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

SYLLABUS – M.PHARMACY 2006-2007
BRANCH VIII – PHYTO PHARMACY AND PHYTO MEDICINE

M. PHARMACY

I YEAR

SYLLABUS FOR PHYTO PHARMACY AND PHYTO MEDICINE – BRANCH VIII

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 PHYTO PHARMACY AND PHYTO MEDICINE

BRANCH – VIII

PAPER-II

ADVANCED PHARMACOGNOSY

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

1. General Introduction to Pharmacognosy: 7 Hours.

Role of Pharmacognosy in the herbal industry.
Classification of herbal drugs with special reference to Chemotaxonomy.

2. Commerce and quality control of herbal drugs: 11 Hours.

International trade.
Quality control with reference to WHO guideline.
Common problems encountered maintenance of quality of crude drugs.

3. General aspects of cultivation and collection: 10 Hours.

Good practices in cultivation.
Plant growth regulators.
Weeds and pest control techniques.
Good practices in collection.

4. Plant biotechnology 10 Hours.

i. Plant tissue culture: Introduction, Laboratory requirements for plant tissue culture, culture media, callus culture, cell suspension culture, protoplast culture, industrial application of tissue culture.
ii. Production of secondary plant metabolites by tissue culture technique. Improvement of the yield, and factors effecting thereof.
iii. Fermentation technology : Introduction, Production of secondary plant metabolites by fermentation technology including design and operation of industrial fermentors and Detailed study of production of Ergot alkaloids.

5. Phytochemical study of the following classes of crude drugs 20 Hours.

Basic chemistry, Biosynthesis, General methods of isolation and methods of analysis

Carbohydrates	Flavanoids
Glycosides	Tannins
Alkaloids	Volatile oils
Terpenoids	Coloring and flavoring agents.

6. Pharmacological screening and review of literature for the following group of drugs 12 Hours.

In vivo methods of screening

a) Immunomodulatory drugs and its review.
b) Anticancer drugs and its review.
c) Antidiabetic drugs and its review.
d) Anti hepatotoxic drugs and its review
e) Hypolipidemic drugs and its review.
f) Antiinflammotory and analgesic drugs and its review.

7. Recent advances in Pharmacognosy. 5 Hours.

High through put screening.
Role of biomarkers in crude drug analysis.
Drug discovery from plant sources.
Ethnobotany, Chemotaxonomy and Chemical ecology.

PRACTICALS

I Evaluation of crude drugs

1. Macroscopic and microscopic evaluation.
2. Determination of ash value.
3. Determination of extractive value.
4. Determination of moisture content.
5. Determination of foaming index.
6. Determination of swelling index.
7. Determination of pesticide residue by HPLC.
8. Determination of microbial load.

II. Preliminary phytochemical screening of certain medicinal plants

Application of TLC and paper chromatography in phytochemical evaluation of crude drugs.

III. Isolation and estimation of phyto-constituents

1. Isolation of volatile oil from different sources and estimation of marker by GC and HPTLC.
2. Isolation of fixed oils from different sources and their physical, physiochemical and chemical evaluation.

IV. Isolation of known marker compounds by column chromatography (Demonstrative)

V. Systematic analysis of crude drugs from unknown origin.

VI. Tissue culture

1. Preparation of culture media, selection and preparation of ex-plant, callus culture.
2. Isolation of enzymes from suitable source, and their immobilization.

REFERENCES

1. Trease and Evans Pharmacognosy, W.C. Evans.
2. Pharmacognosy, Varro E.Tyler, Lynn. R.Brady, James E.Robbers
3. Text Book of Pharmacognosy, T.E. Wallis, CBS Pub. Delhi.
4. Ramstad - Modem Pharmacognosy.
5. John - Dodds - Lorin - Experiments in Plant Tissue Culture.
6. CSIR- Cultivation and Utilization of Medicinal Plants.
7. Handa S.S. & Kaul. K.L. Supplement to cultivation & utilization of medicinal plants.
8. CSIR - Wealth of India, Raw Materials.
9. Bartz - Reinhard - Zenk - Plant Tissue Culture and its Biotechnical Applications.
10. Pharmacognosy, C.K. Kokate, A.P. Purohit, and S.B. Gokhale.
11. Quality Standards of Indian Medicinal Plants Vol-I, ICMR, New Delhi.
12. WHO guide lines for the quality control of Herbal plant materials.
13. The Practical evaluation of phytopharmaceutical by brain & turner.
14. Harborne - Comparative Biochemistry of Flavonoids.
15. Biological standardization by J.N.Barn, D.J.Finley and L.G. Good win.
16. Indian pharmacopoea, Indian Herbal Pharmacopoea and other pharmacopoeia.
17. Ayurvedic Formulary of India.
18. British Herbal Pharmacopoeia.
19. Screening methods of Pharmacology By Robert turner.

SYLLABUS FOR PHYTO PHARMACY AND PHYTO MEDICINE

BRANCH – VIII

PAPER – III

HERBAL DRUG DEVELOPMENT AND STANDARDIZATION

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

1. General Methods of Processing of Herbs: 11 Hours.

- Definition, sources, identification and authentification of herbs.
- Different methods of processing of herbs like collection, harvesting, garbling, packing and storage conditions.
- Methods of drying – Natural and artificial drying methods with their merits and demerits.

2. Methods of Preparation of Extracts: 12 Hours.

- Principles of extraction and selection of suitable extraction method.
- Different methods of extraction including maceration, percolation, hot continuous extraction, pilot scale extraction and supercritical fluid extraction with their merits and demerits.
- Purification and Recovery of Solvents.

3. Standardization of Herbal Raw materials and Extracts: 16 Hours.

- Standardization of herbal raw materials including Pharmacognostical, physical, chemical and biological methods with examples.
- Standardization of herbal extracts, physical, chemical and spectral analysis.
- Qualitative and Quantitative estimation of active principles from standardized extracts by HPTLC.
- Biological standardization -Pharmacological screening of herbal extracts and Microbiological evaluation of herbal extracts.
- Toxicity studies of herbal extracts.

4. Isolation and Estimation of Phytoconstituents: 10 Hours.

Different methods (including industrial) for isolation and estimation of phytoconstituents from the following drugs (with special emphasis on HPLC and HPTLC).

1. Hypericin / Hyperforin from Hypericum species.
2. Forskoline from Coleus forskoli.
3. Catechins from Green tea.
4. L-Hydroxy citric acid from Garcinia combogia.
5. L-Dopa from Mucuna pruriens.

6. Andrographolides from Andrographis paniculata.
7. Alicin from Garlic.
8. Piperine from Piper nigram / Piper longum.
9. Bacosides from Bacopa monnieri.
10. Berberine from Berberis aristata.

5. Herbal Formulation Development: 8 Hours.

- Selection of herbal ingredients.
- Different dosage forms of herbal drugs.
- Evaluation of different dosage forms.
- Stability studies of herbal formulations.

6. GMP for the Production of Quality Botanicals: 10 Hours.

- Good Agricultural Practices.
- Good practices in collection of plant materials.
- Primary processing of herbal products.
- Documentation required.
- Other guidelines for Quality Assurance of Herbal drugs.

7. Herbal Cosmetics: 5 Hours.

Cosmetics preparations: Incorporating the herbal extracts in various cosmetic formulations like Skin care preparations (Creams and Lotions), Sunscreens and Sunburn applications, Hair care preparations (Hair oils and Hair shampoos) and Beautifying preparations(Lipsticks, Face powders and Nail polish).

8. Global Regulatory Status on Herbal Medicines. 3 Hours.

PRACTICALS

1. Preparation of some important extracts by using Pilot Scale Extraction Plant.
2. Isolation and estimation of phytoconstituents by HPTLC listed in chapter 4.
3. Preparation of monoherbal formulations and its evaluations.
4. Preparation of polyherbal formulations and its evaluations.
5. Formulation and standardization of some important herbal cosmetics.
6. Volatile oil Analysis by Gas chromatography.
7. Spectroscopic analysis of some isolated compounds.
8. Estimation of phytoconstituents in mono and polyherbal formulations by HPTLC technique.

LIST OF MAJOR EQUIPMENTS REQUIRED

1. Semi Commercial Scale Extraction Unit.
2. Pilot Scale Spray Drying Unit.
3. High Performance Thin Layer Chromatography (HPTLC).

4. High Performance Liquid Chromatography (HPLC).
5. Gas Chromatography.
6. Phytoformulation Unit (Including Tablet Compression machine,
7. Friabilator. Disintegration apparatus, Hardness tester etc.,)

REFERENCES

1. Herbal drug industry by R.D. Choudhary, Ist edition, eastern publisher, New Delhi: 1996.
2. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine Business horizons, New Delhi, First edition, 2003. Robert Verpoorte, Pulok K Mukharjee.
3. Herbal Cosmetics - H.Pande, Asia Pacific Business press, New Delhi.
4. H.Pande, "The complete technology book on herbal perfumes and cosmetics", National Institute of Industrial Research, Delhi.
5. Quality control of herbal drugs by Pulok K Mukarjee, Ist edition, Business horizons Pharmaceutical publisher, New Delhi, 2002.
6. PDR for herbal medicines, 2nd edition, medicinal economic company, New Jersey, 2000.
7. Indian Herbal Pharmacopoeia, Vol.1&2, RRL, 1DMA, 1998, 2000.
8. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae, 4th edition, Nirali Prakashan, 1996.
9. Text book of Pharmacognosy and Phytochemistry by rangare.
10. Plant drug analysis 2nd edition by Wagner, Bladt.
11. Biological standardization by J.N.Barn, D.J.Finley and L.G. Good win

SYLLABUS FOR PHYTO PHARMACY AND PHYTO MEDICINE

BRANCH – VIII

PAPER-IV

INDIAN SYSTEM OF MEDICINES

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

1. Ayurvedic System of Medicine: **10 Hours.**

- Principles with merits and demerits.
- Introduction on different dosage forms.
- Methods of preparation of Ayurvedic medicines.
- Standardization of Ayurvedic medicines.
- Problems in Standardization of Ayurvedic medicines.

2. Siddha System of Medicines: **8 Hours.**

- Principles with merits and demerits.
- Introduction on different dosage forms.
- Method of preparation of Siddha medicines.
- Standardization of Siddha medicines.
- Problems in Standardization of Siddha medicines.

3. Unani System of Medicines: **8 Hours.**

- Principles with merits and demerits.
- Introduction on different dosage forms.
- Method of preparation of Unani medicines.
- Standardization of Unani medicines.
- Problems in Standardization of Unani medicine.

4. Homeopathy System of Medicines: **8 Hours.**

- Principles with merits and demerits.
- Introduction on different dosage forms.
- Method of preparation of Homeopathic medicines.
- Standardization of Homeopathic medicines.
- Problems in Standardization of Homeopathic medicine.

5. Complimentary Medicines:

- Medicinal sources—Herbal sources, Mineral sources, Animal sources, their collection, purification and processing. **4 Hours.**

- Rules and Regulations to Safeguard the Complimentary Medicines. **4 Hours.**
- Toxicity studies of different formulations used in different Complimentary medicines. **4 Hours.**

6. Tribal medicine: 6 Hours.

Principles, Importance, Merits and Demerits of Tribal Medicines.

7. GMP and Quality Control of Phytomedicine: 15 Hours.

- Status and Applicability of GMP Regulations.
- Objectives of GMP.
- Salient features of GMP under Schedule -T for ISM drugs.
- Components of GMP (Schedule-T) which includes Infrastructural requirements, Working space and Storage area, Machinery and Equipments, Standard Operating Procedure, Health and Hygiene, Documentation and records.
- Quality control of herbal drugs consisting Pharmacopoeial and Non Pharmacopoeial parameters.

8. Pharmacological and Toxicological Screening of drugs used in Indian System of Medicines. **8 Hours.**

PRACTICALS

1. Demonstration of various dosage forms available in each system.
2. Simple preparations used in Ayurvedic System and their Standardization (with special emphasis on HPTLC).
3. Simple preparations used in Siddha system and their Standardization (with special emphasis on HPTLC).
4. Simple preparations used in Unani system and their Standardization (with special emphasis on HPTLC).
5. Simple preparations used in Homeopathy system and their Standardization (with special emphasis on HPTLC).

REFERENCES

1. Ayurvedic Pharmacopoeia.
2. Ayurvedic Formulary of India, the Indian Medical Practitioners Co-operative Pharmacy and Stores Ltd, IMPCOPS.
3. Hand Book on Ayurvedic Medicines, H.Panda National Institute of Industrial Research, Delhi-7.
4. Ayurvedic system of medicine, 2nd edition, Kaviraj, Nagendranath Sengupata, vol. I &II.
5. Siddha Pharmacopoeia by Dr.S. Chidambarathanu pillai, Ist edition.
6. Unani Pharmacopoeia.

7. Homeopathic Pharmacopoeia.
8. Homeopathic Pharmacy An introduction & Hand book by Steven B. Kayne.
9. Alternative medicine, by Dr. K.B. Nangia.
10. Aromatherapy, Valerie Gennari Cooksley.
11. Indian Herbal Pharmacopoeia vol. I &II Indian Drug Manufacturer's association, Mumbai.
12. British Herbal Pharmacopoeia British Herbal Medicine Association,1990 vol.I.
13. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine, Business horizons, New Delhi, First edition, 2003. Robert Verpoorte, Pulok K Mukharjee.
14. Screening methods of Pharmacology by Robert turner.
15. Toxicology and Clinical Pharmacology of Herbal Products, Melanie Johns Cupp.

LIST OF MAJOR EQUIPMENTS REQUIRED

1. High Performance Thin Layer Chromatography (HPTLC).
2. High Performance Liquid Chromatography (HPLC).
3. Gas Chromatography.
4. Equipments used for the ISM Preparations like mixer, stirrier, grinder, etc.,
5. Formulation Unit (Including Tablet Compression machine, Friabilator. Disintegration apparatus, Hardness tester etc.).