THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY
CHENNAI-600 032

SYLLABUS – M.PHARMACY 2006-2007
BRANCH III - PHARMACOGNOSY

M. PHARMACY

I YEAR

SYLLABUS FOR PHARMACOGNOSY – BRANCH III

COMMON TO ALL BRANCHES - PAPER – I

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES

THEORY **75 Hours(3 hrs./week)**

1. UV-VISIBLE SPECTROSCOPY : 6 Hours.

Brief review of electromagnetic spectrum and absorption of radiations. The chromophore concept, absorption law and limitations. Theory of electronic spectroscopy, absorption by organic molecules, choice of solvent and solvent effects, modern instrumentation – design and working principle. Applications of UV-Visible spectroscopy (qualitative and quantitative analysis), Woodward – Fischer rules for calculating absorption maximum, Photometric titrations and its applications.

2. FLAME EMISSION SPECTROSCOPY AND ATOMIC ABSORPTION SPECTROSCOPY : 3 Hours.

Principle, instrumentation, interferences and applications in Pharmacy.

3. SPECTROFLUORIMETRY : 3 Hours.

Theory, instrumentation, advantages, relationship of chemical structure to fluorescence spectra, solvent effect, effect of acids and bases on fluorescence spectra, concentration effects, factors affecting fluorescence intensity, comparison of fluorescence and UV-Visible absorption methods and applications in Pharmacy.

4. INFRARED SPECTROPHOTOMETRY : 6 Hours.

Introduction, basic principles, vibrational frequency and factors influencing vibrational frequency, instrumentation and sampling techniques, interpretation of spectra, applications in Pharmacy. FT-IR-theory and applications, Attenuated Total Reflectance (ATR).

5. NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY : 8 Hours.

Fundamental Principles and Theory, Instrumentation, solvents, chemical shift, and factors affecting chemical shift, spin-spin coupling, coupling constant, and factors influencing the value of coupling constant, spin-spin decoupling, proton exchange reactions, FT-NMR, 2D -NMR, NMDR, NOE, NOESY, COSY and applications in Pharmacy, interpretation of spectra, C13 NMR-Introduction, Natural abundance, C13 NMR Spectra and its structural applications.

6. ELECTRON SPIN RESONANCE SPECTROSCOPY : 2 Hours.

Theory and Principle, Limitations of ESR, choice of solvent, g-values, hyperfine splitting, instrumentation, difference between ESR & NMR and applications.

7. MASS SPECTROSCOPY : 8 Hours.

Basic principles and instrumentation, ion formation and types, fragmentation processes and fragmentation pattern, Chemical ionization mass spectroscopy (CIMS), Field Ionization Mass Spectrometry (FIMS), Fast Atom Bombardment MS (FAB MS), Matrix Assisted laser desorption / ionization MS (MALDI-MS), GC-MS, interpretation of spectra and applications in Pharmacy.

8. X-RAY DIFFRACTION METHODS : 4 Hours.

Introduction, generation of X-rays, X-ray diffraction, Bragg's law, X-ray powder diffraction, interpretation of diffraction patterns and applications.

9. OPTICAL ROTARY DISPERSION : 4 Hours.

Principle, Plain curves, curves with cotton effect, octant rule and its applications with example, circular dichroism and its relation to ORD.

10. THERMAL METHODS OF ANALYSIS : 5 Hours.

Theory, instrumentation and applications of Thermo Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) and Thermo Mechanical Analysis (TMA).

11. CHROMATOGRAPHIC TECHNIQUES : 15 Hours.

a) Classification of chromatographic methods based on mechanism of separation: paper chromatography, thin layer chromatography, ion exchange chromatography, column chromatography and affinity chromatography – techniques and applications.

b) Gas Chromatography : Theory and principle, column operation, instrumentation, derivatisation methods and applications in Pharmacy.

c) High Performance Liquid Chromatography : Principle, instrumentation, solvents used, elution techniques, RP-HPLC, LC-MS and applications in Pharmacy.

d) HPTLC and Super Critical Fluid Chromatography (SFC) : Theory and Principle, instrumentation, elution techniques and pharmaceutical applications.

12. ELECTROPHORESIS : 3 Hours.

Theory and principles, classifications, instrumentation, moving boundary electrophoresis, Zone Electrophoresis (ZE), Isoelectric focusing (IEF) and applications.

13. RADIO IMMUNO ASSAY : 3 Hours.

Introduction, Principle, Theory and Methods in Radio Immuno Assay, Related Immuno Assay procedures and Applications of RIA Techniques.

14. STATISTICAL ANALYSIS : 5 Hours.

Introduction, significance of statistical methods, normal distribution, probability, degree of freedom, standard deviation, correlation, variance, accuracy, precision, classification of errors, reliability of results, confidence interval, Test for statistical significance – students T-test, F-test, Chi-square test, correlation and regression.

PRACTICALS

1. Use of colorimeter for analysis of Pharmacopoeial compounds and their formulations.
2. Use of Spectro photometer for analysis for Pharmacopoeial compounds and their formulations.
3. Simultaneous estimation of combination formulations (minimum of 4 experiments).
4. Effect of pH and solvent on UV Spectrum of certain drugs.
5. Use of fluorimeter for analysis of Pharmacopoieal compounds.
6. Experiments on Electrophoresis.
7. Experiments of Chromatography.
    (a) Thin Layer Chromatography.
    (b) Paper Chromatography.
        1) Ascending Technique.
        2) Descending Technique.

3) Circular Technique.
4) Two dimensional Paper Chromatography and TLC.

8. Experiments based on HPLC & GC.
9. IR, NMR and Mass Spectroscopy – Interpretation of spectra & Structural elucidation (atleast for 4 compounds each).
10. Any other relevant exercises based on theory.

REFERENCES

1. Spectrometric identification of Organic Compounds, Robert. M. Silverstein et al, 7th Edition, 1981.
2. Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor.
3. Principles of Instrumental Analysis by Donglas A. Skoog, James, J. Leary, 4th Edition.
4. Pharmaceutical Analysis – Modern Methods – Part A, Part B, James W. Munson – 2001.
5. Vogel's Text Book of Quantitative Chemical Analysis, 6th Edition, 2004.
6. Chromatographic Analysis of Pharmaceuticals, John A. Adamovics, 2nd Edition.
7. Practical Pharmaceutical Chemistry, Part two, A. H. Beckett & J. B. Stenlake – 4th Edition.
8. Instrumental Methods of Chemical Analysis – B. K. Sharma - 9th Edition.
9. Instrumental Methods of Analysis – Hobert H. Willard, 7th Edition.
10. Organic Spectroscopy – William Kemp, 3rd Edition.
11. Techniques and Practice of Chromatography – Raymond P. W. Scott, Vol. 70.
12. Identification of Drugs and Pharmaceutical Formulations by Thin Layer Chromatography – P. D. Sethi, Dilip Charegaonkar, 2nd Edition.
13. HPTLC – Quantitative Analysis of Pharmaceutical Formulations – P. D. Sethi.
14. Liquid Chromatography – Mass Spectrometry, W. M. A. Niessen, J. Van Der Greef, Vol. 58.
15. Stereo Chemistry – Conformation and Mechanism by P. S. Kalsi, 2nd Edition.
16. Spectroscopy of Organic Compounds by P. S. Kalsi.
17. Organic Chemistry by I. L. Finar Vol. II – 5th Edition.

SYLLABUS FOR PHARMACOGNOSY

BRANCH – III

PAPER – II

PHARMACOGNOSY

Theory **75 Hours (3 hrs./week)**

1. General aspects of sources of natural medicinal products **5 Hours.**

2. Marine Pharmacognosy and its applications **3 Hours.**

3. General cultivation of medicinal plants, their merits and Demerits **8 Hours.**

a. General aspects.
b. Factors involved.
c. Methods used to improve the Quality.
d. Pest control.

4. Cultivation of Rauwolfia, Digitalis, Senna, Clove, Cardamom, Plantago, Artemisia annua, Coleus forskoli, Aloe. **9 Hours.**

5. Commerce and Quality control of natural medicine products including organoleptic, microscopical, physical, chemical and biological evaluation of crude drugs as per WHO guidelines. **10 Hours.**

6. An overview of poisonous plants and their mode of toxicity with special emphasis to indigenous poisonous plants. **2 Hours.**

7. Role of natural products in alternative system of medicine like Siddha, Ayurveda, Homoeopathy, Chinese medicine, Tribal medicines and Neutraceuticals. **4 Hours.**

8. **Drug Improvement:** **11 Hours.**

a. Growth regulators, classification and preparation of growth regulators, Mechanism of action of growth regulators of the following – Auxins, gibberllins, Cytokinins, Absicisic acid.

b. Mineral Supplements – macronutrients, micronutrients, their role in the drug improvement.

c. Role of natural pesticides – Preparation and uses.

9. **10 Hours.**

a. The Principles, rationals and technology involved in the production of herbal formulation and herbal cosmetics.
b. Quality control of Herbal formulations as per international Standards.

10. Aromatic plants : **13 Hours.**

a. Cultivation, industrial production and their application :
   1)Patchouli 2)Geranium 3)Rosemary 4)Eucalyptus oil 5)Davana 6)Cardamom.
b. Modern methods of Extraction of Volatile oils.
   1) Steam distillation 2) Carbondioxide extraction.
c. Standardisation of essential oils, deduction of adulterants.
d. Synthesis and isolation of constituents of volatile oils.
e. Extraction of plant drugs by microwave assisted technique and its merits and Demerits.

PRACTICAL

1. Macroscopical and microscopical evaluation including Quantitative microscopy.
2. Physical, Chemical and Biological evaluation in quality control of crude drugs.
3. a) Estimation of secondary metabolites like alkaloids, terpenoids and flavonoids by different methods.
   (b) Estimation of plant phytoconstituents using modern methods like UV and HPTLC.
4. Extraction and isolation of volatile oils.(Given in chapter 10).
5. Extraction of plant phytoconstituents.
6. Demonstration of simple experiment to study the effect of plant growth regulators.

REFERENCES

1. Pharmacognosy by G.E. Trease, W.C. Evans, ELBS.
2. Pharmacognosy by Varro E.Tyler, Lynn. R.Brady, James E.Robbers.
3. Text Book of Pharmacognosy by T.E. Wallis, CBS Pub. Delhi.
4. Plant Physiology of Frank B.Salisburry, Cleon. W.Ross, CBS Pub. Delhi
5. Indian Medicinal Plants by Kirthikar, Basu.
6. Indian Meteria Medica by K.M. Nalkarni
7. The Essential Oils by Guenther. E.
8. Modern Toxicology vol.II by P.K.Gupta, D.k. Salunkhe
9. Proceeding of the seminar on scope of Aromatic plants & Processing Industries.
10. Pharmacographia Indica by W.Dymock.
11. A Hand Book of Common remedies in Siddha system of medicine- CCRIMH.
12. Clinical applications of the Ayurvedic remedies.
13. Baidyanth Book of Ayurvedic Knowledge.
14. Perfumery technology by Wallis, Billot.M.

15. Jenkin's quantitative pharmaceutical Chemistry by A.M.Knevell.
16. Phytochemical methods of chemical analysis by Harbone.
17. Pharmacoepial standards for Ayurvedic formulations –CCRAS, Delhi.
18. Practical Pharmacognosy by Dr.C.K.Kokate.
19. Practical Pharmacognosy by Dr.P.K.Lala.
20. Bibiliography on pharmacognosy of medicinal plants-Roma Mitra.
21. British Herbal Pharmacopoeia.
22. Essential oils and waxes: H.F.Linskens & J.F.Jackson.
23. The Ayurveda Encyclopedia – Swami Sada Shiva Tirtha.
24. Encyclopedia of Natural medicine – Michael Murray & Joseph. Pizzorno
25. Toxic plants and other Natural toxicants – Tom Garland & Catharine Barr.
26. Alternate medicine – Dr. K.B.Nangia
27. Ayurvedic Medicines – H.Panda.
28. Pharmacognosy and Pharmacobiotechnology – Ashutoshkar.
29. Foundations of Ayurveda – K.H.Krishnamurthy.
30. The complete Germancommision, E.Monographs-Blumenthal Buse, Gold bery, Gruenwald Hall.
31. The Ayurvedic system of medicine – K.N.Sengupta.
32. Arboriculture – Harris, Clark, Matheny.
33. Herbal cosmetics Hand book – H.Panda.
34. Homoeopathic pharmacy – Steven B.Kayne.
35. Dictionary of Indian Folk medicine and Ethnobotony – Dr.S.K.Jain.

SYLLABUS FOR PHARMACOGNOSY

BRANCH III

PAPER – III

BIOGENESIS & CHEMISTRY OF NATURAL PRODUCTS

THEORY **75 Hours (3 hrs./week)**

1) Detailed study of plant physiology and plant Biochemistry, Study of techniques employed in the elucidation of Biosynthetic pathways and the study of important Biosynthetic pathways of plants like photosynthesis, Carbohydrate utilization, Aromatic Biosynthesis, Isoprenoid Biosynthesis with special importance to active principles. **5 Hours.**

2) A detailed study of the following classes of Natural products with special importance to occurrence, chemistry, Biosynthesis, isolation, purification and estimation by Physical, Chemical and Biological methods.

   a) Polypeptide – Proteins – Preparation of insulin, Vasopreesin and Oxytocin. **5 Hours.**
   b) Alkaloids- Atropine, Ergometrine, Reserpine and Vinblastine, morphine and its synthetic analogues. Hypercin, Ginkobiloba, Forskolin. **9 Hours.**
   c) Steroids – Chemistry and stereochemistry of Cholesterol, Preparation and Chemistry of corticosteroids. **5 Hours.**
   d) Glycosides – Cardiac glycosides like Digoxin, Scillaren-A, Ovabain and Peruvoside. **5 Hours.**
   e) Antibiotics – Penicillin, semisynthetic penicillins and Tetracylclines. **8 Hours.**
   f) Vitamins – Vitamin A, Folic acid, Vitamin-B12 and Vitamin C. **8 Hours.**

3) Industrial methods of isolation and estimation of the following natural products **10 Hours.**

a) Digoxin	b) Sennosides	c) Diosgenin
d) Hesperidin	e) Tannic acid	f) Pectin
g) Atropine	h) Quinine	i) Emetin
j) Hydroxycitric acid	k) Forskolin	

4) General methods of screening natural products for the following Biological activities and their structural activity **20 Hours.**

   a) Anti-inflamatory Activity.
   b) Hypoglyceimic.
   c) Diuretic.

d) Cardiac Activity.
e) Antiviral & Antibacterial Activity.
f) Antineoplastic Activity.
g) Psychopharmacological Activity.
h) Antifertility Activity.
i) Screening of Invitro Antioxidant Activity.
j) Antiulcer Activity.
k) Hepato protective Activity.

PRACTICALS

1. Isolation of piperine from pepper.
2. Estimation of piperine in pepper by UV, HPTLC, and HPLC Analysis.
3. Estimation of Total phenolic compounds from plant drugs.
4. Determination of Antioxidant potential of some plant drugs by DPPH and Nitric oxide methods.
5. UV and IR analysis of the following isolated phytochemicals and determination of their purity.
    a) Caffeine.
    b) Piperine.
    c) Quinine.
    d) Andrographolide.
    e) Curcumin.
6. Study on the Micro wave assisted extraction technique of plant drugs.
7. Analysis of extracts obtained from micro wave assisted technique by modern techniques like UV, HPLC and HPTLC and comparison with the extracts obtained from conventional method.
8. Determination of total andrographolides from Kalmegh.
9. Determination of total bitters from the following plant drugs.
    a) Kalmegh.
    b) Eclipta alba.
    c) Picrorhiza.
    d) Tinospora cordifolia.
10. Estimation of total saponins from
    a) Bacopa momnieri.
    b) Tribulus terrestris.
11. Estimation of withanolides from Withania Somnifera.
12. HPTLC estimation of Gugulosterones in Guggul.
13. Estimation of Boswellic acid from Boswellia serrata by non-aqeous titration.
14. Estimation of Berberine from plant drugs by HPTLC.
15. Estimation of flavanoids in Liquorice.
16. Estimation of Glycyrrhizin in Liquorice by spectrophotometric method.

REFERENCES

1. Pharmacognosy by G.E. Trease, W.C. Evans, ELBS.
2. Pharmacognosy by Varro E.Tyler, Lynn. R.Brady, James E.Robbers.
3. Text Book of Pharmacognosy by T.E. Wallis, CBS Pub. Delhi.
4. Plant Physiology of Frank B.Salisburry, Cleon. W.Ross, CBS Pub. Delhi
5. Diosgenin and other steroid drug precursors by Asolkar,CSIR.
6. Antibiotics,Isolation&Seperationby Weinsted.M.I.Wagman,G.H.
7. Hormone Chemistry by W.R.Butt.
8. Quantitative analysis & Steroids by Gorog.S.
9. Steroids by Feiry & Feisher.
10. Alkaloids Chemical & Biological by S.W.Pelletier.
11. Biotechnology of Industrial antibiotics by E.vardemme.
12. Chromatography of Alkaloids by Vapoorte, Swendson.
13. Elements of chromatography by P.K.Lala.
14. Introduction to chromatography theory & Practicals by V.K. Srivastava, K.Kishore.
15. Principles of Biotechnology by Leininger.
16. Jenkins Quantitative Pharmacuetical Chemistry by A.N.Knevell.
17. Handbook of vitamins by L.J.Machlein.
18. Clerk's Isolation & Identification of drugs by A.C.Mottal.
19. Selected Topics in Exp-Pharmacology by Seth.V.K.
20. Burger's Medicinal Chemistry by wolff.M.I.
21. Wilson & Gisvolds Text Book of organic Medicinal and Pharmacuetical Chemistry by Deorge.R.F.
22. Phytochemical methods of chemical analysis by Harbone.
23. Organic chemistry vol.II by I.L.Finar.
24. The Essential oil by Gunther.E.
25. The use of Pharmacological techniques for the evaluation of natural products by B.N.DhavanR.C.Srimal. CDRI, Lucknow.
26. Physical methods in organic chemistry by J.C.P.Schwartz.
27. Techniques in organic chemistry by Weiss Creger.
28. Practical Pharmacognosy by Dr.C.K. Kokate.
29. Practical Pharmacognosy by Dr.P.K.Lala.
30. Herbal medicines – Janne Barnes, Linda. A.Anderson.
31. Chinese materia medica – Yaru – PingZhu.
32. Natural products from plants – Peter.B.Kanfman.
33. Selection, Preparation and pharmacological evaluation of plant material – M.Williamson, David T.Okpako, J.Evans.

SYLLABUS FOR PHARMACOGNOSY

BRANCH – III

PAPER – IV

PHYTOCHEMISTRY & BIOTECHNOLOGY

THEORY **75 Hours(3 hrs./week)**

1) Phytochemistry : **11 Hours.**

a. Introduction and general methods of phytochemical plant analysis, methods of extraction, isolation, separation, identification and analysis of results.
b. Microbiological conversions, aberrant synthesis in Higher plants.

2) Genetics and comparative phytochemistry in pharmacognosy. **3 Hours.**

3) Secondary plant metabolism : **10 Hours.**

a. Primary and secondary metabolism.
b. The function of secondary metabolites.
c. The usefulness of secondary metabolites.
d. Secondary metabolites in chemosystematics.
e. Plant tissue culture as a medium of study of secondary plant metabolism.

4) Microchemical Analysis : **4 Hours.**

A study of the elements of optical crystallography, using ordinary light microscope, the polarizing microscope, the polarizing microscope and various microtechniques useful in the identification of crude drugs and their constituents.

5) Fermentation Chemistry: **17 Hours**

a. A detailed account of fermentation technology with examples and applications.
b. Chemical aspects of the production of Pharmaceutically and economically important substances by microorganisms :
   i) Penicillin ii) Dextrose from starch & cellulose substrates
   iii) Vitamin B 12 iv) Ergot alkaloids
c. Yeast and its use, production of single cell proteins.
d. Industrial fermentation and pharmaceutical effluents – its treatment and legal requirement.

6) Plant Tissue Culture: 20 Hours.

A detailed study of plant tissue culture and its application in pharmacognosy :

a. Introduction, History and development of plant tissue culture.
b. Laboratory requirements and general techniques.
c. Tissue culture media, nutrients and mineral supplements.
d. Callus culture.
e. Isolated culture and genetic manipulation of plant protoplasts.
f. Secondary product formation by cell suspension cultures.
g. Hairy root culture and its applications.
h. Biotransformation.

7) A chemical and spectral study of the constituents of Primary and Secondary phytometabolites. 10 Hours.

PRACTICALS

1) Preliminary phytochemical screening and detection of various plant constituents such as

a. Carbohydrates.
b. Alkaloids.
c. Anthraquinones.
d. Flavanoids.
e. Polyphenolic compounds.
f. Lipids.
g. Proteins and Aminoacids.

2) Preparation of extracts enriched with active principles and studying their Stability.

3) Phytochemical analysis of isolated plant constituents by UV, HPLC and HPTLC.

4) UV analysis of some crude drugs and phytochemicals for identification and detection of adulterants.

5) Analysis of medicinally use oils by various methods.

6) Estimation of cineole, Eugenol, Citral and other terpenoidal compounds by suitable methods.

REFERENCES

1. Pharmacognosy by G. E.Trease, W.C.Evans, ELBS.
2. Pharmacognosy by Varro E.Tyler, Lynn R.Brady, James E.Robbera.
3. Plant Physiology by Frank B.Salisburry, Cleon.W.Rose, CBS Pub. Delhi.
4. Antibiotics Isolation & Separation by M.L.Wenisten, G.H. Wagman.
5. Introduction to Biotechnology by Bullock, John.
6. Biotechnology of Higher plants by Gorden E. Russel
7. Modern Biotechnology by S.B. Primrose.
8. Plant cell culture – A practical approach by R.A. Dixon.
9. Plant cell culture technology by M.M. Yeoman.
10. Plant tissue culture by Dennis N.Butcher, David. S.Ingram.
11. Plant tissue culture by Pitman.
12. Plant tissue culture – theory & practice by S.S.Bhajwani, M.K.Razdan.
13. A Laboratory guide to Organic Natural Products by R.Ikan
14. Environmental Chemistry by Anil Kupur.D.
15. Basic gas chromatography by Menair, Bondhi.
16. Quantitative thin layer chromatography & its industrial application by Trieber.L.R.
17. Biotechnology of Industrial antibiotics by E.J.Vardamme.
18. Chromatography of alkaloids by Verpoorte Swendson.
19. Elements of chromatography by P.K.Lala.
20. Introduction to chromatography – theory & practice by V.K.Srivastava, K.Kishore.
21. Principles of Biotechnology by Leininger.
22. Handbook of Vitamins by L.S.Machlein.
23. Industrial Microbiology by L.E.Cassida.
24. Microbial Technology by Peppler, Perlman.
25. Burger's Medicinal Chemistry by M.I.Wollf.
26. Wilson and Gisvolds Text Book of Organic Medicinal and Pharmacuetical Chemistry by Deorge.R.F.
27. Phyto chemical methods of chemical analysis by Harbone.
28. Cytogenetics and evolution of plant Breedings by R.S.Shukla.
29. Introduction to organic laboratory techniques by Pavia Lampman.
30. Drug analysis by chromatography by Egon stahl0.
31. Secondary plant metabolism by Margaret L.Vikery, Brian Vikery.
32. Practical Pharmacognosy by Dr.C.K.Kokate.
33. Practical Pharmacognosy by Dr.P.K.Lala.
34. The review of Natural products – Ara Dermarderosia.
35. Phytochemical Dictionary – Jestorey. B.Harbone.FRS.
36. PDR for Herbal medicines.
37. Methods in plant tissue culture – U.Kumar.
38. Plant cell and tissue culture – Angela Stafford and Grahamwarren.
39. Phytochemicals – R.Bidlack, Tomaye, s.Meskin.
40. Propagating plants – Alan toogood.
41. Modern methods of plant analysis –High performance Liquid chromatography in plant science –H.F.Linskens and J.F.Jacksons.
42. Indian Herbal Pharmacopiea -Regional Research Laboratory.
43. Principles and practice of phytotherapy - Simon Mills & Kerry Bone.