. S., 'Spices and Condiments', NBT India,1976.
3. Spice Statistics by Spices Board, GOI, Cochin,2007.

## TECHNOLOGY OF OILS AND FATS

**Subject Code: BFOTD1-513** | **L T P C 4 0 0 4** | **Duration: 60(Hrs.)**

**Course Objectives:**
1. To understand the basics of fats and oils.
2. To impart knowledge regarding processing of fats and oils.
3. To familiarize students with deteriorative changes in fats and oils.
4. To analyze physico-chemical properties of fats and oils.
5. To create awareness about nutritional importance of oils and fats.

**Course Outcomes:**
1. Understanding the basics of fats and oils.
2. Imparting knowledge regarding processing of fats and oils.
3. Familiarizing students with deteriorative changes in fats and oils.
4. Analyzing physico-chemical properties of fats and oils.
5. Creating awareness about nutritional importance of oils and fats.

### UNIT-I (14 Hrs.)

Introduction to oils and fats, Physical and chemical properties of fats and oils, Nutritional importance of oils and fats.

### UNIT-II (16 Hrs.)

Source and physico-chemical properties of following oils:
Animal – Butter oil, lard and tallow.
Plant – Groundnut, Sunflower, Soybean and Coconut oil. Extraction of oils/fats.
Problems during storage – rancidity, reversion.

### UNIT-III (15 Hrs.)

Refining: degumming, choice of alkali, batch and continuous refining.
Bleaching: choice of adsorbent, batch and continuous bleaching.
Deodorization: process parameters: batch and continuous processing

### UNIT-IV (15 Hrs.)

Hydrogenation of oils: mechanism, process parameters and batch processing. Fractionation and winterization of oils.
Alternative processing methods: PCT (physical cleaning techniques)

**Recommended Books:**
1. Meyer L.H., 'Food Chemistry', CBS Publisher, New Delhi,2006.
2. Potter N. N. 'Food Science', 5th Edition, CBS Publisher, New Delhi, 2006
3. Lawson H., 'Food Oils & Fats: Technology, Utilization and Nutrition', CBS Publisher, New Delhi,1995.

## TECHNOLOGY OF OILS AND FATS LAB XV

**Subject Code: BFOTD1-514** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To familiarize students with physico-chemical properties of fats and oils.
2. To impart knowledge regarding various quality indices of fats and oils.
3. To understand organoleptic properties of fats and oils for their appropriate use in food products.
4. To analyze extent of rancidity in fats and oils using appropriate tests.
5. To create awareness regarding adulteration of fats and oils and detection techniques.

**Course Outcomes:**

1. Familiarizing students with physico-chemical properties of fats and oils.
2. Imparting knowledge regarding various quality indices of fats and oils.
3. Understanding organoleptic properties of fats and oils for their appropriate use in food products.
4. Analyzing the extent of rancidity in fats and oils using appropriate tests.
5. Creating awareness regarding adulteration of fats and oils and detection techniques.

**PRACTICAL**

1. To determine moisture content of oilseed.
2. To determine FFA of oil.
3. Determination of Iodine Value, R.M. Value and Polenske Value.
4. To determine Saponification value, anisidine value and peroxide value of oil.
5. Determination of melting point of fats.
6. Detection of sesame oil in vanaspati by furfural test.
7. Detection of adulteration with mineral oil, Cotton seed oil or Groundnut oil.
8. Organoleptic evaluation of fats and oils.
9. To carry out refining and bleaching of oil in lab.
10. To estimate colour of oil.
11. Visit to vegetable oils industry.

# SEMESTER SIXTH

## FOOD ENGINEERING

**Subject Code: BFOTS1-601** **L T P C** **Duration: 60(Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To familiarize the students with fundamental concepts and terminology of food engineering.
2. To understand the basic principles, processes and components of material and energy balances.
3. To impart knowledge regarding principles of fluid flow, types of fluids, and equations involved.
4. To develop an ability for an appropriate selection of pump for different types of fluids.
5. To interpret data using psychrometry and utilize this information for developing appropriate storage and processing conditions for different products.

**Course Outcomes:**

1. Familiarizing the students with fundamental concepts and terminology of food engineering.
2. Understanding the basic principles, processes and components of material and energy balances.
3. Imparting knowledge regarding principles of fluid flow, types of fluids, and equations involved.
4. Developing an ability for an appropriate selection of pump for different types of fluids.
5. Interpretation of data using psychrometry and utilizing this information for developing appropriate storage and processing conditions for different products.

### UNIT I (15 Hrs.)

Fundamental Concepts and Definitions: Dimensions and units, thermodynamic systems (closed, open and isolated), intensive and extensive properties, equilibrium state, density, specific volume, specific weight, specific heat, enthalpy, entropy, pressure, temperature scales.

### UNIT II (15 Hrs.)

Material Balances: Basic principles, process flow diagrams, total mass balance, component mass balance. Energy Balances: Basic principles, energy terms, specific heat of solids and liquids, properties of saturated and superheated steam, heatbalances.

### UNIT III (15 Hrs.)

Fluid Flow Principles: Fluid statics and dynamics, mass balance and energy balance, Bernoulli's equation, concept of viscosity, Newtonian and non-Newtonian fluids, streamline and turbulent flow, Reynold's number, Selection of pumps

### UNIT IV (15 Hrs.)

Psychrometrics: Properties of dry air: composition of air, specific heat of dry air, enthalpy of dry air, dry bulb temperature, Wet bulb temperature, Relative humidity, Dew point temperature.

**Recommended Readings:**

1. Rao C.G., 'Essentials of Food Process Engineering'. B S publications,2006
2. Rao D.G., 'Fundamentals of Food Engineering', PHI learning private Ltd.,2010.
3. Singh R.P. and Heldman D.R., Introduction to Food Engineering, 2nd, 3rd and 4th Edition, Academic press, 1993, 2003,2009.
4. Fellow P., Food Processing Technology,1988.

## FOOD AND NUTRITION

**Subject Code: BFOTS1-602** **L T P C** **Duration: 60(Hrs.)**
**3 1 0 4**

**Course Objectives:**

1. To understand the concept, terminology, and importance of food and nutrition.
2. To familiarize students with different methods of cooking, their effects on properties of foods, merits and demerits.
3. To impart knowledge regarding global trends, nutritional labeling, codex-, and FSSAI guidelines.
4. To develop an ability to plan meals addressing specific needs of society.
5. To create awareness regarding micro-, and macro nutrients present in food in terms of their sources, role, RDA and deficiency.

**Course Outcomes:**

1. Understanding the concept, terminology, and importance of food and nutrition.
2. Familiarizing the students with different methods of cooking, their effects on properties of foods, merits and demerits.
3. Imparting knowledge regarding global trends, nutritional labeling, codex-, and FSSAI guidelines.
4. Developing an ability to plan meals addressing specific needs of society.
5. Creating awareness regarding micro-, and macro nutrients present in food in terms of their sources, role, RDA and deficiency.

### UNIT I (15 Hrs.)

Introduction to food and nutrition: Basic terms used in study of food and nutrition, BMI and nutritional status, understanding relationship between food, nutrition and health. Balanced diet Functions of food-physiological, psychological and social, concept of balanced diet, Food Groups, Food Pyramid.

### UNIT II (16 Hrs.)

Nutrients: Classification, digestion, functions, dietary sources, RDA, clinical manifestations of deficiency and excess and factors affecting absorption of the following in brief: Energy, Carbohydrates, lipids and proteins, Fat soluble vitamins-A, D, E and K, Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C. Minerals – calcium, iron, iodine, fluorine, copper and zinc

### UNIT III (14Hrs.)

Concepts of Meal planning: Factors affecting meal planning, understanding specific considerations for planning meal for different groups of people (Infants, Toddler, Adolescents, Adults, Old age and pregnant women)

### UNIT IV (15 Hrs.)

Methods of cooking: Dry, moist, frying and microwave cooking, Advantages, disadvantages and the effect of various methods of cooking on foods. Nutritional labeling. Importance, global trends, codex guidelines, nutritional labelling in India, FSSAI guidelines.

**Recommended Readings**

1. Bamji M.S., Krishnaswamy K. and Brahmam G.N.V., 'Textbook of Human Nutrition', 3rd Edition, Oxford and IBH Publishing Co. Pvt. Ltd.,2009.
2. Srilakshmi 'Food Science', 4th Edition, New Age International Ltd.,2007.
3. Srilakshmi, 'Dietetics', Revised 5th Edition. New Age International Ltd.,2005.
4. Wardlaw M.G. and Paul M Insel Mosby, 'Perspectives in Nutrition', 3rd Edition,1996.
5. Codex Guidelines on Nutrition Labelling (CAC/GL 2_1985) (Rev.1_1993). Rome, Food and Agriculture Organisation of the United Nations / World Health Organisation,1993.
6. Food Safety and Standards Authority of India portal, Government ofIndia
7. Gopalan C., 'Nutritive Value of Indian Foods', NIN, ICMR,1990.
8. Seth V. and Singh K., 'Diet planning through the Life Cycle: Part 1. Normal Nutrition.A
9. Practical Manual., 4th Edition, Elite Publishing House Pvt. Ltd.,2005.

## SENSORY EVALUATION OF FOOD

**Subject Code: BFOTD1-611** | **L T P C** **4 0 0 4** | **Duration: 60(Hrs.)**

**Course Objectives:**

1. To understand the structure and physiology of taste organs, and mechanism of taste perception.
2. To impart knowledge regarding sensory evaluation of different quality attributes of foods and their significance.
3. To familiarize students with taste-, olfactory-, and color abnormalities.
4. To analyze taste, odor, color, and texture of food products using different techniques.
5. To summarize different types of equipments involved in evaluation of sensory attributes of food products.

**Course Outcomes:**

1. Understanding the structure and physiology of taste organs, and mechanism of taste perception.
2. Imparting knowledge regarding sensory evaluation of different quality attributes of foods and their significance.
3. Familiarizing students with taste-, olfactory-, and color abnormalities.
4. Analyzing taste, odor, color, and texture of food products using different techniques.
5. Summarizing different types of equipments involved in evaluation of sensory attributes of food products.

### UNIT I (16 Hrs.)

Taste: Introduction and importance of taste, Structure and physiology of taste organs- tongue, papillae, taste buds, salivary glands, Mechanism of taste perception. Chemical dimensions of basic tastes: sweet, salt, sour, bitter and umami. Factors affecting taste quality, reaction time, taste modification, absolute and recognition of threshold taste abnormalities. Taste measurement

### UNIT II (15 Hrs.)

Odour: Introduction, definition and importance of odour and flavor, Anatomy of nose, physiology of odour perception, Mechanism of odour perception, Odour classification, chemical specificity of odour. Odour measurement using different techniques – primitive to recent techniques. Merits and demerits of each method. Olfactory abnormalities.

### UNIT III (16 Hrs.)

Colour: Introduction and importance of colour. Dimensions of colour and attributes of colour, appearance factors, gloss etc. Perception of colour, Colour abnormalities Measurement of colour; Munsell colour system, CIE colour system, Hunter colour system, spectrophotometry and colorimetry etc.

### UNIT IV (13 Hrs.)

Texture: Introduction, definition and importance of texture Phases of oral processing
Texture perception, receptors involved in texture perception Texture classification
Texture measurement – basic rheological models, forces involved in texture measurement.

**Recommended Readings**

1. Rao E. S., 'Food Quality Evaluation', Variety Books, 2013.
2. Amerine P. and Roessler, 'Principles of Sensory Evaluation of Food', Academic Press, London, 1965.
3. Meilgard D., 'Sensory Evaluation Techniques', 3rd Edition. CRC Press LLC,1999.
4. Man J., 'Principles of Food Chemistry', 3rd Edition., Springer,2007.
5. Brannen and et al., 'Food Additives', Marcel Dekker, New York,1990.

## SENSORY EVALUATION OF FOOD LAB XVI

**Subject Code: BFOTD1-612** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objectives:**
1. To impart knowledge regarding training of sensory panel.
2. To perform different analytical tests for sensory evaluation of food.
3. To measure quality attributes of various food products.
4. To create awareness regarding sensory attributes of food products and their importance.
5. To evaluate different quality parameters of food products using instruments.

**Course Outcomes:**
1. Imparting knowledge regarding training of sensory panel.
2. Performing different analytical tests for sensory evaluation of food.
3. Measuring quality attributes of various food products.
4. Creating awareness regarding sensory attributes of food products and their importance.
5. Evaluation of different quality parameters of food products using instruments.

**PRACTICAL**
1. Training of sensory panel.
2. To perform recognition and sensitivity tests for four basic tastes.
3. To perform analytical tests of sensory evaluation.
4. Recognition tests for various food flavors, flavor defects in milk.
5. Sensory evaluation of milk and milk products.
6. Texture evaluation of various food samples- crispier/ cookies/ biscuits/ snack foods
7. Measurement of colour by using Tintometer/ Hunter Color Labetc.
8. Qualitative tests for hydrogenated fats, butter, ghee
9. Platform tests for milk
10. Quality evaluation of various food stuffs- cereals, pulses, honey, jaggery, sugar, tea, coffee etc.

**Recommended Readings**
1. Rao E. S., ‘Food Quality Evaluation’, Variety Books, 2013.
2. Amerine P. and Roessler, ‘Principles of Sensory Evaluation of Food’, Academic Press, London, 1965.
3. Meilgard ‘Sensory Evaluation Techniques’, 3rd Edition. CRC Press LLC,1999.
4. deMan J., ‘Principles of Food Chemistry’, 3rd Edition., Springer,2007.
5. Brannen and et al., ‘Food Additives’, Marcel Dekker, New York,1990.

## FOOD PLANT LAYOUT

**Subject Code: BFOTD1-613** **L T P C** **Duration: 60(Hrs.)**
**4 0 0 4**

**Course Objectives:**

1. To understand the concept of layout designing and its importance.
2. To impart knowledge regarding factors to be considered for selection of site for setting up a plant.
3. To familiarize the students with considerations for selection of material, process, and machinery.
4. To summarize the importance of management in setting up a plant.
5. To create awareness regarding layout symbols.

**Course Outcomes:**

1. Understanding the concept of layout designing and its importance.
2. Imparting knowledge regarding factors to be considered for selection of site for setting up a plant.
3. Familiarizing the students with considerations for selection of material, process, and machinery.
4. Summarizing the importance of management in setting up a plant.
5. Creating awareness regarding layout symbols.

### UNIT-I (15 Hrs.)

Plant design concepts and general design considerations Plant Layout problems, Importance and Objectives Advantages of a good layout

### UNIT-II (15 Hrs.)

Plant location: location factors and their interaction with plant location, Importance of a plant layout selection of site and layouts of different food industries.

### UNIT-III (15 Hrs.)

Selection of building material, selection and planning of manufacturing process and service facilities. Process selection; process flow charts, selection of equipment and machinery; maintenance and replacement, depreciation of machinery

### UNIT IV (15 Hrs.)

Management set up in a plant. Plant layout, layout symbols.

**Recommended Books:**

1. Marriott, ‘Principle of Food Sanitation’, 5th Edition, CBS Publishers, New Delhi,2006.
2. Green J.H. and Kramer A.,‘Food Processing Waste Management’, AVI Publishers,USA.,1979.
3. Potter N. N., ‘Food Science’, 5th Edition., CBS Publishers, New Delhi,2006.
4. Sharma S.C., ‘Plant Layout and Material Handling’,3rd Edition Khanna Publishers,2000.
5. James M. M., ‘Plant layout & design’,Collier Macmillan Ltd.,1962

## FOOD PLANT LAYOUT LAB XVII

**Subject Code: BFOTD1-614** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To impart knowledge regarding preparation of process diagrams for different food products.
2. To familiarize students with calculation of cost in relation to designing, processing, and depreciation.
3. To understand the factors to be considered while designing the layout and process diagrams of different manufacturing units.
4. To develop an ability to prepare layout for manufacturing plants of different food products.
5. To create awareness regarding depreciation of machinery and processing.

**Course Outcomes:**

1. Imparting knowledge regarding preparation of process diagrams for different food products.
2. Familiarizing students with calculation of cost in relation to designing, processing, and depreciation.
3. Understanding the factors to be considered while designing the layout and process diagrams of different manufacturing units.
4. Developing an ability to prepare layout for manufacturing plants of different food products.
5. Creating awareness regarding depreciation of machinery and processing.

**PRACTICAL**

1. Preparation of layout and process diagram of potato crisp manufacturing plant.
2. Preparation of layout and process diagram of Jam/Marmalade manufacturingplant.
3. Preparation of layout and process diagram of Bread makingplant.
4. Preparation of layout and process diagram of a dairy industry.
5. Preparation of layout and process diagram of wine makingunit.
6. Preparation of layout and process diagram of a modern slaughter house.
7. Preparation of layout and process of diagram of a confectionaryunit.
8. Calculation of depreciation of machinery and processingcosts.

## FOOD SAFETY

**Subject Code: BFOTD1-621** **L T P C** **Duration: 60(Hrs.)**
**4 0 0 4**

**Course Objectives:**

1. To understand the concept of food safety, factors involved, and its importance.
2. To impart knowledge regarding importance of hygiene and sanitation in food service establishments and ways to ensure the same.
3. To familiarize students with Indian food regulatory regime and Global Scenario.
4. To develop an ability of hazard management and ensuring food safety.
5. To create awareness regarding emerging pathogens, and recent advancements in food production, processing, and safety.

**Course Outcomes:**

1. Understanding the concept of food safety, factors involved, and its importance.
2. Imparting knowledge regarding importance of hygiene and sanitation in food service establishments and ways to ensure the same.
3. Familiarizing students with Indian food regulatory regime and Global Scenario.
4. Developing an ability of hazard management and ensuring food safety.
5. Creating awareness regarding emerging pathogens, and recent advancements in food production, processing, and safety.

### UNIT I (15 Hrs.)

Introduction to Food Safety: Definition, Types of hazards, biological, chemical, physical hazards, Factors affecting Food Safety, Importance of Safe Foods.
Food Hazards of Physical and Chemical and Microbiological origin, Management of hazards, Need, Control of parameters, Temperature control and Food storage.

### UNIT II (14 Hrs.)

Hygiene and Sanitation in Food Service Establishments, Introduction, Sources of contamination, Control methods using physical and chemical agents, Waste Disposal, Pest and Rodent Control and Personnel Hygiene, Food laws and Standards

### UNIT III (16 Hrs.)

Indian Food Regulatory Regime, Global Scenario and Other laws and standards related to food safety (FSSAI, AGMARK, FPO, MFPO, MPO, BIS AND ISO)

### UNIT IV (15 Hrs.)

Recent concerns: New and Emerging Pathogens, Genetically modified foods\Transgenics, Organic foods and newer approaches to food safety

**Recommended Readings**

1. Lawley R., Curtis L. and Davis J., 'The Food Safety Hazard Guidebook', RSC publishing, 2004.
2. De Vries, 'Food Safety and Toxicity', CRC, New York,1997'
3. Marriott, N. G., 'Principles of Food Sanitation', AVI, New York,1985.
4. Forsythe, S. J., 'Microbiology of Safe Food', Blackwell Science, Oxford,2000.
5. Forsythe S. J., 'The Microbiology of Safe Food', 2nd Edition, Willey- Blackwell, U.K., 2010.
6. Mortimore S. and Wallace C. 'HACCP, A practical approach', Chapman and Hill, London,1995.
7. Clive de Blackburnand Peter McClure., Foodborne Pathogens Woodhead Publishing, 2009.

## FOOD SAFETY LAB XVIII

**Subject Code: BFOTD1-622** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To familiarize students with different types of media preparations used in microbiology.
2. To identify type of microbes present using different microbiological techniques.
3. To impart knowledge regarding microbiological contamination of water and its analysis.
4. To develop an ability for microbiological examination of food samples and interpretation of data.
5. To create awareness regarding types of hazards, importance of hygiene and sanitation and ways for their assessment.

**Course Outcomes:**

1. Familiarizing students with different types of media preparations used in microbiology.
2. Identifying type of microbes present using different microbiological techniques.
3. Imparting knowledge regarding microbiological contamination of water and its analysis.
4. Developing an ability for microbiological examination of food samples and interpretation of data.
5. Creating awareness regarding types of hazards, importance of hygiene and sanitation and ways for their assessment.

**PRACTICAL**

1. Preparation of different types of media (complex, differential and selective)
2. Enumeration of aerial microflora using PDA
3. Identification of Molds by lactophenol bluestaining
4. Negative Staining
5. Microbiological Examination of food
6. Bacteriological Analysis of Water by MPN method
7. Assessment of surface sanitation by swab and rinse method
8. Assessment of personal hygiene
9. Detection of Physical and chemical hazards in food.
10. Determination of coliforms in water.

**Recommended Readings**

1. Lawley R., Curtis L. and Davis J., ‘The Food Safety Hazard Guidebook’, RSC publishing, 2004.
2. De Vries, ‘Food Safety and Toxicity’, CRC, New York,1997.
3. Marriott, N. G., ‘Principles of Food Sanitation’, AVI, New York,1985.
4. Forsythe, S. J., ‘Microbiology of Safe Food’, Blackwell Science, Oxford,2000.
5. Forsythe S. J., ‘The Microbiology of Safe Food’, 2nd Edition, Willey- Blackwell, U.K., 2010.
6. Mortimore S. and Wallace C. ‘HACCP, A practical approach’, Chapman and Hill, London,1995.
7. Clive de Blackburnand Peter McClure., Foodborne Pathogens Woodhead Publishing, 2009.

## FOOD QUALITY MANAGEMENT

**Subject Code: BFOTD1-623** **L T P C 4 0 0 4** **Duration: 60(Hrs.)**

**Course Objectives:**

1. To understand the concept of quality and its importance in agri-food production chain.
2. To familiarize students with quality management systems in India and their role in quality control and assurance.
3. To impart knowledge regarding different types of ingredients and processing techniques involved in food production.
4. To analyze chemical, technological and toxicological aspects of different types of food additives used in food industry.
5. To create awareness regarding contamination of food, its sources and control.

**Course Outcomes:**

1. Understanding the concept of quality and its importance in agri-food production chain.
2. Familiarize the students with quality management systems in India and their role in quality control and assurance.
3. Imparting knowledge regarding different types of ingredients and processing techniques involved in food production.
4. Analyzing chemical, technological and toxicological aspects of different types of food additives used in food industry.
5. Creating awareness regarding contamination of food, its sources and control.

### UNIT I (15 Hrs.)

Introduction to food quality management – Definition of quality, quality concepts, quality perception, quality attributes.
Concepts of quality management: Objectives, importance and functions of quality control and quality assurance; Quality management systems in India

Quality in the Agri- food production chain-Techno- managerial approach, food quality relationship and food quality management functions. Dynamics on the agri- food production chain, core developments in food quality management.

### UNIT II (15 Hrs.)

Contamination in Food: Physical, chemical contaminants (heavy metals, pesticide residues, antibiotics, agrochemicals, veterinary drug residues, environmental pollutants, radio-nucleides, solvent residues, chemicals) and Natural toxins.

### UNIT III (15 Hrs.)

Chemical, technological and toxicological aspects
Risk assessment studies: Safety and quality evaluation of additives and contaminants, Acute and chronic studies. Introduction, need of food additives in food processing and preservation, Characteristics and classification of food additives.
Antimicrobial agents. -Nitrites, sulphides, sulphur dioxide, sodium chloride, hydrogen peroxide.

**UNIT IV (15 Hrs.)**

High fructose corn syrup, cryogenic freezing, supercritical fluid extraction, fat mimetics, flavour encapsulation, use of nano technology in foods etc.

**Recommended Readings**

1. Pieternel A, L. and Willem J. M., 'Food Quality Management Technological and Managerial principles and practices', Wageningen,2009.
2. Brannen and et al., 'Food Additives', Marcel Dekker, New York,1990.
3. Jones J. M., 'Food Safety', Eagan Press,1992.
4. Shapton D.A. and Shapton N.F., 'Principles and Practices for the safe processing of Foods' CRC Press,1998.
5. DeMan, 'Principles of Food Chemistry', 3rd edition, Springer,2007.

## FOOD QUALITY MANAGEMENT LAB XIX

**Subject Code: BFOTD1-624** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objectives:**

1. To familiarize students with qualitative estimation of different food components in various food stuffs.
2. To conduct quality inspection of different food stuffs.
3. To analyze different food components quantitatively.
4. To implement GMP and HACCP in food industry.
5. To evaluate different food contaminants in food stuffs.

**Course Outcomes:**

1. Familiarizing students with qualitative estimation of different food components in various food stuffs.
2. Conducting quality inspection of different food stuffs.
3. Analyzing different food components quantitatively.
4. Implementing GMP and HACCP in food industry.
5. Evaluating different food contaminants in food stuffs.

**PRACTICAL**

1. Qualitative tests for hydrogenated fats, butter, and ghee.
2. Quality inspection of various food stuffs- cereals, pulses, spices and condimentsetc.
3. Estimation of sulphur dioxide in foods
4. Chromatographic estimation of colour.
5. Analysis of edible common salt for moisture content, MIW and totalchlorides.
6. Estimation of ammonia nitrogen inwater.
7. Estimation of benzoic acid/ sorbic acid in foods.
8. To implement HACCP plan in particular phases of food chain.
9. To evaluate various processes in food plant for implementation of GMP.
10. Determination of insecticides in given food samples.
11. Determination of heavy metals in food samples.

**Recommended Readings**

1. Pieternel A, L. and Willem J. M., ‘Food Quality Management Technological and Managerial principles and practices’, Wageningen,2009.
2. Brannen and et al., ‘Food Additives’, Marcel Dekker, NewYork,1990.
3. Jones J. M., ‘Food Safety’, Eagan Press,1992.
4. Shapton D.A. and Shapton N.F., ‘Principles and Practices for the safe processing of Foods’ CRC Press,1998.
5. DeMan, ‘ssPrinciples of Food Chemistry’, 3rd edition, Springer, 2007

# SEMESTER SEVENTH

## FOOD STORAGE ENGINEERING

**Subject Code: BFOTS1-701** **L T P C** **Duration: 60(Hrs.)**
**4 0 0 4**

**Course Objectives**

1. To familiarize students with the importance of scientific storage systems.
2. To understand various post-harvest changes and causes of spoilage in fruits and grains.
3. To provide the knowledge about various storage structures.
4. To create awareness regarding prevention methods to protect fruits and grains from insects and pests.
5. To understand the design of storage structures and various specifications for designs of storage systems.

**Course Outcomes**

1. Familiarize students with the importance of scientific storage systems.
2. Understanding various post-harvest changes and causes of spoilage in fruits and grains.
3. Providing knowledge about various storage structures.
4. Creating awareness amongst students about prevention of fruits and grains from insects and pests.
5. Understanding the design of storage structures and various specifications for designs of storage systems.

### UNIT I (12 Hrs.)

Introduction: Importance of scientific storage systems, post-harvest physiology of semi- perishables and perishables, climacteric and non-climacteric fruits, respiration, ripening, changes during ripening, ethylene bio-synthesis. Damages Direct damages, indirect damages, causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, sprouting), destructive agents (rodents, birds, insects, etc.), sources of infestation and control

### UNIT II (17 Hrs.)

Storage structures: Traditional storage structures, improved storage structures, modern storage structures, godown layout, staking pattern and rodent proof godown design; Farm silos: Horizontal silos, tower silos, pit silos, trench silos, size and capacity of silos. Storage of grains Respiration of grains, moisture and temperature changes in stored grains; conditioning of environment inside storage through ventilation. Aeration and stored grain management Purposes of aeration, aeration theory, aeration system design, aeration system operation

### UNIT III (16 Hrs.)

Damage due to insects and pests during storage and its control, seed coating, fumigations, etc.; Damage caused by rodents and its control. Storage of perishables cold storage, controlled and modified atmospheric storage, hypobaric storage, evaporative cooling storage, conditions for storage of perishable products, control of temperature and relative humidity inside storage

### UNIT IV (15 Hrs.)

Design of storage structures Functional and structural design of grain storage structures, pressure theories, pressure distribution in the bin, grain storage loads, pressure and capacities, warehouse and silos, BIS specifications, functional, structural and thermal design of cold stores

**Recommended Readings:**


1. R. Paul Singh and Dennis R. Heldman. 2014. Introduction to Food Engineering, 5th Ed. Elsevier, Amsterdam, The Netherlands.
2. Albert Ibarz and Gustavo V. Barbosa-Cánovas. 2003. Unit Operations in Food Engineering. CRC Press, Boca Raton, FL, USA.
3. George D. Saravacos and Athanasios E. Kostaropoulos. 2002. Handbook of Food Processing Equipment. Springer ScienceBusiness Media, New York, USA. R. K. Sinnott. 1999. Chemical Engineering, Vol. 6, Chemical Engineering Design, 3rd Ed. Butterworth-Heinemann, Oxford, UK.
4. Kenneth J. Valentas, Enrique Rotstein and R. Paul Singh. 1997. Handbook of Food Engineering Practice. CRC Press, Boca Raton, FL, USA.
5. Peter F. Stanbury, Allan Whitakar and Stephen J. Hall. 1995. Principles of Fermentation Technology, 2 nd Ed. Elsevier Science Ltd., Burlington, MA, USA.
6. J.F. Richarson and D.G. Peacock. 1994. Coulson &Richardsons's Chemical Engineering, Vol. 3, Chemical &Biochemical Reactors & Process Control, 3rd Ed. Elsevier Butterworth-Heinemann, Amsterdam, The Netherlands.
7. James R. Couper, W. Roy Penney, James R. Fair and Stanley M. Walas 2012 Chemical Process Equipment: Selection and Design. Elsevier Inc
8. Mahajani, V. V. and Umarji, S. B., Process equipment design, Macmillan.
9. Bhattacharyya, B. C., Introduction to Chemical Equipment design, CBS Publishers and Distributors.
10. Geankoplis C. J. Transport processes and unit operations, Prentice-Hall

## FOOD BIOTECHNOLOGY

**Subject Code: BFOTS1-702** **L T P C** **Duration: 60(Hrs.)**
**4 0 0 4**

**Course Objectives**

1. To impart knowledge about basics of food biotechnology.
2. To create the awareness about different toxins and various naturals antimicrobial agents used in food preservation.
3. To remember the concept of genetic engineering and its role in food production enhancement.
4. To understand the methods and applications of protein engineering in food technology.
5. To analyze the role of Intellectual property rights (IPR) in biotechnology and their associated benefits.

**Course Outcomes**

1. Imparting knowledge about basics of food biotechnology.
2. Creating the awareness about different toxins and various naturals antimicrobial agents used in food preservation.
3. Remembering the concept of genetic engineering and its role in food production enhancement.
4. Understanding the methods and applications of protein engineering in food technology.
5. Analyzing the role of Intellectual property rights (IPR) in biotechnology and their associated benefits.

### UNIT I(15 Hrs.)

Introduction to food biotechnology: basic principles of genetic engineering, improvement of the processing of various crops by genetic engineering, food safety.

### UNIT II(16 Hrs.)

Natural antimicrobials for food preservation: Phytoalexins, essential oils and their components, bacteriocins of Lactic acid bacteria, nisin, pediocinsetc, applications of bacteriocins in food systems. Aflatoxins-production, control and reduction using molecular strategy.

### UNIT III(14 Hrs.)

Protein engineering in food technology: Methods and applications of protein engineering (e.g. glucoseisomerase, Lactobacillusbeta-galactosidase and peptideantibioticnisin). Biotechnology and Food ingredients: biogums,fatsubstitutes, biocolors, organicacids and sweetners.

### UNIT IV(15 Hrs.)

Food Bio-technology and Intellectual property rights (IPR), benefits of securing IPRs; bioethics in food biotechnology. Transgenic plants and animals: Their contribution to food production enhancement.

**Recommended Readings:**

1. B.H.Lee,‘Fundamentals ofFood Biotechnology’,VCHPublishers,NewYork,U.S.A.
2. M.P.Tombs,‘BiotechnologyinFoodIndustry’,Wiley-Blackwell,U.K.
3. D.Knorr,‘Food Biotechnology’,MarcelDekker, INC,NewYork,U.S.A.
4. A.Schwartzberg and A Rao ‘Biotechnology & Food Process Engineering’ Marcel Dekker,INC,New York.
5. I.Goldberg and R. Williams, ‘Biotechnology and Food Ingredients’, Springer Science &BusinessMedia, Germany.
6. R.D.KingandP.S.J.Cheetham,‘FoodBiotechnology’,ElsevierAppliedScience,London.

## TECHNOLOGY OF BEVERAGES

**Subject Code: BFOTS1-703** | **L T P C 4 0 0 4** | **Duration: 60(Hrs.)**

**Course Objectives**

1. To impart the knowledge of types and importance of beverages.
2. To understand the technology behind processing of different beverages to meet the legal specifications.
3. To familiarize with the concept of water treatment along with quality parameters involved.
4. To use different types of additives to address the specified needs of consumers.
5. To create awareness regarding quality control tests used in beverages.

**Course Outcomes**

1. Imparting the knowledge of types and importance of beverages.
2. Understanding the technology behind processing of different beverages to meet the legal specifications.
3. Familiarize with the concept of water treatment along with quality parameters involved.
4. Application of different types of additives to address the specified needs of consumers.
5. Creating awareness regarding quality control tests used in beverages.

### UNIT-I (15 Hrs.)

History and importance of beverages and status of beverage industry, Processing of beverages: Packaged drinking water, juice-based beverages, synthetic beverages, still, carbonated, Low-calorie and dry beverages, isotonic and sports drinks Dairy based beverages Alcoholic beverages, fruit beverages, specialty beverages.

### UNIT-II (15 Hrs.)

Tea, coffee, cocoa, plant extracts, etc. FSSAI specifications for beverages, Ingredients, manufacturing and packaging processes and equipment for different beverages, Water treatment and quality of process water.

### UNIT III (15 Hrs.)

Sweeteners, colorants, acidulants, Clouding and clarifying and flavouring agents for beverages. Use of carbon dioxide in carbonation.

### UNIT-IV (15 Hrs.)

Quality tests and control in beverages. Miscellaneous beverages: Coconut water, sweet toddy Sugar cane juice, coconut beverage, flavoured syrups.

**Recommended Readings:**

1. Hans Michael Eblinger. 2009. Handbook of Brewing: Processes, Technology, Markets.Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim. Germany.
2. Y.H. Hui. 2007. Handbook of Food Products Manufacturing: Principles, Bakery, Beverages, Cereals, Cheese, Confectionary, Fats, Fruits, and Functional Foods. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
3. Philip R. Ashurst. 2005. Chemistry and Technology of Soft Drinks and Fruit Juices, 2nd Ed. Blackwell Publishing Ltd., Oxford, UK.
4. AmalenduChakraverty, Arun S. Mujumdar, G.S. VijayaRaghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.

## SNACKS AND EXTRUSION TECHNOLOGY

**Subject Code: BFOTS1-704** **L T P C** **Duration: 60 (Hrs.)**

**4 0 0 4**

**Course Objectives**

1. To acquire knowledge about compositions, formulations and quality testing of Snack foods.
2. To make students aware about specifications, compositions, ingredients, processing techniques of
3. breakfast cereals and texturized vegetable protein
4. To familiarize with different types of extruders.
5. To learn about manufacturing of different extruded products.
6. To get knowledge about Chemical and nutritional changes in food during extrusion.

**Course Outcomes**

1. Imparting knowledge about compositions, formulations and quality testing of Snack foods.
2. Creating awareness aware about specifications, composition, ingredients, processing techniques of breakfast cereals and texturized vegetable protein
3. Familiarizing with different types of extruders.
4. Understanding manufacturing of different extruded products.
5. Analyzing the chemical and nutritional changes in food during extrusion.

**UNIT I (14 Hrs.)**

Snack foods: Types, specifications, compositions, ingredients, Formulations, processing, equipment, packaging, storage and quality testing, Snack food seasonings

**UNIT II (15 Hrs.)**

Classification of Breakfast cereals: Raw materials, process and quality testing of vermicelli, spaghetti: and macronic products Texturized vegetable protein: Definition, processing techniques, and foods Ready to eat breakfast cereals by extrusion cooking. Specifications, compositions, ingredients Formulations, processing Packaging, storage and quality testing for breakfast cereals, macaroni and malts.

**UNIT III (15 Hrs.)**

Extrusion: definition, introduction to extruders, principles and types, Uses of extruders in the food industry, Single screw extruder: principle of working, factors affecting extrusion process, Twin screw extruder: counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder

**UNIT IV (16 Hrs.)**

Pre-conditioning of raw materials used in extrusion process Use of dry extruders in extrusion Chemical and nutritional changes in food during extrusion. Extrusion technology and applications in food processing.

**Recommended Readings:**

1. NIIR Board of Consultants & Engineers. 2014. The Complete Technology Book on Bakery Products (Baking Science with Formulation & Production), 3rd Ed. NIIR, New Delhi.
2. Peter P. Grewling. 2013. Chocolates & Confections, 2nd Ed. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
3. E.J. Pyler and L.A. Gorton. 2009. Baking Science & Technology, Vol. II: Formulation & Production, 4 th Ed. Sosland Publishing Company, Kansas City, MO, USA.
4. E.J. Pyler and L.A. Gorton. 2008. Baking Science & Technology, Vol. I: Fundamentals & Ingredients, 4th Ed. Sosland Publishing Company, Kansas City, MO, USA.
5. Y.H. Hui. 2007. Handbook of Food Products Manufacturing: Principles, Bakery, Beverages, Cereals, Cheese, Confectionary, Fats, Fruits, and Functional Foods. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
6. John J. Kingslee. 2006. A Professional Text to Bakery and Confectionery. New Age International, New Delhi.
7. Harold Corke, Ingrid De Leyn, Nanna A. Cross, Wai-Kit Nip, Y.H. Hui. 2006. Bakery Products: Science and Technology. Blackwell Publishing Ltd., Oxford, UK.
8. Joseph Amendola and Nicole Rees. 2003. Understanding Baking: The Art and Science of Baking, 3rd Ed. John Wiley & Sons, Inc., Hoboken, New Jersey, USA.
9. Duncan Manley. 2000. Technology of Biscuits, Crackers and Cookies, 3rd Ed. Woodhead Publishing Limited, Cambridge, England.
10. N.L. Kent and A.D. Evers. 1994. Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture, 4th Ed. Elsevier Science Ltd., Oxford, UK.
11. E.B. Jackson. 1995. Sugar Confectionery Manufacture, 2nd Ed. Springer-Verlag, US.
12. B.W. Minife. 1989. Chocolate, Cocoa, and Confectinery – Science and Technology, 3rd Ed. Chapman and Hall, Inc., New York, USA.
13. Samuel A. Matz. 1976. Snack Food Technology, 2nd Ed. AVI Publishing Co., Inc., Westport, Connecticut, USA.

## TECHNOLOGY OF BEVERAGES LAB XX

**Subject Code: BFOTS1-705** **L T P C** **Duration: 60(Hrs.)**

**0 0 4 2**

**Course Objectives**

1. To impart knowledge regarding quality analysis of water.
2. To understand the technology behind processing of different types of beverages.
3. To familiarize with the methods involved in determination of different additives used in the formulation of beverages.
4. To analyze different quality parameters of beverages so as to meet the legal specifications.
5. To understand the mode of working in industrial setups as an individual and as a team.

**Course Outcomes**

1. Imparting knowledge regarding quality analysis of water.
2. Understanding the technology behind processing of different types of beverages.
3. Familiarize with the methods involved in determination of different additives used in the formulation of beverages.
4. Analysis of quality parameters of beverages so as to meet the legal specifications.
5. Understanding the mode of working in industrial setups as an individual and as a team.

**PRACTICALS**

1.Quality analysis of raw water

2. Determination of brix value, pH and acidity of beverages

3. Determination of density and viscosity of caramel

4. Preparation of synthetic beverage

5. Determination of colours in soft drinks by wool technique

6. Preparation of iced and flavoured tea

7. Preparation of instant tea

8. Assessment of purity of carbon dioxide

9. Preparation of carbonated and non-carbonated beverages

10. Preparation of sports drink

11. Preparation of dairy/ fruit-based beverage

12. Determination of caffeine in beverages

13. Quality analysis of tea and coffee

14. Preparation of miscellaneous beverages

15. Visit to carbonation unit

16. Visit to mineral water plant

## SNACKS AND EXTRUSION TECHNOLOGY LAB XXI

**Subject Code: BFOTS1-706** **L T P C** **Duration: 60(Hrs.)**
**0 0 4 2**

**Course Objectives**

1. To learn about identifications and composition of various ingredients used for manufacturing of snacks and extruded products.
2. To gain knowledge about testing of different raw materials used in preparation of snacks and extruded products.
3. To learn about manufacturing of different snack food products and extruded products.
4. To become familiarize with different tests to quality evaluation of extruded products.
5. To become aware about packaging of snack food products and extruded products.

**Course Outcomes**

1. Understanding of identifications and composition of various ingredients used for manufacturing of snacks and extruded products.
2. Imparting knowledge about testing of different raw materials used in preparation of snacks and extruded products.
3. Development of different snack food products and extruded products.
4. Familiarizing with different tests to quality evaluation of extruded products.
5. Creating awareness about packaging of snack food products and extruded products.

**PRACTICALS**

1. Identification and composition of various ingredients used for preparation of snacks
2. Flours, their classifications and characterization
3. Determination of flour gluten
4. Determination of water absorption characteristics and dough development time
5. Determination of dough rising capacity
6. Determination of calcium carbonate in fortified atta
7. Quality evaluation of selected snack items
8. Preparation of pasta
9. Preparation of macroni
10. Preparation of vermicelli
11. Preparation of noodles
12. Preparation of selected extruded products
13. Packaging and quality evaluation of extruded products
14. Visit to snack industry

# Maharaja Ranjit Singh Punjab Technical University
## Bathinda-151001

## FACULTY OF SCIENCES

# SYLLABUS

## FOR

## M.Sc. (FOOD SCIENCE AND TECHNOLOGY)

## 2021 BATCH ONWARDS

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**(ii) Subject to change in the syllabi at any time.**

**Please visit the University website time to time.**

| Semester 1st | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MFOT1-101 | Principles of Food Preservation | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-102 | Basic Food Microbiology | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-103 | Food Chemistry | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-104 | Food Analysis and Instrumentation Lab.-I | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| MFOT1-106 | Food Microbiology Lab.-II | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective –I (Select any one) | | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-158 | Nutraceutical and Functional Foods | | | | | | | |
| MFOT1-157 | Nutrition and Health | | | | | | | |
| Open Elective –I (Select any one) | | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| **Total** | | 19 | 0 | 8 | 320 | 380 | 700 | 23 |

*Departmental Elective: Subject to the availability of teacher and minimum 10 students as per university guidelines.
**Open Elective: Student must choose open elective subject offered by other departments.

| Semester 2nd | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MFOT1-206 | Basic Food Engineering | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-207 | Technology of Cereals and Millets | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-208 | Computer Fundamentals and Statistics | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-209 | Technology of Cereals and Millets Lab.-III | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective –II (Select any one) | | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-258 | Technology of Beverages | | | | | | | |
| MFOT1-259 | Technology of Malting and Brewing | | | | | | | |
| Departmental Elective –III (Select any one) | | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-260 | Food Biotechnology | | | | | | | |
| MFOT1-261 | Food Additives | | | | | | | |
| | **Total** | 20 | 0 | 4 | 260 | 340 | 600 | 22 |

*Departmental Elective: Subject to the availability of teacher and minimum 10 students as per university guidelines.
After 2nd Semester the students will undertake an In-plant summer training of six weeks in industry/organization. The evaluation of training will be done in the fourth semester.

| Semester 3rd | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MFOT1-315 | Technology of Fruits and Vegetables | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-311 | Unit Operations in Food Engineering | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-312 | Food Packaging | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| MFOT1-313 | Technology of Fruits and Vegetables Lab.- IV | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| MFOT1-314 | Food Packaging Lab.-V | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| Departmental Elective –IV (Select any one)* | | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| MFOT1-364 | Food Standards and Quality Assurance | | | | | | | |
| MFOT1-363 | Technology of Pulses and Oil seeds | | | | | | | |
| Open Elective –II (Select any one)** | | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| MFOT1-420 | Dissertation*** | 0 | 0 | - | - | - | - | 2 |
| **Total** | | 17 | 0 | 8 | 320 | 380 | 700 | 23 |

*Departmental Elective: Subject to the availability of teacher and minimum 10 students as per university guidelines.
**Open Elective: Student must choose open elective subject offered by other departments.
***Thesis will continue in 4th Semester. Students will have to finalize the topic of research and its objectives in 3rd Semester.

| Semester 4th | | Contact Hrs. | | | Marks | | | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | **Total** | |
| MFOT1-415 | Technology of Egg, Meat, Fish and Poultry | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-416 | Technology of Milk and Milk Products | 4 | 0 | 0 | 40 | 60 | 100 | 4 |
| MFOT1-417 | Food Analysis and Instrumentation | 3 | 0 | 0 | 40 | 60 | 100 | 3 |
| MFOT1-418 | Technology of Animal Products Lab.-VI | 0 | 0 | 4 | 60 | 40 | 100 | 2 |
| MFOT1-419 | In Plant Summer Training Viva | 0 | 0 | 0 | 60 | 40 | 100 | 1 |
| MFOT1-420 | Dissertation | 0 | 0 | 16 | Satisfactory/ Unsatisfactory | | | 8 |
| **Total** | | 11 | 0 | 20 | 240 | 260 | 500 | 22 |

Overall

| **Semester** | **Marks** | **Credits** |
|---|---|---|
| 1st | 700 | 23 |
| 2nd | 600 | 22 |
| 3rd | 700 | 23 |
| 4th | 500 | 22 |
| Total | 2500 | 90 |

# SEMESTER FIRST

## PRINCIPLES OF FOOD PRESERVATION

**Subject Code: MFOT1-101** **L T PC 4 0 0 4** **Duration: 60Hrs.**

**Course Objectives:**
To imparting knowledge on the causes of food spoilage and principles of food preservation.
To understanding the applications of basic and advanced equipments used for food preservation.
To creating the awareness about limits of chemical preservatives safe for human consumption.
To analyzing the effectiveness of novel preservation techniques over traditional methods with respect to food and environment.

**Course Outcomes:**
Imparting knowledge on the causes of food spoilage and principles of food preservation.
Understanding the applications of basic and advanced equipments used for food preservation.
Creating the awareness about limits of chemical preservatives safe for human consumption.
Analyzing the effectiveness of novel preservation techniques over traditional methods with respect to food and environment.

### UNIT-I (15 Hrs.)

Introduction and historical developments of food preservation.
Principles of Food Preservation. Food Spoilage: Microbial, physical, chemical and miscellaneous.
Heat Preservation and Processing: Thermal death curve, canning of foods, canning process, equipment, effect on food, aseptic processing.

### UNIT-II (15 Hrs.)

Dehydration: Drying curves, water activity, drying process, types of dryers, dehydration effect in food.
Concentration: Technology of concentration, equipment, process, and changes in food during concentration.
Intermediate Moisture (IM) Foods: Principles, characteristics, advantages, and problems in developing new IM foods.

### UNIT-III (16 Hrs.)

Refrigeration Storage: Requirements of refrigeration storage, changes in foods during refrigeration storage.
Freezing and Frozen Storage: Freezing curves, factors determining freezing rate, types of freezers, changes in food during freezing.
Ionizing Radiation: Source; equipment; mechanism of preservation, dose determination, effect on food.
Microwaves: Mechanism of heating, equipment and its effect on food.
Household Preservation Methods: Salt curing, oiling and smoking.
Chemical Preservation: types, uses and effects of class I and class II preservatives in foods.

### UNIT-IV (14 Hrs.)

Recent Methods in Food Preservation: Pulse electric, ultrasound, infrared, high pressure, Ohmic heating, hurdle technology, nanotechnology in food processing.

**Recommended Books**

1. N.P. Norman and H.H. Joseph, 'Food Science', CBS Publishers & Distributors Pvt. Ltd., New Delhi, India.
2. W.C. Frazier and D.C. Westh off, 'Food Microbiology', Tata McGraw Hill Publishing Company Ltd., New Delhi, India.
3. M. Kalia and S. Sangita, 'Food Preservation and Processing', Kalyani Publishers, New Delhi, India.

4. B. Sivasankar,'Food Processing and Preservation', Prentice Hall of India Pvt. Ltd., New Delhi, India.
5. J.N. Desrosier and N.W. Desrosier, 'Technology of Food Preservation', CBS Publishers & Distributors Pvt. Ltd., New Delhi,India.
6. P. Fellows, 'Food Process Technology: Principles and Technology', CRC Press, Cambridge, England.
7. N. Khetarpaul, 'Food Processing and Preservation', Daya Publishing House, NewDelhi,India.

## BASIC FOOD MICROBIOLOGY

**Subject Code: MFOT1-102** | **L T P C 4 0 0 4** | **Duration: 60Hrs.**

**Course Objectives:**

To applying the knowledge of HACCP and food safety to prevent the growth of microbes in foods.
To detection of food borne pathogens using novel techniques of analysis.
To evaluating the factors encouraging and restricting the growth of microbes in foods.
To analyzing the role of pathogens in food borne illnesses.

**Course Outcomes:**

Applying the knowledge of HACCP and food safety to prevent the growth of microbes in foods.
Detection of food borne pathogens using novel techniques of analysis.
Evaluating the factors encouraging and restricting the growth of microbes in foods.
Analyzing the role of pathogens in food borne illnesses.

### UNIT-I (15 Hrs.)

Microbiology: Introduction, historical developments in food microbiology; prokaryotes and eukaryotes; classification of microorganisms- a brief account; sources of microorganisms in foods; microbial growth, growth curve; factors affecting growth-intrinsic and extrinsic factors controlling growth of microorganisms, microbiological criteria of foods and their significance.

### UNIT-II (15 Hrs.)

Effect of food preservatives, heating process, irradiation, low temperature storage, chemical preservatives, high-pressure processing; water activity and hurdle technology on microbial growth.

### UNIT-III (16 Hrs.)

Foods Microbiology and Public Health: Food poisoning, types of food poisonings, important features etc; bacterial agents of food borne illness, food poisoning by *clostridium, salmonella, E. coli, bacillus, staphylococcus* etc.; non-bacterial agents of food borne illness: poisonous algae, and fungi - a brief account, the HACCP system and food safety used in controlling microbiological hazards.

### UNIT-IV (14 Hrs.)

Food spoilage and microbes of milk, meats, fish, fruits, vegetables and cereals, spoilage of canned foods; Indicators microorganisms, methods of isolation and detection of microorganisms; conventional methods; rapid methods (newer techniques) – immunological methods; fluorescent, antibody, radio immunoassay, principles of ELISA, PCR (Polymerized chain reactions).

**Recommended Books**

1. J.M. Jay, 'Modern Food Microbiology', CBS Publishers, New Delhi, India.
2. G.J. Banwart, 'Basic Food Microbiology', CBS Publishers, New Delhi, India.
3. M.R. Adam and M.O. Moss, 'Food Microbiology', CRC Press, U.S.A.
4. B. Ray, 'Fundamental Food Microbiology', CRC Press, New York, U.S.A.
5. R.Y. Stanier, 'General Microbiology', Palgrave Macmillan, Dunfermline, United Kingdom.

## FOOD CHEMISTRY

**Subject Code: MFOT1-103** | **L T PC 4 0 0 4** | **Duration: 60Hrs.**

**Course Objectives:**

1. To learn about the knowledge of chemical composition of food.
2. To Understanding the harmful effects of allergens and toxic constituents of foods on human health.
3. To analyzing the factors affecting nutritional composition of food.
4. To evaluating the processes leading to desirable and undesirable changes occurring in food.

**Course Outcomes:**

1. Imparting the knowledge of chemical composition of food.
2. Understanding the harmful effects of allergens and toxic constituents of foods on human health.
3. Analyzing the factors affecting nutritional composition of food.
4. Evaluating the processes leading to desirable and undesirable changes occurring in food.

### UNIT-I (16 Hrs.)

Food Chemistry: Definition, scope and importance.

Carbohydrates: classification, physical and chemical properties of sugars, functional properties, and uses of pectic substances, gums and dietary fiber in food; browning reaction in food: enzymatic and non-enzymatic browning, their occurrence and applications in food; starches: functionality of starch in foods, gelatinization and retro-gradation of starches, modified starches, resistant starches.

Vitamins: Water and fat–soluble vitamins, use of vitamins in foods and their properties. Effect of processing on vitamins.

Minerals of Foods: Calcium, phosphorus, iron, copper, lead, zinc and arsenic.

### UNIT-II (14 Hrs.)

Proteins: structures of protein and amino acids; physical, chemical and functional properties of proteins, functional properties of food proteins, modification of food protein in processing and storage and its implications, texturized, denaturation of protein, gel formation. Enzymes- sources, properties, role of enzymes in dairy, starch and sugar, juice/beverage, and meat industry.

### UNIT-III (14 Hrs.)

Lipids Classification, Properties- lipolysis, auto-oxidation, rancidity and flavor reversion, thermal decomposition and effect of ionizing radiations; modification of fats and oils (hydrogenation and inter-esterification); role of food lipids in flavor; nutritional aspects of natural and modified fats; fat mimetics.

### UNIT-IV (16 Hrs.)

Plant Pigments: Chlorophyll, anthocyanins and carotenoids, occurrence, structure, chemistry, functions and changes during processing.

Essential Oils: Occurrence, structure, biosynthesis, extraction of essential oils, uses in foods. Flavoring compounds in foods.

Allergens, toxic constituents and anti-nutritional factors of foods (enzyme inhibitors, trypsin and chymotrypsin inhibitor, amylase inhibitor, flatulence causing sugars, phytolectins).

**Recommended Books**

1. L.H. Meyer, 'Food Chemistry', Van Nostr and, Reinhold Comp Publications , , USA. New York,
2. C. Alias and G. Linden, 'Food Biochemistry', Ellis Horwood, New York,U.S.A.
3. Y. Pomeranz and R. Meloon, 'Food Analysis: Theory and Practice', Westport, An AVI Publication, New York, Sydney, Toronto.
4. R.O. Fennema, 'Food Chemistry', Marcel Dekker, New York, U.S.A.
5. L.H. Meyer, 'Food Chemistry', Van Nostr and, Reinhold Company Publication, New York, U.S.A.

## FOOD ANALYSIS AND INSTRUMENTATION LAB - I

**Subject Code: MFOT1-104** **L T P C** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objective:**

1. To understanding the nutritional composition of food.
2. To application of novel techniques in food analysis.
3. To evaluating the quality parameters of food products to ensure food safety and public health.
4. To analysis of proximate composition of food products.

**Course outcome:**

1. Understanding the nutritional composition of food.
2. Application of novel techniques in food analysis.
3. Evaluating the quality parameters of food products to ensure food safety and public health.
4. Analysis of proximate composition of food products.

### PRACTICAL

1. Analysis of given food sample for its moisture, fat, protein and ash contents.
2. Determination of vitamin C content in a given sample of citrus juice.
3. Estimation of calcium and phosphorus content in a given sample of food.
4. Calculation of iodine value and saponification value of given sample of fat or oil.
5. Estimation of tannins in a given sample of tea.
6. To study the process of Thin Layer Chromatography (TLC) to separate out various components in a given sample.
7. To estimate the amount of reducing sugars in a given food sample.
8. Calculation of smoke point, flash point and fire point of a given sample of vegetable oil.
9. Estimation of caffeine content in a given sample of coffee.
10. Determination of crude fiber content in given sample of vegetable/fruit.
11. Determination of non-reducing sugars, total sugars and starch in fruit sample.
12. Determination of total ash, acid insoluble and soluble ash in a given flour sample.
13. Estimation of rancidity in rancid oil/fat.
14. Detection of adulterants in oil/fat samples.
15. Estimation of Free Fatty Acids (FFA) in crude and refined oil sample.
16. Sensory analysis of various processed food products like jam, bread, and biscuit.
17. Determination of % age moisture, fat and curd content of Table Butter.

## FOOD MICROBIOLOGY LAB-II

**Subject Code: MFOT1-106** **L T P C** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To imparting the knowledge of media preparation, staining methods and handling practices
2. To understand about of microbial tools and techniques for detection of spoilage microorganisms.
3. To analyzing the microbial load of different food products to determine their safety for human consumption.
4. To evaluating the growth curve of microbes in relation to its effect on food quality.

**Course Outcomes:**

1. Imparting the knowledge of media preparation, staining methods and handling practices.
2. Application of microbial tools and techniques for detection of spoilage microorganisms.
3. Analyzing the microbial load of different food products to determine their safety for human consumption.
4. Evaluating the growth curve of microbes in relation to its effect on food quality.

### PRACTICALS

1. Study of the different parts and use of laboratory microscope.
2. Preparation and sterilization of culture media, glassware.
3. Estimation of bacterial population in a given sample of food by Direct Microscopic Count (DMC) method.
4. Estimation of bacterial load of food sample by SPC (Standard Plate Count)method.
5. Insolation of pure culture of bacteria by pour plate and streak plate methods.
6. To study simple staining of bacteria.
7. To conduct Gram's staining of bacteria and differentiate between Gram +ve and Gram -ve bacteria.
8. Microbial analysis of cereals and cereal products such as wheat flour and biscuits.
9. Microbial analysis of spices (red chilies and coriander).
10. Detection of presence of *E. coli* and other *Coliform* bacteria in water by MPN and high coliform test.
11. Studies on the bacterial growth curve.
12. Estimation of total microbial count of:
13. Surrounding air
14. Workers
15. Fruit and vegetable products
16. Isolation of bacteria by serial dilution technique.
17. To study various sub-culturing techniques.
18. To study about spawn preparation of mushroom.

## NUTRACEUTICAL AND FUNCTIONAL FOODS

**Subject Code: MFOT1-158** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting the knowledge of nature, types, and scope of nutraceutical and functional foods.
2. To application of nutraceutical and functional foods for the treatment of various disorders.
3. To creating the ability of effective communication with society regarding therapeutical effects of nutraceutical and functional foods.
4. To evaluating the functionality of nutraceutical compounds with respect to their stability and shelf life.

**Course Outcomes:**

1. Imparting the knowledge of nature, types, and scope of nutraceutical and functional foods.
2. Application of nutraceutical and functional foods for the treatment of various disorders.
3. Creating the ability of effective communication with society regarding therapeutical effects of nutraceutical and functional foods.
4. Evaluating the functionality of nutraceutical compounds with respect to their stability and shelf life.

### UNIT-I (15 Hrs.)

Defining nutraceuticals and functional foods. Nature, type and scope of nutraceutical and functional foods.

Nutraceutical and functional food applications and their health benefits. Nutraceutical compounds and their classification based on chemical and biochemical nature with suitable and relevant descriptions.

### UNIT-II (15 Hrs.)

Nutraceuticals for specific situations such as cancer, heart disease, stress, osteoarthritis, hypertension. Antioxidants and other phytochemicals, (isoflavones, lycopenes), their role as nutraceuticals and functional foods.

Dietary fibers and complex carbohydrates as functional food ingredients.

### UNIT-III (15 Hrs.)

Protein as a functional food ingredient. Probiotic foods and their functional role.

Cereal products as functional foods – Oats, wheat bran, rice bran etc.

### UNIT-IV (15 Hrs.)

Functional vegetable products, oil seeds and sea foods.

Coffee, tea and other beverages as functional foods/drinks and their protective effects. Stability of Nutraceutical compounds and estimation of their shelf life.

**Recommended Books**

1. G. Mazza, ‘Functional Foods: Biochemical and Processing Aspects’, Techonomic Publication Lancaster, USA.
2. R.S. Kirk and R. Sawyer, ‘Pearson’s Composition and Analysis of Foods’, Wesley Longman Inc. California, USA.
3. R.E.C. Wildman, ‘Handbook of Nutraceuticals and Functional Foods’, CRC Press, New York, U.S.A.
4. AOAC, ‘Official Methods of Analysis’, Association of Official Analytical Chemists,USA.

## NUTRITION AND HEALTH

**Subject Code: MFOT1-157** **L T P C 4 0 0 4** **Duration: 60Hrs**

**Course Objectives:**

1. To imparting knowledge about basic terminology of nutrition and different functions of food.
2. To application and role of foods to address various health issues.
3. To creating the awareness regarding social, cultural and physiological aspects of foods.
4. To analyzing the nutritional requirements for different age groups.

**Course Outcomes:**

1. Imparting knowledge about basic terminology of nutrition and different functions of food.
2. Application and role of foods to address various health issues.
3. Creating the awareness regarding social, cultural and physiological aspects of foods.
4. Analyzing the nutritional requirements for different age groups.

### UNIT-I (14 Hrs.)

Foods and Nutrients: Basic definitions, functions of food and nutrients, levels of status, changing concepts of nutrition.
Energy: Energy content of foods, physiological fuel value - review, measurement expenditure. estimating energy requirements of individuals and groups. regulation metabolism, control of food intake and weight.
Energy Balance: Food energy measure, energy control in human metabolism, basal metabolic rate (B.M.R.), factors affecting B.M.R., measuring B.M.R., energy requirements and its estimation.

### UNIT-II (16 Hrs.)

Nutrition and Weight Management: Obesity and its causes, body composition, B.M.I., weight for height measures, health implications of obesity, problems of weight management.
Glycaemia Index of Foods: Control its importance.
Recommended dietary allowances (R.D.A.), ICMR standards, food guide, exchange lists, health promotion guidelines
Carbohydrates: Classification, dietary importance, Special functions of carbohydrates in body tissues, Relationship between dietary fiber and various health problems

### UNIT-III (16 Hrs.)

Fats: Functions of EFA, role of ω-3, ω -6 fatty acids in health and disease. Trans fatty acids and prostaglandins, essential fatty acids, cholesterol, LDL and HDL and their health importance Proteins: Nature and essentiality of amino acids and proteins, functions of protein, the concept of protein balance, comparative quality of food proteins, biological value, net protein utilization, protein efficiency ratio, therapeutic applications of specific amino acids
Vitamins: Clinical applications, sources, requirements and functions of vitamin A, D, E, K, C and ‘B’ complex, vitamins toxicity problems.

### UNIT-IV (14 Hrs.)

Minerals: Minerals in human health, macro and micro minerals, trace minerals- functions, clinical applications, food sources and requirements
Functional Foods: concept and categories of functional foods and their importance Food security: problem and prospects.

**Recommended Books**

1. P. Insel, R.E. Turner and D. Ross, 'Discovering Nutrition', ADA, Jones and Bartlett Publishers Inc., USA.
2. S.R. Williams, 'Essentials of Nutrition and Diet Therapy', Mosby Publishing, NewYork, U.S.A.
3. P.V.Hegartyand V. Hegarty, 'Nutrition Food and the Environment', Eagen Press, United States.
4. A.F. Brian and G. Allen, 'Food Science, Nutrition & Health', Edward Arnold, A member of Hodder Headline Group London, Sydney,Auckland.
5. S.R. Mudambi and M.V. Rajagopal, 'Fundamentals of Food & Nutrition'. New Age International (P) Limited, Publishers, New Delhi, India.
6. ICMR, 'Nutrient Requirement & RDA' ICMR, New Delhi.
7. M.J. Gibney, M. Elia, O. Ljungqvist and J. Dowsett, 'Clinical Nutrition', The Nutrition Society Textbook Series, Blackwell Publishing Company.

# SEMESTER SECOND

## BASIC FOOD ENGINEERING

**Subject Code: MFOT1-206** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**
1. To imparting the knowledge about fundamental concepts of food engineering.
2. To understanding the principles of food engineering for efficient utilization of finance and project management in food industry.
3. To analyze different problems related to commercial sterilization of food products.
4. To aware about interpretation of data using psychrometry and synthesis of information for developing appropriate storage and processing conditions.

**Course Outcomes:**
1. Imparting the knowledge about fundamental concepts of food engineering.
2. Understanding the principles of food engineering for efficient utilization of finance and project management in food industry.
3. Analysis of problems related to commercial sterilization of food products.
4. Interpretation of data using psychrometry and synthesis of information for developing appropriate storage and processing conditions.

### UNIT-I (15 Hrs.)

Fundamental Concepts and Definitions: Dimensions and units, thermodynamic systems (closed, open and isolated), intensive and extensive properties, equilibrium state, density, specific volume, specific weight, specific heat, enthalpy, entropy, pressure, temperature scales.
Material Balances: Basic principles, process flow diagrams, total mass balance, component mass balance, material balance problems involved in dilution, concentration and dehydration.

### UNIT-II (15 Hrs.)

Energy Balances: Basic principles, energy terms, specific heat of solids and liquids, properties of saturated and superheated steam, heat balances.
Fluid Flow Principles: Fluid statics and dynamics, mass balance and energy balance, Bernoulli's equation, concept of viscosity, Newtonian and non-Newtonian fluids, streamline and turbulent flow, Reynold's number.

### UNIT-III (15 Hrs.)

Heat Transfer: Modes of heat transfer, conductive, convective and radiative heat transfer, thermal properties of foods, conductive heat transfer in a rectangular slab, tubular pipe and multilayered systems, estimation of convective heat transfer coefficient, forced convection and free convection, estimation of overall heat transfer coefficient
Heat exchangers: plate, tubular, scraped surface and steam infusion.

### UNIT-IV (15 Hrs.)

Thermal Process Calculations: Commercially sterile concept, concept of D, F and Z values, reference F value, effect of temperature on thermal inactivation of micro-organisms, lethality function, thermal process calculation for canned foods. Calculation of processing time in continuous flow systems.
Psychrometrics: Properties of dry air: composition of air, specific heat of dry air, enthalpy of dry air and dry bulb temperature.
Properties of Water Vapor: specific volume of water vapor, specific heat of water vapour, Gibbs- Dalton law, Dew point temperature, relative humidity, humidity ratio, wet bulb temperature. Study of Psychrometric chart.

**Recommended Books**
1. R.P. Singh and D.R. Heldman, 'Introduction to Food Engineering', Academic Press, INC, London.

2. R.L. Earle, ‘Unit Operations in Food processing’, Pergamon Press Oxford,U.K.
3. R.T. Toledo, ‘Fundamentals of Food Process Engineering’, CBS Publishers, New Delhi, India.
4. J.C. Batty and S.L. Folkman, ‘Food Engineering Fundamentals’, John Wiley and Sons, New York,U.S.A.

## TECHNOLOGY OF CEREALS & MILLETS

**Subject Code: MFOT1-207** **L T PC** **Duration: 60 Hrs**
**4 0 0 4**

**Course Objectives:**

1. To imparting the knowledge of structure and chemical composition of different cereal grains.
2. To application of techniques and machineries for the quality assessment of cereal grains and their products.
3. To analyzing the role of ingredients in development of food products from different cereal grains.
4. To understanding the utilization of by-products of milling and formulation of convenience foods for sustainable development.

**Course Outcomes:**

1. Imparting the knowledge of structure and chemical composition of different cereal grains.
2. Application of techniques and machineries for the quality assessment of cereal grains and their products.
3. Analyzing the role of ingredients in development of food products from different cereal grains.
4. Understanding the utilization of by-products of milling and formulation of convenience foods for sustainable development.

### UNIT-I (15 Hrs.)

Wheat Chemistry and Technology: Structure and chemical composition of wheat grain. Criteria of wheat quality – physical and chemical factors. Wheat milling – general principles and operation; cleaning, conditioning and roller milling systems. Flour extraction rates and various flour grades. Criteria of flour quality. Enzymes of wheat and their technological significance.

Dough rheology and its measurement. Functionality of wheat proteins, carbohydrates, lipids and enzymes in bread making. Durum wheat- chemistry, quality and technology of pasta products.

### UNIT-II (15 Hrs.)

Bread making processes, importance of critical unit operations, functions of ingredients/additives such as fat, emulsifiers, oxidants, reducing agents and conditioners. Bread faults and remedies.

Technology of biscuit, cake, cookie and cracker manufacturing. Baking powders as leavening agents in bakery industry.

### UNIT-III (16 Hrs.)

Rice Chemistry and Technology: Structure and chemical composition of rice grain, milling of rice–types of rice mill; huller mill, Sheller-cum-cone polisher mill. Modern rice milling unit operation-dehusking, paddy separation, polishing and grading. Factors affecting rice yield during milling. By-products of rice milling. Rice parboiling technology. CFTRI process of parboiling.

Properties of parboiled rice, changes during parboiling. Advantages and disadvantages of parboiling. Cooking characteristics of rice. Rice convenience foods: precooked rice, canned rice, expanded rice, rice-based infant food formulae, rice cakes, rice noodles.

### UNIT-IV (14 Hrs.)

Corn Technology: Wet and dry milling of corn, products of wet and dry milling of corn, corn sweeteners and their uses.

Malt Technology: Malting of barley: steeping, germination and drying. Different types of malts and their food applications.

Technology of Coarse Cereal Grains: chemical, technological and milling aspects of sorghum, oats and millets.

**Recommended Books**

1. A.M. Samuel, 'The Chemistry and Technology of Cereals as Food and Feed', CBS Publisher &

Distribution, New Delhi, India.
2. Y. Pomeranz, 'Wheat: Chemistry and Technology', American Association of Cereal Chemists, St. Paul, M N,U.S.A.
3. A.C. Eliasson and K. Larsson, 'Cereals in Bread Making', Marcel Dekker. Inc. New York, U.S.A.
4. R.C. Honeney, 'Principles of Cereal Science and Technology', American Association of Cereal Chemists, St. Paul, U.S.A.
5. Y. Pomeranz, 'Advances in Cereal Science and Technology', American Association of Cereal Chemists, St. Paul, U.S.A.
6. B.O. Juliano, 'Rice Chemistry and Technology', American Association of Cereal Chemists, St. Paul, U.S.A.
7. J.M.V. Blanshard, P.J. Frazier and T. Galliard, 'Chemistry and Physics of Baking', Royal Society of Chemistry, London.
8. A.Chakraverty, 'Postharvest Technology of Cereals, Pulses and Oilseeds', Oxford and IBH, New Delhi, India.
9. S.C. Durbey, 'Basic Baking: Science and Craft', Gujarat Agricultural University, Anand (Gujrat).
10. N.L. Kent, 'Technology of Cereals', Pergamon Press, Oxford, UK.
11. R. H. Matthews, 'Legumes: Chemistry, Technology and Human Nutrition, CRC Press York, U.S.A
12. D.K. Salunkhe, S.S. Kadam, 'Handbook of World Food Legumes: Chemistry, processing and Utilization', CRC Press, Florida, U.S.A.

## COMPUTER FUNDAMENTALS AND STATISTICS

**Subject Code: MFOT1-208** **L T P C** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting the basic knowledge of computer, number system and computer networks.
2. To create the awareness about application of software packages for making reports, documents and effective presentations.
3. To analysis and interpretation of data using statistical techniques.
4. To understanding the types and functions of different hardware and software devices for better project management.

**Course Outcomes:**

1. Imparting the basic knowledge of computer, number system and computer networks.
2. Application of software packages for making reports, documents and effective presentations.
3. Analysis and interpretation of data using statistical techniques.
4. Understanding the types and functions of different hardware and software devices for better project management.

**UNIT-I (15 Hrs.)**

Introduction of Computer: Characteristics, classification of computer; block diagram of computer and overview of working.
Number System: Non-positional vs. positional number, binary, octal, decimal, hexa-decimal conversion of number system.

**UNIT-II (13 Hrs.)**

Hardware: Input, output, and secondary storage devices, central processing unit.
Software: Types of software; meaning, functions and types of operating system.

**UNIT-III (17 Hrs.)**

Understanding Computer Networks: Types; topologies for LANS, transmission media; analog and digital signals; network security.
Working with Software Packages: An introduction to PC-software packages; word processor- working with text, tables, checking spelling and grammar, printing a document; spreadsheet software-working with worksheet, formulas and functions, inserting charts; PowerPoint presentation-working with different views and designing presentation; window XP-working with files and folders, windows explorer.
Lab.: Windows explorer, MS-Word, MS-Excel, MS-PowerPoint and Internet Surfing.

**UNIT-IV (15 Hrs.)**

Methods of data collection, sampling and sampling methods, measurement of central tendency, mean, median, mode, standard deviation, standard error, variance. Correlation & regression analysis, analysis of variance (ANOVA), tests of significance, t-test, z- test and f- test.

**Recommended Books**

1. ‘Introduction to Information Technology’, Pearson Education, New Delhi, India.
2. P.Norton, ‘Introduction to Computers’, TataMcGraw Hill Education Pvt. Ltd., New Delhi, India.
3. D.E. Comer, ‘Computer Networks and Internet’, Pearson Education, New Delhi. India.
4. V. Rajaraman, Fundamentals of Computers, Prentice Hall of India, New Delhi, India.
5. ‘Office 2000: No Experience Required’, BPB Publications, New Delhi, India.
6. A.K. Ray and T. Acharya, Information Technology: Principles and Applications’, Prentice Hall of India, New Delhi, India.
7. A.S. Tanenbaum, ‘Computer Networks’, Eastern Economy Edn., PHI, New Delhi, India.

## TECHNOLOGY OF CEREALS LAB - III

**Subject Code: MFOT1-209** **L T PC** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To imparting knowledge of proximate composition of flours from different cereal grains.
2. To understanding the mode of working in industrial setup as an individual and as a team.
3. To evaluation of different properties of cereal starches using modern techniques.
4. To analysis of quality attributes of cereal grains so as to meet legal specifications.

**Course Outcomes:**

1. Imparting knowledge of proximate composition of flours from different cereal grains.
2. Understanding the mode of working in industrial setup as an individual and as a team.
3. Evaluation of different properties of cereal starches using modern techniques.
4. Analysis of quality attributes of cereal grains so as to meet legal specifications.

### PRACTICAL

1. Experimental milling of rice and assessment of presence of head rice yield, broken, immature kernels and degree of polishing.
2. Experimental parboiling of rice by different methods and evaluation of parboiled rice.
3. Determination of proximate analysis of wheat flour for moisture, ash, protein and fat contents.
4. Determination of wet gluten and dry gluten content of given sample of wheat Flour.
5. Determination of alpha-amylase activity in wheat flour by falling number apparatus.
6. Determination of amylose content of cereal and legume starches by iodine binding method.
7. Isolation of rice starch and its quantification.
8. Determination of different cooking parameters of various rice cultivars.
9. Determination of the alcoholic acidity of a given sample of wheat flour.
10. Study of pasting properties of corn starch by Rapid Visco Analyzer.
11. Study of thermal properties of different Cereal starches by Differential Scanning Calorimeter.
12. To compare different types of wheat flours by Polenshke test.
13. Determination of turbidity and percentage light transmittance of cereal starches
14. Determination of textural properties of cooked rice using Texture Analyzer.
15. Experimental baking of different baked products like biscuits, breads and cakes and their evaluation for different parameters.
16. Visit to milling and bakery industry.

## TECHNOLOGY OF BEVERAGES

**Subject Code: MFOT1-258** | **L T P C 4 0 0 4** | **Duration: 60Hrs**

**Course Objectives:**

1. To imparting the knowledge of types and importance of beverages.
2. To understanding the technology behind processing of different beverages to meet the legal specifications.
3. To application of low calorie sweeteners for preparation of beverages to address the specified needs of consumers.
4. To creating awareness to communicate regarding safety levels of additives used in beverage preparation along with quality standards of bottled water.

**Objective Outcomes:**

1. Imparting the knowledge of types and importance of beverages.
2. Understanding the technology behind processing of different beverages to meet the legal specifications.
3. Application of low calorie sweeteners for preparation of beverages to address the specified needs of consumers.
4. Creating awareness to communicate regarding safety levels of additives used in beverage preparation along with quality standards of bottled water.

**UNIT-I (15 Hrs.)**

Beverages: Definition, types, importance of beverages in our diets. Treatment of water for food industry. Technology of Alcoholic Beverages: Wine, cider, brandy, perry, toddy, bear and whisky.

**UNIT-II (16 Hrs.)**

Manufacturing of carbonated beverages and technology of carbonation.
Technology of soft drinks : ingredients and additives used in production of soft drinks.
Citrus beverages, whey beverages and utilization of whey in development of fortified drinks, use of low calorie sweeteners in beverages.

**UNIT-III (14 Hrs.)**

Production, processing and chemistry of tea manufacturing and types of tea.
Production, processing, roasting and brewing of coffee, soluble coffee, decaffeinated coffee, monsoon coffee, coffee brew concentrate and chicory.

**UNIT-IV (15 Hrs.)**

Cocoa processing, cocoa beverages and chocolate.
Packaged drinking water- manufacturing processes, quality evaluation of raw and processed water, methods of water treatment, BIS quality standards of bottled water.

**Recommended Books**

1. D.K. Tressler and M.A. Joslyn, ‘Fruit and Vegetable Juice Processing Technology’, The AVI Publication Com., Inc.U.S.A.
2. N. Manay Shakuntala and M. Shadaksharaswamy, ‘Foods: Facts and Principles’, New Age Inter. Publishers, New Delhi,India.
3. N.F. Haard and D.K. Salunkhe, ‘Postharvest Biology and Handling of Fruits and Vegetables’, AVI Publishing Co. Westport, U.S.A
4. A.A. Kader, ‘Postharvest Technology of Horticultural Crops’, University of California Division of Agriculture and National Resources, California, U.S.A

## TECHNOLOGY OF MALTING AND BREWING

**Subject Code: MFOT1-259** **L T PC** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting the basic knowledge of production, trade, structure and composition of barley.
2. To application of malt for development of different food products.
3. To quality evaluation of ingredients involved in production of beer.
4. To understanding the techniques involved in processing and quality assessment of beer.

**Course Outcomes:**

1. Imparting the basic knowledge of production, trade, structure and composition of barley.
2. Application of malt for development of different food products.
3. Quality evaluation of ingredients involved in production of beer.
4. Understanding the techniques involved in processing and quality assessment of beer.

### UNIT-I (15 Hrs.)

Barley: Production and trade, composition and structure of barley. preparation and storage of barley for malting, suitability of different cereals for malting, characteristics of barley for malting and brewing, problem of dormancy and water sensibility. Steeping techniques, germination of barley, morphological, enzymatic and chemical changes during malting, role of gibberellic acid in malting, techniques of malting composition of malt, malting of wheat and other cereals. Kilning, changes during kilning, Kilning techniques.

### UNIT-II (16 Hrs.)

Quality evaluation of malt, special malts, milling techniques. Significance of water quality in brewing process. Mashing: Changes during mashing, methods of mashing, treatment of cereals used as adjucts, properties and complications of using adjuncts of different sources. Filtration of wort and sparging. Spent grain: Composition and uses.

### UNIT-III (15 Hrs.)

Techniques of wort boiling, changes during boiling, hops, selection of hops, acidification of mash, wort cooling, methods of fermentation, management of primary fermentation.
Lagering: objectives and techniques. Beer: Composition, filtration, racking, pasteurization and defects.

### UNIT-IV (14 Hrs.)

Application of Malt in Food: baking, infant food etc. Quality control–malt specifications and test procedures. Brewing operations, constituents of hops. brewing adjuncts
Beer Quality–flavor, taste, alcohol content, chemical constituent etc. Head retention–factors affecting head retention. Haze formation.

**Recommended Books**

1. M.J. Lewis and T.W. Young ‘Malting and Brewing Science Vol. I’, Springer Science & Business Media,Germany.
2. M.J. Lewis and T.W. Young ‘Malting and Brewing Science Vol. II’, Springer Science & Business Media, Germany.

## FOOD BIOTECHNOLOGY

**Subject Code: MFOT1-260** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting the knowledge of basic principles of genetic engineering with respect to food.
2. To understanding the applications of bacteriocins in food systems along with their safety levels.
3. To creating awareness of bioethics in food biotechnology.
4. To application of novel processes and techniques for improvement in various foods.

**Course Outcomes:**

1. Imparting the knowledge of basic principles of genetic engineering with respect to food.
2. Understanding the applications of bacteriocins in food systems along with their safety levels.
3. Creating awareness of bioethics in food biotechnology.
4. Application of novel processes and techniques for improvement in various foods.

### UNIT-I (15 Hrs.)

Introduction to Food Biotechnology: basic principles of genetic engineering, improvement of the processing of various crops by genetic engineering, food safety.

### UNIT-II (15 Hrs.)

Natural Antimicrobials for Food Preservation: Phytoalexins, essential oils and their components, bacteriocins of Lactic acid bacteria, nisin, pedioc insetc, applications of bacetriocins in food systems. Aflatoxins - production, control and reduction using molecular strategy.

### UNIT-III (15 Hrs.)

Protein Engineering in Food Technology: Methods, applications of protein engineering (e.g. glucose isomerase, Lactobacillus beta-galactosidase and peptide antibiotic nisin).
Biotechnology and Food ingredients: biogums, fat substitutes, biocolors, organic acids and sweeteners.

### UNIT-IV (15 Hrs.)

Food Biotechnology and Intellectual property rights (IPR), benefits of securing IPRs; bioethics in food biotechnology.
Transgenic Plants and Animals: Their contribution to food production enhancement.

**Recommended Books**

1. B.H. Lee, ‘Fundamentals of Food Biotechnology’, VCH Publishers, New York, U.S.A.
2. M.P. Tombs, ‘Biotechnology in Food Industry’, Wiley-Blackwell, U.K.
3. D. Knorr, ‘Food Biotechnology’, Marcel Dekker, INC, New York, U.S.A.
4. A. Schwartzberg and A Rao ‘Biotechnology & Food Process Engineering’ Marcel Dekker, INC, New York.
5. I. Goldberg and R. Williams, ‘Biotechnology and Food Ingredients’, Springer Science &Business Media, Germany.
6. R.D. King and P.S.J. Cheetham, ‘Food Biotechnology’, Elsevier Applied Science, London.

## FOOD ADDITIVES

**Subject Code: MFOT1-261** | **L T P C 4 0 0 4** | **Duration: 60Hrs.**

**Course Objectives:**
1. To imparting knowledge of types and functions of different food additives.
2. To understanding the limitations of application of food additives in food products.
3. To creating awareness regarding use of food additives and their permissible limits.
4. To applications of recent advances in additives in context to different food attributes.

**Course Outcomes:**
1. Imparting knowledge of types and functions of different food additives.
2. Understanding the limitations of application of food additives in food products.
3. Creating awareness regarding use of food additives and their permissible limits.
4. Applications of recent advances in additives in context to different food attributes.

### UNIT-I (14 Hrs.)

Introduction to Food Additives: General classification, types, uses, functions, legal aspects, risks and benefits.
Preservatives: Antimicrobial agents (types, mode of action and their application), antioxidants (types and mechanism of oxidation inhibition), anti-browning agents (types, functions and modeofaction).
Chelating Agents and Sequestrants: Types, uses and mode of action.

### UNIT-II (15 Hrs.)

Acidulants and pH Control Agents: Types, uses and mode of action.
Coloring Agents: Synthetic food colorants, color chemistry, applications and levels of use, natural colorants, sources of natural color (plant, microbial, animal and insects), misbranded colors, color extraction techniques, color stabilization
Flavoring Agents: Flavors (natural and synthetic flavors), off flavor in foods, flavor enhancers, flavor stabilization, flavoren capsulation.

### UNIT-III (16 Hrs.)

Sweeteners: Natural and artificial sweeteners, nutritive and non-nutritive sweeteners, properties and uses of saccharin, acesulfame-K, aspartame, corn sweeteners, invert sugar sucrose and sugar alcohols (polyols) as sweeteners in food products
Emulsifiers: Types, selection of emulsifiers, emulsion stability, functions and mechanism of action.
Stabilizers: Types, uses and functions.

### UNIT-IV (15 Hrs.)

Food Spices and Condiments: Types and uses spices and condiments, composition extraction, general processing, uses and special attributes of important Indian spices like pepper, cinnamon, clove, ginger, turmeric, cardamom, fenugreek and fennel etc., seasonings and condiments blends Advances in Food Additives: Classification, functions, safety aspects, recent advances with relevance to color, flavor enhancement, sweeteners and preservatives.

**Recommended Books**
1. A.L. Branen, ‘Food Additives’, Marcel Dekker Inc., New York, U.S.A.
2. J.W. Purseglove ‘Spices’ Longman Publishers, London, England.
3. D.R. Tainter and A.T. Grenis, ‘Spices and Seasonings- A Food Technology Handbook’, VCH Publishers, Inc., Hoboken,U.S.A.
4. J. Merory, ‘Food Flavorings, Composition, Manufacture and Use’, AVI Publishing Inc., Westport, U.S.A.
5. K.T. Farrell ‘Spices, Condiments and Seasonings’, Springer,U.S.A.

# SEMESTER THIRD

## TECHNOLOGY OF FRUITS AND VEGETABLES

**Subject Code: MFOT1-315** **L T P C** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting knowledge about classification and nutritional value of fruits and vegetable.
2. To application of appropriate techniques and modern machineries for the production of quality products from fruits and vegetable.
3. To creating awareness about spoilage in fruits and vegetables to avoid the occurrence of food borne illnesses.
4. To development and utilization of by products from fruits and vegetables waste to address the environmental concerns.

**Course Outcomes:**

1. Imparting knowledge about classification and nutritional value of fruits and vegetable.
2. Application of appropriate techniques and modern machineries for the production of quality products from fruits and vegetable.
3. Creating awareness about spoilage in fruits and vegetables to avoid the occurrence of food borne illnesses.
4. Development and utilization of by products from fruits and vegetables waste to address the environmental concerns.

### UNIT-I (15 Hrs.)

Classification and nutritional value of fruits and vegetables. Pre-harvest factors influencing post- harvest physiology, post-harvest handling, physical and chemical techniques to increase the post- harvest life of fresh fruits and vegetables.

Physical and chemical indices of fruit maturity, ripening, bio-chemical changes during ripening, processing and storage.

### UNIT-II (15 Hrs.)

Different storage methods for fruits and vegetables like modified atmospheric storage, cold storage, controlled atmospheric storage etc., Pre-processing operations; Washing, blanching, peeling, sorting/grading, peeling, blanching, coring, destoning. Minimal processing of fruits and vegetables, quality factors for processing, fruit product order (FPO).

### UNIT-III (15 Hrs.)

Technology of jam, jellies, marmalades, specifications, role of pectin and theories of gel formation.

Technology for juice pressing, juice extraction and clarification, methods of bottling, enzymatic clarification and debittering of juices, fruit juice powders- preparation and packaging.

Fruit juice beverages, squash, cordial, crush, RTS, nectar, syrups, their types and production, blending of juices.

Technology of tomato products: Sauce, puree, ketchup and tomato paste

Fruit preserves, candied fruits, dehydrated fruits & vegetables and fruit leather

### UNIT-IV (15 Hrs.)

Canning of fruits and vegetables, preparation of syrups and brines, spoilage of canned fruits and vegetables. Fermented vegetable products, By products from fruit and vegetable wastes.

Mushroom Technology: Types of edible mushrooms, processing of mushrooms.

**Recommended books:**

1. R.P. Srivastava and S. Kumar, ‘Fruit and Vegetable Preservation and Practice’, Bio-Green Books, New Delhi, India.
2. A.K.Thompson,‘FruitandVegetables–Harvesting,HandlingandStorage’,Blackwell

3. Publishing, UK.
4. B. Pantastico, ‘Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables’, AVI Publishing Company, Inc., Westport, U.S.A.
5. W.V. Cruess, ‘Commercial Fruit and Vegetable Products’, Allied Scientific Publishers,Bikaner, India.
6. Girdharilal, ‘Preservation of Fruits and Vegetables’, ICAR, NewDelhi.
7. M.E. Dauthy, ‘Fruit and Vegetable Processing’, International Book Distributing Co. Lucknow,India.
8. L.P. Hamson, ‘Commercial Processing of Vegetables’, Noyes Data Corporation, New Jersey.

## UNIT OPERATIONS IN FOOD ENGINEERING

**Subject Code: MFOT1-311** **L T PC** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting knowledge of preliminary unit operations.
2. To understanding the principles of food engineering and apply these to manage the projects in industrial set ups.
3. To creating awareness regarding selection and application of tools and techniques used for the production and storage of foods.
4. To formulate and analyze the complex problems of unit operations used in food engineering.

**Course Outcomes:**

1. Imparting knowledge of preliminary unit operations.
2. Understanding the principles of food engineering and apply these to manage the projects in industrial set ups.
3. Creating awareness regarding selection and application of tools and techniques used for the production and storage of foods.
4. Formulate and analyze the complex problems of unit operations used in food engineering.

### UNIT-I (15 Hrs.)

Preliminary Unit Operations: Material handling: Conveyors and elevators, types of conveyors and elevators.

Cleaning: Dry-cleaning; screening, aspiration and magnetic cleaning, wet cleaning; soaking, spray washing, ultrasonic washing, sorting and grading: methods, advantages of sorting and grading.

### UNIT-II (15 Hrs.)

Conversion Unit Operations: Size reduction: Benefits, criteria for size reduction, size reduction of solid, fibrous and liquid foods.

Mixing: Mixing terminology, mixers for dry solids (tumbler and vertical screw mixers). mixers for high viscosity pastes (dough mixer), mixers for low viscosity pastes, effect of mixing on foods.

Filtration: Filtration terminology (feed slurry, filtrate, filter medium, filter cake), filtration equipments.

### UNIT-III (15 Hrs.)

Processing/Preservation Unit Operations: High temperature operations: Pasteurization, pasteurizer and its functioning.

Evaporation: Single effect evaporator, multiple effect evaporators and plate evaporators, batch type pan evaporators, natural circulation, forced circulation, rising film, falling film and agitated thin film evaporators.

Dehydration: Terminology, dehydration systems; tray drier, tunnel drier, spray drier, fluidized bed drying, vacuum drying and drum driers.

### UNIT-IV (15 Hrs.)

Low Temperature Operations: Refrigeration, components of refrigeration system, compressors, condensers and expansion valve, selection of refrigerant, cooling load, coefficient of performance, refrigerant flow rate.

Freezing Systems: Direct contact and indirect systems, freezing load calculations.

Freeze Drying: Conventional drying versus freeze drying, Basic principle, freeze dryer and its components

**Recommended Books**

1. R.P. Singh and D.R. Heldman, 'Introduction to Food Engineering', Academic Press, INC, London.
2. R.L. Earle, 'Unit Operations in Food processing', Pergamon Press, Oxford,U.K.

3. J.G. Brennan, J. R. Butters, N. D. Cowell and A. E. V. Lilley, ‘Food Engineering Operations’, Elsevier, New York, U. S.A.
4. J.C. Harper, ‘Elements of Food Engineering’, AVI, Westport, U.S.A.

## FOOD PACKAGING

**Subject Code: MFOT1-312** **L T PC 3 0 0 3** **Duration: 45Hrs.**

**Course Objective:**

1. To imparting knowledge regarding packaging and its functions.
2. To understanding of safety considerations in food packaging.
3. To creating awareness regarding novel methods of food packaging.
4. To selection and application of appropriate packaging materials and techniques depending on the requirements of food products.

**Course Outcomes:**

1. Imparting knowledge regarding packaging and its functions.
2. Understanding of safety considerations in food packaging.
3. Creating awareness regarding novel methods of food packaging.
4. Selection and application of appropriate packaging materials and techniques depending on the requirements of food products.

### UNIT-I (10 Hrs.)

Introduction to food packaging, primary food packaging and secondary packaging, factors involved in the evolution and selection of a food package, functions of food packaging. Packaging requirements of selected foods-cereals and snack food, beverages, milk and dairy products, poultry & eggs, red meat, frozen food, horticultural products.

Safety Considerations in Food Packaging: Food safety problems associated with package, package labeling and food safety, recycling of packaging materials.

### UNIT-II (12 Hrs.)

Paper and Paper Based Packaging Materials: Types of paper (Kraft, bleached, greaseproof) paper products (paper bags, cartoons, drums and molded paper containers), functional properties of paper, testing of paper packaging materials.

Plastic Packaging Materials: Classification of polymers, functional and mechanical.

Properties of thermoplastic polymers, processing and converting of thermoplastic polymers (extrusion, blow molding, injection molding, compression molding, lamination and heat sealing).

### UNIT-III (12 Hrs.)

Metal Packaging Materials: Functional properties of metal containers, tin plate containers - quality control tests, can manufacturing and protective coatings.

Glass packaging materials: Composition and manufacturing of glass containers, glass container nomenclature, mechanical and optical properties of glass containers, testing of glass container

Aseptic Packaging of Foods: Sterilization of packaging material, food contact surfaces & aseptic packaging systems, retort pouches.

### UNIT-IV (11 Hrs.)

Active Food Packaging: Definition, physical and chemical principles involved.

Edible Films and Coatings as Active Layer: Concept, different edible films used, use of edible active layers to control water vapor transfer and gas exchange

Oxygen Absorbents: Classification and main type of oxygen absorbents, factors influencing the choice of oxygen absorbents, application of oxygen absorbents for shelf -life extension of foods, disadvantages of oxygen absorbents.

Ethanol Vapor: Ethanol vapor generator, uses of ethanol for shelf - life extension of foods, disadvantages of ethanol/vapor generators.

**Recommended Books**

1. G.L. Robertson, ‘Food Packaging: Principles and Practice’, Taylor &Francis.
2. S. Sacharow and R.C. Griffin, ‘Principles of Foods Packaging’, Avi Publication Co. Westport, U.S.A.
3. A.S. Athalye, ‘Plastics in Packaging’, Tata McGraw Hill Publishing Co., New Delhi, India.
4. M.L. Rooney, ‘Active Food Packaging’, Blackie Academic & Professional, Glasgow,UK.
5. M. Bakker, ‘The Wiley Encyclopedia of Packaging Technology’, John Willey & Sons. Inc;_New York, U.S.A.
6. ‘Food Packaging Technology Handbook’, NIIR Board, National Institute of Industrial Research, New Delhi, India.
7. R. Ahvenainen, ‘Novel Food Packaging Techniques’, CRC Press, U.S.A.
8. J. Han and J. Han, ‘Innovations in Food Packaging’, Elsevier Academic Press, U.S.A.
9. R. Coles, D. McDowell and M.J. Kirwan, ‘Food Packaging Technology’, CRC Press, U.S.A.

## TECHNOLOGY OF FRUITS AND VEGETABLES LAB - IV

**Subject Code: MFOT1-313** **L T P C** **Duration: 60Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To imparting knowledge regarding extraction of juices and preparation of products from fruits and vegetables.
2. To creating awareness about quality assessment of products for production of quality food.
3. To analyzing the microbiological parameters of the products to meet the safety standards.
4. To evaluating the cost of food products for better management of finance in one's own work and industrial set ups.

**Course Outcomes:**

1. Imparting knowledge regarding extraction of juices and preparation of products from fruits and vegetables.
2. Creating awareness about quality assessment of products for production of quality food.
3. Analyzing the microbiological parameters of the products to meet the safety standards.
4. Evaluating the cost of food products for better management of finance in one's own work and industrial set ups.

### PRACTICALS

1. Extraction of Juices of different fruit (citrus, pomegranate, apple)
2. Evaluation of vitamin C content and
3. Determination of pH
4. Evaluation of browning time
5. Determination of Acidity
6. Cost evaluation of Juice
7. Sensory evaluation of the products
8. Shelf –life study
9. Preparation of jams (using different fruits)and
10. Determination of pectin content
11. Evaluation of Total Soluble Solids(TSS)
12. Evaluation of sugars using lane eynon method
13. Determination of pH
14. Evaluation of acidity
15. Sensory evaluation of the products
16. Cost evaluation product prepared sensory evaluation & organoleptic test
17. Preparation of jelly and
18. Estimation of Pectin content
19. Determination of total soluble solids(TSS)
20. Jelmeter test
21. Checking for pH
22. Checking of acidity
23. Cost evaluation of product
24. Microbiological analysis
25. Sensory evaluation of the products
26. Preparation of marmalade (using different fruits)
27. Jam Marmalade
28. Jelly Marmalade

29. Preparation of preserves and candies
30. Evaluation of TSS
31. Determination of Endpoint
32. Microbiological Analysis
33. Evaluation of product cost
34. Sensory evaluation of the products
35. Preparation of potato chips and
36. Calculation of product dimension
37. Determination of time-temp combination for product
38. Study of the effect of anti-browning agents
39. Preparation of tomato products (Sauce, Ketchup, Soup, puree)for
40. Evaluation of TSS
41. Evaluation of pH
42. Evaluation of acidity
43. Cost evaluation
44. Microbiological analysis
45. Pickling & fermented products
46. Preparation and shelf-life study of ready-to-serve beverages
47. Experimental studies on drying and dehydration of fruits and vegetables.

## FOOD PACKAGING LAB - V

| Subject Code: MFOT1-314 | L T P C<br>0 0 4 2 | Duration: 60Hrs. |
|---|---|---|

**Course Objectives:**

1. To identification of different packaging materials as per the requirements of food products using principles of food packaging.
2. To understanding the application of novel food packaging techniques.
3. To evaluating the quality of packaged food products so as to provide safe food for consumption.
4. To analyzing the physical parameters of packaging materials to meet the legal specifications.

**Course Outcomes:**

1. Identification of different packaging materials as per the requirements of food products using principles of food packaging.
2. Understanding the application of novel food packaging techniques.
3. Evaluating the quality of packaged food products so as to provide safe food for consumption.
4. Analyzing the physical parameters of packaging materials to meet the legal specifications.

### PRACTICAL

1. Designing of an ideal packaging material for different type of food products.
2. Identification of different packaging materials.
3. Testing of paper based packaging materials.
4. Equilibrium Relative Humidity (ERH) study of foods.
5. To study uniformity and amount of wax in wax paper for packaging of hygroscopic foods.
6. To study chemical resistance of plastic and paper packaging materials.
7. To study Water Vapor Transmission Rates (WVTR) of paper and plastic polymers.
8. Shelf life studies of packaged foods.
9. Study of grease resistance of paper, plastic laminates and aluminum foil for the packaging of fatty foods.
10. To perform various functional tests on corrugated fiberboard boxes.
11. Determination of Cobb value of different types of paperboard.
12. Shrink packaging of poultry products.
13. Aseptic packaging of different food products.
14. Vacuum packaging of dry powders.
15. Testing of glass containers for thermal shock resistance.
16. Determination of tensile strength and heat seal strength of different plastics.
17. To conduct drop and vibration tests on different types of corrugated fiberboard boxes.
18. Determination of tin coating weight and porosity of tin plate container.
19. Determination of lacquer coating in tin containers.
20. Study of manufacture of 2-piece and 3-piece metal cans.
21. Visit to paper manufacturing industry.

## FOOD STANDARDS AND QUALITY ASSURANCE

**Subject Code: MFOT1-364** **L T PC 3 0 0 3** **Duration: 60Hrs.**

**Course Objectives:**

1. To imparting knowledge of concepts of food quality and assurance.
2. To understanding the laws and regulation in relations to food quality and safety.
3. To applications of good hygiene and good laboratory practices with respect to environmental considerations.
4. To creating awareness about various sampling techniques and analysis of data using statistical quality control.

**Course Outcomes:**

1. Imparting knowledge of concepts of food quality and assurance.
2. Understanding the laws and regulation in relations to food quality and safety.
3. Applications of good hygiene and good laboratory practices with respect to environmental considerations.
4. Creating awareness about various sampling techniques and analysis of data using statistical quality control.

### UNIT-I (15 Hrs.)

Introduction to concepts of food quality, quality control, quality control cycle, responsibilities of quality control department, food safety, Current challenges to food safety
Food adulteration, nature of adulterants, methods of evaluation of food adulterants and toxic constituents.

### UNIT-II (15 Hrs.)

Principles of food quality assurance, total quality management (TQM), good manufacturing /management practices, good hygienic practices, good lab practices, general awareness and role of management practices in quality control, food safety management, applications of HACCP in food safety, concept of food traceability for food safety

### UNIT-III (15 Hrs.)

Microbial Quality Control: Determination of microorganisms in foods by cultural, microscopic, physical, chemical methods. Statistical quality control in food industry, Sampling techniques

### UNIT-IV (15 Hrs.)

Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI), Codex alimentarious commission, USFDA, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 1400

**Recommended Books**

1. R. Early, 'Guide to Quality Management Systems for the Food Industry', Blackie, Academic and Professional, London.
2. W.A. Gould and R.W. Gould, 'Total Quality Assurance for the Food Industries', CTI Publications Inc. Baltimore.
3. Y. Pomeraz and C.E. MeLoari, 'Food Analysis: Theory and Practice', CBS Publishers and Distributor, New Delhi, India.
4. F.L. Bryan, 'Hazard Analysis Critical Control Point Evaluations- A Guide to Identifying Hazards and Assessing Risks Associated with Food Preparation and Storage', World Health Organization,

Geneva.
5. R. Kirk and R. Sawyer, 'Pearson's Composition and Analysis of Food', Longman Scientific and Technical, England.
6. 'Manuals of Food Quality Control, Additives Contaminants Techniques', Food and Agricultural Organization, Rome.
7. T.E. Furia, 'Regulatory Status of Direct Food Additives', CRC Press, Florida, U.S.A.

## TECHNOLOGY OF PULSES AND OIL SEEDS

**Subject Code: MFOT1-363** **L T PC** **Duration: 60 Hrs.**
**3 0 0 3**

**Course Objective:**

1. To imparting knowledge about importance of fats and oils in human nutrition.
2. To understanding the importance of oilseed processing and applying these to one's own work and in industrial setups.
3. To creating awareness about selection and application of techniques and machineries in milling and extraction processes.
4. To demonstrating knowledge about anti-nutritional factors and their modes of elimination so as to ensure public health.

**Course outcomes:**

1. Imparting knowledge about importance of fats and oils in human nutrition.
2. Understanding the importance of oilseed processing and applying these to one's own work and in industrial setups.
3. Creating awareness about selection and application of techniques and machineries in milling and extraction processes.
4. Demonstrating knowledge about anti-nutritional factors and their modes of elimination so as to ensure public health.

**UNIT-I (15 Hrs.)**

Importance of fats and oils in human nutrition, Chemical, physical and functional properties of fats and oils.
Importance of oilseeds processing in India.

**UNIT-II (15 Hrs.)**

Commercial oil resources, basic processing of fats and oils - oil extraction, expeller pressing and solvent extraction, degumming, refining, bleaching, hydrogenation, fractional cystallization, inter-esterification, glycerolizes, molecular distillation, plasticizing and tempering. Preparation of protein concentrates and isolates and their use in high protein foods, fermented and traditional products.

**UNIT-III (15 Hrs.)**

Fat substitutes and mimetics.
Common pulses produced in the country. Soybean: processing and utilization.
Milling methods for pulses, home scale commercial and recent methods with equipment's.

**UNIT-IV (15 Hrs.)**

Anti-nutrients in pulses and modes of elimination.
Main processing methods: Cooking, germination, sprouting, fermentation, roasting, puffing, frying and extrusion cooking etc.
Products from legumes and uses: Starch, flour, protein concentrates and isolates.

**Recommended Books**

1. R.J. Hamilton and A. Bharti, 'Fats and Oils: Chemistry and Technology', Applied Science, London.
2. D.K. Salunkhe, J.K, Chavan, R.N. Adsule and S.S. Kadam, 'World Oilseeds: Chemistry, Technology and Utilization', VNR, New York, U.S.A.
3. I.A. Wolf, 'Handbook of Processing and Utilization in Agriculture', CRC Press, Florida, U.S.A.

# SEMESTER FOUR

## TECHNOLOGY OF EGG, MEAT, FISH AND POULTRY

**Subject Code: MFOT1-415** **L T PC** **Duration: 60 Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting knowledge about composition and nutritional value of meat, fish and poultry.
2. To applying ethical principles in various practices involved in slaughtering of animals.
3. To evaluation of internal and external quality parameters of egg to ensure safety for consumption.
4. To creating awareness regarding utilization of by products from meat industry in context to environment.

**Course Outcomes:**

1. Imparting knowledge about composition and nutritional value of meat, fish and poultry.
2. Applying ethical principles in various practices involved in slaughtering of animals.
3. Evaluation of internal and external quality parameters of egg to ensure safety for consumption.
4. Creating awareness regarding utilization of by products from meat industry in context to environment.

### UNIT-I (15 Hrs.)

Status and scope of meat industry in India. Structure and physico-chemical properties of muscle. Meat: Composition and nutritive value, conversion of muscle into meat, environmental and animal production factors that affect meat quality, post mortem changes in meat, rigor mortis, cold shortening, pre-rigor processing.

### UNIT-II (15 Hrs.)

Aging of meat, meat tenderization- natural and artificial methods. Properties of fresh meat-water holding capacity, color, palatability.
Cooking methods for meat.
Storage and preservation of meat: Chilling, freezing, curing, smoking, dehydration, canning. Spoilage of meat.

### UNIT-III (15 Hrs.)

Restructured meat products, meat analouges.
Meat industry by products: Importance and applications.
Fish: Factors affecting quality of fresh fish, fish dressing, chilling, freezing, salting and canning of fish. Manufacturing of fish oil, fish protein concentrate, fish meal. By-products of fish industry, their technology of utilization.

### UNIT-IV (15 Hrs.)

Egg: Structure, composition, nutritive and functional properties.
Quality of Egg: Internal quality evaluation, egg candling, egg grading, microbial spoilage of eggs, preservation and storage methods for eggs.
Egg powder.
Packaging and transportation of eggs.
Poultry: Types, chemical and nutritive value of poultry meat, poultry dressing and slaughtering methods, preservation, grading and packaging of poultry meat.

**Recommended Books**

1. W.J. Stadelman and J. Owen,'Egg Science & Technology', AVI Publishing Company, INC. Westport, U.S.A.
2. R.A. Lawrie and D. Ledward, 'Lawrie's Meat Science', Woodhead Publishers,UK.
3. G. Mead, 'Poultry Meat Processing and Quality', Woodhead Publishers, UK.
4. P.C. Panda, 'Text Book on Egg and Poultry Technology', Vikas Publishers, Chennai, India.

## TECHNOLOGY OF MILK AND MILK PRODUCTS

**Subject Code: MFOT1-416** **L T PC** **Duration: 60Hrs.**
**4 0 0 4**

**Course Objectives:**

1. To imparting knowledge about composition, nutritive value and processing of milk and milk products.
2. To understanding the microbiological quality of fresh milk to ensure its safety for human consumption and processing.
3. To cost effective utilization of by-products of dairy industry to address the environmental concerns.
4. To creating awareness about scope, strengths and opportunities of dairy industry and its implementation to become entrepreneur.

**Course Outcomes:**

1. Imparting knowledge about composition, nutritive value and processing of milk and milk products.
2. Understanding the microbiological quality of fresh milk to ensure its safety for human consumption and processing.
3. Cost effective utilization of by-products of dairy industry to address the environmental concerns.
4. Creating awareness about scope, strengths and opportunities of dairy industry and its implementation to become entrepreneur.

**UNIT-I (15 Hrs.)**

Dairy Industry in India: Scope, strengths and opportunities for dairy industry.
Milk: Definition, composition and nutritive value, factors affecting composition of milk. Physicochemical properties and nutritive value of milk.
Liquid Milk Processing: filtration/clarification, standardization, pasteurization (LTLT, HTST, UHT), homogenization.
Microbiology of milk

**UNIT-II (15 Hrs.)**

Technology of Recombined and Reconstituted Milk: Composition, process of manufacture, defects
Technology of Condensed and Evaporated Milk: process of manufacture, defects (their causes and prevention).
Technology of Milk Powders (WMP, SMP): process of manufacture, defects (their causes and prevention), instantization of milk powder.
Technology of Indigenous Milk Products: Dahi, butter, ghee, channa, paneer etc.

**UNIT-III (15 Hrs.)**

Technology of Cheese: Classification, composition, nutritive value, process of manufacture of cheddar, mozzarella, cottage and processed cheese, defects (their causes and prevention).
Technology of frozen milk products: process of manufacture, defects (their causes and prevention).

**UNIT-IV (15 Hrs.)**

Milk and Milk Product Standards and Legislations in India: Grading of milk and criterion of grading, reconstituted milk, synthetic milk.
Membrane Processing of Milk: types of membranes, applications of reverse osmosis, ultra filtration and microfiltration in dairy industry.
Milk adulteration, synthetic milk. By products of dairy industry and their utilization. Imitation dairy products.

**Recommended Books:**

1. Sukumar, De 'Outlines of Dairy Technology', Oxford University Press,UK.
2. G. Smith, 'Dairy processing improving quality', Woodhead Publishers, New Delhi,India.

3. A.T. Andrews and J. R. Varley, ‘Biochemistry of Milk Products’ Woodhead Publishers, New Delhi, India.
4. R. Early, ‘Technology of Dairy Products’, Springer Science & Business Media, Germany.
5. R.P. Aneja, B.N. Mathur, R.C. Chandan and A.K. Banerjee, ‘Technology of Indian Milk Products’, Dairy India Publishers, New Delhi, India.

## FOOD ANALYSIS AND INSTRUMENTATION

**Subject Code: MFOT1-417** **L T PC 3 0 0 3** **Duration: 45Hrs.**

**Course Objectives:**

1. To imparting knowledge about proximate analysis of food products.
2. To understanding the selection and application of appropriate modern techniques for quality assessment of foods.
3. To creating awareness regarding sampling techniques, statistical analysis and interpretation of data along with expression of results.
4. To application of novel methodologies for microbial load analysis of food to ensure safety for consumption.

**Course Outcomes:**

1. Imparting knowledge about proximate analysis of food products.
2. Understanding the selection and application of appropriate modern techniques for quality assessment of foods.
3. Creating awareness regarding sampling techniques, statistical analysis and interpretation of data along with expression of results.
4. Application of novel methodologies for microbial load analysis of food to ensure safety for consumption.

**UNIT-I (10 Hrs.)**

Introduction to food analysis, types of samples and sampling techniques, storage and preservation of samples, expression of results.

Proximate Analysis of Foods: Principles of moisture, fat, protein, carbohydrates, crude fiber and vitamins in foods.

**UNIT-II (10 Hrs.)**

Sensory Analysis of Foods: Overview of the sensory principles and practices, selection and screening of the sensory panel, types of panel (trained, semi trained), methodology of sensory evaluation: discriminative tests: difference tests, paired comparison, duo trio, triangle; descriptive tests.

**UNIT-III (12 Hrs.)**

Instrumentation in Food Analysis: Principles, types and applications of spectroscopy, photometry, electrophoresis; chromatography and atomic absorption spectro photometry.

**UNIT-IV (13 Hrs.)**

Instrumentation in Food Analysis: Color measurement in foods; X-ray analysis of foods and its applications; mass spectroscopy; nuclear magnetic resonance (NMR); differential scanning calorimetry (DSC).

Refractometry and ultrasonic in food analysis; texture analysis in foods, sensory versus instrumental analysis of texture, rapid methods of microbial analysis; immunoassays methods.

**Recommended Books**

1. R.S. Kirk and R. Sawyer, 'Pearson's Composition & Analysis of foods', Longman Scientific and Technical, UK.
2. G.G. Birk, J.G. Herman and K.J. Parker, 'Sensory Properties of Foods', Applied Science, London.

## TECHNOLOGY OF ANIMAL PRODUCTS LAB -VI

**Subject Code: MFOT1-418** **L T P C** **Duration: 60 Hrs.**
**0 0 4 2**

**Course Objectives:**

1. To imparting knowledge development of various processed foods from animal products.
2. To understanding the mode of working in industrial setup as an individual and as a team.
3. To evaluation of microbiological quality of milk and milk products to ensure their safety for consumption.
4. To analysis of quality parameters of animal products so as to meet the legal specifications.

**Course Outcomes:**

1. Imparting knowledge development of various processed foods from animal products.
2. Understanding the mode of working in industrial setup as an individual and as a team.
3. Evaluation of microbiological quality of milk and milk products to ensure their safety for consumption.
4. Analysis of quality parameters of animal products so as to meet the legal specifications.

### PRACTICALS

1. Determination of specific gravity, total solids (T.S) % and SNF (Solid not fat) % in the given milk sample.
2. Determination of percentage fat in the given sample of milk by Gerber centrifuge method.
3. Determination of titrable acidity (T.A.) and pH of milk.
4. Determination of added Urea in the given sample of milk.
5. Determination of added starch in the given sample of milk.
6. To conduct clot on boiling (COB) and Alcohol – Alizarin test for testing milk quality.
7. Determination of added water in a given sample of milk.
8. Preparation qualitative testing of milk products like Chhana, Khoa and Paneer, Icecream.
9. Determination of added preservatives, neutralizers in the given sample of milk.
10. Estimation of bacterial numbers in a given sample of milk by direct microscopic count in a given sample of milk.
11. Determination of microbiological quality of milk of MBR test.
12. To study dismantling, cleaning and assembling of HTST pasteurizer for milk.
13. Separation of cream by cream separator.
14. Visit to a milk collection/chilling and milk processing plant.
15. Determination of external and internal quality of poultry egg.
16. To study the effect of time, temperature on coagulation properties of egg.
17. Determination of time temperature condition on formation of iron sulphide in egg.
18. Preservation and evaluation of different egg products.
19. Preparation and evaluation of different egg products
20. Preparation of different types of meat products using different methods of preservation.
21. Visit to meat, fish and poultry processing industries.
22. Determination of tenderness and water holding capacity of different meat.

**Total Credits= 22**

| Semester V | | Contact Hours | | | Max Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | | |
| BAGRS1-551 | Principles of Integrated Pest and Disease Management | 2 | 0 | 0 | 40 | 60 | **100** | **2** |
| BAGRS1-552 | Manures, Fertilizers and Soil Fertility Management | 2 | 0 | 0 | 40 | 60 | **100** | **2** |
| BAGRS1-553 | Pests of Crops and Stored Grain and their Management | 2 | 0 | 0 | 40 | 60 | **100** | **2** |
| BAGRS1-554 | Diseases of Field and Horticultural Crops and their Management -I | **2** | **0** | **0** | **40** | **60** | **100** | **2** |
| BAGRS1-555 | Crop Improvement-I *(Kharif Crops)* | **1** | **0** | **0** | **40** | **60** | **100** | **1** |
| BAGRS1-556 | Entrepreneurship Development and Business Communication | **1** | **0** | **0** | **40** | **60** | **100** | **1** |
| BAGRS1-557 | Geoinformatics and Nano-technology and Precision Farming | **1** | **0** | **0** | **40** | **60** | **100** | **1** |
| BAGRS1-558 | Intellectual Property Rights | 1 | 0 | 0 | 40 | 60 | **100** | **1** |
| BAGRS1-559 | Principles of Integrated Pest and Disease Management Lab | 0 | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-560 | Manures, Fertilizers and Soil Fertility Management Lab | 0 | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-561 | Pests of Crops and Stored Grain and their Management Lab | 0 | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-562 | Diseases of Field and Horticultural Crops and their Management -I Lab | 0 | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-563 | Crop Improvement-I *(Kharif Crops)* Lab | 0 | 0 | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-564 | Entrepreneurship Development and Business Communication Lab | 0 | 0 | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-565 | Geoinformatics and Nano-technology and Precision Farming Lab | 0 | 0 | 2 | 20 | 30 | **50** | **1** |
| | **ELECTIVE** | | | | | | | |
| XXXXX | Landscaping/ System Simulation and Agroadvisory/ Protected Cultivation/ Micro propagation Technologies | **2** | **0** | **0** | **40** | **60** | **100** | **2** |
| XXXXX | Landscaping/ System Simulation and Agroadvisory/ Protected Cultivation/ Micro propagation Technologies Lab | 0 | 0 | 2 | 20 | 30 | **50** | **1** |
| Total | | **14** | **0** | **16** | **520** | **780** | **1300** | **22** |

**Electives:**

1. Landscaping: **BAGRD1-571**
2. System Simulation and Agroadvisory: **BAGRD1-572**
3. Protected Cultivation: **BAGRD1-573**
4. Micro propagation Technologies- **BAGRD1-574**

**Electives Lab:**

**1.** Landscaping Lab: **BAGRD1-575**
**2.** System Simulation Agroadvisory Lab: **BAGRD1-576**
**3.** Protected Cultivation Lab: **BAGRD1-577**
4. Micro propagation Technologies Lab- **BAGRD1-578**

**Total Credits= 22**

| Semester VI | | Contact Hours | | | Max Marks | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|
| **Subject Code** | **Subject Name** | **L** | **T** | **P** | **Int.** | **Ext.** | | |
| BAGRS1-651 | Rainfed Agriculture & Watershed Management | 1 | 0 | 0 | 40 | 60 | **100** | **1** |
| BAGRS1-652 | Protected Cultivation and Secondary Agriculture | 1 | 0 | 0 | 40 | 60 | **100** | **1** |
| BAGRS1-653 | Diseases of Field and Horticultural Crops and their Management-II | 2 | 0 | 0 | 40 | 60 | **100** | **2** |
| BAGRS1-654 | Post-harvest Management and Value Addition of Fruits and Vegetables | 1 | 0 | 0 | 40 | 60 | **100** | **1** |
| BAGRS1-655 | Management of Beneficial Insects | **1** | **0** | **0** | **40** | **60** | **100** | **1** |
| BAGRS1-656 | Crop Improvement-II *(Rabi crops)* | **1** | **0** | **0** | **40** | **60** | **100** | **1** |
| BAGRS1-657 | Principles of Organic Farming | **1** | **0** | 0 | **40** | **60** | **100** | **1** |
| BAGRS1-658 | Farm Management, Production & Resource Economics | **1** | **0** | 0 | **40** | **60** | **100** | **1** |
| BAGRS1-659 | Principles of Food Science and Nutrition | **2** | **0** | 0 | 40 | 60 | **100** | **2** |
| BAGRS1-660 | Rainfed Agriculture & Watershed Management Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-661 | Protected Cultivation and Secondary Agriculture Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-662 | Diseases of Field and Horticultural Crops and their Management-II Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-663 | Post-harvest Management and Value Addition of Fruits and Vegetables Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-664 | Management of Beneficial Insects Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-665 | Crop Improvement-II *(Rabi crops)* Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-666 | Principles of Organic Farming Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| BAGRS1-667 | Farm Management, Production & Resource Economics Lab | **0** | **0** | 2 | 20 | 30 | **50** | **1** |
| | **ELECTIVE** | | | | | | | |
| XXXXX | Hi-tech. Horticulture/ Agricultural Journalism/ Food Safety and Standards/ Agri-business Management | 2 | 0 | 0 | 40 | 60 | 100 | 2 |
| XXXXX | Hi-tech. Horticulture/ Agricultural Journalism/ Food Safety and Standards/ Agri-business Management Lab | 0 | 0 | 2 | 20 | 30 | 50 | 1 |
| Total | | **13** | **0** | **18** | **580** | **870** | **1450** | **22** |

**Electives:**
1. Hi-tech. Horticulture: **BAGRD1-671**
2. Agricultural Journalism: **BAGRD1-672**
3. Food Safety and Standards: **BAGRD1-673**
4. Agri-business Management: **BAGRD1-674**

**Electives Lab:**
1. Hi-tech. Horticulture Lab: **BAGRD1-675**
2. Agricultural Journalism Lab: **BAGRD1-676**
3. Food Safety and Standards Lab: **BAGRD1-677**
4. Agri-business Management Lab: **BAGRD1-678**

**Overall Marks / Credits**

| Semester | Marks | Credits |
|---|---|---|
| V | 1300 | 22 |
| VI | 1450 | 22 |
| **Total** | **2750** | **44** |

## PRINCIPLES OF INTEGRATED PEST AND DISEASE MANAGEMENT

**Subject Code: BAGRS1-551** | **L T P C** 2 0 0 2 | **Duration: 30 (Hrs.)**

**Course Outcomes:**

1. To aware students about various insect and pest of agriculture.
2. To familiarize students with agricultural insects.
3. To create awareness about biological analysis of insects and implementation of strategies for successful pest management

**Course Outcomes:**

1. Providing knowledge about various types of insects and pests in agriculture.
2. Students will able to recognise the agricultural important insects.
3. The students will be able to examine insects deeply up to biological level of analysis and make different strategies for successful pest management.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 1 | | | | | | | | | | |
| CO2 | | | | 3 | | | | | | | | |
| CO3 | | | | 2 | | | | | | | | |

### UNIT-I (7 Hours)

Categories of insect pests and diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of insect pests, diseases and pest risk analysis.

### UNIT-II (7 Hours)

Methods of detection and diagnosis of insect pest and diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level.

### UNIT-III (8 Hours)

Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Ecological management of crop environment. Introduction to conventional pesticides for the insect pests and disease management. Survey surveillance and forecasting of Insect pest and diseases

### UNIT-IV (8 Hours)

Development and validation of IPM module. Implementation and impact of IPM (IPM module for Insect pest and disease. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Case histories of important IPM programmes.

**Recommended Text Books / Reference Books:**

1. Singh RS. 2013. Introduction to Principles of Plant Pathology. Oxford and IBH Co., New Delhi.
2. Pathak, V. N. Essentials of plant pathology. Prakash Pub., Jaipur
3. Agrios, G. N. Plant Pathology. 5th edition, Published by a division of Reed Elsvier India Pvt., Ltd., New Delhi (2005)
4. Kamat, M. N. Introductory Plant Pathology. Prakash Pub, Jaipur
5. Stakman EC & Harrar JG. 1957. Principles of Plant Pathology. Ronald Press, USA.
6. Tarr SAJ. 1964. The Principles of Plant Pathology. McMillan, London.
7. Vander Plank, JE. 1975. Principles of Plant Infection. Acad. Press
8. Verma JP, Varma A & Kumar D. (Eds). 1995. Detection of Plant Pathogens and their Management. Angkor Publ., New Delhi
9. Mehrotra RS & Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH,

10. Dhingra OD & Sinclair JB. 1986. Basic Plant Pathology Methods. CRC Press
11. Fox RTV. 1993. Principles of Diagnostic Techniques in Plant Pathology. CABI Nene YL & Thapliyal PN. 1993. Fungicides in Plant Disease Control. Oxford & IBH, New Delhi.
12. Palti J. 1981. Cultural Practices and Infectious Crop Diseases. Springer- Verlag, New York.
13. Vyas SC. 1993 Handbook of Systemic Fungicides. Vols. I-III. Tata McGraw

## MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT

**Subject Code: BAGRS1-552** **L T P C** **Duration: 30 (Hrs.)**

2 0 0 2

**Course Outcomes:**

1. To familiarize students with different manures and fertilizers
2. To aware students about different fates of fertilizers.
3. To develop ability of students in evaluating soil fertility and nutrient uptake by plants

**Course Outcomes:**

1. Providing knowledge about different types of manures and fertilizers and their application.
2. Providing knowledge about the different fates of fertilizers.
3. Students will able to evaluate fertility of soil and plant nutrients uptake.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | 1 | | | | | | | | | | | |
| CO2 | | 2 | | | | | | | | | | |
| CO3 | | 2 | | | | | | | | | | |

### UNIT-I (6 Hours)

Introduction and importance of organic manures, properties and methods of preparation of bulky and concentrated manures. Green/leaf manuring. Fertilizer recommendation approaches. Integrated nutrient management

### UNIT-II ( 6 Hours)

Chemical fertilizers: classification, composition and properties of major nitrogenous, phosphatic, potassic fertilizers, secondary & micronutrient fertilizers, Complex fertilizers, nano fertilizers Soil amendments, Fertilizer Storage, Fertilizer Control Order.

### UNIT-III (8 Hours)

History of soil fertility and plant nutrition. criteria of essentiality. role, deficiency and toxicity symptoms of essential plant nutrients, Mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants

### UNIT-IV (10 Hours)

Chemistry of soil nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and micronutrients. Soil fertility evaluation, Soil testing. Critical levels of different nutrients in soil. Forms of nutrients in soil, plant analysis, rapid plant tissue tests. Indicator plants. Methods of fertilizer recommendations to crops. Factor influencing nutrient use efficiency (NUE), methods of application under rainfed and irrigated conditions.

**Recommended Text Books / Reference Books:**

1. Mariakulandi and Manickam: 1975 : Chemistry of fertilizers and manures.
2. Mariakulandi and Manickam (1975) : Chemistry of manures an fertilizers
3. Tandon H. L. S. (1994) : Recycling of crop, animal, human and industrial Wastes in Agriculture. FDCO, Delhi Krishna and Murthy (1978) : Manual on compost and other organic manures .
4. Rakshit A. 2015.Manures Fertilizers and Pesticides Paperback – Import. CBS Publishing; 1ST edition, pp. 266.

**PESTS OF CROPS AND STORED GRAINS AND THEIR MANAGEMENT**

| Subject Code: BAGRS1-553 | L T P C<br>2 0 0 2 | Duration: 30 (Hrs.) |
|---|---|---|

**Course Outcomes:**

1. To aware students about various types of insects and pests
2. To familiarize students with families families and orders of class Insecta and economic losses caused by them
3. To develop ability for identification of agriculturally important insect-pest based on morphological characteristics, feeding habit and habitat

**Course Outcomes:**

1. Providing knowledge about various types of insects and pests in agriculture.
2. To be able to understand about different families and orders of class Insecta which cause economic losses for human beings.
3. To be able to identify morphological characteristics, feeding habit and habitat of agriculturally important insect-pest.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 2 | | | | | | | | | | |
| CO2 | | | | 3 | | | | | | | | |
| CO3 | | 3 | | | | | | | | | | |

**UNIT-I (6 Hours)**

General account on nature and type of damage by different arthropods pests. Scientific name, order, family, host range, distribution, biology and bionomics

**UNIT-II (9 Hours)**

Nature of damage, and management of major pests and scientific name, order, family, host range, distribution, nature of damage and control practice other important arthropod pests of various
Insect pests of cotton: Cotton jassid, whitefly, aphid, spotted bollworm, pink boll worm, American bollworm, tobacco caterpillar, mealy bug, red cotton bug, dusky cotton bug, grey weevil.
Insect pests of sugarcane: Early shoot borer, top borer, Gurdaspur borer, stalk borer, pyrilla, whitefly, black bug and mealy bug.
Insect pests of rice: Stem borer, rice leaf folder, white backed planthopper, brown plant hopper, rice hispa, rice bug.
Insect pests of wheat, maize and sorghum: Wheat aphid, army worm, maize borer, Pink stem borer, sorghum shoot fly.
Insect pests of pulses: gram cut worm, gram pod borer, lentil pod borer, tur pod fly,pea leaf miner, pea green aphid, pea blue butterfly, bean thrips, red hairy caterpillar, Bihar hairy caterpillar, spotted pod borer and blister beetle.
Insect pests of brinjal and okra: brinjal hadda, brinjal shoot and fruit borer, cotton jassid, cotton whitefly, spotted bollworms.
Insect pests of cruciferous and cucurbitaceous vegetables: cabbage butterfly, diamond back moth, cabbage semilooper, cabbage head borer, mustard aphid, mustard sawfly, painted bug, red pumpkin beetle, melon fruit fly.

Insect pests of tomato, potato and onion: tomato fruit borer, potato tuber moth, whitefly, onion thrips, onion maggot.
Insect pests of mango: mango hopper, mealy bug, mango stem borer, bark eating caterpillar, fruit fly.
Insect pests of citrus: citrus caterpillar, leaf miner, citrus psylla, whitefly, fruit sucking moth.
Insect pests of grapevine and cashew: grapevine leaf hopper, thrips, leaf roller, cashew tree borer, cashew leaf miner.
Insect pests of banana and pomegranate: banana scale moth, banana weevil, anar butterfly.

**UNIT-III (6 Hours)**

Insect pests of chillies, garlic, turmeric, ginger, coriander, spices and condiments : chilli thrips, whitefly, castor capsule borer, Bihar hairy caterpillar, cardamom thrips, pollu beetle.

Insect pests of oilseeds (mustard, sunflower, groundnut, castor): mustard aphid, mustard saw fly, painted bug, leaf miner, Bihar hairy caterpillar, green peach aphid, cabbage semilooper, tobacco caterpillar, sesamum leaf webber, sunflower head borer, tobacco caterpillar, cutworms. groundnut aphid, white grub, castor capsule borer, castor hairy caterpillar

Factors affecting losses of stored grain and role of physical, biological, mechanical and chemical factors in deterioration of grain.

**UNIT-IV (9 Hours)**

Insect pests, mites, rodents, birds and microorganisms associated with stored grain and their management. Storage structure and methods of grain storage and fundamental principles of grain store management.

**Recommended Text Books / Reference Books:**

1. A.S. Atwal and G.S. Dhaliwal :Agricultural Pests of South Asia and their Management
2. B.V. David and V.V. Rammurthy: Elements of Economic Entomology
3. Manishekharan and Sudarrajan : Pest Management in Field Crops.
4. Pedigo L.P. : Entomology and Pest Management.
5. VenuGopal Rao: Insect Pest Management.
6. B.P. Khare : Storage Entomology

**DISEASES OF FIELD & HORTICULTURAL CROPS & THEIR MANAGEMENT-I**

| Subject Code: BAGRS1-554 | L T P C<br>2 0 0 2 | Duration: 30 (Hrs.) |
|---|---|---|

**Course Objectives:**

1. To make students able in recognizing the various diseases of horticultural crops.
2. To aware students about causes of diseases and their symptoms
3. To encourage them to use economical and environmentally friendly techniques for management of diseases

**Course Outcomes:**

1. To be able to recognise the various diseases of horticultural crops.
2. Students study about the causes of these diseases and their symptoms, which aids in the identification of diseases in horticultural and field crops.
3. Management techniques that are both economical and environmentally friendly can be used.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | 1 | | | | | | | | | | |
| CO2 | | 2 | | | | | | | | | | |
| CO3 | | | | | | | 3 | | | | | |

**UNIT-I (7 Hours)**

Symptoms, etiology, disease cycle and management of major diseases of following crops: Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro;Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose,

**UNIT-II (8 Hours)**

Bajra :downy mildew and ergot; Groundnut: early and late leaf spots, wilt Soybean: Rhizoctonia blight, bacterial spot, seed and seedling rot and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; black & green gram: Cercospora leaf spot and anthracnose, web blight and yellow mosaic, Castor: Phytophthora blight; Tobacco: black shank, black root rot and mosaic

**UNIT-III (7 Hours)**

Horticultural Crops: Guava: wilt and anthracnose; Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top;Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight;

**UNIT-IV (8 Hours)**

Cruciferous vegetables: Alternaria leaf spot and black rot; Brinjal: Phomopsis blight and fruit rot and Sclerotinia blight; Tomato: damping off,wilt, early and late blight, buck eye rot and leaf curl and mosaic; Okra: Yellow Vein Mosaic; Beans: anthracnose and bacterial blight; Ginger: soft rot; Colocasia: Phytophthora blight, Tea - blister blight; Coffee – rust.

**Recommended Text Books / Reference Books:**

1. Agrios, GN. 2010. Plant Pathology. Acad. Press
2. Diseases of Horticultural Crops fruits (1999) By Verma L.R and Sharma R.c,Indus Publishing company, New Delhi
3. Diseases of fruit crops (1986) By V.N.Pathak ,Oxford & IBH publication, New Delhi
4. Diseases of fruit crops (1986) By R.S.Singh ,Oxford & IBH publication, New Delhi
5. Diseases of Fruits and vegetables (2007) S.A.M.H. Naqvi,Springer Science & Business Media
6. Diseases of Plantation Crops (2014) By P.Chowdappa, Pratibha Sharma IPS 263pp
7. Diseases of Horticulture Crops and their management ,ICAR e-book for B.Sc.(Agri) & B.Tech (Agri) By TNAU pp172
8. Advances in the diseases of Plantation crops & spices (2004) P.Santha Kumari,International Book Distributing Company

## CROP IMPROVEMENT – I (KHARIF CROPS)

**Subject Code: BAGRS1-555** | **L T P C** 1 0 0 1 | **Duration: 15 (Hrs.)**

**Course Objectives:**

1. To make students aware about the wild relatives and their value in developing unique kharif crop varieties.
2. To develop ability in students to learn about techniques used for the preservation of genetic material for use in kharif crop improvement.
3. To familiarize students about the breeding techniques used to enhance kharif crops.

**Course Outcomes:**

1. Learners know the value of wild relatives in developing unique kharif crop varieties.
2. The student learns how to preserve genetic material for use in kharif crop improvement.
3. The student learns how to use breeding techniques to enhance kharif crops.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | 1 | | | | | | | | | |
| CO2 | | | | | 2 | | | | | | | |
| CO3 | | | | 1 | | | | | | | | |

### UNIT-I (4 Hours)

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fibres; fodders and cash crops; vegetable and horticultural crops

### UNIT-II (4 Hours)

Plant genetic resources, its utilization and conservation, study of genetics of qualitative and quantitative characters; Important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops

### UNIT-III ( 3 Hours)

Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress,tolerance and quality (physical, chemical, nutritional)

### UNIT-IV (4 Hours)

Hybrid seed production technology in Maize, Rice, Sorghum, Pearl millet and Pigeonpea, etc. Ideotype concept and climate resilient crop varieties for future.

**Recommended Text Books / Reference Books:**

1. Crop Breeding and Biotechnology, HariHar Ram KalyaniPublication, New Delhi.
2. Breeding of Asian Field crops D. A. Sleper J.M., Poehlman ,Blackwell Publishers
3. Principle and Procedures of Plant Breeding Biotechnological and Conventional Approach, G. S. Chahal, S. S. Gosla Narosa Publishers House. New Delhi.

## ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION

| Subject Code: BAGRS1-556 | L T P C<br>1 0 0 1 | Duration: 15 (Hrs.) |
|---|---|---|

**Course Outcomes:**

1. To make students familiar with business environment.
2. To aware students about entrepreneurial tactics.
3. To enable students in developing business plan.

**Course Outcomes:**

1. Identify business prospects by analysing the business environment.
2. Analyze the efficiency of various entrepreneurial tactics.
3. Making sense of their own business plan

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | 2 | | | | | | | | | | | |
| CO2 | | | | | 2 | | | | | | | |
| CO3 | | | | | | | | | | | 2 | |

### UNIT-I (3 Hours)

Concept of Entrepreneur, Entrepreneurship Development, Characteristics of entrepreneurs; Impact of economic reforms on Agribusiness/ Agrienterprises

### UNIT-II (3 Hours)

SWOT Analysis & achievement motivation, Government policy and programs and institutions for entrepreneurship development

### UNIT-III (6 Hours)

Entrepreneurial Development Process; Business Leadership Skills; Developing organizational skill (controlling, supervising, problem solving, monitoring & evaluation), Developing Managerial skills, Business Leadership Skills (Communication, direction and motivation Skills), Problem solving skill

### UNIT-IV (3 Hours)

Supply chain management and Total quality management, Project Planning Formulation and report preparation; Financing of enterprise, Opportunities for agrientrepreneurship and rural enterprise

**Recommended Text Books / Reference Books:**

1. Akhouri, M.M.P., Mishra, S.P. and Sengupta, Rita (1989). Trainers Manual on Developing Entrepreneurial Motivation, NIESBUD, New Delhi
2. Betty, Gorddan B. (1979). Entrepreneurship, Playing to Win, Taraporewala, Mumbai
3. Entrepreneurship Development Institute in India (1987). Developing New Entrepreneurs, EDII, Ahmedabad, NISIET, Library : 338.93/EDI/87/25104.
4. Mancuso, Joseph (1974). The Entrepreneurs Handbook, Vol.I& II, Artech House Inc. USA.
5. Patel, V.G. (1987). Entrepreneurship Development in India and its relevant Developing Countries, Entrepreneurship Development Institute of India, Ahmedabad, NISIET, Library : 338.93 (540)/PAT/87/25103.
6. Singh, A.K., Lakhan Singh, R. and Roy Berman (2006). Dimensions of Agricultural Extension, Aman Publishing House, Meerut.
7. Mondal Sagar and G.L.Ray (2009). Text Book of Entrepreneurship and Rural Development. Kalyani Publishers, Ludhiana. ISBN 978-81-272-5599-2

## GEOINFORMATICS, NANO-TECHNOLOGY AND PRECISION FARMING

**Subject Code: BAGRS1-557** **L T P C** **Duration: 15 (Hrs.)**

1 0 0 1

**Course Objectives:**

1. To develop the ability of motivating the farmers to use original data from the field.
2. To familiarize students about the balanced and unbalanced amount of agricultural inputs.
3. To make them aware about sustainable crop production.

**Course Outcomes:**

1. Motivate the farmers to use original data from the field to analyse the spatial and temporal variability of the input factors.
2. Trying to educate farmers on the effects of using unbalanced amounts of agricultural inputs such irrigation, fertiliser, insecticides, and pesticides.
3. Effectively uses of inputs for sustainable crop production without harming environment.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | 2 | | | | | | | | |
| CO2 | | | | | | 3 | | | | | | |
| CO3 | | | | | | | 3 | | | | | |

### UNIT-I (3 Hours)

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geo-informatics- definition, concepts, tool and techniques; their use in Precision Agriculture.

### UNIT-II (3 Hours)

Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies

### UNIT-III (5 Hours)

Spatial data and their management in GIS; Remote sensing concepts and application in agriculture; Image processing and interpretation; Global positioning system (GPS), components and its functions; Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture

### UNIT-IV (4 Hours)

Nanotechnology, Definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

**Recommended Text Books / Reference Books:**

1. GIS : Fundamentals, Applications & Implementations – Dr. K Elangovan New India publishing Agency, New Delhi.
2. Remote sensing , GIS and wet land management - Er Tasneem Abbasi & Prof. S.A. Abbasi

## INTELLECTUAL PROPERTY RIGHTS

**Subject Code: BAGRS1-558** | **L T P C** 1 0 0 1 | **Duration: 15 (Hrs.)**

**Course Objectives:**

1. Students will study the background, principles, and varieties of international treaties and conventions for the protection of intellectual property.
2. To educate people on the importance that intellectual property plays in trade, commerce, and growth.
3. The many ecosystems and their sustainable applications will be taught to students.

**Course Outcomes:**

1. Students will understand the concept of intellectual property rights.
2. Builds procedural understanding of the legal system and problem-solving with regard to intellectual property rights.
3. Development of a legal consultancy and service company.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | 1 | | | | |
| CO2 | | | | | | 1 | | | | | | |
| CO3 | | | | | | | | | | | 1 | |

### UNIT-I (4 Hours)

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India:-Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets.

### UNIT-II (3 Hours)

Patents Act 1970 and Patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, Patent opposition and revocation, infringement, Compulsory licensing, Patent Cooperation Treaty, Patent search and patent database.

### UNIT-III (5 Hours)

Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders.

### UNIT-IV (3 Hours)

Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing.

**Recommended Text Books / Reference Books:**

1. Introduction to Intellectual Property Rights by H.S. Chawla, Oxford & IBH Publishing Co. Pvt. Ltd. 113-B ShahpurJat, 2nd Floor, Asian Games Village side New Delhi 110 049, India
2. Encyclopedia of Intellectual Property rights Volume No. 1 to 10 by Priyanjan Trivedi (2008)
3. Plant Breeding by B.D. Singh (2006), Kalyani Publication
4. Intellectual Property Right Under Golbalization by Tawar S. Serials Publication, New Delhi. ..

## PRINCIPLES OF INTEGRATED PEST AND DISEASE MANAGEMENT LAB

**Subject Code: BAGRS1-559** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives:**

1. Students will be able to identify several plant diseases and pathogens.
2. Identification of various pests' and pathogens' life cycles for the purpose of management measures.
3. Develop various IPM techniques to control pests and diseases without contaminating the soil, water, or environment.

**Course Outcomes:**

1. Students will able to detect the different pathogens and diseases in plants.
2. Identification of life cycle of different pests and pathogens for control measures.
3. Make different IPM strategies so that the pests and diseases can be controlled without soil, water and environment pollution.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**PRACTICALS**

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of biocontrol agents, different predators and natural enemies. Mass multiplication of *Trichoderma*, *Pseudomona*s, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agroecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases .Awareness campaign at farmers fields.

## MANURES, FERTILIZERS AND SOIL FERTILITY MANAGEMENT LAB

**Subject Code: BAGRS1-560** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives:**

1. Providing information on the many types of manure and fertilisers used in various crops depending on soil conditions.
2. To understand the significance of plant nutrients, how they are delivered to plants, and the variables that affect their availability.
3. Should build a soil testing laboratory and be knowledgeable about the soil testing process in order to give farmers with correct information

**Course Outcomes:**

1. Providing knowledge about different kinds of manure and fertilizers used in different crops

according to soil condition.
2. To comprehend the importance of plant nutrients, their mechanisms of transport to plants, and the factors that control their availability.
3. To be able about procedure of soil testing and establish soil testing laboratory to provide accurate knowledge to farmers.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**PRACTICALS**

1. Determination of organic carbon in soils
2. Determination of alkaline hydrolysable N in soils
3. Principle of colorimeter, its calibration, application and determination of available P in soils
4. Principle of flame photometer, its calibration, application and determination of available K in soils
5. Determination of exchangeable cations in soils
6. Determination of available S in soils
7. Principle of atomic absorption spectrophotometer, its calibration, application and determination of DTPA extractable Zn, Fe, Mn and Cu in soils
8. Digestion of plant samples for determination of nutrients
9. Determination of total N in plants
10. Determination of total P in plants
11. Determination of total K and S in plants
12. Determination of Zn, Fe, Mn and Cu in plants
13. Determination of total N in urea
14. Determination of water soluble P in SSP and DAP
15. Determination of total N and P in manure

## PESTS OF CROPS AND STORED GRAINS AND THEIR MANAGEMENT LAB

**Subject Code: BAGRS1-561** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives:**

1. Acquainted with identifying several insect pests that affect stored grains, vegetables, and fields.
2. To determine the pest's type of damage and symptoms so that the appropriate pest management method can be used for effective control.
3. By using integrated pest management, crop pests can be managed without endangering the wellbeing of surrounding wildlife, plants, or the environment.

**Course Outcomes:**

1. Familiarized with identification of different insect pest of field, vegetables and stored grains at the field level.
2. To identify the type of damage and symptoms brought on by the pest so that the proper pest management strategy can be utilised for efficient control.
3. Integrated pest management can control crop pests without adversely affecting the health of plants, animals, or the environment.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

### PRACTICALS

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to insects. Calculations on the doses of insecticides application technique. Fumigation of grain store / godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

## DISEASES OF FIELD & HORTICULTURAL CROPS & THEIR MANAGEMENT-I LAB

**Subject Code: BAGRS1-562** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives:**

1. The typical pathogens that cause diseases will be addressed to the students.
2. Appropriate management techniques can be used by understanding the various means of distribution.
3. It is possible to take actions that are both economical and environmentally friendly.

**Course Outcomes:**

1. Students will be familiar with the typical disease-causing microorganisms.
2. By knowing the different dissemination means suitable management practices can be applied.
3. Economical and eco-friendly measures can be used.

Mapping

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**PRACTICALS**

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for Herbarium; Note: Students should submit 50 pressed and well mounted specimens.

## CROP IMPROVEMENT – I LAB

**Subject Code: BAGRS1-563** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives:**
1. The life cycles of various crops will be taught to the students.
2. The dissemination of information on hybridization's many techniques.
3. The many techniques for producing seeds will be taught to the students.

**Course Outcomes:**
1. Students will learn about the life cycles of different crops.
2. Providing knowledge about the different methods of hybridization.
3. Students will learn about the different methods of seed production**.**

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**PRACTICALS**

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops. Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

## ENTREPRENEURSHIP DEVELOPMENT AND BUSINESS COMMUNICATION LAB

| Subject Code: BAGRS1-564 | L T P C | Duration: 30 (Hrs.) |
|---|---|---|
| | 0 0 2 1 | |

**Course Objectives:**
1. Analyze the business environment to seek business opportunities.
2. Describe the elements that contribute to the success of entrepreneurial endeavours.
3. Describe the importance of marketing and management for small businesses.

**Course Outcomes:**
1. To find business possibilities, analyse the business environment.
2. Describe the components that make entrepreneurial initiatives successful.
3. Describe the significance of management and marketing for small firms.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**PRACTICALS**

Assessing entrepreneurial traits, problem solving skills, managerial skills and achievement motivation, exercise in creativity, time audit through planning, monitoring and supervision, identification and selection of business idea, preparation of business plan and proposal writing, visit to entrepreneurship development institute and entrepreneurs.

## GEOINFORMATICS, NANO-TECHNOLOGY AND PRECISION FARMING LAB

| Subject Code: BAGRS1-565 | L T P C | Duration: 30 (Hrs.) |
|---|---|---|
| | 0 0 2 1 | |

**Course Objectives:**
1. Supplying GIS knowledge to evaluate spatiotemporal variability.
2. Supplying remote sensing expertise so that data may be interpreted.
3. Give fertiliser advice based on the analysis of the soil.

**Course Outcomes:**
1. Providing knowledge about GIS to assess the spatiotemporal variability.
2. Providing knowledge about remote sensing in order to interpret data.
3. Give fertilizers recommendation on the basis of soil mapping.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**Practical**

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

## LANDSCAPING

**Subject Code: BAGRD1-571**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**Duration: 30 (Hrs.)**

**Course Objectives:**

1. Students will gain knowledge of gardening's significance, range, and various forms.
2. Choose a variety of trees, shrubs, and methods for their propagation.
3. The various establishment, care, and grass management strategies will be covered with the students.

**Course Outcomes:**

**1**. Students will learn about the importance, scope and different types of gardening.
2. Selection of different trees, shrubs and their propagation techniques.
3. Students will learn about the different principles of establishment, maintenance and lawn management practices.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

### UNIT-I (7 Hours)

Importance and scope of landscaping. Principles of landscaping, garden styles and types, terrace gardening, vertical gardening, garden components, adornments, lawn making, rockery, water garden, walk-paths, bridges, other constructed features etc. gardens for special purposes.

### UNIT-II (7 Hours)

Trees: selection, propagation, planting schemes, canopy management, shrubs and herbaceous perennials: selection, propagation, planting schemes, architecture. Climber and creepers: importance, selection, propagation, planting, Annuals: selection, propagation, planting scheme

### UNIT-III (6 Hours)

Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas

**UNIT-IV (10 Hours)**

Peri-urban landscaping, Landscaping of schools, public places like bus station, railway station, townships, river banks, hospitals, play grounds, airports, industries, institutions. Bonsai: principles and management, lawn: establishment and maintenance. CAD application.

**Recommended Text Books / Reference Books:**

1. Complete Gardening in India – Gopalswamiengar
2. Complete Home Gardening – Dey, S.C.
3. Floriculture and Landscaping – Bose, T.K.
4. Floriculture and Landscaping – Deshraj
5. Floriculture in India – Randhawa and Mukhopadhyay
6. Introduction to Landscaping, Designing, Construction and Maintenance – Ronald J.Biondo and Charles B. Schroder
7. Landscape Gardening & Design with Plants – Supriya Kumar Bhattacharjee
8. Landscaping principles and practices – Jack E. Ingels

## LANDSCAPING LAB

**Subject Code: BAGRD1-575** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives**

1. To aware students about various techniques of landscaping.
2. To familiarize them with methods used for propagation.
3. To teach them about designing of conservatory.

**Course Outcomes:**

1. To know about the different implements used in landscaping.
2. To know the different methods of propagation.
3. Students will learn about designing of conservatory and lathe house.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**Practical**

Identification of trees, shrubs, annuals, pot plants; Propagation of trees, shrubs and annuals, care and maintenance of plants, potting and repotting, identification of tools and implements used in landscape design, training and pruning of plants for special effects, lawn establishment and maintenance, layout of formal gardens, informal gardens, special type of gardens (sunken garden, terrace garden, rock garden) and designing of conservatory and lathe house. Use of computer software, visit to important gardens/ parks/ institutes.

## SYSTEM SIMULATION AND AGROADVISORY

**Subject Code: BAGRD1-572** **L T P C** **Duration: 30 (Hrs.)**

2 0 0 2

**Course Objectives:**

1. Students will study the many methods of weather forecasting.
2. Use of weather-based agro-advisory bulletins.
3. Students must be aware of the importance of forecasting in farming.

**Course Outcomes :**

1. Students will learn about the different techniques of weather forecasting**.**
2. Use of agro-advisory bulletin based on weather forecast.
3. To know the value of forecasting in agricultural farming.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**UNIT-I (8 Hours)**

System Approach for representing soil-plant-atmospheric continuum, system boundaries, Crop models, concepts & techniques, types of crop models, data requirements, relational diagrams

**UNIT-II (8 Hours)**

Weather forecasting, types, methods, tools & techniques, forecast verification; Value added weather forecast, ITK for weather forecast and its validity;

**UNIT-III (7 Hours)**

Other garden plants: palms, ferns, grasses and cacti succulents. Pot plants: selection, arrangement, management. Bio-aesthetic planning: definition, need, planning; landscaping of urban and rural areas

**UNIT-IV (7 Hours)**

Crop-Weather Calendars; Preparation of agro-advisory bulletin based on weather forecast. Use of crop simulation model for preparation of Agro-advisory and its effective dissemination.

## SYSTEM SIMULATION AND AGROADVISORY LAB

**Subject Code: BAGRD1-576** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives:**

1. To aware them about preparation of charts based on weather forecasting.
2. To familiarize them about weather and crop management practices.
3. To teach them about use of statistical models in weather forecasting.

**Course Outcomes:**

1. To prepare different working charts based on weather forecast.
2. Analysis of varying weather and crop management practices.
3. Use of statistical accurate models in weather forecasting.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**Practical**

Preparation of crop weather calendars. Preparation of agro-advisories based on weather forecast using various approaches and synoptic charts. Working with statistical and simulation models for crop growth. Potential & achievable production; yield forecasting, insect & disease forecasting models. Simulation with limitations of water and nutrient management options. Sensitivity analysis of varying weather and crop management practices. Use of statistical approaches in data analysis and preparation of historical, past and present meteorological data for medium range weather forecast. Feedback from farmers about the agroadvisory.

## PROTECTED CULTIVATION

| Subject Code: BAGRD1-573 | L T P C<br>2 0 0 2 | Duration: 30 (Hrs.) |
|---|---|---|

**Course Objectives:**

1. Students must be aware of the significance and extent of protected cultivation.
2. To be knowledgeable about various crop, soil, and water management techniques.
3. Students will get knowledge about protected growing techniques for off-season crop production.

**Course Outcomes:**

1 To know the importance and scope protected cultivation.
2. To know the different methods of crop, soil and water management practices.
3. Students will learn about how offseason crops can be grown under protected cultivation.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

### UNIT-I (8 Hours)

Protected cultivation- importance and scope, Status of protected cultivation in India and World types of protected structure based on site and climate

### UNIT-II (8 Hours)

Cladding material involved in greenhouse/ poly house. Greenhouse design, environment control, artificial lights, Automation. Soil preparation and management, Substrate management. Types of benches and containers. Irrigation and fertigation management. Propagation and production of quality planting material of horticultural crops

**UNIT-III (7 Hours)**

Greenhouse cultivation of important horticultural crops – rose, carnation, chrysanthemum, gerbera, orchid, anthurium, lilium, tulip, tomato, bell pepper, cucumber, strawberry, pot plants, etc

**UNIT-IV (7 Hours)**

Cultivation of economically important medicinal and aromatic plants.
Off-season production of flowers and vegetables. Insect pest and disease management

## PROTECTED CULTIVATION LAB

**Subject Code: BAGRD1-577** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives:**
1. Students will discover how to cultivate seedlings in a protected environment.
2. Making various soil pastes to gain knowledge about measuring soil EC and pH.
3. To manage fertigation and irrigation together.

**Course Outcomes:**
1. Student will learn how seedlings can be raised under protected cultivation.
2. To learn about the measurement of soil EC and pH by making different soil pastes.
3. To regulate irrigation along with fertigation.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**Practical**
Raising of seedlings and saplings under protected conditions, use of protrays in quality planting material production, Bed preparation and planting of crop for production, Inter cultural operations, Soil EC and pH measurement, Regulation of irrigation and fertilizers through drip, fogging ad misting.

## MICRO PROPAGATION TECHNOLOGIES

**Subject Code: BAGRD1-574** | **L T P C** 2 0 0 2 | **Duration: 30 (Hrs.)**

**Course Objectives:**
1. To understand the origins, significance, and use of micro-propagation.
2. Students will discover how small portions can be used to establish new plants.
3. To learn about the variety of plants utilising various propagation techniques.

**Course Outcomes:**
1. To know the history, importance and scope of micro-propation.
2. Students will learn how new plants can be established by using small parts.
3. To know the diversity of plants using different method of propagation.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**UNIT-I (8 Hours)**

Introduction, History, Advantages and limitations; Types of cultures (seed, embryo, organ, callus, cell)

**UNIT-II (8 Hours)**

Stages of micro propagation, Axillary bud proliferation (Shoot tip and meristem culture, bud culture)

**UNIT-III (7 Hours)**

Organogenesis (callus and direct organ formation), Somatic embryogenesis, cell suspension cultures

**UNIT-IV (7 Hours)**

Production of secondary metabolites, Somaclonal variation, Cryopreservation

## MICRO PROPAGATION TECHNOLOGIES LAB

**Subject Code: BAGRD1-578** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives:**

1. Providing information on the many tools used in laboratories to create culture medium.
2. The various media preparation and sterilising processes will be covered with the students.
3. The various stocks and working solutions produced in labs will be taught to students.

**Course Outcomes:**

1. Providing knowledge about different equipments used in laboratory to prepare culture media.
2. Students will learn about the different methods of preparation and sterilization techniques of media.
3. Students will learn the different stock and working solution prepared in labs.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | |
| CO2 | | | | | | | | | | | | |
| CO3 | | | | | | | | | | | | |

**Practical**

Identification and use of equipments in tissue culture Laboratory, Nutrition media composition, sterilization techniques for media, containers and small instruments, sterilization techniques forexplants, Preparation of stocks and working solution, Preparation of working medium, Culturing of explants: Seeds, shoot tip and single node, Callus induction, Induction of somatic embryos regeneration of whole plants from different explants, Hardening procedures.

# SEMESTER

# VI

## Rainfed Agriculture & Watershed Management

| Subject Code: BAGRS1-651 | L T P C | Duration: 15 (Hrs.) |
|---|---|---|
| | 1 0 0 1 | |

**Course Objectives:**

**The Specific objectives of this course are to make students able to:**

1. know about meaning, definition, concept of rainfed agriculture and watershed management in India.
2. understand soil, water and climatic conditions prevalent in rainfed areas.
3. comprehend soil and water conservation techniques, watershed management including contingent crop planning and adaptation irrigation mechanisms to counter droughts.

**Course Outcomes: Students will be able to:**

CO1. learn farming practices that rely on rainfall for water.
CO2. study comprehensive assessment of water management in agriculture.
CO3 make use of water for a larger area by suitable watershed management techniques.
CO4. conserve the soil by adopting latest soil conservation techniques.
CO5. learn the concept of integrated watershed management (IWM).

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | 3 | | | | |
| CO2 | | | 2 | | | | | | | | | |
| CO3 | | | | | 1 | | | | | | | |
| CO4 | 1 | | | | | | | | | | | |
| CO5 | | | | | | | 1 | | | | | |

**UNIT-I (4 Hours)**

Rainfed agriculture: Introduction, types, History of rainfed agriculture and watershed in India; Problems and prospects of rain fed agriculture in India.

**UNIT-II (4 Hours)**

Soil and climatic conditions prevalent in rainfed areas; Soil and water conservation techniques, Drought: types, effect of water deficit on physio-morphological characteristics of the plants, Crop adaptation and mitigation to drought.

**UNIT-III (4 Hours)**

Water harvesting: importance, its techniques, Efficient utilization of water through soil and crop management practices, Management of crops in rainfed areas, Contingent crop planning for aberrant weather conditions.

**UNIT-IV (3 Hours)**

Concept, objective, principles and components of watershed management, factors affecting watershed management, problems and approach

**Recommended Text Books / Reference Books:**
1. S.R.Reddy, 1999. Principles of Agronomy. Kalyani Publishers, New Delhi.
2. T.Yellamanda Reddy and G.H.Sankara Reddi, 2010. Principles of Agronomy. Kalyani Publishers, New Delhi.
3. Reddy, S. R. and Prabhakar Reddy, G. 2015. Dryland Agriculture. Kalyani Publishers.
4. Arnon,I. 1972. Crop Production in Dry Regions (Vol.I), Leonard Hill Pub. Co, London.
5. Dhruva Narayana, V.V., Sastry, G.S. and Patnaiak, V.S. 1999. Watershed Management in India. ICAR, New Delhi.
6. Jeevananda Reddy,S.2002. Dryland Agriculture in India: An agro-climatological and agro meteorological perspective. B S publications

## Protected Cultivation and Secondary Agriculture

| Subject Code: BAGRS1-652 | L | T | P | C | Duration: 15 (Hrs.) |
|---|---|---|---|---|---|
| | 1 | 0 | 0 | 1 | |

**Course Objectives**: **The specific objectives of this course are to:**
1. Familiarize the students with the design of greenhouse, cost estimation and economic analysis.
2. Develop skill to erect protected structure equipped with irrigation, active and passive solar heating systems, drying.
3. Enable the students to know about important engineering properties and their application in post harvest technology equipments design and operation.

**Course Outcomes: Students will be able to**
CO1. learn about greenhouse technology, types of green houses and construction of green houses.
CO2. gain knowledge of greenhouse equipments, materials of construction for traditional and low cost green houses.
CO3. learn about Irrigation systems used in greenhouses, shade net house in protected cultivation.
CO4. grab the of knowledge of cleaning and grading moisture measurement.
CO5. understand the material handling equipment, principle and working.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 1 | | | |
| CO2 | | | | | 1 | | | | | | | |
| CO3 | | 2 | | | | | | | | | | |
| CO4 | | | | | | | | | | | 2 | |
| CO5 | | | | | | | 1 | | | | | |

### UNIT-I (3 Hours)

Greenhouse technology: Introduction, Types of Greenhouses; Plant response to Greenhouse environment, Planning and design of greenhouses, Design criteria of green house for cooling and heating purposes.

### UNIT-II (4 Hours)

Greenhouse equipment, materials of construction for traditional and low cost greenhouses. Irrigation systems used in greenhouses, typical applications, passive solar greenhouse, hot air greenhouse heating systems, greenhouse drying.

**UNIT-III (4 Hours)**

Important Engineering properties such as physical, thermal, aero & hydrodynamic properties of cereals, pulses and oilseed, their application in PHT equipment design and operation. Drying and dehydration.

**UNIT-IV (4 Hours)**

Moisture measurement, EMC, drying theory, various drying methods, commercial grain dryer (deep bed dryer, flat bed dryer, tray dryer, fluidized bed dryer, circulatory dryer and solar dryer), Material handling equipment; conveyer and elevators, their principle, working and selection.

**Recommended Text Books / Reference Books:**

1. Prasad Kumar. Green House Management for Horticulture Crops
2. Radha Manohar, K and Igathinathane. C. Greenhouse Technology and Management, 2nd Edition, BS Publications.
3. Tiwari, G.N. Greenhouse Technology for Controlled Environment. Narosa Publishing house Pvt.Ltd.
4. Singh Brahma and Balraj Singh., 2014. Advances in Protected Cultivation, New India Publishing Company.
5. Sahay, K.M. and Singh, K.K. 1994. Unit operations of Agricultural Processing. Vikas Publishing house Pvt. Ltd. New Delhi.
6. Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi.
7. Ojha, T.P and Michael, A.M. Principles of Agricultural Engineering, Vol. I, Jain Brothers, Karol Bag, New Delhi.

## Diseases of Field and Horticultural Crops and their Management-II

**Subject Code: BAGRS1-653** | **L T P C** 2 0 0 2 | **Duration: 30 (Hrs.)**

**Course Objectives: The specific objectives of this course are to make the students to:**

1. Know the symptoms, etiology, disease cycle and management of various field crops and horticultural crops.
2.Identify, diagnosis and treatment of selected horticulture and field crops.
3. Compare the means of dispersal of these diseases.

**Course Outcomes: Students will be able to:**

CO1. know the common pathogens of different diseases.
CO2. acquire the knowledge about etiology and symptoms of these diseases which helps in diagnosis of the diseases of field and horticultural crops.
CO3. learn means of dispersal of these diseases suitable management methods can be applied.
CO4. learn eco-friendly and economically suitable management practices may be adopted.
CO5. understand different chemical control methods.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 3 | | | | | | | | |
| CO2 | | | | | | | | 1 | | | | |
| CO3 | | 2 | | | | | | | | | | |
| CO4 | | | | | | | | | | | | 1 |
| CO5 | | | | | | | 3 | | | | | |

**UNIT-I (9 Hours)**

Economic importance, symptoms, causal organism, epidemiology, disease cycle and integrated management of diseases of wheat, barley, sugarcane, rapeseed & mustard, sesamum, sunflower, cotton, pulses.

**UNIT-II (6 Hours)**

Economic importance, symptoms, causal organism, epidemiology, disease cycle and integrated management of mentha, coriander, turmeric and berseem.

**UNIT-III (9 Hours)**

Economic importance, symptoms, causal organism, epidemiology, disease cycle and integrated management of diseases of citrus, mango, grapevine, sapota, ber, apple, pear, peach, plum, coconut, mulberry, chilli, potato, pea, onion, garlic cucurbits.

**UNIT-IV (6 Hours)**

Economic importance, symptoms, causal organism, epidemiology, disease cycle and integrated management of diseases of rose, chrysanthemum, gladiolus, marigold and jasmine.

**Recommended Text Books / Reference Books:**

1. Rangaswami, G & Mahadevan, K.2001. Diseases of crop plants in India, Prentice Hall of India Pvt.Ltd, New Delhi.
2. Singh, R.S.2005. Plant Diseases. Oxford & IBH Publications, New Delhi
3. Pathak, V.N.2001. Diseases of Fruit crops. Oxford & IBH Publications, New Delhi
4. Singh, R.S.1999. Diseases of Vegetable crops. Oxford & IBH Publications, New Delhi
5. Chaube, H.S and V.S. Pundhir, 2012. Crop Diseases & Their Management. PHI Pvt. Ltd, New Delhi

## Post-harvest Management and Value Addition of Fruits and Vegetables

**Subject Code: BAGRS1-654** | **L T P C** 1 0 0 1 | **Duration: 15 (Hrs.)**

**Course Objective**: The specific objectives of this course are to:
1. acquaint student the importance of post-harvest management and processing of fruits and vegetables.
2. impart knowledge about pre and postharvest factors affecting quality of horticultural produce
3. provide technical know-how on value addition of fruits/vegetables through different methods and to design storage structures for freshly harvested agricultural products in the field

**Course Outcomes: Students will be able to:**
CO1. understand the post-harvest technology of horticultural crops.
CO2. recognise the value addition of horticulture crops.
CO3. handle the tool and equipment design for PHT (Post harvest technology) and value addition.
CO4. study the various certification and accreditation i.e. FPO, ISO and other labelling.
CO5. gain knowledge about the tomato processing, caning and drying of fruits and vegetables and various management technologies of food related to conventional and modern packaging methods

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | 1 | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | | | | | 2 | | | | | | | |
| CO3 | | | | | | | 2 | | | | | |
| CO4 | | | | | 3 | | | | | | | |
| CO5 | | | | | | | | 1 | | | | |

**UNIT-I (4 Hours)**

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening;

**UNIT-II (3 Hours)**

Respiration and factors affecting respiration rate; Harvesting and field handling; post harvest practices; Storage (ZECC, cold storage, CA, MA, and hypobaric)

**UNIT-III (4 Hours)**

Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy– Concepts and Standards; Fermented and non-fermented beverages.

**UNIT-IV (4 Hours)**

Tomato products- Concepts and Standards; Drying/ Dehydration of fruits and vegetables– Concept and methods, osmotic drying. Canning– Concepts and Standards, packaging of products.

**Recommended Text Books / Reference Books:**

1. P.H.Pandey. Principles & Practices of Post Harvest Technology
2. Amar Singh. Fruit Physiology and Production
3. Rathore, N.S., Mathur, G.K., Chasta, S.S. 2012. Post-harvest Management and Processing of Fruits and Vegetables. ICAR, New Delhi.
4. Srivastava, R.P. and Sanjeev Kumar. 2002. Fruit and Vegetable Preservation: Principles and Practices. International Book Distribution Company, Lucknow.
5. Giridharilal, G.S., Siddappa and Tondon, G.L. 2007. Preservation of Fruits and Vegetables. ICAR, New Delhi.
6. Mitra, S.K. 2005. Post Harvest Physiology and Storage of Tropical and Subtropical Fruits. CABI Publishers, Kolkatta.

## Management of Beneficial Insects

| Subject Code: BAGRS1-655 | L T P C<br>1 0 0 1 | Duration: 15 (Hrs.) |
|---|---|---|

**Course Objectives**: **The specific objectives of this course are to make the students able to:**
1. know about importance of beneficial insects. Understand bee, silk and lac biology, morphology of host plants and their pest and diseases.
2. comprehend methods of rearing and management practices of bee keeping, mulberry and lac cultivation.
3. identify parasitoids and predators used in biological control of pests in bee, silk and lac cultivation and become familiarize with equipment’s used in their production.

**Course Outcomes: Students will be able to**

CO1. practice apiculture, sericulture and lac culture as an entrepreneur according to agro climatic zone.
CO2. understand commercial methods of rearing, equipment, seasonal management, insect pest and disease.
CO3. identify different bio control agents (Predator, Parasite and Parasitoids) and their use for sustainable pest management.
CO4. learn about mass multiplication technique of biological control agents and established a bio control lab in future as an entrepreneur.
CO5. know about important species for commercial use of honey bee, silkworm and lac insect.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | 2 | | | | | | | | | |
| CO2 | | | | | 1 | | | | | | | |
| CO3 | | | | | | 2 | | | | | | |
| CO4 | | | | 3 | | | | | | | | |
| CO5 | | | | | | | | | 2 | | | |

**UNIT-I (4 Hours)**

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honeybee. Role of pollinators in cross pollinated crops. Toxicity of insecticides

**UNIT-II (4 Hours)**

Types of silkworm and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Insect-pests and diseases of silkworm and their management. Rearing appliances of mulberry silkworm and methods of disinfection.

**UNIT-III (3 Hours)**

Lac insects: Species, morphology, biology, host plants. Lac production – seed lac, button lac, shellac, lac-products. Identification of major parasitoids and predators commonly being used in biological control.

**UNIT-IV (4 Hours)**

Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Important species of pollinator, weed killers and scavengers with their importance. An introduction to economics and marketing of honey, silk and lac.

**Recommended Text Books / Reference Books:**

1. Aruga H. 1994. Principles of Sericulture. Oxford & IBH, New Delhi.
2. B.Vasanta Raj. Elements of Economic Entomology
3. Atwal AS. 2006. The World of the Honey Bee. Kalyani Publ., New Delhi.
4. Ganga G. 2003. Comprehensive Sericulture. Vol. II.Silkworm Rearing and Silk Reeling. Oxford & IBH, New Delhi.
5. Partiban S & David BV. 2007. Management of Household Pests and Public Health Pests. Namratha Publ., Chennai.
6. Singh S. 1975. Beekeeping in India. ICAR, New Delhi.

## Crop Improvement-II *(Rabi crops)*

**Subject Code: BAGRS1-656** | **L T P C** 1 0 0 1 | **Duration: 15 (Hrs.)**

**Course Objective: The specific objectives of this course will be to make the students to:**

1. gain the knowledge on the centre of origin, distribution and wild relatives of various rabi crops
2. understand the genetics of qualitative and quantitative characters and plant genetic resources and their conservation process.
3. understand the major breeding objectives, procedures and innovative approaches for development of hybrids and varieties for different purposes.

**Course Outcomes: Students will be able:**

CO1. learn importance of wild relative to produce new varieties of Rabi crop.
CO2. learn Gene preservation method for further use to improve Rabi varieties.
CO3. apply breeding methods to improve Rabi crops.
CO4. identify resistance genes related to Rabi crop with high yield potential against Pest and pathogen and utilization genes.
CO5. learn new genetic approaches to achieve a definite ideotype of rabi crop.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | 3 | | | | | | | | |
| CO2 | | | | | | | | 1 | | | | |
| CO3 | | | 1 | | | | | | | | | |
| CO4 | 2 | | | | | | | | | | | |
| CO5 | | | | | | | | | | 2 | | |

### UNIT-I (3 Hours)

Centres of origin, distribution of species, wild relatives in different cereals, pulses, oilseeds, fodder crops and cash crops, Problems and present status of crop improvement in India with emphasis on the work done in Punjab. National and International centres of crop improvement

### UNIT-II (3 Hours)

Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters. Conventional versus non-conventional methods for crop improvement.

### UNIT-III (6 Hours)

Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional).

### UNIT-IV (3 Hours)

Hybrid seed production technology of rabi crops. Ideotypes concept and climate resilient crop varieties for future.

**Recommended Text Books / Reference Books:**
1. Allard, R.W. 1960. Principles of Plant Breeding. John Wiley & Sons, New York.
2. Phundan Singh. 2006. Essential of Plant Breeding. Kalyani Publishers, Ludhiana. 54
3. Poehlman, J.M. and Borthakur, D. 1995. Breeding of Asian Field Crops. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
4. Sharma, J.R. 1994. Principles and Practice of Plant Breeding. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
5. Kalloo, G.1994. Vegetable Breeding. Panima Educational Book Agency, New Delhi.
6. Kumar, N. 2006. Breeding of Horticultural Crops - Principles and Practices. New India Publishing Agency, New Delhi.
7. George Acquaah..2012. Principles of Plant Genetics and Breeding. Blackwell Publishing Ltd., USA.

## Principles of Organic Farming

| Subject Code: BAGRS1-657 | L | T | P | C | Duration: 15 (Hrs.) |
|---|---|---|---|---|---|
| | 1 | 0 | 0 | 1 | |

**Course Objective**: **The specific objectives of this course will be to make the students to:**
1. understand meaning, concepts and principles of organic farming and initiatives taken by government, NGOs and private sector for its promotion.
2. know about Organic ecosystem and Organic nutrient resources and its fortification.
3. comprehend choice of crops and varieties in organic farming and use of organic inputs for management of insect, pest, disease and weed.

**Course Outcomes: Students will be able to:**
CO1. make proper use of initiatives taken by Government for organic produce.
CO2. evaluate the role of NGOs in producing organic products.
CO3. select the crops and varieties for organic produce.
CO4. learn the process of certification of organic produce.
CO5. analyse the steps in preparation and quality analysis of enrich compost, vermi compost and bio-fertilizers/bio-inoculants.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | 2 | | | | |
| CO2 | | | | | 1 | | | | | | | |
| CO3 | | 3 | | | | | | | | | | |
| CO4 | | | | | | | | | | | | 1 |
| CO5 | | | | | | | | | | | 2 | |

**UNIT-I (4 Hours)**

Principles and scope of organic farming in India; Initiatives taken by Government (central and state), NGOs and other organizations for promotion of organic agriculture. Organic farming - concept and definition, its relevance to India and global agriculture and future prospects. Organic production requirements. Biological intensive nutrient management. Recycling of organic residues. Soil improvement and amendments.

**UNIT-II (5 Hours)**

Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to nutrient use in organic farming; Choice of crops and varieties in organic farming. Soil fertility- nutrient recycling, organic residues, organic manures, composting, soil biota and decomposition of organic residues, earthworms and vermi compost, green manures and bio fertilizers. Farming systems, crop rotations, intercropping in relation to maintenance of soil productivity.

**UNIT-III (3 Hours)**

Fundamentals of insect- pests, diseases and weed management under organic mode of production; Operational structure of National Programme for Organic Production (NPOP);

**UNIT-IV (3 Hours)**

Certification process and standards of organic farming; Processing, labelling, economic considerations, viability, marketing and export potential of organic products.

**Recommended Text Books / Reference Books:**

1. Arun K. Sharma. 2002. A Hand book of organic farming. Agrobios, India. 627p.
2. Palaniappan, S.P and Annadurai, K.1999. Organic farming-Theory and Practice. Scientific publishers, Jodhpur,India. 257p.
3. Mukund Joshi and Prabhakarasetty, T.K. 2006. Sustainability through organic farming. Kalyani publishers, New Delhi. 349p.
4. Balasubramanian, R., Balakishnan, K and Siva Subramanian, K. 2013. Principles and practices of organic farming. Satish Serial Publishing House. 453p 39
5. Tarafdar, J.C., Tripathi, K.P and Mahesh Kumar, 2009. Organic agriculture. Scientific Publishers, India. 369p.
6. Tiwari, V.N., Gupta, D.K., Maloo, S.R and Somani, L.L. 2010. Natural, organic, biological, ecological and biodynamic farming. Agrotech Publishing Academy, Udaipur. 420p.
7. Dushyent Gehlot. 2005. Organic farming- standards, accreditation, certification and inspection. Agrobios, India. 357p

## Farm Management, Production & Resource Economics

| Subject Code: BAGRS1-658 | L | T | P | C | Duration: 15 (Hrs.) |
|---|---|---|---|---|---|
| | 1 | 0 | 0 | 1 | |

**Course Objective: The specific objectives of this course is to make the students able to:**
1. know the concept of farms and principles of farm management, objectives, types and characteristics, various laws and relationship between different factors and products.
2. understand the cost concept, farm business, and technical and economic efficiency analysis of various enterprises, farm records, and linear programming.
3. comprehend the risk and uncertainty in agriculture, crop insurance, resource economics, externalities and management of common property resources.

**Course Outcomes: Students will be able to:**
CO1. gain knowledge about comprehensive treatment of the traditional agricultural production economics topics
CO2. focus on the neoclassical factor-product, factor-factor and product- product models
CO3. understand limited resources available in the economy
CO4. know about availability of rich natural endowments to achieve sustainable agricultural development
CO5. gain knowledge of the causes of regional variations in productivity and production, social and economic inequality, size of land holdings and lack of quality inputs etc.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | | 2 | | | |
| CO2 | | | | | | | 1 | | | | | |
| CO3 | | | | | 3 | | | | | | | |
| CO4 | | | 2 | | | | | | | | | |
| CO5 | | | | | | | | | | 1 | | |

**UNIT-I (4 Hours)**

Agricultural Production Economics: definition, nature and scope. Laws of returns. Factor product relationship: determination of optimum input and output. Farm management: meaning, definition and importance.

**UNIT-II (3 Hours)**

Economic principles applied to the organizations of farm business. Types and systems of farming. Farm planning and budgeting. Risk and uncertainty. Agricultural finance: nature and scope, compounding and discounting.

**UNIT-III (5 Hours)**

Agricultural credit: meaning, definition, need and classification. Credit appraisal. History of financing agriculture in India. Agricultural Financial Institutions. Assessment of crop losses. Determination of compensation.

**UNIT-IV (3 Hours)**

Crop insurance. Agricultural Cooperation- philosophy and principles, History of Indian Cooperative Movement. Cooperative credit structure and reorganization of cooperative credit structure and single window system.

**Recommended Text Books / Reference Books:**

1. V.T. Raju, D.V.S Rao. Economics of Farm Production and Management
2. Bishop, C.E. and W. D. Tousaint. 1958. Introduction to Agricultural Economic Analysis. John Wiley and Sons, London.
3. Heady, Earl O. 1964. Economics of Agricultural Production and Resource Use. Prentice Hall of India, Private Limited, New Delhi
4. S.S. Johl, J.R. Kapur. 2006. Fundamentals of Farm Business Management.
5. Kahlon, A.S. and Karam Singh. 1965. Principles of Farm Business Management. Kalyani Publishers, New Delhi.
6. Raju, V.T. and D.V.S. Rao. 2006. Economics of Farm Production and Management. Oxford & IBH Publishing Co. Pvt. Limited, New Delhi

## Principles of Food Science and Nutrition

| Subject Code: BAGRS1-659 | L T P C<br>2 0 0 2 | Duration: 30 (Hrs.) |
|---|---|---|

**Course Objectives**: **The specific objectives of this course are to:**
1. familiarize the students to basic concepts of food science, food composition and food chemistry
2. understand concepts of food microbiology and its use in production of fermented foods
3. develop insights in principles and methods of food processing and preservation.

**Course Outcomes:**

CO1. critically evaluates information on food science and nutrition issues appearing in the popular press.
CO2. discuss the important pathogen and spoilage microorganism in foods.
CO3. discuss basic principles and practices of cleaning and sanitation in food preparation operation.
CO4. identify and explain nutrients in foods and the specific functions in maintaining health.
CO5. impart knowledge about malnutrition, nutritional disorders; energy metabolism and balanced/ modified diets

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | 1 | | | | | | |
| CO2 | | | | | | | | | 2 | | | |
| CO3 | | | 3 | | | | | | | | | |
| CO4 | | | | | | | 2 | | | | | |
| CO5 | 1 | | | | | | | | | | | |

**UNIT-I (9 Hours)**

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bio actives, important reactions). Food and its functions - energy giving, body building, protecting and regulating. Basic food groups.

**UNIT-II (6 Hours)**

Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.);

**UNIT-III (9 Hours)**

Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders. Nutrients, their functions, sources and deficiency diseases - proteins, carbohydrates, lipids, vitamins - fat soluble and water soluble, minerals. Concept of balanced diet. Recommended Dietary Allowances (RDA) for various age groups according to their physiological status for specific nutrients and energy.

**UNIT-IV (6 Hours)**

Energy metabolism (carbohydrates, fats, proteins); Balanced/modified diets, Menu planning, New trends in food science and nutrition. Water and electrolyte balance - functions and distribution in body. Basal metabolism - methods of measurement and factors affecting BMR.

Nutrition, infection and immunity. Nutritional status using dietary survey, anthropometry, clinical signs and biochemical methods. Nutrition education, nutrition policies and their implementation. Non-conventional foods and their use.

**Recommended Text Books / Reference Books:**

1. P.H.Pandey. Principles & Practices of Post Harvest Technology
2. D.V. Reedy. Applied Nutrition
3. Sumati R. Mudambi, Shalini M. Rao and M.V. Rajagopal. 2006. Food Science, 2nd Ed. New Age International (P) Limited, New Delhi.
4. Martin Eastwood. 2003. Principles of Human Nutrition. Blackwell Science Ltd., Oxford.
5. Norman N. Potter. 1998. Food Science, 5th Ed. Springer Science+ Business Media, New York.
6. Michael J. Pelczar Jr., E.C.S. Chan and Noel R. Krieg. 1998. Microbiology, 5th Ed. Tata McGraw-Hill Education, New Delhi.
7. William C. Frazier and & Dennis C. Westfoff. 1987. Food Microbiology, 4th Ed. Tata McGraw-Hill Education, New Delhi.
8. L.E. Casida Jr. 1968. Industrial Microbiology. New Age International Publishers, New Delhi.

9. P. Fellows. 2000. Food Processing Technology: Principles and Practice, 2nd Ed. CRC Press, Boca Raton, FL, USA.
10. Marcus Karel and Darvl B. Lund.2003. Physical Principles of Food Preservation, 2nd Ed. Marcel Dekker, Inc., NY, USA.
11. Gerald Wiseman. 2002. Nutrition and Health. Taylor & Francis, London.

## Rainfed Agriculture & Watershed Management Lab

**Subject Code: BAGRS1-660** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives: The specific objectives of this course are to make the students able to:**

1. identify several plant diseases and pathogens.
2. identify of various pests' and pathogens' life cycles for the purpose of management measures.
3. develop various IPM techniques to control pests and diseases without contaminating the soil, water or environment.

**Course Outcomes: Students will be able to:**

CO1. detect the different pathogens and diseases in plants.
CO2. identify life cycle of different pests and pathogens for control measures.
CO3. make different IPM strategies so that the pests and diseases can be controlled without soil, water and environment pollution.
CO4. make use of rainfall water for a larger area by suitable watershed management techniques.
CO5. conserve soil by adopting latest soil conservation techniques.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | 2 | | | | | | |
| CO2 | 3 | | | | | | | | | | | |
| CO3 | | | | | | | | | 1 | | | |
| CO4 | | | | 1 | | | | | | | | |
| CO5 | | | | | 2 | | | | | | | |

**PRACTICALS**

Studies on climate classification, studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons. Studies on cropping pattern of different rainfed areas in the country and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures.

## Protected Cultivation and Secondary Agriculture Lab

**Subject Code: BAGRS1-661** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives :- The specific objectives of this course are to:**

1. understand the infrastructure of greenhouse system.
2. recognise the different properties of produce influenced by environment.
3. aware about the various equipment's used in greenhouse system.

**Course Outcomes: - Students will able to:**

CO1. learn about the ventilation techniques used in greenhouse.

CO2. handle different agricultural tools.

CO3. know different post - harvest handling techniques.

CO4. know the different methods of available moisture techniques.

CO5. learn about Irrigation systems used in greenhouses, shade net house in protected cultivation.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | | | | | | 1 | | |
| CO2 | | | | | | 3 | | | | | | |
| CO3 | | | | | | | | | 2 | | | |
| CO4 | | | | | | | | | | | | 1 |
| CO5 | | | | 2 | | | | | | | | |

**PRACTICALS**

Study of different type of greenhouses. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside greenhouse. Study of greenhouse equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying, moisture meter and infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials). Field visit to seed processing plant/ protected cultivation center.



## Diseases of Field and Horticultural Crops and their Management-II Lab

**Subject Code: BAGRS1-662** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives: The specific objectives of this course are to:**

1. understand the signs, causes, progression, and control of disease in a variety of field and horticultural

crops.
2. recognise, evaluate and manage of specific field crops and horticulture.
3. compare the means of dispersal of these diseases.

**Course Outcomes: Students will be able to:**
CO1. learn about the typical organisms causing various ailments.
CO2. learn the causes and symptoms of various illnesses so that you can diagnose diseases in horticultural and field crops.
CO3. learn means of dispersal of these diseases suitable management methods can be applied.
CO4. learn how to use management techniques that are both environmentally benign and economically viable.
CO5. know the various chemical control techniques.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | 3 | | | | | | | | | |
| CO2 | | | | | | 1 | | | | | | |
| CO3 | | 2 | | | | | | | | | | |
| CO4 | | | | 2 | | | | | | | | |
| CO5 | | | 1 | | | | | | | | | |

## PRACTICALS

Identification and histopathological studies of selected diseases of field and horticultural crops. Field visit to Govt. fruit nurseries and orchards for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

## Post-harvest Management and Value Addition of Fruits and Vegetables Lab

| Subject Code: BAGRS1-663 | L T P C<br>0 0 2 1 | Duration: 30 (Hrs.) |
|---|---|---|

**Course Objectives**: **The specific objectives of this course are to:**

1. understand the importance of post-harvest management and processing of fruits and vegetables.

2. impart knowledge about chilling and freezing injury in vegetables and fruits.

3. evaluate the quality of the products.

**Course Outcomes: Students will be able to:**
CO1. learn applications of packaging and increasing shelf life of fruits and vegetables.
CO2. study the effect of different factors on the shelf life of products.
CO3. handle the tool and equipment design for PHT (Post harvest technology) and value addition.
CO4. prepare different products from fruits and vegetables.
CO5. evaluate the quality of products.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | | | | | | | 2 | | | |
| CO3 | | 3 | | | | | | | | | | |
| CO4 | | | | 3 | | | | | | | | |
| CO5 | | | | | 2 | | | | | | | |

**PRACTICALS**

Applications of different types of packaging, containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar, candy, tomato products and canned products. Quality evaluation of products -- physico-chemical and sensory. Visit to processing unit/industry.

## Management of Beneficial Insects Lab

| Subject Code: BAGRS1-664 | L T P C<br>0 0 2 1 | Duration: 30 (Hrs.) |
|---|---|---|

**Course Objectives: The specific objectives of this course are to:**

1. learn the importance of beneficial insects.
2. study the biology of bee, silkworm and lac insect, morphology of host plants and their pest and diseases.
3. study different rearing methods and management practices of bee keeping, mulberry and lac cultivation.

**Course Outcomes: Students will be able to:**

CO1. practice apiculture, sericulture and lac culture as an entrepreneur according to agro climatic zone.

CO2. understand commercial methods of rearing, equipment, seasonal management, insect pest and disease.

CO3. make the use of different bio control agents (Predator, Parasite and Parasitoids) for sustainable pest management.

CO4. learn about mass multiplication technique of biological control agents and established a bio control lab in future as an entrepreneur.

CO5. study different species of bees, silkworm and lac insect for commercial use.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | 1 | | | | | | | | | |
| CO3 | | | | 2 | | | | | | | | |
| CO4 | | | | | 3 | | | | | | | |
| CO5 | | | | | | 1 | | | | | | |

**PRACTICALS**

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and diseases. Bee pasturage, bee foraging and communication. Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping/ sericulture/ lac culture. Identification and control of natural enemies.

## Crop Improvement-II *(Rabi crops)* Lab

**Subject Code: BAGRS1-665** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives: The specific objectives of this course are to:**

1. know the centres of origin, distribution and related species of rabi crops.
2. know the different qualitative and quantitative traits of rabi crops.
3. understand different hybridization techniques of different rabi crops.

**Course Outcomes: Students will be able to:**

CO1. know handling techniques of rabi crops.
CO2. learn the gene preservation methods.
CO3. recognise genetic variability and seed vigour.
CO4. study the different field techniques for hybrid seed production.
CO5. learn the in-situ conservation of genetic traits of crops.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO1 | | | | | 2 | | | | | | | |
| CO2 | | | 2 | | | | | | | | | |
| CO3 | | | | | | | 1 | | | | | |
| CO4 | | 1 | | | | | | | | | | |
| CO5 | | | | | 3 | | | | | | | |

**PRACTICALS**

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Berseem and Sugarcane; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed descent methods; Study of field techniques for seed production and hybrid seed production in Rabi crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed/ hybrid seed production research station.

## Principles of Organic Farming Lab

**Subject Code: BAGRS1-666** | **L T P C** 0 0 2 1 | **Duration: 30 (Hrs.)**

**Course Objectives: The specific objectives of this course are to:**

1. to understand concepts and principles of organic farming.

2. know about Organic ecosystem and Organic nutrient resources and its fortification.
3. make the right choice of crops and varieties in organic farming and to avoid the use of chemical/inorganic inputs for management of insect, pest, disease and weed.

**Course Outcomes: Students will be able to:**
CO1. make proper use of initiatives taken by Government for organic produce.
CO2. evaluate the role of NGOs in producing organic products.
CO3. prepare different composts organic in nature.
CO4. analyse the different quality parameters of organic product.
CO5. handle and manage the organic produce.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| CO2 | | | | | 2 | | | | | | | |
| CO3 | | 3 | | | | | | | | | | |
| CO4 | | | | 3 | | | | | | | | |
| CO5 | | | 1 | | | | | | | | | |

## Practical

Visit of organic farms to study the various components and their utilization; Preparation of enrich compost, vermicompost, bio-fertilizers/bio-inoculants and their quality analysis; Indigenous technology knowledge (ITK) for nutrient, insect, pest disease and weed management; Cost of organic production system; Post harvest management; Quality aspect, grading, packaging and handling of organic produce.

## Farm Management, Production & Resource Economics Lab

**Subject Code: BAGRS1-667** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives: The specific objectives of this course are to:**

1. select profitable enterprises combinations.

2. make decisions regarding farm budgets and farm records.

3. collect and analyse data from various resources.

**Course Outcomes: Students will be able to:**
CO1. understand farm layout plans.
CO2. know about farm assets and cost benefit ratio.
CO3. become aware about utilisation of limited resources available at the farm.
CO4. use eco -friendly resources to achieve sustainable agricultural development.
CO5. gain knowledge about the seasonal variations in the production and productivity.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | 3 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 2 | | | | | | | | | | | |
| CO3 | | | | | | | | 1 | | | | |
| CO4 | 2 | | | | | | | | | | | |
| CO5 | | | | 1 | | | | | | | | |

## Practical

Preparation of farm layout. Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

# Hi-tech Horticulture

**Subject Code: BAGRD1-671** **L T P C** **Duration: 30 (Hrs.)**

2 0 0 2

**Course Objectives: The specific objectives of this course are to:**

1 impart knowledge of mechanization, micro propagation and protected cultivation of horticultural crops
2 develop understanding of application of precision farming in horticultural crop
3 analyse the greenhouses based on shape, utility, construction, covering materials and cost.

**Course Outcomes: Students will be able to:**

CO1. deal with seed production technology of horticultural crops.
CO2. study Plant Propagation and Nursery Management.
CO3. learn importance & scope of hi-tech horticulture in India.
CO4. manage Hi-tech nursery & mechanization of horticultural crops.
CO5. learn Protected cultivation: advantages & constraints.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 1 | | | |
| CO2 | | | | | 2 | | | | | | | |
| CO3 | | 2 | | | | | | | | | | |
| CO4 | | | | | | | | | | 2 | | |
| CO5 | | | | | | 1 | | | | | | |

**UNIT-I (7 Hours)**

Introduction & importance; Nursery management and mechanization; micro propagation of horticultural crops.

**UNIT-II (7 Hours)**

Modern field preparation and planting methods, Protected cultivation: advantages, controlled conditions, method and techniques.

**UNIT-III (6 Hours)**

Micro irrigation systems and its components; EC, pH based fertilizer scheduling, canopy management, high density orcharding.

**UNIT-IV (10 Hours)**

Components of precision farming: Remote sensing, Geographical Information System (GIS), Differential Geo-positioning System (DGPS), Variable Rate applicator (VRA), application of precision farming in horticultural crops (fruits, vegetables and ornamental crops); mechanized harvesting of produce.

**Recommended Text Books/ Reference Books:**

1. T. A. More, Karale A. R. and Patil M.T. 2001. Hi-tech Horticulture, CAFT (Fruits), MPKV, Rahuri.

2. Balraj Singh.2005. Protected cultivation of vegetable crops, Kalyani Publishers, New Delhi.

3. Patil, M.T and Patil, P.V. 2004. Commercial Protected Floriculture, MPKV, Rahuri

4. Commercial Floriculture – Prasad & Kumar.

5. Proceedings of International seminar on protected cultivation in India, held at Bangalore (1997)

6. Greenhouse operation and management- Paul. V. Nelson

## Hi-tech. Horticulture Lab

| **Subject Code: BAGRD1-675** | **L T P C**<br>0 0 2 1 | **Duration: 30 (Hrs.)** |
|---|---|---|

**Course Objectives: The specific objectives of this course are to:**

1. understand different micro-propagation techniques of horticultural crops.
2. develop and understanding of precision farming in horticultural crops.
3. understand the utility, construction material and cost of green house.

**Course Outcomes: Students will be able to:**

CO1. deal with seed production technology of horticultural crops.
CO2. study plant propagation and nursery management.
CO3. learn importance & scope of hi-tech horticulture in India.
CO4. manage Hi-tech nursery & mechanization of horticultural crops.
CO5. learn Protected cultivation: advantages and limitations.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 1 | | | | | | | |
| CO2 | | 3 | | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | | | | | | | | 2 | | | | |
| CO4 | | | | 1 | | | | | | | | |
| CO5 | | | | | | | 1 | | | | | |

## Practical

Types of polyhouses and shade net houses, Intercultural operations, tools and equipments identification and application, Micro propagation, Nursery-protrays, micro-irrigation, EC, pH based fertilizer scheduling, canopy management, visit to hi-tech orchard/nursery.

# Agricultural Journalism

**Subject Code: BAGRD1-672** | **L T P C** 2 0 0 2 | **Duration: 30 (Hrs.)**

**Course Objectives: The specific objectives of this course are to:**

1. impart learning of different kinds of communication media
2. learn gathering agricultural information and writing stories
3. impart the knowledge of Mass communication & Journalism covering a wide areas of studies.

**Course Outcomes: Students will be able to:**

CO1. get knowledge about mass communication & journalism covering a wide areas of studies.
CO2. grasp the concepts of communication, its role and importance in society.
CO3. learn about skills related to Information Communication Technologies (ICTs)
CO4. know the objectivity and critical thinking for communicating to masses through a variety of mediums
CO5. become an enlightened citizen as well as a dynamic professional with commitment to deliver one's responsibilities strictly adhering to highest standard of ethics and professionalism.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | 1 | | | | | | | | | |
| CO2 | | | | | | 2 | | | | | | |
| CO3 | | | | | | | | | 3 | | | |
| CO4 | | | | | | | | | | | | 1 |
| CO5 | | | | 2 | | | | | | | | |

**UNIT-I (8 Hours)**

Agricultural Journalism: The nature and scope of agricultural journalism, characteristics and training of the agricultural journalist, how agricultural journalism is similar to and different from other types of journalism.

**UNIT-II (8 Hours)**

Newspapers and magazines as communication media: Characteristics; kinds and functions of newspapers and magazines, characteristics of newspaper and magazine readers. Form and content of newspapers and magazines: Style and language of newspapers and magazines, parts of newspapers and magazines.

**UNIT-III (7 Hours)**

The agricultural story: Types of agricultural stories, subject matter of the agricultural story, structure of the agricultural story. Gathering agricultural information: Sources of agricultural information, interviews, coverage of events, abstracting from research and scientific materials, wire services, other agricultural news sources.

**UNIT-IV (7 Hours)**

Writing the story: Organizing the material, treatment of the story, writing the news lead and the body, readability measures. Illustrating agricultural stories: Use of photographs, use of artwork (graphs, charts, maps, etc.), writing the captions. Editorial mechanics: Copy reading, headline and title writing, proofreading, lay outing.

**Recommended Text Books/ Reference Books:**

1. Arvind Kumar (1999). The Electronic Media. Anmol Publications, New Delhi.
2. Bhatt, S.C. (1993) Broadcast Journalism. Basic Principles Har Anand Publications, Delhi.
3. Bhatnagar, R. (2001). Print Media and Broadcast Journalism. Indian Publisher Distributors, Delhi
4. Katyal, V.P (2007). Fundamentals of Media Ethics. Cyber Tech Publishers, New Delhi.
5. Yadava, J.S and Mathur, P. (1998). Issues in Mass Communication: the basic concepts. Volumes 1 and 2. Indian Institute of Mass Communication, New Delhi.

## Agricultural Journalism Lab

| Subject Code: BAGRD1-676 | L T P C | Duration: 30 (Hrs.) |
|---|---|---|
| | 0 0 2 1 | |

**Course Objectives: The specific objectives of this course are to:**

1. teach students about many forms of communication
2. learn how to write facts and get knowledge about agriculture
3. spread information about journalism and mass communication throughout several fields of study.

**Course Outcomes: Students will be able to:**

CO1. learn about journalism and mass communication in a variety of fields of study.

CO2. comprehend the ideas behind communication, as well as its significance in society.

CO3. study ICT-related skills.

CO4. communicate with the public effectively through a number of media by being objective and critical-thinking.

CO5. become a dynamic professional with a commitment to carrying out one's duties while adhering to the highest standards of integrity and competence.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | 2 | | | |
| CO2 | | | | | | 2 | | | | | | |
| CO3 | | | | | 3 | | | | | | | |
| CO4 | | | 1 | | | | | | | | | |
| CO5 | | | | | | | 2 | | | | | |

## Practical

Practice in interviewing. Covering agricultural events. Abstracting stories from research and scientific materials and from wire services. Writing different types of agricultural stories. Selecting pictures and artwork for the agricultural story. Practice in editing, copy reading, headline and title writing, proof-reading, layouting. Testing copy with a readability formula. Visit to a publishing office.

# Food Safety And Standards

**Subject Code: BAGRD1-673** | **L T P C** 2 0 0 2 | **Duration: 30 (Hrs.)**

**Course Objectives: The specific objectives of this course are to:**

1. know about the food safety and its various standards.
2. ensure that food is safe and is handled safely, as well as to ensure the health-related quality of food and that its quality in other respects accords with the food regulations
3. protect the consumer from health hazards and financial losses caused by foods that violates the food regulations

**Course Outcomes: Students will be able to:**

CO1. understand the food safety, hazards and risks, types of hazards - biological, chemical, physical hazards.
CO2. gain knowledge about food storage, hygiene and sanitation.
CO3. understand food laws and standards Indian food regulatory regimes.
CO4. explain importance of nutrients in food and the specific functions in maintaining health.
CO5. discuss the important pathogen and spoilage microorganism in foods.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | | 1 |
| CO2 | | | | | | | | | | 1 | | |
| CO3 | | | | | | | 2 | | | | | |
| CO4 | | | | 1 | | | | | | | | |
| CO5 | | | | | | | | | | | | 2 |

**UNIT-I (8 Hours)**

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design.

**UNIT-II (8 Hours)**

Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures. Food Safety Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series.

**UNIT-III (7 Hours)**

TQM- concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards- Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens.

**UNIT-IV (7 Hours)**

Packaging, Product labelling and Nutritional labelling. Genetically modified foods\ transgenic. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

**Recommended Text Books/ Reference Books:**

1) Food Microbiology. W.C. Frazier and D.C. Westhoff, 4th Edn. Tata McGraw-Hill Publishing Company Limited, New Delhi.

2) Food Safety Handbook. Ronald H. Schmidt and Gary E. Rodrick. 2003. John Wiley & Sons, Inc., Hoboken. New Jersey, USA.

3) Food Safety and Food Quality. R.E. Hester and R.M. Harrison. 2001. Royal Society of Chemistry, Cambridge, UK.

4) The Safety of Foods (Sicherheit von Lebensmitteln). GrahamGraham, H. D. (Edit.) 2.

5) Auflage. AVI Publishing Co., Inc., Westport, Connecticut (USA)

6) Food Chemistry (New Edition).Owin R. Fenema

7) Handbook of Food Toxicology. S.S. Deshpande, CRC Press. 2002.

8) Food Hygiene and Sanitation. S. Roday,Tata McGraw-Hill Education

9) Food Microbiology. M.R. Adams and M.O. Moss

10) Food Quality Assurance: Principles and Practices. Inteaz Alli. 2004. CRC Press, Boca Raton, FL, USA.

11) Food Plant Sanitation: Design, Maintenance, and Good Manufacturing Practices.Michael M. Cramer. 2013. CRC Press, Boca Raton, FL, USA.

12) Regulatory status of Direct Food Additives. Furia TE.1980. CRC Press.

16) Sensory Evaluation of Food - Theory and Practice. Jellinek G. 1985. Ellis Horwoood.

18) Quality Control in Food Industry. Krammer A & Twigg BA.1973.Vol.I, II. AVI Publ.

## Food Safety And Standards Lab

| **Subject Code: BAGRD1-677** | **L T P C** | **Duration: 30 (Hrs.)** |
|---|---|---|
| | 0 0 2 1 | |

**Course Objectives: The specific objectives of this course are to:**

1. know about food safety and its varied standards.

2. Ensure the health-related quality of food, that it is handled properly, and that its quality in all other regards complies with food rules.

3. safeguard consumers from health risks and financial losses brought on by eating food that doesn't comply with food regulations

**Course Outcomes: Students will be able to:**

CO1. analyse the different physio-chemical properties of water.

CO2. learn about cleanliness, hygiene, and food storage.

CO3. knowledge of food laws and regulations Indian laws governing food.

CO4. emphasise the significance of nutrients in food and their specialised roles in supporting health.

CO5. learn about the pathogens and bacteria that cause food to deteriorate.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 3 | | | | | | |
| CO2 | 1 | | | | | | | | | | | |
| CO3 | | | | | | | | | 1 | | | |
| CO4 | | | | 3 | | | | | | | | |
| CO5 | | | | | 2 | | | | | | | |

## Practical

Water quality analysis physio-chemical and microbiological. Preparation of different types of media. Microbiological Examination of different food samples. Assessment of surface sanitation by swab/rinse method. Assessment of personal hygiene. Biochemical tests for identification of bacteria. Scheme for the detection of food borne pathogens. Preparation of plans for Implementation of FSMS - HACCP, ISO: 22000.

## Agri-business Management

| Subject Code: BAGRD1-674 | L T P C<br>2 0 0 2 | Duration: 30 (Hrs.) |
|---|---|---|

**Course Objectives: The specific objectives of this course are to:**

1. know about the concepts of agribusiness and agro-based industries.
2. understand primary and supportive activities and different management functions.
3. comprehend financial statements and marketing Management.

**Course Outcomes: Students will be able to**

CO1. know the concept of agribusiness and agro-based industries.

CO2. understand primary and supportive activities and different management functions.
CO3. analyse Financial statements and Marketing Management.
CO4. evaluate Product Life Cycle (PLC) and project cycle.
CO5. analyse Product Life Cycle (PLC) and project cycle.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | |
| CO2 | | 1 | | | | | | | | | | |
| CO3 | | | | 3 | | | | | | | | |
| CO4 | | | 2 | | | | | | | | | |
| CO5 | | | | | | 1 | | | | | | |

**UNIT-I (8 Hours)**

Nature and scope of agribusiness. Evolution and changing dimensions of agribusiness in India with special reference to Punjab. Characteristics of production, consumption and marketing of agricultural surplus. Processing of agricultural output.

**UNIT-II (8 Hours)**

Entrepreneurship in agribusiness. Types and patterns of organization in agribusiness. Principles of management and application in agribusiness enterprises. Locational factors and various other problems faced by agro industrial and other enterprises related with agribusiness. Business environment: PEST & SWOT analysis. Management functions: Roles & activities, Organization culture.

**UNIT-III (7 Hours)**

Planning, meaning, definition, types of plans. Purpose or mission, goals or objectives, Strategies, polices procedures, rules, programs and budget. Components of a business plan, Steps in planning and implementation. Organization staffing, directing and motivation. Ordering, leading, supervision, communications, control. Capital Management and Financial management of Agribusiness. Financial statements and their importance.

**UNIT-IV (7 Hours)**

Marketing Management: Segmentation, targeting & positioning. Marketing mix and marketing strategies. Consumer behaviour analysis, Product Life Cycle (PLC). Sales & Distribution Management. Pricing policy, various pricing methods. Project Management; project cycle, identification, formulation, appraisal, implementation, monitoring and evaluation. Project Appraisal and evaluation techniques.

**Recommended Text Books/ Reference Books:**

1) Agribusiness Management by Dr. Shivaji Nagpure & Dr. R.G. Deshmukh, M/s. AGROMET Publishers, Nagpur.

2) Indian Agriculture & Agri-Business Management by Dr. Smita Diwase, M/s. Scientific Publishers, Jodhpur, Rajasthan.

3) Agricultural Finance & Management by S. Subha Reddy, & P. Raghu Ram, M/s. Oxford IBH Publishing Co. Pvt. Ltd., New Delhi.

4) Agri Business Management by Dr. J.S. Amarnath & Dr. A.P.V. Samvel, M/s. Satish Serial Publishing House, Delhi-110033.

5) The Agribusiness Book by Mukesh Pandey, Deepali Tewari, M/s. ibdc Publishers, Lukhnow (U.P.), Pin-226 001.

6) Economics analysis of Agricultural Projects by J. Price Gittinger, M/s. The Economics Development Institute/World Bank, Washington D.C.-20433, U.S.A.

## Agri-business Management Lab

**Subject Code: BAGRD1-678** **L T P C** **Duration: 30 (Hrs.)**

0 0 2 1

**Course Objectives: The specific objectives of this course are to:**

1. learn the concepts of agribusiness and agro-based industries.
2. study the functions and benefits of different financing institutions.
3. study the trends in prices of agricultural commodities.

**Course Outcomes: Students will be able to:**

CO1. know the concept of agribusiness and agro-based industries.
CO2. understand primary and supportive activities and different management functions.
CO3. analyse Financial statements and Marketing Management.
CO4. understand the scenario of market.
CO5. analyse Product Life Cycle (PLC) and project cycle.

**Mapping**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | | | | | | |
| CO2 | | 1 | | | | | | | | | | |
| CO3 | | | | | | | | 3 | | | | |
| CO4 | | | 2 | | | | | | | | | |
| CO5 | | | | 1 | | | | | | | | |

### Practical

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Viable of a project: IRR, NPW and payback criteria.