1st Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-101	Inorganic Chemistry	3	0	0	40	60	100	3
BBSC1-102	Organic Chemistry	3	0	0	40	60	100	3
BBSC1-103	Mathematical Physics	3	0	0	40	60	100	3
BBSC1-104	Mechanics-I	3	0	0	40	60	100	3
BBSC1-105	English	3	0	0	40	60	100	3
BBSC1-106	Solid Geometry	3	0	0	40	60	100	3
BBSC1-107	Differential Calculus	3	0	0	40	60	100	3
BBSC1-108	Punjabi/OR Punjab History & Culture	3	0	0	40	60	100	3
BBSC1-109	Chemistry Lab-I	0	0	4	60	40	100	2
BBSC1-110	Physics Lab-I	0	0	4	60	40	100	2
Total		**24**	**0**	**08**	**440**	**560**	**1000**	**28**

2nd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-201	Physical Chemistry-I	3	0	0	40	60	100	3
BBSC1-202	Inorganic Chemistry-II	3	0	0	40	60	100	3
BBSC1-203	Organic Chemistry-II	3	0	0	40	60	100	3
BBSC1-204	Special Theory of relativity	3	0	0	40	60	100	3
BBSC1-205	Electricity and Magnetism	3	0	0	40	60	100	3
BBSC1-206	Coordinate Geometry	3	0	0	40	60	100	3
BBSC1-207	Calculus-II	3	0	0	40	60	100	3
BBSC1-208	Environment Education	3	0	0	40	60	100	0
BBSC1-209	Chemistry Lab-II	0	0	4	60	40	100	2
BBSC1-210	Physics Lab-II	0	0	4	60	40	100	2
	Total	**24**	**0**	**08**	**440**	**560**	**1000**	**25**

3rd Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-301	Physical Chemistry-II	3	0	0	40	60	100	3
BBSC1-302	Organic Chemistry-III	3	0	0	40	60	100	3
BBSC1-303	Vibration and Waves	3	0	0	40	60	100	3
BBSC1-304	Mechanic-II	3	0	0	40	60	100	3
BBSC1-305	Algebra-I	3	0	0	40	60	100	3
BBSC1-306	Analysis-I	3	0	0	40	60	100	3
BBSC1-307	Drug Abuse	3	0	0	40	60	100	0
BBSC1-308	Chemistry Lab-III	0	0	2	60	40	100	1
BBSC1-309	Physics Lab-III	0	0	2	60	40	100	1
	Total	**21**	**0**	**04**	**400**	**500**	**900**	**20**

4th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-401	Physical Chemistry-III	3	0	0	40	60	100	3
BBSC1-402	Inorganic Chemistry-III	3	0	0	40	60	100	3
BBSC1-403	Statistical Physics and Thermodynamics	3	0	0	40	60	100	3
BBSC1-404	Quantum Mechanics	3	0	0	40	60	100	3
BBSC1-405	Algebra-II	3	0	0	40	60	100	3
BBSC1-406	Analysis-II	3	0	0	40	60	100	3
BBSC1-407	Chemistry Lab-IV	0	0	2	60	40	100	1
BBSC1-408	Physics Lab-IV	0	0	2	60	40	100	1
BBSC1-409	Computer Programming Lab	0	0	4	60	40	100	2
	Total	**18**	**0**	**08**	**420**	**480**	**900**	**22**

5th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-501	Inorganic Chemistry-IV	3	0	0	40	60	100	3
BBSC1-502	Organic Chemistry-IV	3	0	0	40	60	100	3
BBSC1-503	Condensed Matter Physics	3	0	0	40	60	100	3
BBSC1-504	Laser and Optics	3	0	0	40	60	100	3
BBSC1-505	Differential Equation	3	0	0	40	60	100	3
BBSC1-506	Numerical Methods	3	0	0	40	60	100	3
BBSC1-507	Chemistry Lab-V	0	0	2	60	40	100	1
BBSC1-508	Physics Lab-V	0	0	2	60	40	100	1
	Total	**18**	**0**	**04**	**360**	**440**	**800**	**20**

6th Semester		Contact Hrs.			Marks			Credits
Sub. Code	**Subject**	**L**	**T**	**P**	**Internal**	**External**	**Total**	
BBSC1-601	Physical Chemistry-IV	3	0	0	40	60	100	3
BBSC1-602	Organic Chemistry-V	3	0	0	40	60	100	3
BBSC1-603	Electronics	3	0	0	40	60	100	3
BBSC1-604	Nuclear and Particle Physics	3	0	0	40	60	100	3
BBSC1-605	Number Theory	3	0	0	40	60	100	3
BBSC1-606	Mathematical Statistics	3	0	0	40	60	100	3
BBSC1-607	Chemistry Lab-VI	0	0	2	60	40	100	1
BBSC1-608	Physics Lab-VI	0	0	2	60	40	100	1
	Total	**18**	**0**	**04**	**360**	**440**	**800**	**20**

PHYSICAL CHEMISTRY-I

Subject Code: BBSC1-201 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Partial Molar Properties and Fugacity

Partial molar properties. Chemical potential of a perfect gas, dependence of chemical potential on temperature and pressure, Gibbs- Duhem equation, real gases, fugacity, its importance and determination, standard state for gases. Stability of phases, clapeyron equation. Clausius-clapeyron equation and its application to solid-liquid, liquid-vapour and solid-vapour equilibria.

Thermodynamics of Simple Mixtures

Thermodynamic functions for mixing of perfect gases. Chemical potential of liquids. Raoult's law, Henry's law. Thermodynamic functions for mixing of liquids (ideal solutions only). Mixtures of volatileliquids, vapour pressure diagrams. Lever's rule, distillation diagrams. Real solutions and activities, standard states for solvent and solute.

Unit-II

Physical Transformation of Pure Materials

First and second order phase transitions. Attainment of low temperature and energetics of refrigeration,adiabatic demagnetization.

Phase Equilibria

Phase rule and its thermodynamic derivation. One component systems-water, sulphur, carbon dioxide,helium. Two component systems, construction and interpretation of general phase diagrams for liquidvapour, liquid-liquid and liquid-solid systems. A simple system involving chemical reaction. Eutectics, freezing mixtures, ultra purity, zone refining.

Unit-III

Chemical Equilibrium

Direction of spontaneous change in a chemical reaction, extent of reaction, stoichiometric coefficients,equilibrium constant in terms of G. Temperature and pressure dependence of equilibrium constant, homogeneous & heterogeneous equilibria.

Thermodynamics of Electrolytic Solutions

Activities of ions in solutions, a model of ions in a solution, qualitative idea of Debye-Huckel theory,ionic strength, mean ionic activity coefficient and the Debye-Huckel limiting law for activity coefficients.

Unit-IV

Colligative Properties

Solutions of non-volatile solutes: colligative properties, elevation in boiling point, depression in freezingpoint, osmosis and osmotic pressure

Electrochemical Cells

Interfacial potential difference, the electrodes, potential at interfaces, electrode potentials, galvanic cells,emf, direction of spontaneous reactions. Concentration dependence of emf, equilibrium Constant fromelectrode potential, standard electrode potentials and their determination. Measuring activity co-efficient,thermodynamic data from cell emf. The temperature dependence of emf. Applications of emf.

Measurements–solubility product, potentiometric titrations, pK and pH measurements of pK and pH.Acid-base titrations. Concentration cells with & without transference.

Recommended Books

1. Physical Chemistry by P.W. Atkins, 8th Ed., Oxford University Press, 2006 (Indian Print).
2. Physical Chemistry by T. Engel & P. Reid, 1st ed., Pearson Education, 2006.
3. Physical Chemistry by Castellan, 3rd Ed., Addison Wisley/Narosa, 1985 (Indian Print)
4. Physical Chemistry by G. M. Barrow, 6th Ed., New York, McGraw Hill, 1996.
5. Physical Chemistry by R. J. Silbey, R. A. Albert &Moungi G. Bawendi, 4th Ed., New York: John Wiley, 2005.

INORGANIC CHEMISTRY-II

Subject Code: BBSC1-202 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Chemical Bonding-II
Ionic bond
Factors affecting the stability of ionic compounds. Lattice energy, Born Lande equation and its applications, Madelung constant, Born-Haber cycle, applications of lattice energy, covalent character in ionic compounds, polarizing power and polarizability, Fazan's rules, Ionic radii, Factors affecting the radii of ions, Radii of polyatomic ions, Efficiency of packing and crystal lattices, Radius ratio rule, calculation of some limiting radius ratio values for different coordination members, Structure of crystal lattices, NaCl,CaCl, ZnS(Zinc blende and Wurzite), fluorite, rutile and cadmium iodide. Predictive powerof thermochemical calculations on ionic compounds.

Unit-II

Perfect and imperfect crystal
Intrinsic and extrinsic defects, point defects, line and plane defects, vacancies-Schottky and Frenkeldefects. Thermodynamics of Schottky and Frenkel defect formation, colourcentres, non-stoichiometryand defects. Metals insulators and semiconductors, Band theory, Band structure of metals, Insulators andsemiconductors, intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, Hightemperature super conductors.
Intermolecular forces and metallic bond
Van der Waals forces (Keesom, Debye & London Interactions). Structure of metals, valence bond andbond model.

Unit-III

The *p*-block elements
Group III
(i) Boron, Al, Ga, In, Ti family: Chemical reactivity and trends.
Boron : Structures of crystalline boron, electronic and/or crystal structures of borides, boranes and carboranes, metallo-carboranes and their chemistry. Boron halides. Boric acid, borates, boron-nitrogen compounds, LiAlH4 – its uses as a reducing and hydrogenating reagent, structure of alumina

and aluminates. Chemistry of manufacture and setting of Portland cement, organometallic compounds of Al.

Unit-IV

Group IV

(ii) Carbon, Si, Ge, Sn, Pbfamily : Chemical reactivity and group trends
Carbon : Allotropic forms, graphitic compounds, graphite intercalation compounds, carbides.
Silicon : Silicon carbides, silicides, silanes and silylamines structures of silicate mineral, organosilicon compounds and silicones. Tin and lead oxides, halides, Pb accumulators, organometallic compounds of Sn and Pb.

Recommended Books

1. Cotton F.A., Wilkinson G.W. and Gaus P.L., Basic Inorganic Chemistry, Pubs: John Wiley & Sons ,1987.
2. Lee J.D., Concise Inorganic Chemistry, 4th edition, Pubs: ELBS,1991.
3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.
4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition, Pubs: Butterworth/Heinemann, 1997.
5. Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6th Edition, Pubs: John Wiley & Sons. Inc., 1999.
6. Shriver D.F., Atkins F.W. and Langford C.M., Inorganic Chemistry; 3rd Edition, Pubs: Oxford University Press, 1999.
7. Douglas B., Daniel D. Mc and Alexander J., Concepts of Models of Inorganic Chemistry, Pubs: John Wiley,1987.
8. Gray H.B., Electrons and Chemical Bonding, Pubs: W.A., J Benjamin Inc.,1965.

ORGANIC CHEMISTRY-II

Subject Code: BBSC1-203 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Arenes and Aromaticity

Nomenclature of benzene derivatives. The aryl group. Aromatic nucleus and side chain. Structure ofbenzene : molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene,resonance structure, MO picture. Aromatic electrophilic substitution – general pattern of the mechanism, role of σ-and π complexes. Mechanism of 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. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes and biphenyl.

Unit-II

Alkyl and Aryl Halides

Nomenclature and classes of alkyl halides, methods of formation, chemical reactions. Mechanisms ofnucleophilic substitution reactions of alkyl halides, SN2 and SN1 reactions with energy profile diagrams.Polyhalogencompounds : chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions. Relative relativities of alkyl halides vs. allyl, vinyl and aryl halides. Synthesis and uses of DDT and BHC.

Unit-III

Alcohols

Classification and nomenclature. Monohydric alcohols – nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols. Dihydric alcohols – nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)4 and HIO4 and pinacol-pinacolone rearrangement. Trihydric alcohols – nomenclature and methods of formation, chemical reactions of glycerol.

Unit-IV

Phenols

Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Mechanisms ofFries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Ledrer-Manasse reaction and Reimer-Tiemann reaction.

Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions – 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.

Recommended Books:

1. Morrison R.T. and Boyd P.S., Organic Chemistry, 5th Edn., Pubs: Allyn and Bacon Inc., Boston (1992).
2. Mukerji S. M., Singh S. P. and Kapoor R. P., Organic Chemistry Vol. I/II, Pubs: Wiley Eastern Ltd., New Delhi, 1985.
3. Wade L.G.Jr., Organic Chemistry, Pubs:Prentice-Hall,1990.
4. Solomons G, Fundamentals of Organic Chemistry, Pubs: John Wiley,2002.
5. Carey F.A., Organic Chemistry, Pubs: McGraw-Hill, Inc, 2003.
6. Streitwisser A., Jr. and Heathcock C.H., Introduction to Organic Chemistry, 3rd Edn., Pubs: MacMillan Pub. Co., N.Y,1992.

SPECIAL THEORY OF RELATIVITY

Subject Code: BBSC1-204 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Newton's Laws of Motion

Forces and equations of motion, Lorentz force, Motion of a charged particle in a uniform constant electric field, Charged particle in a uniform alternating electric field. Charged particle in a uniform magnetic field.

Galilean Transformation

Inertial reference frames, absolute and relative accelerations and velocity, Galilean Transformation, Foucault's pendulum, Conservation of Momentum, Fictitious Forces, Collisions, Velocity and Acceleration in Rotating coordinate systems.

Unit-II

Lorentz Transformations

Michelson-Morley Experiment, Basic postulates of special relativity, Lorentz transformations, Simultaneity and causality in relativity. Length contraction, Time dilation, Velocity Transformation, Space-like and time-like intervals, Aberration of light, relativistic Doppler effect.

Unit-III

Relativistic Dynamics

Conservation of Momentum, Relativistic momentum, Relativistic Energy, Transformation of Momentum and Energy, Equivalence of Mass and Energy. Particles with zero Rest mass. Transformation of force, Four vectors.

Unit-IV

Problems in Relativistic Dynamics

Acceleration of Charged Particle by constant, longitudinal electric field, Acceleration by a Transverse Electric field, charged particle in a magnetic field, centre of mass system and Threshold Energy. Energy available from Moving charge, Antiproton Threshold, Photoproduction of mesons.

Principle of Equivalence

Inertial and Gravitational Mass, Gravitational Mass of photons, Gravitational Red-Shift, Equivalence.

Recommended Books

1. Mechanics (Berkeley) Physics Course I : Charles Kittle, Walter D. Knight, M. Alvin and A. Ruderman (Tata McGraw Hill), 1981.
2. Mechanics : H.S. Hans and S.P. Puri (Tata McGraw Hill), 2003.
3. Introduction to Classical Mechanics : R.G. Takwale&P.S.Puranik (Tata-McGraw-Hill), 2000.

ELECTRICITY AND MAGNETISM

Subject Code: BBSC1-205 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Electric Fields in Matter

Dielectrics, Moments of a charge distribution, Potential and field of a dipole, Atomic and molecular dipoles, Induced dipole moments, Permanent dipole moments, electric field caused by polarized matter, field of a polarized sphere, dielectric sphere in a uniform field, Gauss's law and a dielectric medium, Electrical susceptibility and atomic polarizability, Energy changes in polarization, Polarization in changing fields.

Unit-II

The Fields of Moving Charges

Magnetic forces, Measurement of a charge in motion, invariance of charge, Electric field measured in different frames of reference, Field of a point charge moving with constant velocity, Field of a charge that starts or stops, Force on a moving charge, Interaction between a moving charge and other moving charges.

Magnetic Field

Definition, some properties of the magnetic field, Vector potential, Fieldof current carrying wire and solenoid, change in **B** at a current sheet; Transformations ofelectric and magnetic fields. Rowland's experiment, Hall effect.

Unit-III

Electromagnetic Induction

Universal law of induction, Mutual inductance, Reciprocity theorem, Self inductance, Energy stored in a Magnetic field. A circuit containing self inductance, Displacement current and Maxwell's equations.

Alternating Current Circuits

A resonance circuit, Alternating current, A.C. networks, Admittance and impedance, skin effect, power and energy in A.C. circuits, Anderson's Bridge, Q factor for series resonance.

Unit-IV

Magnetic Fields in Matter

Response of various substances to magnetic field, Force on a dipole in an external field, Electric currents in Atoms, Electron spin and Magnetic moment, types of magnetic materials, Magnetic susceptibility.

Tutorials

Relevant problems given at the end of each chapter in books 1, 2 and 3.

Recommended Books

1. Mathematical Methods in the Physical Sciences :M.L.Boas (Wiley), 2002
2. Introduction to Mathematical Physics : C. Harper (Prentice Hall of India), 2004.
3. Electricity and Magnetism (Berkley, Phys. Course 2): E.M. Purcell (Tata McGraw Hill), 1981.
4. Elements of Electromagnetics : M.N.O. Sadiku (Oxford University Press), 2001.
5. Electricity and Magnetism : A.S. Mahajan & A.A. Rangwala (Tata- McGraw Hill), 1988.
6 Electricity and Magnetism : A.N. Matveev (Mir) (1986).

Coordinate Geometry

Subject Code: BBSC1-206 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Pair of Straight lines
Joint equation of pair of straight lines and angle between them, condition of parallelism and perpendicularity, joint equation of the angle bisectors, joint equation of lines joining origin to the intersection of a line and a curve.

Circle
General equation of circle, circle through intersection of two lines, Tangents and Normals, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality, power of a point w.r.t circle, radical axis, co-axial family of circles ,limiting points.

Conic
General equation of conic, Tangents, normals, chord of contact, pole and polar, of tangents from a point, equation of chord in terms of midpoint, diameter. Conjugate diameters of ellipse and hyperbola, special properties of parabola, ellipse and hyperbola, conjugate hyperbola, asymptotes of hyperbola, rectangular hyperbola.

Transformation of axes in two dimensions
Shifting of origin, rotation of axes, the second degree equation S=ax2+2hxy+by2+2gx+2fy+c=0, its and O. Reduction of the second degree equation into standard□□invariantsform. Identification of curves represented by S=0 (including pair of lines)

Polar coordinates
Polar equations of straight lines ,circles and conics. Polar equation of chords, tangents normals only.

Calculus-II

Subject Code: BBSC1-207 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Vector Analysis
Vectors in the plane Cartesian Co-ordinates and vectors in spaces. Dot and cross products. Lines and planes in space, Cylinders and Quadric surfaces. Cylindrical and Spherical coordinates
Vector valued functions and space curves. Modelling Projectile Motion. Arc length and Unit Tangent vector curvature, Torsion and the TNB Frame. Line and Surface integrals. (Scope as in chapters 10, 11 and 14 of Calculus and Analytic Geometry by Thomas and Finney, Ninth Edition)

Multivariable Functions
Functions of several variables. Limits and continuity. Partial derivatives. Differentiability. The
chain rule, Directional derivatives, Gradient vectors and tangent planes. Extreme values and saddle points. Lagrange multipliers Double integrals. Double integrals in Polar Form. Triple integrals in Rectangular co-ordinates. Triple integrals in Cylindrical and Spherical coordinates. (Scope as in Chapters 12 and 13 of Calculus and Analytic Geometry by Thomas and Finney,
Ninth Edition).

Recommended Books

1. Thomas and Finney: Calculus and Analytic Geometry, Ninth Edition.
2. Liefhold, Louis: Calculus and Analytic Geometry.
3. LipmenBers: Calculus.

ENVIRONMENT EDUCATION

Subject Code: BBSC1-208 **L T P C** **Duration: 45 Hrs.**
3 0 0 0

1. Environment Concept
Introduction, concept of biosphere – lithosphere, hydrosphere, atmosphere; Natural resources - their need and types: Principles and scope of Ecology; concepts of ecosystem, populat ion, community, biotic interact ions, biomes, ecological, succession.

2. Atmosphere
Parts of atmosphere, components of air: pollution, pollutants, their sources, permissible limits, risks and possible control measures.

3. Hydrosphere
Types of aquatic systems; Major sources (including ground water) and uses of water, problems of the hydrosphere, fresh water shortage; pollution and pollutants of water. permissible limits, risks and possible control measures.

4. Lithosphere
Earth crust, soil - a life support system, its texture, types, components. pollution and pollutants, reasons of soil erosion and possible control measures.

5. Forests
Concept of forests and plantations, types of vegetation and forests, factors governing vegetation, role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban Forests, ChipkoAndolan.

6. Conservation of Environment
The concepts of conservat ion and sustainable development, why to conserve, aims and object ives of conservat ion, policies of conservation; conservation of life support systems - soil, water, air, wildlife, forests.

7. Management of Solid Waste
Merits and demerits of different ways of solid waste management - open dumping, landfill, incineration, resource reduction, recycling and reuse. vermicomposting and vermiculture, organic farming.

8. Indoor Environment
Pollutants and contaminants of the in-house environment; problems of the environment linked to urban and rural lifestyles: possible adulterants of the food: uses and harms of plastics and polythene: hazardous chemicals, solvents and cosmetics.

9. Global Environmental issues
Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity: Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment

Indian Laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General information about laws relating to control of air, water and noise pollution. What to do to seek redressal.

11. Biodiversity

What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. Noise and Microbial Pollution

Pollution due to noise and microbes and their effects.

13. Human Population and Environment

Population growth and family welfare, Human Health, HIV AIDS, Human Rights.

14. Social Issues

Environmental Ethics : Issues and possible solutions, problems related to lifestyle, sustainable development; Consumerisms and waste generation.

15. Local Environmental Issues:

Environmental problems in rural and urban areas. Problem of Congress Grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

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.

CHEMISTRY Lab-II

Subject Code: BBSC1-209 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

1. Qualitative Analysis

Qualitative analysis of inorganic mixtures containing not more than six radicals including interfering radicals like phosphate, oxalate, tartrate and similar radicals.

2. Quantitative Analysis

Volumetric Methods

(a) Acid-base titrations

Preparation of standard hydrochloric acid and sodium hydroxide solution. Preparation of some buffers and measuring their pH value, pH titration of unknown soda ash.

(b) Oxidation Reduction titrations

(i) Potassium permanganate and potassium dichromate titrations
(ii) Iodimetric and iodometric titrations
(iii) Potassium Iodate titrations.

(d) Precipitation titrations- Titrations involving silver nitrate.

Recommended Books

1. Svehla G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
2. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman, 1978.
3. Palmer, W.G., Experimental Inorganic Chemistry; 1st edition, Pubs: Cambridge, 1954.

Physics Lab-II

Subject Code: BBSC1-210 **L T P C** **0 0 4 2** **Duration: 60 Hrs.**

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 (Determine dB/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, KitabMahal, 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.

PHYSICAL CHEMISTRY-II

Subject Code: BBSC1-301 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Thermodynamics-I

Definition of thermodynamics terms: system, surroundings. Types of systems, intensive and extensive properties. State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementary idea of thermo chemistry.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.

Unit-II

Thermodynamics-II

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 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 criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

Unit-III

Thermodynamics-III

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 Helmhotz 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-IV

Chemical Equilibrium

Equilibrium constant and free energy, Thermodynamic derivation of law of mass action. Le Chatelier's principle. Reaction isotherm and reaction isochore-Clapeyron equation and Clausius-Claperyron equation.

Recommended Books

1. Physical Chemistry. G.M. Barrow, International Student Edition. McGraw Hill.
2. University General Chemistry. C.N.R. Rao. Macmillan.
3. Physical Chemistry. R.A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry, P.W. Aikins, Oxford.

ORGANIC CHEMISTRY-III

Subject Code: BBSC1-302 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Alcohols

Classification and nomenclature. Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters. Hydrogen bonding, Acidic nature,

Reactions of alcohols. Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols-nomenclature, methods of formation chemical reaction of vicinal glycols, oxidative cleavage with [$Pb(OAc)_4$and HIO_4] and Pinacol-Pinacolone rearrangement. Trihydric alcohol-nomenclature, methods of formation and chemical reactions of glycerol.

Unit-II

Phenols

Nomenclature, structure and bonding. Preparation of Phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonanace stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic subsititution, acylation and carboxylation Mechanisms of Fries rearrangement. Gatterman synthesis, Hauben. Hostch reaction. Lederer-Mianasse reaction and Reimer-Tiemann reaction.

Unit-III

Aldehydes and Ketones

Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyes and ketones using 1,3-dithianes, synthesis of ketones from nitrites and carboxylic acids.

Unit-IV

Some important reactions of aldehydes and ketones

Mechanism of nucleophillic addition to carbonyl group with particular emphasis of Benzoin, Aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction. Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV (MeerweinPondoroffVorley) reaction, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones. An Introduction to α, β unsaturated aldehydes and ketones, Michael addition.

Recommended Books

1. Organic Chemistry. Morrison and Boyd, Prentice Hall.
2. Organic Chemistry. L.G. Wade lr.Prentice Hall.
3. Fundamentals of Organic Chemistry. Solomons, John Wiley.
4. Organic Chemistry. Vol. I, II & III. S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).

VIBRATIONS AND WAVES

Subject Code: BBSC1-303 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Simple harmonic motion, energy of a Simple Harmonic Oscillation (SHO). Compound pendulum, Electrical oscillations. Transverse vibrations of a mass on a string, composition of two perpendicular SHM of same period and of period ratio 1 : 2. Anharmonic oscillations. Decay of free vibrations due to damping. Differential equation of motion, types of damping. Determination of damping co-efficient-logarithmic decrement, relaxation time and Q-Factor. Electromagnetic damping (Electrical oscillator).

Unit-II

Differential equation for forced mechanical and electrical oscillators. Transient and steady state oscillation. Displacement and velocity variation with driving force frequency, variation of phase with frequency resonance, Power supplied to an oscillator and its variation with frequency, Q value of a forced oscillator and band width. Q-value as an amplication factor of low frequency response.

Unit-III

Stiffness coupled oscillators. Normal co-ordinates and normal modes of vibration. Inductance coupling of electrical oscillators, Types of waves, Wave equation (transverse) and its solution, The string as a forced oscillator, Characteristic impedance of a string. Impedance matching. Reflection and transmission of energy, Reflection and Transmission Energy, Reflection and transmission of string, wave and group velocity. Standing waves on a string of fixed length. Energy of vibrating energystring,wave and group velocity.

Unit-IV

Physical interpretation of Maxwell's equations. Electromagnetic waves and wave equation in a medium having finite permeability and permittvity but with conductivity $\sigma=0$. Pointing vector. Impedance of a dielectric to EM waves, EM waves in a conducting medium and skin depth. EM waves velocity in a conductor an anomalous dispersion. Response of a conducting medium of EM waves. Reflection and transmission of EM waves at a boundary of two dielectric media for normal incidence. Reflection of EM waves from the surface of a conductor at normal incidence.

Recommended Books

1. Fundamentals of Vibrations and Waves by S.P.Puri, Tata McGraw Hill, New Delhi.
2. Physics of Vibrations and Waves by H.J.Pain, Wiley & Sons, New Delhi
3. Waves and Oscillations, by E.Crawford, Berkeley Physics Course, McGraw-Hill Publications, New Delhi.
4. EM Waves and Radiating Systems by Edward C.Jordan and K.G.Balmain, Prentice Hall of India, New Delhi.

MECHANIC-II

Subject Code: BBSC1-304 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Cartesian and spherical polar co-ordinate systems, area, volume, displacement, velocity and acceleration in these systems, Solid angle, Various forces in Nature(brief introduction), Centre of mass, Equivalent one body problem, Central forces, Equation of motion under central force,Equation of orbit in inverse square, Force field and turning points, Kepler laws and their derivations.

Unit-II

Relationship of conservation laws and symmetries of space and time. Inertial frame of reference. Coriolis force and its applications. Variation of acceleration due to gravity with latitude. Focault pendulum (qualitative). Elastic collision in Laboratory and C.M.system, velocities, angels and energies, Cross section of elastic scattering, Rutherford scattering (qualitative).

Unit-III

Rigid body motion: Rotational motion, principal moments and axes. Euler's equations; precession and elementary gyroscope. Galilean transformation and Invariance, Non-Inertial frames, concept of stationary universal frame of reference and ether. Michelson-Morley experiment and its result.

Unit-IV

Postulates of special theory of relativity. Lorentz transformations, Observer and viewer in relativity. Relativity of simultaneity. Length, Time, Velocities,Relativistic Doppler effect. Variation of mass with velocity, mass-energy equivalence, rest mass in an inelatic collision, Relativistic momentum and energy, their transformation, concepts of Minkowski space, four vector formulation.

Recommended Books

1. Mechanics: Berkeley Physics Course, vol. I by C.Kittel, W.D.Knight and M.A.Ruderman, Mc Graw-Hill Publication.
2. Mechanics : H.S.Hans and S.P.Puri, Tata Mc Graw Hill Publication, New Delhi

ALGEBRA-I

Subject Code: BBSC1-305 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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

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

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

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**.

ANALYSIS-I

Subject Code: BBSC1-306 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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

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

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

Sequences and series of functions, Pointwise and uniform convergence. Mn-test, Mtest, 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.

DRUG ABUSE

Subject Code: BBSC1-307 **L T P C** **Duration: 45 Hrs.**
3 0 0 0

Unit-I

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

Unit-II

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

Unit-III

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

Treatment and Control of Drug Abuse: Medical Management: Medication for treatment and to reduce withdrawal effects. Psychological Management: Counseling, Behavioral 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. IshwarModi and ShaliniModi, '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.

CHEMISTRY LAB-III

Subject Code: BBSC1-308 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

Volumetric Analysis and TLC
Volumetric Analysis

(a) Determination of acetic acid in commercial vinegar using NaOH, Alkalinity of water sample.
(b) Determination of alkaline content of antacid.
(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry .
(d) Estimation of hardness of water by EDT A.
(e) Estimation of ferrous and ferric by dichromate method.
(f) Estimation of copper using sodium thiosulphate.

Organic Chemistry
Laboratory Techniques

Thin Layer Chromatography
Determination of R_f values of different components.
(a) Separation of green leaf pigments (spinach leaves may be used)
(b)Preparation and separation of 2, 4-dinitrophenylhydrazones of acetone, benzophenoneand cyclohexanone using toluene and light petroleum mixture (40 : 60).
(c) Separation of a mixture of dyes.

Recommended Books

1. Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orienl P Longman.
2. Vogel's Text book of Quantitative Inorganic Analysis (revised), J.Bassett, R. C. Denney, G.H. Jeffery and J. Mendham, ELBS.
3. Standard Methods of Chemical Analysis, W. W. Scott, The Technical Press.
4. Experimental Inorganic Chemistry, W. G. Palmer, Cambridge.
5. Handbook of Preparative Inorganic Chemistry, Vol. I & II, Brauer, Academic Press.
6. Inorganic Synthesis, Mc-Graw Hill.
7. Experimental Organic Chemistry, Vol. I & II, P. R. Singh, D.S. Gupta, andBajpai, Tata Mc-Graw

Hill.
8. Laboratory Manual In Organic Chemistry, R. K. Bansal, Wiley Eastern.
Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V. frogers, P.W.G. Smith and AR. Tatchell, ELBS

PHYSICS LAB-III

Subject Code: BBSC1-309 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

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 λ^2 – T Law.
3. To study Lissajous Figures.
4. Determination of modulus of rigidity by (i) dynamic method Maxwell's needle/Torsional pendulum; (ii) Forced torsional oscillations excited using electromagnet.
5. Determination of coefficient of viscosity of a given liquid by Stoke's method. Study its temperature dependence.
6. To determine the Young's modulus by (i) bending of beam using traveling microscope/laser, (ii) Flexural vibrations of a bar.
7. To study one dimensional collision using two hanging spheres of different materials.
8. Dependence of scattering angle on kinetic energy and impact parameter in Rutherford scattering (mechanical analogue).
9. To measure the coefficient of linear expansion for different metals and alloys.
10. Determination of E.C.E. of hydrogen and evaluation of Faraday and Avogadro constants.
11. To study the magnetic field produced by a current carrying solenoid using a pick-up coil/Hall sensor and to find the value of permeability of air.
12. To determine the frequency of A.C. mains using sonometer.
13. To study given source of electrical energy and verify the maximum power theorem.

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, KitabMahal, New Delhi.

PHYSICAL CHEMISTRY-III

Subject Code: BBSC1-401 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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 and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic Pb-Ag sytems, desilverisation of lead. Solid Solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCI-H_2O), ($FeCI_3H_2O$) systems. Freezing mixtures, acetone-dry ice. Partially miscible liquids: Lower and upper consolute temperature, Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law, thermodynamic derivation & applications.

Unit-II

Electrochemistry-l (a)

Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent 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-Onsagar's equation for strong electrolytes (elemental treatment only).

Unit-III

Electrochemistry-I (b)

Transport number, definition and determination by Hittorf method and moving boundary method. Applications of conductance measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations.

Unit-IV

Electrochemistry-II

Types of reversible electrodes-gas-metal ion, metal-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.Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.EMF of a cell and its measurements, Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage. Concentration cell 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 pK., determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiomentric methods. Buffers--mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of saits, Corrosion-types, theories and methods of combating it.

Recommended Books

1. Physical Chemistry. G.M. Barrow, International Student Edition. McGraw Hill.
2. University General Chemistry. C.N.B. Rao. Macmillan.
3. Physical Chemistry. R.A. Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry, P.W. Aikins, Oxford.
5. Physical Chemistry. G.M. Barrow, International Student Edition. McGraw Hill.

INORGANIC CHEMISTRY-III

Subject Code: BBSC1-402 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit-II

Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stability of water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

Unit-III

Acids and Bases

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

Unit-IV

Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

Recommended Books

1.Basic Inorganic Chemistry. F.A. Cotton. G. Wilkinson and P.L..Gaus. Wiley.
2.Concise Inorganic Chemistry. J.D. Lee. ELBS.
3.Concepts of Models of Inorganic Chemistry. B. Doaglas. D. McDaniel and 1. Alexander,John Wiley.
4.Inorganic Chemistry. D.E. Shriver, P. W. Aikins and C.H. Langford. Oxford.
5. Inorganic Chemistry. A.G. Sharpe, ELBS.
6. Inorganic Chemistry. G.L. Miessler and O.A. Tarr, Prentice Hall.

STATISTICAL PHYSICS AND THERMODYAMICS

Subject Code: BBSC1-403 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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

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

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

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, MeghnadSaha, 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.

QUANTUM MECHANICS

Subject Code: BBSC1-404 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Formalism of Wave Mechanics: Brief introduction to need and development of quantum mechanics, Wave-particle duality, de-Broglie hypothesis, Complimentarity and uncertainty principle, Gaussian wave-packet, Schrodinger equation for a free particle, operator correspondence and equation for a particle subject to forces. Normalization and probability Interpretation of wave function, Super position principle, Expectation value, probability current and conservation of probability, Admissibility conditions on the wave function. Ehrenfest theorem, Fundamental postulates of wave mechanics, Eigen functions and eigen values. Operator formalism, Orthogonal systems, Expansion in eigen functions, Hermitian operators. Simultaneous eigen functions. Equation of motion.

Unit-II

Problems in one and three dimensions: Time dependent Schrodinger equation. Application to stationary states for one dimension, Potential step, Potential barrier, Rectangular potential well, Degeneracy, Orthogonality, Linear harmonic oscillator, Schrodinger equation for spherically symmetric potential, Spherical harmonics. Hydrogen atom energy levels and eigen functions. Degeneracy, Angular momentum.

Unit-III

One Electron Atomic Spectra

Excitation of atom with radiation. Transition probability, Spontaneous transition, Selection rules and life time, Spectrum of hydrogen atom. Frank Hertz Experiment, Line structure, Normal Zeeman effect, Electron spin, Stern Gerlach experiment, Spin orbit coupling (electron magnetic moment, total angular momentum),Hyperfine structure, Examples of one electron systems, Anomalous,Zeeman effect, Lande-g factor (sodium D-lines).

Unit-IV

Many Electron System Spectra

Exchange symmetry of wave functions, exclusion principle, Shells, Sub shells in atoms, atomic spectra (Helium), L.S. coupling, Selection rules, Regularities in atomic spectra, Interaction energy, X-ray spectra, Mosley law, Absorption spectra, Auger effect. Molecular bonding, Molecular spectra, Selection rules, Symmetric structures, Rotational, vibrational electronic level and spectra of molecules, Raman spectra.

Recommended Books

1. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill.
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley.
3. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, Tata McGraw Hill.
4. Quantum Mechanics, G. Aruldhas, 2ndEdn. 2002, PHI Learning of India.

5. Quantum Mechanics, Bruce Cameron Reed, 2008, Jones and Bartlett Learning.
6. Quantum Mechanics for Scientists & Engineers, D.A.B. Miller, 2008, Cambridge University Press.
7. Quantum Mechanics, Eugen Merzbacher, 2004, John Wiley and Sons, Inc.
8. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, Pearson Edu.
9. Quantum Mechanics, Walter Greiner, 4thEdn., 2001, Springer.

ALGEBRA-II

Subject Code: BBSC1-405 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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

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

Inner product, Length, Orthogonality, Orthogonal projections, Cauchy-Schwartz inequality, Gram-Schmidt orthogonalisation process, Inner product spaces.

Unit-IV

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.

ANALYSIS-II

Subject Code: BBSC1-406 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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

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

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

Metric Spaces
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.

CHEMISTRY LAB-IV

Subject Code: BBSC1-407 **L T P C** **Duration: 30 Hrs.**
0 0 21

Qualitative Analysis
Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Physical Chemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.
2. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride.

Recommended Books

1. Experimental Organic Chemistry, Vol. I & II, P. R. Singh, D.S. Gupta, andBajpai, Tata Mc-Graw Hill.
2. Laboratory Manual In Organic Chemistry, R. K. Bansal, Wiley Eastern.
3. Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V.
4. frogers, P.W.G. Smith and AR. Tatchell, ELBS
5. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
6. Experiments in Physical Chemistry, R.C. Das, and B. Behra, Tata Mc-graw Hill.
7. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.

PHYSICS LAB-IV

Subject Code: BBSC1-408 **L T P C** **Duration: 30 Hrs.**
0 02 1

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 a 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, KitabMahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985, Vani Publication.

COMPUTER PROGRAMMING LAB

Subject Code: BBSC1-409 **L T P C** **Duration: 60 Hrs.**
0 0 4 2

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. ShubhnandanJamwal, '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.

INORGANIC CHEMISTRY-IV

Subject Code: BBSC1-501 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Metal-ligand Bonding in Transition Metal Complexes

Limitations of valence bond theory, an elementary idea of crystal- field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Unit-II

Thermodynamic and Kinetic Aspects of Metal Complexes

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit-III

Magnetic Properties of Transition Metal Complexes

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, Correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moment, application of magnetic moment data for 3d-metal complexes.

Unit-IV

Electronic Spectra of Transition Metal Complexes

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for $d^1$and d^9 states, discussion of electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complexion.

Recommended Books

1. Basic Inorganic Chemistry, F.A. Cotton, G Willdson and P.L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J.D. Leee, ELBS.
3. Concept of models of Inorganic Chemistry, B. Douglas, D. McDaniel, and J. Alexander, Jolin Wiley.
4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W. W. Porterfield Addison-Welsey.
6. Inorganic Chemistry, A. G Sharpe, ELBS
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.

ORGANIC CHEMISTRY-IV

Subject Code: BBSC1-502 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Spectroscopy

Nuclear magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromoethane, ethyl acetate, toluene and acetophenone.

Unit-II

Electromagnetic spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert's law, Molar absorptivity, presentation and analysis of UV Spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

Unit-III

Infrared (IR)

Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, Selection rules, intensity and

position of IR bands, measurement of lR spectrum, fingerprint region, characteristic absorption of various functional groups and Interpretation of IR spectra of simple organic compounds. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR, and PMR spectroscopic techniques.

Unit-IV

Organometallic Compounds

Organomagnesium Compounds The Grignard reagents formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithiumcompounds: formation and chemical reactions.

Organosulphur Compounds

Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, and sulphonamides.

Recommended Books

1. Fundamentals of Organic Chemistry, Solomons, John Wiley.
2. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
3. Organic Chemistry, F.A Carey, McGraw-Hill, Inc.
4. Introduction to Organic Chemistry, Streitwieser, Healthcock and Kosover and Kosover, Macmillan.

CONDENSED MATTER PHYSICS

Subject Code: BBSC1-503 **L T P C** **Duration: 45Hrs.**
3 0 0 3

Unit-I

Crystal Structure. Symmetry operations for a two dimensional crystal. Two dimensional Bravais lattices, Three dimensional Bravais lattices" Basic primitive cells. Crystal planes and Miller indices. Diamond and NaCI structure. Packing fraction for Cubic and hexagonal closed packed structure.

Unit-II

Crystal Diffraction: Bragg's Law, Experimental methods for crystal structure studies, laue equations, Reciprocal lattices of SC, BCC and FCC, Bragg's Law in reciprocal lattice. Brillouin zones and its derivation in two dimensions, Structure factor and atomic form factor.

Unit-III

Lattice vibrations, Concepts of phonons, Scattering of protons by phonons. Vibration of mono-atomic, di-atomic, linear chains. Density of modes, Einstein and Debye models of specific heat, Free electron model of metals. Free electron, Fermi gas and Fermi energy.

Unit-IV

Band theory, Kronig-Penney Model. Metals and insulators, Conductivity and its variation with

temperature in semiconductors, Fermi levels in intrinsic and extrinsic semiconductors, Qualitative discussion of band gap in semiconductors, superconductivity, Magnetic field effect in superconductors, BCS theory. Thermal properties of superconductors

Recommended Books

1. Introduction to Solid State Physics by C. Kittel (Wiley Eastern)
2. Elements of Modern Physics by S. H. Patil (TMGH, 1985)
3. Solid State Physics by Puri and Babbar.

LASER AND OPTICS

Subject Code: BBSC1-504 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Interference: Concept of coherence, Spatial and temporal coherence. Coherence time, Coherence length, Area of coherence, Conditions for observing interference fringes, Interference by wave front division and amplitude division, Michelson's interferometer—working, Principle and nature of fringes, Interference in thin films, Role of interference in anti-reflection and high reflection dielectric coatings. Multiple beam interference, Fabry-Perot interferometer, Nature of fringes, Newton Rings.

Unit-II

Diffraction: Huygens-Fresnel theory, half-period zones, Zone plates, Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at rectangular and circular apertures, Effects of diffraction in optical imaging, resolving power of telescope. The diffraction grating, its use as a spectroscopic element and its resolving power.Polarization: Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction, Nicol prism, Sheet polarizer, Retardation plates, Production and analysis of polarized light (quarter and half wave plates).

Unit-III

Laser Fundamentals

Derivation of Einstein's relations. Concept of stimulated emission and population inversion. Broadening of spectral lines, natural, collision and Doppler broadening. Line width, Line profile, Absorption and amplification of a parallel beam of light passing through a medium. Threshold condition, Introduction of three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes.

Unit-IV

Laser Systems

types of lasers, Ruby and Nd: YAG lasers, He-Ne and CO_2 lasers-construction, mode of creating population inversion and output characterstics. Semiconductor lasers, Dye lasers, Q-switching, Mode locking, Applications of lasers–a general outline. Basics of holography

Recommended Books

1. Fundamentals of Optics, F.A. Jenkins and Harvery E. White (McGraw Hill) 4th edition, 2001.
2. Optics, AjoyGhatak (McMillan India) 2nd edition, 7th reprint 1997.
3. Introduction to Atomic Spectra, H.E. White (McGraw Hill Book Co.)
4. Optics, Born and Wolf (Pergamom Press), 3rd edition, 1965.
5. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi,1996.
6. Lasers and Non-linear Optics, B.B. Laud (New Age Pub.), 2002.
7. Lasers, Svelto (Plenum Press), 3rd Ed., New York.

DIFFERENTIAL EQUATIONS

Subject Code: BBSC1-505 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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

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

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

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.

NUMERICAL METHODS

Subject Code: BBSC1-506 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition, GaussJacobi, Gauss-Siedel and SOR iterative methods.

Unit-II

Interpolation: Finite differences, Newton Gregory forward and backward formula, Lagrange's formulaewith error, divided differences, Newton's formulae, Central differences, Hermite interpolation.

Unit-III

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

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.**

CHEMISTRY LAB-V

Subject Code: BBSC1-507 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

Synthesis and Analysis

(a) Preparation of sodium trioxalatoferrate(III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permagnometry.
(b) Preparation of Ni-DMG complex, $[Ni\ (DMG)_2]^{2+}$
(c) Preparation of copper tetra-ammine complex. $[Cu\ (NH_3)_4]\ SO_4$.
(d) Preparation of cis-and trans-bis(oxalato) diaquachromate(III) ion.

Synthesis or Organic Compounds

(a) Iodoform from ethanol and acetone
(b) Aromatic electrophlic substitution of benzene
1. p-nitroacetanilide

2. 2,4,6-tribromophenol Diazotization/Coupling
3. Preparation of methyl orange and methyl red
4. Preparation of benzoic acid from toluene
5. Preparation of m-nitroaniline from m-dinitrobenzene

Recommended Books

1. Experimental Inorganic Chemistry, W. G. Palmer, Cambridge.
2. Handbook of Preparative Inorganic Chemistry, Vol. I & II, Brauer, Academic Press.
3. Inorganic Synthesis, Mc-Graw Hill.
4. Experimental Organic Chemistry, Vol. I & II, P. R. Singh, D.S. Gupta, andBajpai, Tata Mc-Graw Hill.
5. Laboratory Manual In Organic Chemistry, R. K. Bansal, Wiley Eastern.

Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V. frogers, P.W.G. Smith and AR. Tatchell, ELBS Experiments in General Chemistry C.N.R. Rao and U.C. Agarwal, East-West Press.

PHYSICS LAB-V

Subject Code: BBSC1-508 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

1. To determine the Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
2. To determine the Refractive Index of the Material of a given Prism using Sodium Light.
3. To determine Dispersive Power of the Material of a given Prism using Mercury Light.
4. To determine the value of Cauchy Constants of a material of a prism.
5. To determine the Resolving Power of a Prism.
6. To determine wavelength of sodium light using Fresnel Biprism.
7. To determine wavelength of sodium light using Newton's Rings.
8. To determine the wavelength of Laser light using Diffraction of Single Slit.
9. To determine wavelength of (1) Sodium & (2) spectrum of Mercury light using plane diffraction Grating .
10. To determine the Resolving Power of a Plane Diffraction Grating.
11. To measure the intensity using photosensor and laser in diffraction patterns of single and double slits.
12. Familiarization with Schuster`s focussing; determination of angle of prism.

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, KitabMahal, New Delhi.

PHYSICAL CHEMISTRY-IV

Subject Code: BBSC1-601 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Raman Spectrum

Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Unit-II

Electronic Spectrum

Concept of potential energy curves for bonding and antibondingmolecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π and n M.O.their energy levels and their respective transitions.

Unit-III

Solid State

Definition of space lattice and unit cell.

Laws of crystallography-(i) Law of constancy of interfacial angles. (ii) Law of rationality of indices (iii) Law of symmetry elements in crystals. X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCl, KCI and CsCI (Laue's method and powder method).

Unit-IV

Photochemistry

Interaction of radiation with matter, difference between thermal and photochemical process. Laws of photochemistry: Grothus-Drapperlaw, Stark-Einstein law, Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, non- radiative processes (internal conversion, intersystem crossing), quantumyield, photosensitized
reactions-energy transfer processes (simple examples). Basic concepts of Laser and Maser. Photochemistry of vision and colour.

Recommended Books

1. Physical Chemistry, G.M. Barrow, International Student edition, McGraw Hill.
2. University General Chemistry, C.N.R. Rao. Macmillan.
3. Physical Chemistry, R.A Alberty, Wiley Eastern Ltd.
4. The Elements of Physical Chemistry, P. W. Atkins, Oxford.
5. Physical Chemistry Through Problems, S.K. Dogra and S. Dogra, Willey Eastern Ltd.
6. Fundamentals of Photochemistry, Rohtga and Mukherji.

ORGANIC CHEMISTRY-V

Subject Code: BBSC1-602 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

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 mechanism of electrophlic substitution. Mechanism of nucleophlic substitution reaction in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six membered heterocycles.Preparation and reactions of indole, quinoline and isoquinolinewith special reference to Fischer indole synthesis, Skraup synthesis and Bischler- Napieralski synthesis. Mechanism of electrophlic substitution reactions of indole, quinoline and isoquinoline.

Unit-II

Synthesis of Polymers

Ziegler-Natta polymerziation and vinyl polymers. Condensation or step growth polymerziation. Urea formaldhehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Organic Synthesis ViaEnolates

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enoltautomerism of ethyl acetoacetate. Alkylation and acylation of enamines.

Unit-III

Carbohydrates

Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses.

Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers, and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)-glucose. Mechanism of mutarotation. Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharide starch and cellulose without involving structure determination.

Unit-IV

Amino Acids, Peptides, Proteins and Nucleic Acids

Classification, structure and stereochemistry of amino acids. Acid base behaviour, isoelectric point and electrophoresis. Preparation and reactions of α-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Introduction, Constituents of nucleic acids Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Recommended Books

1. Fundamentals of Organic Chemistry, Solomons, John Wiley.
2. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
3. Organic Chemistry, F.A Carey, McGraw-Hill, Inc.
4. Introduction to Organic Chemistry, Streitwieser, Healthcock and Kosover and Kosover, Macmillan.

ELECTRONICS

Subject Code: BBSC1-603 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Concept of current and voltage sources, p-n junction, Biasing of diode, V-A characteristics. Diode equation, Breakdown diodes: Zener breakdown and avalanche breakdown, Zener diode. Rectification: half wave, full wave rectifiers and bridge rectifiers, Qualitative analysis of Filter circuits (RC LC and π filters) Efficiency, Ripple factor, Voltage regulation. Voltage multiplier circuits.

Unit-II

Junction transistor: structure and working, relation between different currents in transistors, Sign conventions. Amplifying action, Different configurations of a transistor and their comparison, CB and CE characteristics. Structure, Characteristics, operation of FET, JFET and MOSFET,Pinch off voltage, Enhancement and Depletion mode, Comparison of JFETs and MOSFETs, Difference in field effect transistor and junction type transistor.Photo-conductive devices: Photo-conductive cell, Photodiode, Solar cell, LED, LCD.

Unit-III

Thyristor, SCR, TRIAC, DIAC: Construction, Characteristics and Operation; Comparison between transistors and thyristors; Difference between SCR and TRIAC. UJT: its construction, Equivalent circuit, Characteristics and parameters, uses.Thermistor: Types, Construction, Characteristics, Uses, Advantages over other temperature sensing devices. IMPATT and TRAPATT devices, PIN diode: Construction, Charatersitics, Applications.

Unit-IV

Gunn effect and diodes: Mechanism, Characteristic, Negative differential resistivity and Domain formation. Tunnel diode: Tunneling Phenomenon, Operation, Applications. Merits and Drawbacks, Transistor biasing: Stabilization of operating point, Fixed bias, Collector to base bias, Bias circuit with emitter resistor, Voltage divider biasing circuit. CE amplifier: Working and analysis using h-parameters, Equivalent circuits, Determination of current gain, Power gain, Input impedance, FET amplifier: Voltage, Current and Power gain Feed back in amplifiers: Types & advantage of negative feedback. Emitter follower as negative feedback circuit.

Recommended Books

1. Basic Electronics and Linear Circuits by N. N. Bhargave, D.C. Kulshreshtha and S. C. Gupta.

2. Electronic Devices and Circuits: J. B. Gupta (Publ. KATARIA & SONS)
3. Electronic Devices and Circuits: G. K. Mithal, Khanna Publishers
4. Fundamentals of Electronics by D. Chatopadhyay, P.C. Rakshit, B. Saha and N.N.Purkit.
5. Basic Electronic by D.C.Tayal (Himalaya Pub.)

NUCLEAR AND PARTICLE PHYSICS

Subject Code: BBSC1-604 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

General Properties of Nuclei and Nuclear Models: 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. Liquid drop model approach, semi empirical mass formula and significance of various terms, condition of nuclear stability. Two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

Unit-II

Radioactive decay and Nuclear Reactions: Alpha decay: basics of α-decay processes, theory of αemission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct reaction, resonance reaction, Coulomb scattering (Rutherford scattering).

Unit-III

Interaction of Nuclear Radiations with matter and detection of Nuclear radiations: Energy loss due to ionization (BetheBlock formula), energy loss of electrons, Cerenkov radiation, Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter. Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation. Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si &Ge) for charge particle and photon detection (concept of charge carrier and mobility).

Unit-IV

Particle Physics and Particle Accelerators: 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. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).
2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
4. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
5. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi.
6. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004).
7. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
8. Theoretical Nuclear Physics, J.M. Blatt &V.F.Weisskopf (Dover Pub.Inc., 1991)

NUMBER THEORY

Subject Code: BBSC1-605 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Division algorithm, Euclid's algorithm for the greatest common divisor, Linear Diophantine equations, Prime numbers, fundamental theorem of arithmetic, infinitude of primes, Distribution of primes, twin primes, Goldbach conjecture, Fermat primes.

Unit-II

Modular arithmetic, Basic properties of congruence's, linearcongruence's, Simultaneous linear congruence's, Chinese Remainder Theorem, An extension of Chinese Remainder Theorem.

Unit-III

Arithmetic modulo p, Fermat's little theorem, Wilson's theorem, Pseudo-primes and Carmichael numbers, Solving congruences modulo prime powers.

Unit-IV

Greatest integer function, τ and σ functions, Mobius Inversion formula, Euler's Phi function, Euler's theorem, someproperties of the Phi Function.

Recommended Books

1. D. Burton: Elementary Number Theory, Sixth Edition, McGraw-Hill.
2. Niven and Zuckerman: An Introduction To Number Theory.
3. T.M. Apostol, 'Introduction to Analytic Number Theory', Springer.
4. Paul T. Bateman, 'Analytic Number Theory', World scientific.
5. H. Rosen Kenneth, 'Elementary Number Theory', 6th Edn.

6. G.H. Hardy, 'An Introduction to the Theory of Numbers', 6th Edn.

MATHEMATICAL STATISTICS

Subject Code: BBSC1-606 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Unit-I

Classical and axiomatic approach to the theory of probability, additive and multiplicative law of probability, conditional probability and Bayes theorem, Random variable, function of random variable, and their distributions, probability mass function, probability density function, cumulative distribution function.

Unit-II

Concept of random variables and probability distributions: Two dimensional random variables, Joint, Marginal and conditional distributions, Independence of random variables, Expectation, Conditional expectation, Moments, Product moments, Probability generating functions, Moment generating function and its properties.

Unit-III

Study of various discrete and continuous distributions: Binomial, Poison, Negative binomial distributions.

Unit-IV

Concept of sampling distribution and its standard error, Derivation of sampling distributions of Chisquare, t and F distribution of sample mean and variance Testing of hypotheses, fundamental notions important tests based on normal distributions, Tests of significance: tests based on normal distribution, Chi-square, t and F statistic.

Recommended Books

1. R.V. Hogg &Craige, 'Introduction to Mathematical Statistics', 7th Edn.,2005
2. S.C. Gupta, V.K. Kapoor, 'Fundamental of Mathematical Statistics', 7th Edn., S. Chand, 1990.
3. Goon, Gupta and Das Gupta, 'Fundamentals of Statistics', 5th Edn., World Press, 1975.
4. V.K. Rohatgi, 'Introduction to Probability Theory & Mathematical Statistics', 2009.
5. Goon, Gupta and Das Gupta, Fundamentals of Statistics, Edition, Publisher, World Press, 1975.

CHEMISTRY LAB-VI

Subject Code: BBSC1-607 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

Laboratory Techniques

1. Column Chromatography
2. Separation of fluorescein and methylene blue.
3. Separation of leaf pigments from spinach leaves.

4. Physical Experiments

(a) To determine the strength of the given acid conductometrically using standard alkali solution.
(b) To determine the solubility and solubility product of a given sparingly soluble electrolyte conductometrically.
(c) To study the saponification of ethyl acetate conductometrically.
(d) To determine the ionisation constant of a weak acid conductometrically.
(e) To determine the strength of the given acid solution pH- metrically by using standard alkali solution.
(f) To determine the molar refraction of methanol, ethanol and propanol.
(g) To study the distribution of benzoic acid between benzene and water, and ether and water.
(h) Knowledge of Stereochemical Study of Organic Compounds.
Rand S configuration of optical isomers.
E, Z configuration of geometrical isomers.
Conformational analysis of cyclohexanes and substituted cyclohexanes.

Recommended Books

1. Vogel's Textbook of Practical Organic Chemistry, B. S. Furniss, Al Hannaford, V. frogers, P.W.G. Smith and AR. Tatchell, ELBS
2. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press.
3. Experiments in Physical Chemistry, R.C. Das, and B. Behra, Tata Mc-graw Hill.
4. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
5. Advanced Exp. Chemistry, Vol. I-Physical, J.N. Gurutu and R. Kapoor, S. Chand & Co.

PHYSICS LAB-VI

Subject Code: BBSC1-608 **L T P C** **Duration: 30 Hrs.**
0 0 2 1

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 astablemultivibrator of given specifications using 555 Timer.
7. To design a monostablemultivibrator 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
13. 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.