Syllabus

For

M.Pharm. (Pharmacognosy)
(Effective from the Session: 2017-18)
### Master of Pharmacy (M. Pharm.)

**SCHEMES FOR INTERNAL ASSESSMENTS AND END SEMESTER EXAMINATIONS (SEM. I & II)**

(W.E.F. Session 2017-18)

**PHARMACOGNOSY-MPG**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>Internal Assessment</th>
<th>End Semester Exams</th>
<th>Total Marks</th>
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<tr>
<td>MPG101T</td>
<td>Modern Pharmaceutical Analytical Techniques</td>
<td>10</td>
<td>15</td>
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<td>MPG102T</td>
<td>Advanced Pharmacognosy- I</td>
<td>10</td>
<td>15</td>
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<tr>
<td>MPG103T</td>
<td>Phytochemistry</td>
<td>10</td>
<td>15</td>
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<tr>
<td>MPG104T</td>
<td>Industrial Pharmacognostical Technology</td>
<td>10</td>
<td>15</td>
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<tr>
<td>MPG105P</td>
<td>Pharmacognosy Practical I</td>
<td>20</td>
<td>30</td>
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**Semester II**

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<td>Medicinal Plant Biotechnology</td>
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<td>MPG203T</td>
<td>Indian System of Medicine</td>
<td>10</td>
<td>15</td>
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<td>MPG204T</td>
<td>Herbal Cosmetics</td>
<td>10</td>
<td>15</td>
<td>1 Hr</td>
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<td>MPG205P</td>
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# Schemes for Internal Assessments and End Semester Examinations (Semester III & IV)

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<th>Course Code</th>
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<tr>
<td>MRM301T (New)</td>
<td>Research Methodology and Biostatistics</td>
<td>40</td>
<td>60</td>
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<td>100</td>
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<tr>
<td>MRM302T (New)</td>
<td>Journal Club</td>
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| Semester IV | | | | | | | | |
| MRM401T (New) | Journal Club | - | - | - | 25 | - | - | 25 | 1 |
| MRM402P (New) | Discussion /Presentation (Proposal Presentation) | - | - | - | 75 | - | - | 75 | 3 |
| MRM403P (New) | Research Work and Colloquium | - | - | - | - | 400 | 1 Hr | 400 | 16 |
| **Total** | | | | **500** | **20** | | | | |
Scope
This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objective
After completion of course student is able to know,
- The analysis of various drugs in single and combination dosage forms.
- Theoretical and practical skills of the instruments.

THEORY


   **IR spectroscopy**: Theory, modes of molecular vibrations, sample handling, instrumentation of dispersive and Fourier–Transform IR spectrometer, factors affecting vibrational frequencies and applications of IR spectroscopy.

   **Spectrofluorimetry**: Theory of fluorescence, factors affecting fluorescence, quenchers. Instrumentation and applications of fluorescence spectrophotometer.

   **Flame Emission Spectroscopy and Atomic Absorption Spectroscopy**: Principle, instrumentation, interferences and applications.

2. **NMR Spectroscopy**: Quantum numbers and their role in NMR, principle, instrumentation, solvent requirement in NMR, relaxation process, NMR signals in various compounds. Chemical shift, factors influencing chemical shift, spin-spin coupling, coupling constant, nuclear magnetic double resonance. Brief outline of principles of FT-NMR and 13C NMR. Applications of NMR spectroscopy.

3. **Mass Spectroscopy**: Principle, theory, instrumentation of mass spectroscopy, different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI analyzers of quadrupole and time of flight, mass fragmentation and its rules, metastable ions, isotopic peaks. Applications of mass spectroscopy.

4. **Chromatography**: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:
   a) Thin Layer chromatography.
   b) High Performance Thin Layer Chromatography.
   c) Ion exchange chromatography.
   d) Column chromatography.
   e) Gas chromatography.
   f) High Performance Liquid chromatography.
   g) Ultra High Performance Liquid chromatography.
   h) Affinity chromatography.
   i) Gel Chromatography.
5. **Electrophoresis:** Principle, instrumentation, working conditions, factors affecting separation and applications of the following:
   a) Paper electrophoresis.
   b) Gel electrophoresis.
   c) Capillary electrophoresis.
   d) Zone electrophoresis.
   e) Moving boundary electrophoresis.
   f) Isoelectric focusing.

**X-ray Crystallography:** Production of X rays, different X ray methods, Bragg's law, rotating crystal technique, X ray powder technique, types of crystals and applications of X-ray diffraction.

6. **a. Potentiometry:** Principle, working, ion selective electrodes and application of potentiometry.

   **b. Thermal Techniques:** Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications.

   Differential thermal analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA).

   TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

   **c. Immunological Assays:** RIA (Radio immune assay), ELISA, bioluminescence assays.

**REFERENCES**

ADVANCED PHARMACOGNOSY - I  
(MPG 102T)

Scope
To learn and understand the advances in the field of cultivation and isolation of drugs of natural origin, various phytopharmaceuticals, nutraceuticals and their medicinal use and health benefits.

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

- Advances in the cultivation and production of drugs.
- Various phyto-pharmaceuticals and their source, its utilization and medicinal value.
- Various nutraceuticals/herbs and their health benefits.
- Drugs of marine origin.
- Pharmacovigilance of drugs of natural origin.

THEORY  

1. **Plant drug cultivation:** General introduction to the importance of pharmacognosy in herbal drug industry. Indian council of agricultural research, current good agricultural practices, current good cultivation practices, current good collection practices. Conservation of medicinal plants: Ex-situ and in-situ conservation of medicinal plants.  

2. **Marine Natural Products:** General methods of isolation and purification, study of marine toxins, recent advances in research in marine drugs, problems faced in research on marine drugs such as taxonomical identification, chemical screening and their solution.

3. **Nutraceuticals:** Current trends and future scope, inorganic mineral supplements, vitamin supplements, digestive enzymes, dietary fibres, cereals and grains, Health drinks of natural origin, antioxidants, polyunsaturated fatty acids, herbs as functional foods. Formulation and standardization of neutraceuticals, regulatory aspects, FSSAI guidelines. Sources, name of marker compounds and their chemical nature, medicinal uses and health benefits of following-  

4. **Phytopharmaceuticals:** Occurrence, isolation and characteristic features (Chemical nature, uses in pharmacy, medicinal and health benefits) of following-
   a) Carotenoids: i) α and β - Carotene; ii) Xanthophyll (Lutein).
   b) Limonoids: i) d-Limonene; ii) α-Terpineol.
   c) Saponins: i) Shatavarins.
   e) Phenolic acids: Ellagic acid.
   f) Vitamins.
   g) Tocotrienols and Tocopherols
   h) Andrographolide, Glycolipids, Gugulipids, Withanolides, Vascine, Taxol.
   i) Miscellaneous.

5. **Pharmacovigilance of Drugs of Natural Origin:** WHO and AYUSH guidelines for safety monitoring of natural medicine, spontaneous reporting schemes for bio-drug adverse reactions, bio drug-drug and bio drug-food interactions with suitable examples.
REFERENCES (Latest Editions of)

2. Pharmacognosy-Tyler, Brady, Robbers.
3. Modern Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I & II.
5. Marine Natural Products-Vol.I to IV.
PHYTOCHEMISTRY  
(MPG 103T)

Scope
Students shall be equipped with the knowledge of natural product drug discovery and will be able to isolate, identify and extract and the phytoconstituents.

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

- Different classes of phytoconstituents, their biosynthetic pathways, their properties, extraction and general process of natural product drug discovery.
- Phytochemical fingerprinting and structure elucidation of photoconstituents.

THEORY   

60 Hrs

1. Biosynthetic pathways and Radio tracing techniques: Constituents & their Biosynthesis, Isolation, Characterization and purification with a special reference to their importance in herbal industries of following phyto-pharmaceuticals containing drugs:  
   a) Alkaloids: Ephedrine, Quinine, Strychnine, Piperine, Berberine, Taxol, Vinca alkoloids.
   b) Glycosides: Digitoxin, Glycyrrhizin, Sennosides, Bacosides, Quercitin.
   c) Steroids: Hecogenin, guggulosterone and withanolides.
   d) Coumarin: Umbelliferone.
   e) Terpenoids: Cucurbitacins.

12 Hrs

2. Drug Discovery and Development: History of herbs as source of drugs and drug discovery, the lead structure selection process, structure development, product discovery process and drug registration, Selection and optimization of lead compounds with suitable examples from the following source: Artemesin, Andrographolides. Clinical studies emphasising on phases of clinical trials, protocol design for lead molecules.

12 Hrs

3. Extraction and Phytochemical Studies: Recent advances in extractions with emphasis on selection of method and choice of solvent for extraction, successive and exhaustive extraction and other methods of extraction commonly used like microwave assisted extraction, Methods of fractionation. Separation of phytoconstituents by latest CCCET, SCFE techniques including preparative HPLC and Flash column chromatography.

12 Hrs


12 Hrs

5. Structure elucidation of the following compounds by spectroscopic techniques like UV, IR, MS, NMR (1H, 13C)  
   a. Carvone, Citral, Menthol.
   b. Luteolin, Kaempferol.
   c. Nicotine, Caffeine
   d. Glycyrrhizin.
REFERENCES (Latest Editions of)

1. Organic Chemistry by I.L. Finar Vol. II
2. Pharmacognosy by Trease and Evans, ELBS.
3. Pharmacognosy by Tylor and Brady.
5. Clark’s Isolation and Identification of drugs by A.C. Mottal.
9. Natural Products Chemistry Practical Manual by Anees A Siddiqui and Seemi Siddiqui
11. Chemistry of Natural Products- Vol. 1 onwards IWPAC.
12. Modem Methods of Plant Analysis- Peach & M.V. Tracey, Vol. I & II.
INDUSTRIAL PHARMACOGNOSTICAL TECHNOLOGY
(MPG 104T)

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.

THEORY 60 Hrs

1. **Herbal Drug Industry:** Infrastructure of herbal drug industry involved in production of standardized extracts and various 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. 12 Hrs

2. **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. 12 Hrs

3. **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. 12 Hrs

4. **Testing of Natural Products and Drugs:** Herbal medicines - Clinical laboratory testing, stability testing of natural products, protocols. 12 Hrs

5. **Patents:** Indian and international patent laws, proposed amendments as applicable to herbal/natural products and process. Geographical indication, copyright, patentable subject matters, 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. 12 Hrs
REFERENCES (Latest Editions of)

5. Indian Herbal Pharmacopoeia (2002), IDMA, Mumbai.
PHARMACOGNOSY PRACTICAL - I
(MPG 105P)

1. Analysis of Pharmacopoeial compounds of natural origin and their formulations by UV Vis spectrophotometer.
2. Analysis of recorded spectra of simple phytoconstituents.
3. Experiments based on gas chromatography.
4. Estimation of sodium/potassium by flame photometry.
6. Methods of extraction.
7. Phytochemical screening.
8. Demonstration of HPLC- estimation of glycerrhizin
10. Monograph analysis of castor oil.
11. Identification of bioactive constituents from plant extracts.
12. Formulation of different dosage forms and their standardization.
SECOND SEMESTER
MEDICINAL PLANT BIOTECHNOLOGY
(MPG 201T)

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.

THEORY 60 Hrs
1. 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 signaling, DNA recombinant technology.
5. Fermentation Technology: Application of Fermentation technology, production of ergot alkaloids, single cell proteins, enzymes of pharmaceutical interest.
REFERENCES (Latest Editions of)

12. Biotechnological applications to tissue culture by Shargool, Peter D, Shargoal, CKC Press.
13. Pharmacognosy by Varo E. Tyler, Lynn R. Brady and James E. Robberrt, That Tjen, NGO.
ADVANCED PHARMACOGNOSY - II
(MPG 202T)

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.

THEORY

1. **Herbal remedies-Toxicity and Regulations:** Herbals vs conventional drugs, efficacy of herbal medicine products, validation of herbal therapies, pharmacodynamic and pharmacokinetic issues.  
60 Hrs  
12 Hrs

2. **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.  
12 Hrs

3. **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.  
12 Hrs

4. **Analytical Profiles of Herbal Drugs:** Andrographis paniculata, Boswellia serata, Coleus forskholii, Curcuma longa, Embelia officinalis, Psoralea corylifolia.  
12 Hrs

5. **Biological Screening of Herbal Drugs:** Introduction and need for phytopharmaceutical 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, anti-diabetic, hepatoprotective, cardioprotective, diuretics and antifertility. Toxicity studies as per OECD guidelines.  
12 Hrs

REFERENCES (Latest Editions of)

10. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
**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.

**THEORY**

1. 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).

2. Naturopathy, Yoga and Aromatherapy practices
   a) **Naturopathy**: Introduction, basic principles and treatment modalities.
   b) **Yoga**: Introduction and Streams of Yoga. Asanas, Pranayama, Meditations and relaxation techniques.
   c) **Aromatherapy**: Introduction, aroma oils for common problems, carrier oils.

3. 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.

4. 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 equipments, 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.

5. TKDL, Geographical Indication Bill, Government bills in AYUSH, ISM, CCRAS, CCRS, CCRH, CCRU.

**REFERENCES (Latest Editions of)**

7. Indian Herbal Pharmacopoeia, IDMA, Mumbai.
8. British Herbal Pharmacopoeia, BRITISH Herbal Medicine Association, UK.
10. Indian System of Medicine and Homeopathy in India, Planning and Evaluation Cell, Govt. of India, New Delhi.
11. Essential of Food and Nutrition, Swaminathan, Bappco, Bangalore.
HERBAL COSMETICS
(MPG 204T)

Scope
This subject deals with the study of preparation and standardization of herbal/natural cosmetics. This subject gives emphasis to various national and international standards prescribed regarding herbal cosmeceuticals.

Objectives
After completion of the course, student shall be able to,

- Understand the basic principles of various herbal/natural cosmetic preparations.
- Current good manufacturing practices of herbal/natural cosmetics as per the regulatory authorities.

THEORY


2. Commonly used herbal cosmetics, raw materials, preservatives, surfactants, humectants, oils, colors, and some functional herbs, preformulation studies, compatibility studies, possible interactions between chemicals and herbs, design of herbal cosmetic formulation.

3. **Herbal Cosmetics:** Physiology and chemistry of skin and pigmentation, hairs, scalp, lips and nail, Cleansing cream, Lotions, Face powders, Face packs, Lipsticks, Bath products, soaps and baby product, preparation and standardization of the following : Tonic, Bleaches, Dentifrices and Mouth washes & Tooth Pastes, Cosmetics for Nails.

4. **Cosmeceuticals of Herbal and Natural Origin:** Hair growth formulations, shampoos, conditioners, colorants & hair oils, fairness formulations, vanishing & foundation creams, anti-sun burn preparations, moisturizing creams, deodorants.

5. **Analysis of Cosmetics, Toxicity Screening and Test Methods:** Quality control and toxicity studies as per Drug and Cosmetics Act.

REFERENCES (Latest Editions of)

4. The complete Technology Book on Herbal Perfumes and Cosmetics, National Institute of Industrial Research, Delhi.
5. Herbal Cosmetics and Ayurvedic Medicines (EOU) by Chattopadhyay P.K., National Institute of Industrial Research, Delhi.
8. Technology of Herbal Cosmetics and Toiletries Products with Formulae Published by Engineers India Research Institute, New Delhi.
12. Thomson EG. Modern Cosmetics, Universal Publishing Corporation, Mumbai.
1. Isolation of nucleic acid from cauliflower heads.
2. Isolation of RNA from yeast.
3. Quantitative estimation of DNA.
4. Immobilization technique.
5. Establishment of callus culture.
8. Estimation of total phenolic content in herbal raw materials.
10. Estimation of total flavonoid content in herbal raw materials.
11. Preparation and standardization of various simple dosage forms from Ayurvedic, Siddha, Homoeopathy and Unani formulary.
12. Preparation of certain Aromatherapy formulations.
13. Preparation of herbal cosmetic formulation such as lip balm, lipstick, facial cream, herbal hair and nail care products.
15. Preparation of sunscreen, UV protection cream, skin care formulations.
16. Formulation & standardization of herbal cough syrup.