M. PHARM. (PHARMACOGNOSY)

Total Contact Hours = 34 **Total Marks = 600** **Total Credits = 25**

SEMESTER 1st		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MPHA4- 101	Cultivation of Medicinal Plants	3	1	-	40	60	100	4
MPHA4- 102	Modern Analytical Techniques	3	1	-	40	60	100	4
MPHA4- 103	Plant Drug Standardization	3	1	-	40	60	100	4
MPHA4- 104	Basics of Pharmaceutical Research - I	3	1	-	40	60	100	4
MPHA4-105	Pharmacognosy Lab - I	-	-	14	60	40	100	7
MPHA4- 106	Seminar	-	-	4	100	-	100	2
Total	**Theory = 5 Lab = 1**	12	4	18	320	280	600	25

Total Contact Hours = 32 **Total Marks = 600** **Total Credits = 26**

SEMESTER 2nd		Contact Hrs			Marks			Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
MPHA4 –207	Medicinal Plant biotechnology	4	-	-	40	60	100	4
MPHA4 – 208	Advanced Pharmacognosy-II	4	-	-	40	60	100	4
MPHA4 – 209	Indian system of medicine	4	-	-	40	60	100	4
MPHA4– 210	Herbal cosmetics	4	-	-	40	60	100	4
MPHA4-211	Pharmacognosy Practical II	-	-	12	60	40	100	6
MPHA4 - 212	Seminar/Assignment	-	4	-	100	-	100	4
Total	**Theory = 5 Lab = 1 Seminar = 1**	**16**	**4**	**12**	**320**	**280**	**600**	**26**

SEMESTERS 3rd & 4th		Marks			Credits
Subject Code	**Subject Name**	**Int. (Seminar & Viva on Thesis)**	**Ext. (Evaluation of Thesis)**	**Total**	
MPHA4 - 413	Research Work	100	200	300	24

Note: Thesis shall be presented by the candidate at the end of record academic year.

Overall

Semester	Marks	Credits
1st	600	25
2nd	600	26
3rd & 4th	300	24
Total	**1500**	**75**

CULTIVATION OF MEDICINAL PLANTS

Subject Code – MPHA4-101 **L T P C** **Duration – 45 Hrs**

3 1 0 4

UNIT-I (12 Hrs)

Production and Management of Medicinal Plants at Farms: Preparation of Soil for Sowing, Depth of Sowing, Method of Digging, Preparation of Beds, Type of Beds, Seeds and Sowing (Germination, Vigour Viability, Longevity, Dormancy), Sowing Techniques, Planting Techniques for Field Crops.

UNIT-II (15 Hrs)

Cultivation of Medicinal Plants: Definition, Eco-Friendly Farming, Organic Farming, Biological Farming, Nature Farming, Alternate Agriculture, Ecological Agriculture, Objective of Ecological Farming; Good Agricultural and Harvesting Practice. Biodynamic Agriculture: Basic Standards and General Principles for Organic Agriculture. Important Tips for Cultivation of Medicinal Plants

UNIT-III (10 Hrs)

Diseases of Medicinal Plants with Special Reference to Belladonna, Cinchona, Digitalis, Dioscorea, Datura, Ginseng, Glycyrrhiza, Periwinkle, Plantago, Podophyllum, Rauwolfia, Senna and Withania

UNIT-IV (8 Hrs)

Pest and Pest Management in Medicinal Plants with Emphasis on Biopesticides, Cultivation Methods Developed in India for The Following Plants and Commercial Significance: Ginseng, Podophyllum, Withania, Senna, Andrographis, Periwinkle, Glycyrrhiza and Mentha.

Recommended Books

1. W.C. Evans, Trease and Evans, 'Pharmacognosy', 15th Edn., W.B. Sounders & Co., London, **2002.**
2. V.E. Tyler, L.R. Brady, J.E. Robbers, 'Pharmacognosy', 9th Edn., Lea and Febiger, Philadelphia, **1988.**
3. J. Reinert and Y.P.S Bajaj, 'Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture', Narora Publishing House, New Delhi, **1998.**
4. S.S. Purohit and S.B. Vyas, 'Medicinal Plant Cultivation (A Scientific Approach)', Agrobios, Jodhpur, **2004.**
5. N.J. Walton and D.E. Brown, 'Chemicals from Plants', Imperial College Press, London.

MODERN ANALYTICAL TECHNIQUES

Subject Code – MPHA4-102 **L T P C** **Duration – 45 Hrs**
3 1 0 4

UNIT-I (9 Hrs)

Ultraviolet and Visible Spectroscopy: Introduction, Energy levels and Selection Rules, Woodward-Fieser, Fieser-Kuhn and Nelson rules; Influence of Substituents, Ring Size, Solvent and Conjugation on max. Methodology; Spectral Correlation with Structure, Conjugated Dienes and Polyenes, Unsaturated Carbonyl Compounds; Benzene, Substituted Benzenes and Polynuclear Aromatic Hydrocarbons.

UNIT-II (10 Hrs)

Infrared Spectroscopy: Introduction, Types of Vibrations, Characteristic Regions of the spectrum; Influence of Substituents, Ring Size, Hydrogen Bonding, Vibrational Coupling and Field Effect on Frequency; Methodology; Spectral interpretation with examples.

UNIT-III (12 Hrs)

Nuclear Magnetic Resonance Spectroscopy: ^{1}H NMR spectroscopy: Introduction, Magnetic Nuclei, Chemical Shifts, Shielding and Deshielding, Relaxation Process, Chemical and Magnetic Non-Equivalence, Local Diamagnetic Shielding and Magnetic Non-Equivalence, Spin –Spin Splitting, Pascal's Triangle, Coupling Constant, Mechanism of Coupling Quadrupole Broadening and Decoupling; Effect of Stereochemistry on The Spectrum; Application of 1H NMR with Examples.

^{13}C-NMR Spectroscopy: Natural abundance of 13C, resolution and multiplicity. The FT mode and RF pulse. Use of proton coupled, proton decoupled and off resonance decoupling techniques.

Chromatography: General Principle, Separation Mechanisms and Applications of Chromatographic Techniques such as Gas Chromatography, HPLC, HPTLC.

Chromatography: MPLC, OPLC, Flash, Counter- Current Chromatography and Super Critical Fluid Chromatography.

UNIT– IV (17 Hrs)

Mass Spectrometry: Mass Spectrometry: Introduction, mass spectrum and metastable ion peak, Determination of molecular formula. Recognition of molecular ion peak and the nitrogen rule. General rules of fragmentation, retro Diels –Alder reaction and the McLafferty re-arrangement. Fragmentations associated with functional gropus: aliphatic, aromatic and aralkyl hydrocarbons, alcohols, phenols, ethers; aldehydes, ketones, carboxylic acids and esters; amines and amides, alkyhalides and aralkylhalides. Heteroaromatic compound. Hyphenated techniques: Principle and applications of GC -MS, LC -MS and LC- NMR techniques.

Recommended Books

1. William Kemp, 'Organic Spectroscopy', 3rd Edn., ELBS, Mac Millan, Hampshire, U.K., **1991**.
2. D.H. Williams and I. Fleming, 'Spectroscopic Methods in Organic Chemistry', Tata Mc Graw-Hill Publishing Company Ltd., New Delhi, India, **1993.**
3. R.M. Silverstein, G.C. Bassler and T.C. Morrill, 'Spectrometric Identification of Organic

Compounds', 5th Edn., John Wiley and Sons Inc., New York, U.S.A., **1991.**
4. F.A. Bovey, 'Nuclear Magnetic Resonance Spectroscopy', 2nd Edition, Academic Press Inc., New York, U.S.A., **1988.**
5. Egon Stahl, 'Thin Layer chromatography -A Laboratory Handbook', Springer-Verlag, Berlin.
6. I.L. Finar, 'Organic Chemistry', Vol. 2, The English Language Book Society and Longman Group Limited, UK.
7. P.D. Sethi, 'High Performance Liquid Chromatography', CBS publishing House, New Delhi.

PLANT DRUG STANDARDIZATION

Subject Code – MPHA4-103 **L T P C** **Duration – 45 Hrs**

3 1 0 4

UNIT-I (9 Hrs)

Concept of Standardization of Plant Drugs, Organoleptic Evaluation of Drugs: Including Gross Morphology, Sampling, Preliminary Examination and Foreign Matter

UNIT-II (9 Hrs)

Microscopic Evaluation of Plant Drugs: Quantitative Microscopy, Vein Islet Number, Vein Termination Number, Stomatal Number, Stomatal Index, Palisade Ratio and Number of Sclerenchyma

UNIT-III (12 Hrs)

Micrometry, Measurement of Fibers, Trichomes, Starch Grains and Calcium Oxalate Crystals, Lycopodium Spore Analysis, Fluorescence Analysis, Physical Evaluation of Plant Drug: Determination of Moisture Content, Foreign Organic Matter, Ash Values, Extractive Values and Swelling Index. Refractive Index, Optical Rotation and Their Applications in Standardization of Plant Drugs

UNIT- IV (15 Hrs)

Phytochemical Evaluation of Plant Drug: General Methods of Phytochemical Screening, Isolation and Purification. General Methods of Assays for Alkaloids, Steroids, Terpenoids, Flavonoids, Glycosides, Tannins and Coumarins, Fingerprint Profiling of Crude Drugs and Single and Multicomponent Herbal Preparation. Stability Testing of Natural Products

Recommended Books

1. W.C. Evans, 'Trease and Evans Pharmacognosy', 15th Edn., W.B. Sounders & Co., London, **2002.**
2. 'Guidelines for the Assessment of Herbal Medicines-WHO Report', Geneva, **1991.**
3. 'Quality Control Methods for Medicinal Plant Material', WHO/Pharm/1992, 559/rev, pp. 1-84.
4. 'Pharmacopoeia of India', Govt. of India, Ministry of Health and Family Welfare, Delhi, **1996.**
5. A.N. Kalia, 'Industrial Pharmacognosy', CBS Publishers, New Delhi, **2005**.

BASICS OF PHARMACEUTICAL RESEARCH - I

Subject Code – MPHA4-104 **L T P C** **Duration – 45 Hrs**

3 1 0 4

UNIT-I (8 Hrs)

Drug Design and Discovery: Stages of Drug Discovery, Discovery of Lead Compounds, Pharmacophore Identification and Structure Modification, Physicochemical Alterations, Quantitative Structure Activity Relationship, High Throuput Screening, Acute, Sub-Acute and Chronic Studies, In-Vivo and In–Vitro Studies, Introduction To Preclinical and Clinical Trials, Toxicological Studies, FDA Review Process and Approval.

UNIT-II (9 Hrs)

Good Laboratory Practice: Scope of GLP, Definitions, Current GLP in manufacturing, responsibilities. General provision, organization and Personnel, Building and Facilities, Equipment, Control of Components and Drug product, Laboratory and Control of Records and Reports, Non-clinical Testing, Controls on Animal House, Report Preparation and Documentation, Application of Computers in Quality Control Laboratory

Good Clinical Practices: Introduction, Regulatory perspectives, Provisions, Documentation.

UNIT-III (16 Hrs)

Principles of Experimental Pharmacology: Common Laboratory Animals in Pharmacological Research, Limitations of Animal Tests, Alternatives to Animal Use, Anesthetics used in Laboratory Animals, Some Standard Techniques Used in Laboratory Animals, Euthanasia of Experimental Animals. Regulations for The Care and Use of Laboratory Animals, CPCSEA, OECD Guidelines.

Analytical Method Validation: General Principles, Validation of Analytical and Bio-analytical Method as per ICH Guidelines.

Calibration and Qualification of Analytical Instruments: Electronic Balance, pH Meter, UV-Visible Spectrophotometer, FTIR, GC, HPLC, HPTLC, Disintegration and Dissolution Test Apparatus. **Qualification of Glassware:** Volumetric Flask, Pipette, Beakers and Burette

UNIT-IV (12 Hrs)

Methods in Material Characterization - Particle dimensions: Particle Size and Powder Surface Area, Particle Shape and Surface Morphology.

Characterization of Solid State Structure: Spectroscopy in Pharmaceutical Analysis, X-Ray Diffraction, Solid-State Nuclear Magnetic Resonance, Vibrational Spectroscopy, Calorimetry in Pharmaceutical Analysis, Water Vapor Sorption, Electron and Confocal Microscopy, Density Measurements.

Thermal Methods of Analysis: Theory, Instrumentation and Applications of Thermo Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) and Thermo Mechanical Analysis (TMA)

X-Ray Diffraction Methods: Introduction, Generation of X-Rays, X-Ray Diffraction, Bragg's Law, X-Ray Powder Diffraction, Interpretation of Diffraction Patterns and Applications.

Recommended Books

1. M.E. Wolff, Burger, 'Medicinal Chemistry and Drug Discovery- Principle and Practice'. John Wiley and Sons, New York.

2. R. Franke, 'Theoretical Drug Design Methods', Vol. VII, Elsevier, New York.
3. R.B. Silverman, 'The Organic Chemistry of Drug Design and Action', Academic Press Inc., San Diego, USA.
4. P.I. Good, 'A Managers Guide to Design and Conduct of Clinical Trials', Wiley-Liss, Hobokem, U.S.A., **2002.**
5. A.C. Cartwright and B.R. Matthews (eds.), 'International Pharmaceutical Product Registration', Elis Horwood, New York, U.S.A., **1994.**
6. H.G. Vogel (ed), 'Drug Discovery and Evaluation-Pharmacological Assays', 2nd Edn., Springer Verlag, Berlin, Germany, **2002**.
7. M.N. Ghosh, 'Fundamentals of Experimental Pharmacology', 2nd Edn., Scientific Book Agency, Calcutta, India, **1984.**
8. Sandy Weinberg, 'Good Laboratory Practices', Vol. 129, 3rd Edn., Drugs and Pharm. Sci. Series, Marcel Dekker Inc.
9. Robert M. Silverstein, 'Spectrometric Identification of Organic Compounds', Wiley & Sons Publication.
10. Doglass A. Skoog, Holler, Nieman, 'Principles of Instrumental Analysis', Thomson & Brooks Cole Publication.
11. Hobert H. Willard, 'Instrumental Methods of Analysis' 7th Edn., CBS Publication.
12. Gary D. Christian, 'Analytical Chemistry', Wiley & Sons Publication.
13. A.H. Beckett, J.B. Stenlake, 'Practical Pharmaceutical Chemistry', Volume I & II, 4th Edn., CBS Publications.

PHARMACOGNOSY LAB - I

Subject Code – MPHA4-105 **L T P C**
0 0 14 7

Qualitative and Quantitative Microscopic Examination

1. Microscopic Evaluation of Powdered Drugs and their Mixtures with Adulterants.
2. Spectral Workshop: Workshop Involving Interpretation of IR, NMR and Mass Spectra of Organic Compounds to Elucidate their Chemical Structure.
3. Exercises Based on Standardization and Quality Control of Plant Drugs.
4. Quantitative Estimation of Phytoconstituents.
5. Determination of Phytoconstituents in Crude Drugs and Commercial Herbal Formulations.
6. Pharmacopoeial Evaluation of Natural Products.
7. Determination of Ash Values, Extractive Values, Swelling Index and Foaming Index of Crude Drugs as per WHO Geneva Guidelines.
8. Quantitative Estimation of Phytoconstituents based on Theory by Chemical and Spectrophotometric Method.
9. Preparation of Detailed Monograph of at least one Medicinal Plant Covering Taxonomy, Phytochemistry and Pharmacological Investigation with its Use in Traditional System of

Medicine.

10. Some Basic Experiments on Plant Tissue Culture

SEMINAR

Subject Code – MPHA4-106 **L T P C**

0 0 4 2

1. Introduction, Information and Retrieval Systems.
2. Writing Assignments and Term Papers.
3. Reading Research Papers.
4. Organization and Presentation of Scientific Material, Research Work, Dissertations, Patents Etc.
5. Skills in Oral and Technical Presentations.

Each Student has to present at least three seminars during the Semester.

MEDICINAL PLANT BIOTECHNOLOGY

Subject Code – MPHA4-207 **L T P C** **Duration – 50 Hrs**

4 0 0 4

Scope

- To explore the knowledge of Biotechnology and its application in the improvement of quality of medicinal plants

Objectives

Upon completion of the course, the student shall be able to,

- Know the process like genetic engineering in medicinal plants for higher yield of Phytopharmaceuticals.
- Use the biotechnological techniques for obtaining and improving the quality of natural products/medicinal plants

UNIT-I (12 Hrs)

Introduction to Plant Biotechnology

- Historical perspectives, prospects for development of plant biotechnology as a source of medicinal agents.
- Applications in pharmacy and allied fields.
- Genetic and molecular biology as applied to pharmacognosy, study of DNA, RNA and protein replication, genetic code, regulation of gene expression, structure and complicity of genome, cell signalling,
- DNA recombinant technology.

UNIT-II (12 Hrs)

Different Tissue Culture Techniques

- Organogenesis and embryogenesis, synthetic seed and monoclonal variation, Protoplast fusion, Hairy root multiple shoot cultures and their applications.

- Micro propagation of medicinal and aromatic plants.
- Sterilization methods involved in tissue culture, gene transfer in plants and their applications.

UNIT-III (12 Hrs)

Immobilisation Techniques & Secondary Metabolite Production

- Immobilization techniques of plant cell and its application on secondary metabolite Production.
- Cloning of plant cell: Different methods of cloning and its applications.
- Advantages and disadvantages of plant cell cloning.
- Secondary metabolism in tissue cultures with emphasis on production of medicinal agents.
- Precursors and elicitors on production of secondary metabolites.

UNIT-IV (14 Hrs)

Biotransformation and Transgenesis

- Biotransformation, bioreactors for pilot and large scale cultures of plant cells and retention of biosynthetic potential in cell culture.
- Transgenic plants, methods used in gene identification, localization and sequencing of genes.
- Application of PCR in plant genome analysis.

Fermentation Technology

- Application of Fermentation technology,
- Production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest

Recommended Books

1. Bhagwani, 'Plant Tissue Culture', Vol 5, Elsevier Publishers.
2. Plant Cell and Tissue Culture (Lab. Manual), JRMM. Yeoman.
3. P.K. Gupta, 'Elements in Biotechnology', Rastogi Publications, New Delhi.
4. M.K. Razdan, 'An Introduction to Plant Tissue Culture', Science Publishers.
5. H.D. John and W.R. Lorin, 'Experiments in Plant Tissue Culture', Cambridge University Press.
6. S.P. Vyas and V.K. Dixit, 'Pharmaceutical Biotechnology', CBS Publishers.
7. Jeffrey W. Pollard and John M. Walker, 'Plant Cell and Tissue Culture', Humana Press.
8. Dixon, 'Plant Tissue Culture', Oxford Press, Washington DC, **1985.**
9. Street, 'Plant Tissue Culture'.
10. G.E. Trease and W.C. Evans, 'Pharmacognosy', 3rd Edn., Elsevier.
11. Purohit and Mathur, 'Biotechnology', Agro-Bio.
12. Shargool, Peter D., Shargoal, 'Biotechnological Applications to Tissue Culture', C.K.C. Press.
13. Varo E. Tyler, Lynn R. Brady and James E. Robberrt, 'Pharmacognosy', That Tjen, NGO.
14. Ciddi Veerasham, 'Plant Biotechnology'.

ADVANCED PHARMACOGNOSY-II

Subject Code – MPHA4-208 **L T P C** **Duration – 50 Hrs**
4 0 0 4

Scope

- To know and understand the Adulteration and Deterioration that occurs in herbal/natural drugs and methods of detection of the same. Study of herbal remedies and their validations, including methods of screening

Objectives

Upon completion of the course, the student shall be able to know the,

- Validation of herbal remedies
- Methods of detection of adulteration and evaluation techniques for the herbal drugs
- Methods of screening of herbals for various biological properties

UNIT-I (12 Hrs)

Herbal Remedies

- Toxicity and Regulations: Herbals vs Conventional drugs,
- Efficacy of Herbal medicine products,
- Validation of herbal therapies,
- Pharmacodynamics and Pharmacokinetic issues.

UNIT-II (12 Hrs)

Adulteration and Deterioration

- Introduction, Types of Adulteration/Substitution of Herbal drugs,
- Causes and Measures of Adulteration, Sampling Procedures,
- Determination of Foreign Matter,
- DNA Finger printing techniques in identification of drugs of natural origin,
- Detection of heavy metals, pesticide residues, phytotoxin, microbial contamination in herbs and their formulations.

UNIT-III (14 Hrs)

Ethnobotany and Ethnopharmacology

- Ethnobotany in herbal drug evaluation,
- Impact of Ethnobotany in traditional medicine,
- New development in herbals,
- Bio-prospecting tools for drug discovery,
- Role of Ethnopharmacology in drug evaluation,
- Reverse Pharmacology.

Analytical Profiles of Herbal Drugs

- Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelica officinalis, Psoralea corylifolia.

UNIT– IV (12 Hrs)

Biological Screening of Herbal Drugs

- Introduction and Need for Phyto-Pharmacological Screening,
- New Strategies for evaluating Natural Products,
- In vitro evaluation techniques for Antioxidants, Antimicrobial and Anticancer drugs.
- In vivo evaluation techniques for Anti-inflammatory, Antiulcer, Anticancer, Wound healing, Antidiabetic, Hepatoprotective, Cardio protective, Diuretics and Antifertility,
- Toxicity studies as per OECD guidelines.

Herbal/Natural Cosmetics

- Introduction, Classification & Economic aspects. Regulatory Provisions relation to manufacture of cosmetics: -License, GMP, offences & Penalties, Import & Export of Herbal/natural cosmetics, Industries involved in the production of Herbal/natural cosmetics.

Analysis of Cosmetics, Toxicity Screening and Test Methods

- Quality control and toxicity studies as per Drug and Cosmetics Act.

Recommended Books

1. P. Pushpangadam, Ulf Nyman. V. George, 'Glimpses of Indian Ethano Pharmacology', Tropical Botanic Garden & Research Institute.
2. Raphael Ikan, 'Natural Products: A Lab Guide', Academic Press.
3. G.E. Trease and W.C. Evans, 'Pharmacognosy', W.B. Saunders Edinburgh, New York.
4. Tyler, Brady, Robbers, Lee & Fetiger, 'Pharmacognosy'.
5. Peach & M.V. Tracey, 'Modem Methods of Plant Analysis', Vol. I & II, Springer Publishers
6. R.D. Choudhary, 'Herbal Drug Industry', Eastern Publishers, New Delhi.
7. C.K. Kokate, Purohit, Ghokhale, 'Text book of Pharmacognosy', Nirali Prakashan.
8. T.E. Wallis, 'Text Book of Pharmacognosy', J & A Churchill Ltd., London.
9. Pulok K. Mukherjee, 'Indian Herbal Pharmacopoeia', IDMA, Mumbai.
10. Vinod D. RangarI, 'Text book of Pharmacognosy and Phytochemistry', Part I & II, Career Publication, Nasik, India.
11. H. Wagner and S. Bladt, 'Plant Drug Analysis', Springer, Berlin.
12. Herbal Medicine. Expanded Commission E. Monographs, M. Blumenthal.
13. H. Panda, 'Herbal Cosmetics (Hand Book)', Asia Pacific Business Press Inc, New Delhi.
14. E.G. Thomson, 'Modern Cosmetics', Universal Publishing Corporation, Mumbai.
15. P.P. Sharma, 'Cosmetics - Formulation, Manufacturing & Quality Control', Vandana Publications, New Delhi.

INDIAN SYSTEMS OF MEDICINE

Subject Code – MPHA4-209 **L T P C** **Duration – 50 Hrs**

4 0 0 4

Scope

- To make the students understand thoroughly the principles, preparations of medicines of various Indian systems of medicine like Ayurveda, Siddha, Homeopathy and Unani. Also focusing on clinical research of traditional medicines, quality assurance and challenges in monitoring the safety of herbal medicines.

Objectives

After completion of the course, student is able to

- To understand the basic principles of various Indian systems of medicine
- To know the clinical research of traditional medicines, Current Good Manufacturing Practice of Indian systems of medicine and their formulations.

UNIT-I (12 Hrs)

Fundamental Concepts of Ayurveda, Siddha, Unani and Homoeopathy Systems of Medicine.

- Different dosage forms of the ISM.

Ayurveda

- Ayurvedic Pharmacopoeia,
- Analysis of formulations and bio crude drugs with references to: Identity, purity and quality. Siddha Gunapadam (Siddha Pharmacology), raw drugs/Dhatu/Jeevam in Siddha system of medicine, Purification process (Suddhi).

UNIT-II (12 Hrs)

- Naturopathy, Yoga and Aromatherapy practices
- Naturopathy - Introduction, basic principles and treatment modalities.
- Yoga - Introduction and Streams of Yoga.
- Asanas, Pranayama, Meditations and Relaxation techniques.
- Aromatherapy – Introduction, aroma oils for common problems, carrier oils

UNIT-III (12 Hrs)

- Formulation development of various systems of medicine
- Salient features of the techniques of preparation of some of the important class of Formulations as per Ayurveda, Siddha, Homeopathy and Unani Pharmacopoeia and texts.
- Standardization, Shelf life and Stability studies of ISM formulations.

UNIT- IV (14 Hrs)

- Schedule T – Good Manufacturing Practice of Indian systems of medicine
- Components of GMP (Schedule – T) and its objectives, Infrastructural requirements, working space, storage area, machinery and equipment, standard operating procedures, health and hygiene, documentation and records.
- Quality assurance in ISM formulation industry - GAP, GMP and GLP.
- Preparation of documents for new drug application and export registration.
- Challenges in monitoring the safety of herbal medicines: Regulation, quality assurance and

control, National/Regional.

- Pharmacopoeias.
- TKDL, Geographical indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU

Recommended Books

1. 'Ayurvedic Pharmacopoeia', The Controller of Publications, Civil Lines, Govt. of India, New Delhi.
2. H. Panda, 'Hand Book on Ayurvedic Medicines', National Institute of Industrial Research, New Delhi.
3. Kaviraj Nagendranath Sengupata, 'Ayurvedic System of Medicine', Sri Satguru Publications, New Delhi.
4. 'Ayurvedic Pharmacopoeia. Formulary of Ayurvedic Medicines', IMCOPS, Chennai.
5. Homeopathic Pharmacopoeia. Formulary of Homeopathic Medicines, IMCOPS, Chennai.
6. Steven B. Kayne, 'Homeopathic Pharmacy: An introduction & Hand Book', Churchill Livingstone, New York.
7. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
8. British Herbal Pharmacopoeia, British Herbal Medicine Association, UK.
9. Pulok K. Mukharjee, 'G.M.P. for Botanicals - Regulatory and Quality issues on Phytomedicine', Business Horizons, New Delhi.
10. Indian System of Medicine and Homeopathy in India, Planning and Evaluation Cell, Govt. of India, New Delhi.
11. Swaminathan, 'Essential of Food and Nutrition', Bappco, Bangalore.
12. F.P. Antia, 'Clinical Dietetics and Nutrition', Oxford University Press, Delhi.
13. V.K. Yoga, 'Yoga - The Science of Holistic Living', Vivekananda Yoga Prakashna Publishing, Bangalore.

INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY

Subject Code – MPHA4-210 **L T P C** **Duration – 50 Hrs**

4 0 0 4

Scope

- To understand the Industrial and commercial potential of drugs of natural origin, integrate traditional Indian systems of medicine with modern medicine and also to know regulatory and quality policy for the trade of herbals and drugs of natural origin.

Objectives

By the end of the course the student shall be able to know,

- The requirements for setting up the herbal/natural drug industry.
- The guidelines for quality of herbal/natural medicines and regulatory issues.
- The patenting/IPR of herbals/natural drugs and trade of raw and finished materials.

UNIT-I (14 Hrs)

Biosynthetic Pathways and Radio Tracing Techniques

- Constituents & their Biosynthesis, Isolation, Characterization and purification with a special reference to their importance in herbalindustries of following phyto-pharmaceuticals containing drugs:
- Alkaloids: Ephedrine, Quinine, Strychynine, Piperine, Berberine, Taxol, Vinca alkoloids.
- Glycosides: Digitoxin, Glycyrrhizin, Sennosides, Bacosides, Quercitin.
- Steroids: Hecogenin, guggulosterone and withanolides
- Coumarin: Umbelliferone.
- Terpenoids: Cucurbitacins

Herbal Drug Industry

- Infrastructure of herbal drug industry 12 involved in production of standardized extracts and various Hrs dosage forms. Current challenges in upgrading and modernization of herbal formulations. Entrepreneurship Development, Project selection, project report, technical knowledge, Capital venture, plant design, layout and construction.
- Pilot plant scale –up techniques, case studies of herbal extracts. Formulation and production management of herbals.

UNIT-II (12 Hrs)

Regulatory Requirements for Setting Herbal Drug Industry

- Global marketing management. Indian and international patent law as applicable herbal drugs and natural products. Export - Import (EXIM) policy, TRIPS.
- Quality assurance in herbal/natural drug products. Concepts of TQM, GMP, GLP, ISO-9000.

Monographs of Herbal Drugs

- General parameters of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic Pharmacopoeia, Siddha and Unani Pharmacopoeia, American herbal pharmacopoeia, British herbal pharmacopoeia, WHO guidelines in quality assessment of herbal drugs.

UNIT-III (12 Hrs)

- Testing of natural products and drugs: Herbal medicines - clinical laboratory testing. Stability testing of natural products, protocols.

UNIT-IV (12 Hrs)

Patents

- Indian and international patent laws, proposed 12 amendments as applicable to herbal/natural products and process.
- Geographical indication, Copyright, Patentable subject maters, novelty, non-obviousness, utility, enablement and best mode, procedure for Indian patent filing, patent processing, grant of patents, rights of patents, cases of patents, opposition and revocation of patents, patent search and literature, Controllers of patents.

Recommended Books

1. R.D. Choudhary, 'Herbal Drug Industry', Eastern Publisher, New Delhi, **1996.**

2. Pulok K. Mukharjee, 'GMP for Botanicals - Regulatory and Quality issues on Phytomedicine', Business Horizons Robert Verpoorte, New Delhi, **2003.**
3. Pulok K. Mukarjee, 'Quality Control of Herbal Drugs', Business Horizons Pharmaceutical Publisher, New Delhi, **2002.**
4. 'PDR for Herbal Medicines' Medicinal Economic Company, New Jersey. **2000.**
5. 'Indian Herbal Pharmacopoeia (2002)', IDMA, Mumbai.
6. C.K. Kokate, Purohit, Gokhlae, 'Text Book of Pharmacognosy', Nirali Prakashan, New Delhi.
7. Vinod D. RangarI, 'Text Book of Pharmacognosy and Phytochemistry', Part I & II, Career Publication, Nasik, India.
8. H. Wagner and S. Bladt, 'Plant Drug Analysis', Springer, Berlin.
9. V. Rajpal, 'Standardization of Botanicals. Testing and extraction methods of medicinal herbs' Eastern Publisher, New Delhi, **2004.**
10. J.B. Harborne, 'Phytochemical Dictionary - Handbook of Bioactive Compounds from Plants', Taylor and Francis Ltd, UK. **1999.**
11. D.P.S. Kohli and D.H. Shah, 'Drug Formulation Manual' Eastern Publisher, New Delhi. **1998.**

HERBAL COSMETICS PRACTICALS

Subject Code – MPHA4-211 **L T P C**
0 0 12 6

- Isolation of nucleic acid from cauliflower heads
- Isolation of RNA from yeast
- Quantitative estimation of DNA
- Immobilization technique
- Establishment of callus culture
- Establishment of suspension culture
- Estimation of aldehyde contents of volatile oils
- Estimation of total phenolic content in herbal raw materials
- Estimation of total alkaloid content in herbal raw materials
- Estimation of total flavonoid content in herbal raw materials
- Preparation and standardization of various simple dosage forms from Ayurvedic, Siddha, Homoeopathy and Unani formulary
- Preparation of certain Aromatherapy formulations
- Preparation of herbal cosmetic formulation such as lip balm, lipstick, facial cream, herbal hair and nail care products
- Evaluation of herbal tablets and capsules
- Preparation of sunscreen, UV protection cream, skin care formulations.

- Formulation & standardization of herbal cough syrup.

SEMINAR/ASSIGNMENTS

Subject Code – MPHA4-212 **L T P C**

0 4 0 4

- Introduction, Information and Retrieval Systems.
- Writing Assignments and Term Papers
- Reading Research Papers
- Organization and Presentation of Scientific Material, Research Work, Dissertations, Patents Etc.
- Skills in Oral and Technical Presentations
- Tutorials related to subject taught

Each Student has to present at least three seminars during the Semester.