

**Teaching hours:** 3Hrs/week

**Duration of Exam:** 3 Hrs.

**Max. Marks:** 100

## **MAT-I MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES**

**1. Chromatographic techniques** - Principles of separation and applications of TLC, Column chromatography, Paper chromatography, Ion exchange chromatography, G.C, HPTLC , HPLC and electrophoresis.

**2. Infrared spectroscopy** - Introduction, basic theory, modes of vibration, instrumentation, The Hook's Law & calculations of frequencies for different types of bonds, coupled interactions, hydrogen bonding radiation source, sample handling, applications of IR spectroscopy and introduction about FT-IR.

**3. Ultraviolet spectroscopy** – Introduction, electronic transitions, the origin and designation of UV band, absorption laws, calculation of Lambda maxim, the chromophore concept, factors effecting the position of UV bands, instrumentation, qualitative and quantitative applications.

### **4. Nuclear Magnetic Resonance spectroscopy –**

**A. <sup>1</sup>H NMR Spectroscopy** - Introduction, principle, instrumentation, solvents, chemical shift, spin-spin coupling, coupling constant, spin-spin splitting, chemical equivalence, Pascal triangle. Application including interpretation of Proton-NMR spectra.

**B. <sup>13</sup>C NMR Spectroscopy** – Introduction, peak assignments, off resonance decoupling, selective proton decoupling, chemical shifts and factors affecting them, chemical shift equivalence, and spin coupling. Applications of <sup>13</sup>C NMR.

**5. Mass Spectrometry** - Basic principle and theory involved, Instrumentation, types of ions, fragmentation, rearrangements, recognition of molecular ion peak, mass spectra of representative compounds, chemical ionization mass spectrometry (CIMS), field ionisation mass spectrometry (FIMS), fast atom bombardment mass spectrometry (FAB-MS). Applications.

**6. Thermal analysis** - Introduction to various thermal methods of analysis, basic principle and theory, Different types of calorimeters and micro calorimeters differential thermal analysis (DTA), differential scanning calorimetry (DSC) and micro calorimetry.

**7. Pharmacological evaluation** of drugs in biological fluids: Bioassay.

**8. Microbiological assays.**

## **9. Radioimmunoassays.**

**10.Quantitative microscopy** of herbal drugs. Lycopodium spore method, stomatal number, stomatal index, palisade ratio, vein-islet number, and vein-termination number.

## **11. BIOSTATISTICS AND COMPUTER APPLICATION**

i). Methods of collection of data, classification of data, graphical representation of data, frequency, polygon, histogram, measure of central tendency, mean mode and median dispersion and standard deviation.

ii). Confidence level, Null hypothesis, Calculation of statistical significance between two means, Analysis of variance.

iii). Association of attributes centigency, classification of attributes, coefficient of association, chi square test.

iv). Theory of probability, simple probability, law of probability, Permutation and combinations, ratios percentages and proportions and statistical difference between proportions. Analysis of variance two way ANOVA and multiple comparison procedures.

v) Correlation and regression, least square method and its application, significance of coefficient of correlation, non linear regression.

vi) Calculation of ED50, LD50, probit analysis.

## **II COMPUTER APPLICATIONS**

### **BOOK RECOMMENDED**

1. R.M.Silverstein, F.X.Webster, Spectrometric Identification of organic compounds, 6th ed. John Wiley & sons, New-York, 1998.
2. Remington, The science and practice of pharmacy, Mack publishing company. Easton Pennsylvania.
3. Organic spectroscopy by Willam Kemp
4. E. Heftmann, A laboratory handbook of chromatography, New - York.
5. H.H.Willard, L.L.Merritt and J.A.Dean, Instrumental methods of analysis, Van Nostrend Reinhold, New York.
6. WWM. Wenland, Thermal analysis, John Willy and sons, New-York.
7. Principle of instrumental analysis,V ed. By Skoog, Holler-Niemen.
8. Modern analytical chemistry by David Harvey. (MC Graw-Hill international edition).

### **(MAT-II) PRACTICALS**

Practicals based on instrumental methods of analysis. A sufficient training will be given through exercises using different kinds of spectral analysis.

**Modern Pharmaceutical Analytical Techniques (Theory & Practical) is a common subject in the first year of the all the five branches of Master of Pharmacy**

# SYLLABUS FOR M.PHARM. IN PHARMACEUTICAL CHEMISTRY

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## PHARMACEUTICAL CHEMISTRY – I DRUG DESIGN INCLUDING ORGANIC NAME REACTIONS

1. Physicochemical properties in relation to drug action; metabolic transformation of drugs and its role in development of new drug molecules; Metabolic antagonism.
2. Stereochemical aspects of drug receptor interactions and mechanism of drug interaction. Isosterism and bioisosterism as guides to structural variations; Concepts of conformational analysis and its role in design and development of new drug molecules.
3. Principle of drug design: Analogue synthesis versus rational design; discovery of lead compounds, Pharmacophoric identification, Prodrugs and soft drug.
4. QSAR and introduction to molecular modeling.
5. In organic chemistry, the following name reactions and molecular rearrangements will be discussed in detail with reference to their application in the synthesis of some medicinal agents, where possible.
  - (a) Claisen- Schmidt reaction e.g. Sulfisoxazole.
  - (b) Perkins reaction e.g. sulindac
  - (c) Friedel Craft Reaction
  - (d) Aldol condensation
  - (e) Mannich reactions e.g. Tolmetin, Atropine, Ethacrynic acid.
  - (f) Beckmann's rearrangement.
  - (g) Wagner-Meerwein rearrangement
  - (h) Wittig Reaction
  - (i) Oppenauer oxidation.
  - (j) (Meerwein- Ponndorf-Verley) M.P.V. Reduction.

## BOOKS RECOMMENDED

1. E.J. Ariens : Drug Design, Academic Press New York (1975).
2. S.H. Salkovisky. A.A. Sinkula and S.C. Valvani, Physical Chemical Properties of Drug, Marcel Dekker Inc. New York.
3. M.E. Wolff, Burger's Medical Chemistry, John Wiley and Sons. New York.
4. R.F. Doerge, Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, J.Lippincott Co., Philadelphia.
5. J. March, Advanced Organic Chemistry, Reaction Mechanism and Structure, John Wiley and Sons, New York.
6. E.S. Gould, Mechanism and Structure in Organic Chemistry Holt. Rinehart and Winston, New York.

## PHARMACEUTICAL CHEMISTRY-II CHEMISTRY OF NATURAL PRODUCTS

### 1. Natural products as Leads for new pharmaceutical.

2. The natural products obtained from terrestrial and microbial sources will be discussed in the light of various degradative and synthetic approaches supported by spectral data. Important members representing the following classes of natural products shall be discussed.

#### 2.1 ALKALOIDS

General introduction and classification, isolation and purification methods, general methods employed for determining the structure of alkaloids, constitution of morphine, reserpine and quinine.

#### 2.2 STEROIDS

General introduction, stereochemistry, nomenclature and structure elucidation of sterols (cholesterol), sapogenin (diosgenin) and cardiac glycosides.

#### 2.3 AMINO ACIDS AND PEPTIDES, NUCLEIC ACIDS :

General introduction, synthesis of peptides and amino acids. End group analysis, structural features of Insulin, vasopressin and oxytocin, structural features of DNA & RNA.

#### 2.4 ANTIBIOTICS :

Classification of antibiotics, structural details of penicillins and tetracyclines, polypeptide antibiotics.

#### 2.5 FLAVONOIDS :

Detailed chemical account of rutin and quercetin.

#### 2.6 TRITERPENOIDS :

A general chemical treatment and structural elucidation of terpenoids

#### 2.7 COUMARINS

General methods of isolation and purification and structural determination of Xanthotoxin and psoralene.

### Books Recommended

1. I.L. Finar, Organic Chemistry, Vol.II, The English Language Books Society and Longman Group Limited.
2. G.A. Cordell, Introduction to Alkaloids, John Wiley and Sons, New York.
3. M.L. Wickery and B. Wickery, Secondary Plant Metabolism McMillan Press Ltd. London.
4. L.F. Fieser and M. Fieser, Steroids, Reinhold Publishing Co. New York.
5. K.B.G. Torsell, Natural Products Chemistry, John Wiley and Sons, New York.
6. J.B. Harborne, Phytochemical Methods, Chapman and Hall, London
7. Burger's Medicinal Chemistry and Drug Discovery, Vol. I. Principle and Practice, 5th, Edition, John Wiley Sons, New York.

## PHARMACEUTICAL CHEMISTRY-III MEDICINAL CHEMISTRY

The following topics will be discussed keeping in view the recent advances:

1. **Cardiovascular Agents** : Anti-hypertensive agents, antiarrhythmic agents, antihyperlipidemic agents, antianginal agents.
2. **Psychopharmacological agents** : Antipsychotic Agents : Introduction, Biochemical basis of mental disorders, Development of antipsychotic agents : Phenothiazines, Butyrophenones: Atypical antipsychotic agents. Antidepressant Drugs : Introduction, Development of tricyclic antidepressants, Monoamine oxidase inhibitors; Selective serotonin-reuptake inhibitors; Atypical antidepressants, Lithium salts. Antianxiety Agents: Introduction, medicinal Chemistry of benzodiazepines; SAR of benzodiazepine derivatives, medicinal chemistry of non-benzodiazepines; serotonin-reuptake inhibitors, development of meprobamate and analogues; atypical anxiolytic agents;
3. **Chemotherapy** : Antiviral agents including the development in chemotherapy of AIDS, Drugs for neoplastic diseases.
4. Drugs affecting immune responses.
5. Radioprotective drugs
6. **Analgesics and anti inflammatory agents**, Prostaglandins, Non steroidal drugs, Steroidal drugs, Endorphins
7. Diuretics

### BOOKS RECOMMENDED

1. M.E. Wolf, Bruggers Medicinal Chemistry, John Wiley and Sons, New York, Vol. I, II & III
2. R.F. Doerge, Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Lippincott.
3. W.O. Foye, Principles of Medicinal Chemistry, Lea and Febiger, Philadelphia.
4. Lednicher and Mitschler, Drug synthesis, Vol. I, II & III.
5. Martindale, The Extra Pharmacopoeia, Pharmaceutical Press, London
6. T. Albert, Selective Toxicity, Chapman and Hall, London.
7. Burger's Med. Chem. & Drug Discovery, Vol. I.
8. Monographs and relevant Review articles appearing in various periodicals and Journals.



# SYLLABUS FOR M.PHARM IN PHARMACOLOGY

## PHARMACOLOGY-I

### BASIC PRINCIPLES OF DRUG THERAPY AND CLINICAL PHARMACOLOGY

#### Theory

**I. Definition, Scope, Organization and growth of Clinical Pharmacology**, Cellular Transduction Mechanisms, Clinical Pharmacokinetics, Monitoring of Drug Therapy, Adverse Drug Reactions, Patient Compliance, Pharmacogenetics, Paediatric and Geriatric Pharmacology, Drug Interactions, Drug Therapy during pregnancy and lactation.

**2. Drugs acting on the autonomic nervous system:**

i) **Neurotransmission:** The Autonomic and Somatic Motor Nervous System.

ii) **Muscarinic Receptor Agonists and Antagonists.**

iii) **Anticholinestrase Agents**

iv) **Agents acting at the neuromuscular junction and autonomic ganglia.**

v) **Catecholamines, Sympathomimetic Drugs and adrenergic receptor antagonists, Ocular Pharmacology.**

vi) **5-Hydroxy tryptamine (Serotonin) receptor agonists and antagonists.**

**3. Drugs acting on the Central Nervous System**

i) Neurotransmission and the Central Nervous System

ii) History and Principles of Anesthesiology

iii) General Anesthetics

iv) Local Anesthetics

v) Hypnotics, Sedatives and Ethanol

vi) Drugs and the treatment of Psychiatric Disorder: Psychosis, Anxiety: Depression and Mania.

vii) Drugs Effective in the therapy of Epilepsy

viii) Drugs effective in the therapy of Migraine

ix) Treatment of Central Nervous system degenerative disorders

x) Opioid Analgesics and Antagonists

xi) Drug Addiction and Drug Abuse

**4. Autocoids : Drug Therapy of Inflammation**

i) Introduction

ii) Histamine, Bradykinin and their Antagonists

iii) Lipid- Derived Autocoids : Eicosanoids and platelet Activati

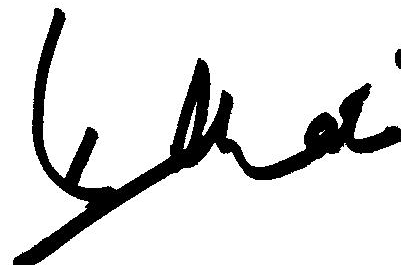
- iv) Analgesic-Antipyretic and Anti-Inflammatory agents and Drugs employed in the treatment of Govt.
- v) Drugs used in the treatment of Asthma.

#### **5. Drugs effecting renal, blood and cardiovascular function:**

- i) Diuretics
- ii) Drugs used in the treatment of Myocardial Ischemia
- iii) Antihypertensive agents and the drug therapy of hypertension.
- iv) Pharmacological treatment of Heart Failure
- v) Antiarrhythmic Drugs
- vi) Drugs used in the treatment of Hyperlipoproteinemias
- vii) Hematopoietic Agents : Growth factors, Minerals and Vitamins
- viii) Anti coagulant, thrombolytic and antiplatelet drugs.

#### **BOOKS RECOMMENDED**

1. Modern Pharmacology by C.R. Craig and R.E. Stitzel
2. Goodman and Gilman's : The Pharmacological Basis of Therapeutics, edited by Alfred Goodman Gilman, Theodore W. Rall, Alan S Nies, and Palmer Taylor
3. Clinical Pharmacology by D.R. Laurence and P.N. Bennett
4. Essentials of Pharmacotherapeutics by F.S.K. Barar
5. Pharmacology by H.P. Rang and M.M. Dale
6. Lewis's Pharmacology revised by James Crossland
7. Oxford Textbook of Clinical Pharmacology and Drug Therapy by D.G. Grahame-Smith and J.K. Aronson
8. S.Singh Essentials of Pharmacology Academica publishers.



# PHARMACOLOGY-II

## RECENT ADVANCES AND EMERGENT TRENDS IN PHARMACOLOGICAL SCIENCES.

### Theory

#### 1) Digestive System

- a) Pharmacotherapy of peptic ulcer, diarrhoea, constipation.
- b) Agents affecting gastrointestinal water, Flux and motility: Emesis and antiemetics; Bile acids and Pancreatic enzymes

#### 2. Therapy of Infectious diseases

- a) General Principles, Antibacterial Drugs Sulphonamides, Quinolones, Penicillins, Cephalosporins, Tetracyclines, Chloramphenicol.
- b) Drugs used in the chemotherapy of Protozoal infections: Malaria
- c) Drugs used in the chemotherapy of Protozoal infections : Trypanosomiasis, Leishmaniasis, Amebiasis, Giardiasis, Trichomoniasis, and other Protozoal infections.
- d) Drugs used in the chemotherapy of Helminthiasis
- e) Drugs used in the chemotherapy of Leprosy, Tuberculosis, Fungal infections, Viral infections
- f) Drugs used in the Chemotherapy of Neoplastic diseases
- g) Immunomodulators : Immunosuppressive agents and Immunostimulants
- h) Newer Chemotherapeutic agents

#### 3. Hormones and Hormones Antagonists

- a) Adenohypophyseal hormones and their Hypothalamic releasing factors.
- b) Hormones of Posterior pituitary
- c) Thyroid and Antithyroid drugs
- d) Estrogens and Progestins, Antifertility agents
- e) Androgens
- f) Adrenocorticotrophic hormones; Adrenocortical steroids and their synthetic analogs; Inhibitors of the synthesis and actions of adrenocortical hormones.
- g) Insulin, oral hypoglycemic agents and the Pharmacology of pancreatic hormones.
- h) Agents affecting Calcification and bone turnover: Calcium phosphate, parathyroid hormones, vitamin D, Calcitonin and other compounds.
- i) Vasopressin and other agents affecting the renal conservation of water.

#### 4. Emerging Trends & Recent advances in:

- a) Receptor and G-Protein
- b) Cyclic nucleotides
- c) TNF, Apoptosis
- d) Ion channel modulators
- e) Neurosteroids and Cannabinoids
- f) Nitric oxide
- g) ANF, Anti oxidants : Melatonin
- h) Gene therapy
- i) Neuropeptide, Substance P, Angiotensin II modulators.



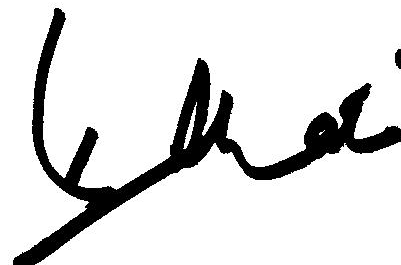
## PHARMACOLOGY-III

### PHARMACOLOGICAL METHODS AND TOXICOLOGY

1. Principles of Pharmacological and Clinical Evaluation of drugs.
2. Pharmacological Techniques to evaluate drugs belonging to following categories.
  - a) Antipsychotics, antianxiety agents; nootropics; antidepressants, antiparkinsonian agents, antiepileptics, analgesics, anti-inflammatory agents, local anaesthetics.
  - b) Antihypertensives, antiarrhythmics, antiatherosclerotics, drugs for myocardial infarction.
  - c) Antiulcer drugs, antidiabetics, antitussives
  - d) Evaluation of antioxidants
  - e) Transgenic animals, genetically prone animal models
  - f) Anti cancer drugs
  - g) In-vitro techniques
  - h) Antifertility agents
3. Drug Toxicity, Safety Evaluation of new drugs
4. Regulations for Laboratory animal care and ethical requirements

#### BOOKS RECOMMENDED

1. Modern Pharmacology by C.R. Craig and R.E. Stitzel
2. Goodman and Gilman's : The Pharmacological Basis of Therapeutics edited by Alfred Goodman Gilman, Theodore W. Rall, Alan S. Nies and Palmar Taylor
3. Clinical Pharmacology by D.R. Laurence and P.N. Benett
4. Essentials of Pharmacotherapeutics by F.S.K. Barar
5. Pharmacology by H.P. Rang and M.M. Dale
6. Lewis's Pharmacology revised by James Crosslang
7. Oxford Textbook of Clinical Pharmacology and Drug Therapy by D.G. Grahame Smith and J.K. Aronson
8. S.Singh Essentials of Pharmacology Academia Publishers.



# SYLLABUS FOR M.PHARM IN PHARMACEUTICS

## (MPT-I) PHARMACEUTICS I

### PRODUCT DEVELOPMENT AND PACKAGING TECHNOLOGY

#### 1. Preformulation Studies.

Study of physical, chemical and pharmaceutical factors influencing formulation of drugs

**2. Study of different types of formulation additives** e.g., diluents, binders, disintegrators, Lubricants, vehicles, antioxidants, preservatives, coloring, flavoring, sweetening, suspending and emulsifying agents, materials for ointment and suppository bases, drug excipient interaction and incompatibilities,

#### 3. Formulation Considerations.

Technology involved, detailed study of equipment (Machines) employed along with layouts, problems to be encountered and evaluation of

**a) Solid dosage forms-** Tablets, Tablet coatings, Capsules

**b) Liquid dosage forms-** liquid orals including solutions, suspensions, elixirs, syrups, and emulsions.

**c) Semisolid dosage forms-** Ointments, creams, suppositories.

**d) Sterile dosage forms-** Parenterals and ophthalmic.

**e) Aerosols.**

**f) Herbal cosmetics**

Designing of fast-release products,

#### 4. Kinetic principles and stability testing.

Order of reaction. Stability study programmes for formulations, Determination of expiry date (shelf life), and overages calculations. Stability indicating assays, Physical stability testing.

#### 5. Polymers

Classification, General methods of synthesis, properties characterization and evaluation. Biodegradable polymers. Classification, mechanism of biodegradation in the body. Pharmaceutical applications of polymers.

#### 6. Theory of dissolution ,

Design of dissolution apparatus. Dissolution media. Dissolution rate testing, release rate constant, dissolution rate data handling.

#### 7. Optimization techniques:

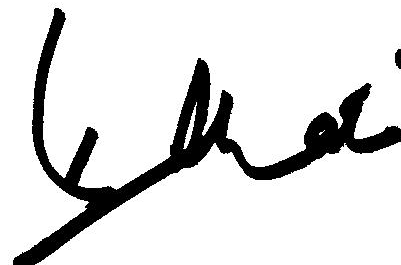
Concept of optimization. Optimization parameters. Classical and Statistical design and optimization methods.

#### 8. Packaging:

- New concepts in pharmaceutical packaging, Package systems, Package design research, Packaging materials with special reference to polymers, metals, glass and plastics, control of packing materials,
- Blister and strip packaging, Testing of containers & closures,
- Pharmacopoeial tests and specifications, Defects in packages, stability of package and packaging material ,
- Ancillary materials used in packaging , Sterilization of packaging materials,
- Packaging of Parenterals, Ophthalmic and aerosols, Corrugated fibre board materials, label and leaflets preparation, Legal requirements.

### **Books Recommended**

1. Lachman, Leon and H.A. Lieberman, The theory and practice of Industrial pharmacy , 3<sup>rd</sup> edition, Varghese publishing Co.
2. Gilbert S. Bankar and C.T., Rhodes, Modern Pharmaceutics, Marcel Decker.
3. Bernard T.L.. and Robert A.Narth , Pharmaceutical process validation, volumes 23, Marcel Decker.
4. Normabn A., Hodges and Stephen P.Denyer, haul book of Microbiological quality control, Tayler and Francis, London.
5. Horth Tonneson, Photostability of Drugs and Drug Formulations,. Taylor and Francis, London.
6. Remingtons pharmaceutical Sciences
7. Martin Physical pharmacy
8. Convors Amiden and stella chemical stability of pharmaceuticals
9. carstensen – Drug stability principles and practice
10. Illum and Davis , Polymers in controlled drug Delivery
11. Carstensen Theory of Pharm systems (vol 2-3)



## PHARMACEUTICS II

### (BIOPHARMACEUTICS/PHARMACOKINETICS AND NOVEL DRUG DELIVERY SYSTEM)

#### 1. PHARMACOKINETIC MODELS-

One and two compartment models. , Pharmacokinetic parameters, Absorption rate constant, Biological half life, Apparent volume of distribution, Renal clearance, Total body Clearance , Pharmacokinetics of multiple dosing, Dosage regimen design, loading and maintenance doses.

Kinetics of sustained-release and continuous blood levels.

#### 2. BIOAVAILABILITY AND BIOEQUIVALENCE

Objective , significance and factors affecting bioavailability and bio equivalence, study design and assessment methods for bioavailability and bioequivalence. correlation of in-vitro dissolution with in-vivo bioavailability. Statistical concepts in estimation of bioavailability and bioequivalence. Regulatory requirements.

#### 3. CONTROLLED DRUG DELIVERY SYSTEM

Theory of controlled release drug delivery systems, Release and diffusion of drugs from C.D.D.S., General methods of design and evaluation of CDDS, Carriers for drug delivery systems, Prodrugs, Physical, chemical and biomedical engineering Approach to Achieve controlled drug delivery.

#### 4. MICROENCAPSULATION-

Methods, kinetics of drug release from microcapsules, technology and applications.

#### 5. TRANSDERMAL DRUG DELIVERY SYSTEMS-

Theory, formulation and evaluation, iontophoresis,

#### 6. IMPLANTS AND INSERTS-

Types, design and evaluation methods,

#### 7. OSMOTICALLY REGULATED SYSTEMS

General considerations, classification and development of osmotic pumps. Applications

#### 8. TARGETED DRUG DELIVERY SYSTEM.

Concept of drug targeting. importance in therapeutics, Methods in drug targeting, Drug immobilization techniques, nanoparticles, liposomes, niosomes, pharmacosomes and resealed erythrocytes, Dendrimers, multiple emulsions.

#### 9. ADVANCED CONCEPTS

in the design, development and production of sustained-release products.

#### 10. PRESENT STATUS AND SCOPE OF BIOTECHNOLOGY IN PHARMACY,

Production and applications of monoclonal antibodies, Fermentation characterization and optimization of fermentation. Types, design and operation of fermenters.

# PHARMACEUTICS III

## DRA, INTELLECTUAL PROPERTY RIGHTS & QUALITY ASSURANCE

**1.Requirements of GMP, CGMP, GLP, USFD, WHO** guidelines and ISO 9000 series, Drugs and cosmetics act and rules,

### **2.Documentation-**

Protocols, forms and maintenance of records in Pharmaceutical industry Preparation of documents for new drug approval and export registration, Patent processing, and its applications.

### **3.Pharmaceutical Process validation**

Concepts in validation. Validation of manufacturing and analytical equipments.Process validation in manufacturing dosage formulations.Applications of process validation.

### **4.Pilot plant scale up Techniques.**

Transfer of Technology from R and D to pilot scale and to plant scale

### **5. Basic concepts of quality control and Quality Assurance systems,**

Source and control of quality variation of Raw materials , containers, closures, personnel, Environment, etc.

**6. In process quality control tests**, IPQC problems in Pharmaceutical industries. ICH guidelines.

**7. Sampling plans**, sampling and characteristic curves.

### **8. Mater formula generation and Maintenance,**

Standard operating Procedure (SOP) for different dosage forms.

### **9. New product launch and trouble shooting in production**

### **10. Clinical trials and toxicological evaluation of drugs**

### **11.Sewage disposal and pollution control**

## **BOOKS RECOMMENDED.**

- 1.Willing , Tuekerman and Hitchings- Good manufacturing practices for pharmaceuticals.
2. Drug and Cosmetic Acts and Rules.
3. Bharati- Drugs and Pharmacy Laws in India.
4. OPPI- Quality Assurance.
5. Patel – Industrial Microbiology.
- 6.Loftus,B.T and Nash,R.A Pharmaceutical process validation
7. Bolton, S., Pharmaceutical statistics
8. Carletiori, Validation of Aseptic pharmaceutical process.
9. Garfield Quality assurance principles for analytical laboratories
10. Indian pharmacopoeia
11. British pharmacopoeia
12. United states pharmacopoeia

# M.PHARM IN PHARMACOGNOSY & PHYTOCHEMISTRY

## PHARMACOGNOSY & PHYTOCHEMISTRY-I

### ADVANCES IN PHARMACOGNOSY

#### 1. Introduction

General Introduction to Pharmacognosy and its importance in herbal drug industry. The classification and vegetable drugs with special reference to chemotaxonomy. Pharmacognostical evaluation and their importance in raw material standardization with suitable examples.

#### 2. Genetics in Pharmacognosy :

Mendel's laws of hereditary and their application to Pharmacognosy, Chemical races, Selections, Hybridization, Polyploidy, mutation, plant growth hormones, their application and effect on plant growth and its constituents.

#### 3. Comparative Phytochemistry :

Relationship between Phytochemistry and Taxonomy. Comparative Phytochemistry of alkaloids, flavonoids and C-glycosides.

#### 4. Plant Tissue Culture techniques and its application in relation to Phytopharmaceuticals :

Introduction, techniques of initiation and maintenance of various types of cultures. Immobilized cell techniques, Biotransformation studies including recent developments in production of biological active constituents in static, suspension and hairy root cultures, Bioreactors for production of biologically active constituents and other applications of plant tissue culture techniques.

**5. Recent advances** in the field of Pharmacognosy with special reference to anticancer, antidiabetic, anti-inflammatory, hepatoprotective, adaptogenic and immunomodulating drugs of plant origin. Skin irritants and sensitizing agents from plant and marine products of medicinal importance. Plant sweeteners.

#### BOOKS RECOMMENDED

1. Evans WC (2002) Trease & Evans' Pharmacognosy, WB. Saunders & Co., London.
2. Swain T. (1963) Chemical Plant Taxonomy, Academic Press
3. Stace C.A. (1985) Plant Taxonomy and Biosystematics, Edn
4. Cultivation and Utilization of Medicinal Plants by C.K. Atal, F
5. Street H.E. (1997) Plant Cell and Tissue Culture, Blackwell

6. Narayanaswami S. (1997). Plant Cell and Tissue Culture, Madras Science Foundation, Madras.
7. Bajaj Y.P.S. "Biotechnology in Agriculture and Forestry-Volumes 4, 7, 8, 9, 15 (1988-91). Springer -Verlag, Berlin.
8. Takashashi N. (1986). Chemistry of Plant Hormones, CRC Press Inc., Florida
9. Gennaro AR (2000). Remington: The Science & Practice of Pharmacy, Lippincott Williams & Wilkins, Philadelphia.
10. Fitoterapia- (1980 onwards).
11. Planta Medica (1980 onwards).
12. Plant Cell, Tissue and Organ Culture (1980 onwards).
13. Journal of Ethnopharmacology (1980 onwards).
14. Journal of Natural Products (1970 onwards).
15. Phytochemistry (1970 onwards).

## PHARMACOGNOSY & PHYTOCHEMISTRY-II

### PHYTOCHEMISTRY & BIOGENESIS

1. General methods of phytochemical & biological screening, isolation and purification of plant constituents.
2. Natural sources, extraction, purification, isolation and characterization of the following Phytopharmaceuticals.  
**Alkaloids** : Morphine, Quinine  
**Glycosides** : Sennosides, Glycyrrhizine, Asiaticosides, Diosgenin, Solasodine, Rutin
3. Industrially important volatile oils: Natural occurrence, their chemistry, ontogenic variation and trade.
4. Methods of investigation of biogenetic pathways.
5. Biogenetic pathways for the production of phytopharmaceuticals, such as Alkylamine (Ephedra), Pyridine, Piperidine (Lobelia), Tropane (Belladonna), Quinoline (Cinchona), Isoquinoline (Opium), Diterpene (Aconite), Indole (Ergot), Cardiac glycosides, Coumarins and Flavones.
6. Study of some herbal formulation as drug and cosmetics.

### BOOK RECOMMENDED

1. Evans WC (2002) Trease & Evans' Pharmacognosy, W.B. Saunders & Co., London.
2. Natural Products for Plants by Kaufmann, CRC Press New York.
3. Cultivation and Utilization of Medicinal & Aromatic Plants by C.K. Atal and B.M. Kapur, R.R.L. Jammu.
4. Pharmacognosy by Tyler and Brady, Lea & Febiger, Philadelphia.
5. Herbal Medicines by Jonne Bernes, Pharmaceutical Press, London.
6. Medicinal Plants in Skincare by Sushil Kumar, CIMAP, Lucknow.
7. Nakanishi K (1977). Chemistry of Natural Products, Kodansha Book Publishing Company, Osaka (Japan).



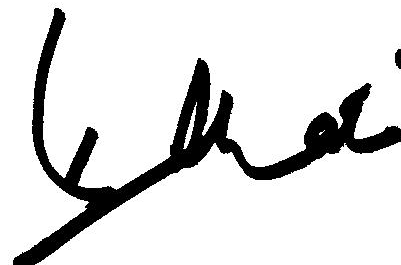
# PHARMACOGNOSY AND PHYTOCHEMISTRY-III

## CULTIVATION & STANDARDIZATION OF MEDICINAL PLANTS

1. Preparation of herbarium specifications, use of flora and keys of plant identification, Microtomy and advanced histological techniques as applied to pharmacognostical specimen, pharmacognostical drawings and macro and microphotography. Quantitative microscopy as applied to drug evaluation and pollen grain analysis.
2. Agrotechnology of medicinal plants ; Ecotypic, Phenotypic and Genotypic Variability affecting phytopharmaceuticals. Prospects and economics and medicinal and aromatic plants in India. Cultivation methods developed in India for the following plants of commercial significance. Glycyrrhiza, Ipecac, Mentha, Poppy, Psyllium and Senna. Tropane alkaloid and steroid containing plants.
3. Application of chromatographic techniques such as column, paper, TLC, HPTLC, GLC, HPLC and DCCC in the isolation and purification of phytopharmaceuticals.
4. Applications of UV, IR, NMR, <sup>1</sup>HNMR, <sup>13</sup>CNMR and Mass spectroscopy for structural elucidation of phytopharmaceuticals. Standardization and quality procedures for the assay of plant products.

### BOOKS RECOMMENDED

1. Chromatography by Heptman.
2. Techniques in Terpenoid Identification by Dr. Mohd. Ali, Birla Publications, Delhi.
3. Cultivation and Utilization of Medicinal & Aromatic Plants by C.K. Atal and B.M. Kapur, R.R.L. Jammu
4. The Wealth of India (Raw Materials) All Volumes, NISCOM, Delhi.
5. Stahl. E. (1987). Thin Layer Chromatography, Springer-Verlag, Berlin-Hiedelberg- New York.
6. Anonymous (1993) Standardisation of Single Unani Drugs, CCRUM, New Delhi.





# SYLLABUS FOR M.PHARM IN PHARMACY PRACTICE

## (MPP-I) PHARMACY PRACTICE- I

### CLINICAL PHARMACY, PHARMACOKINETICS AND TOXICOLOGY

1. Definition, development and scope of Clinical Pharmacy.

**2. Clinical Pharmacokinetics and Pharmacodynamics** (volume of distribution, Clearance, Plasma protein binding, concentration dependent clearance, flow dependent clearance, multicompartment models, physiologic model, Pharmacodynamic models, time course of drug action, cumulative effects of drugs, steep concentration effect curves)

- i) Hysteresis
- ii) Proteresis
- iii) Target concentration strategy
- iv) Variability and control strategies in quantitative therapeutics Bioavailability.
- v) Drug Biotransformation.

**3. Clinical Evaluation of New drugs:** Clinical trials, various phases of clinical trials, design and execution of trials in different clinical settings.

**4. Clinical Laboratory Tests and Studies of Imaging Pharmaceuticals (contrast media):**

**5. Drugs in special Patient Groups** (Pregnancy and nursing, Neonates and children, Elderly).

**6. Clinical Importance of Genetics in Drugs effects.**

**7. Drug therapy monitoring:** Medication chart view, clinical review, TDM Pharmacist interventions, ward round participation, adverse drug reaction management. Medication history and patient counseling. Drug utilization evaluation (DUE) and review (DUR), quality assurances of clinical pharmacy services. Patient data analysis. Introduction of information sources available.

**8. Introduction to toxicology:** occupational and environmental toxicology, chelators and heavy metal intoxication, insecticide poisoning, toxic potentials of over the counter agents, dermatological toxicity. Ototoxicity, nephrotoxicity, hemopoietic toxicity, carcinogenicity and teratogenicity, ocular toxicity. Cardiotoxicity, hepatotoxicity, pulmonary toxicity, neurotoxicity, management of patient during drug toxicity (emergency treatment of poisoning), management and functioning of poisons information Centre (day and night).

## (MPP-II) PHARMACY PRACTICE- II

### APPLIED PHARMACOTHERAPEUTICS INCLUDING PATHOPHYSIOLOGY

Pathophysiology and applied therapeutics of diseases associated with following system/diseases with special reference to the drugs of choice.

1. **Cardiovascular system**- Hypertension, congestive cardiac failure ischaemic heart disease, arrhythmias. Hyperlipidemias.
2. **Respiratory system**-Asthma, chronic obstructive airways disease, drug induced pulmonary diseases.
3. **Renal system**-Acute renal failure, chronic renal failure, renal dialysis and transplantation, drug dosing in renal impairment, drug induced renal disease, electrolytes and fluid balance.
4. **Haematological Disease**- Anaemia, thrombo-embolic disorder, drug induced haematological disorder.
5. **Endocrine system**- Diabetes, thyroid diseases, oral contraceptive, hormone replacement therapy, osteoporosis.
6. **Nervous system**- Epilepsy, Parkinson's disease, stroke and transient ischaemic attacks, headache, Alzheimer's Huntington's chorea.
7. **Psychiatric disorders**- Schizophrenia, depression, anxiety disorders, sleep disorder.
8. **Gastrointestinal system**- Ulcer disease, inflammatory bowel diseases, hepatitis, jaundice, drug dosing in liver dysfunction, diarrhoea and constipation.
9. **Pathophysiology of Inflammation and repair**, Immunology basic principles.
10. **Rheumatic diseases**- Rheumatoid arthritis, gout, juvenile rheumatoid arthritis.
11. **Infectious diseases**- Meningitis, respiratory tract infections, gastroenteritis, pneumonia, bacterial endocarditis, septicaemia, otitis media, urinary tract infections, tuberculosis, leprosy, protozoal infections, helmentiasis, HIV, opportunistic infections, and fungal infections.
12. **Skin and Sexually transmitted diseases**- Psoriasis, acne, eczema, scabies, syphilis and gonorrhoea.
13. **Oncology cell cycle General principles of Cancer Chemotherapy**- Commonly used cytotoxic drugs. Chemotherapy of lung cancer, breast cancer, head and neck cancer, prostate cancer, cervical cancer, haematological malignancies.
14. **Ophthalmology**- Galucoma and eye infections.
15. **Pain management**- Pain pathways, analgesics and NSAIDs , opiates, local anaesthetics, neuralgia including trigeminal and glosso-pharyngeal neuralgias.
16. **Nutrition Malnutrition and deficiency states**- Enteral and parenteral nutrition.

## (MPP-III) PHARMACY PRACTICE-III

### HOSPITAL AND COMMUNITY PHARMACY

#### A. COMMUNITY PHARMACY

1. Introduction to the concept of community pharmacy, its activities and professional responsibilities.
2. The role of the community pharmacy and its relationship to other local health care providers.
3. Prescribed medication order interpretation and legal requirements.
4. Patient counseling in community pharmacy.
5. Over the counter (OTC) sales.
6. Services to nursing homes/Clinics.
7. Community Pharmacy Management: Financial material and staff management infrastructure requirements, drug information resources computers in community pharmacy.
8. Code of ethics for community pharmacists.
9. Polypharmacy and its implication.

#### B. HOSPITAL PHARMACY

10. The role of hospital pharmacy department and its relationship to other hospital departments and staff,
- 11. Hospital Drug policy:** Drug committee formulary and guidelines, other hospital committee such as infection control committee and research & ethics committee.
- 12. Hospital Pharmacy Management:** Staff (professional and non professional), materials (drugs, non drugs, consumables), financial (drug budget, cost centers, sources of revenue collection), policy and maintenance and planning, infrastructure requirements (building furniture and fittings, specialized equipment, maintenance and repair), workload statistics, hospital formulary,
13. Organization of hospital pharmacy services.
- 14. Drug Distribution:** Purchasing warehousing (storage conditions, expiry date control, recycling of drugs, stocktaking drug recalled, drug distribution method, ward stock, individual patient dispensing, specific requirements for inpatients, outpatients, casualty emergency, theatre, ICU/ICCU, drugs of dependence.
15. Manufacturing: Sterile and non-sterile production, including total parental nutrition, cytotoxics.
- 16. Radio Pharmaceuticals:** IV additive service, pre packing and labeling, quality control.
- 17. Research:** Practice based research. Research support including clinical trials laboratory based research.
- 18. Pharmacoepidemiology:** Definitions and scope; methods (qualitative, quantitative and meta analysis models); system for monitoring drug effects, advantages and disadvantages of pharmacoepidemiology.
- 19. Pharmacoconomics:** Definitions and scope, types of models and cost effectiveness analysis.
- 20. Public Health Policy and Health Care System.**

**21. Rational Prescription and Prescription Writing.**

**22. Communication Skills:** Principle and elements of communications skills, non verbal communication in pharmacy, barriers in communication, listening skills, explaining skills and ethics in communication.

**23. Adverse drug reactions:** incidence of adverse drug reactions, recognizing of adverse drug reactions, types of adverse drug effects hypersensitivity reactions , selected adverse effects on selected organs, drug addiction and drug abuse, drug interactions: definitions of drug interactions: principles of prevention of adverse drug interactions, clinical importance of drug interactions involving enzyme induction, pharmacoepidemiology documentation of clinical pharmacokinetic and clinical pharmacology data for commonly used drug, management of drug information's services.

**BOOKS RECOMMENDED**

- 1.Hassan WE, Hospital Pharmacy, Lec and Febiger publication.
2. Allwood MC and Blackwell, Textbook of Hospital pharmacy.
3. Avery's Drug treatment 4<sup>th</sup> Edn.1997, Adis Internation Limited.
- 4.Roger and Walkar, Clinical Pharmacy and Therapeutics, Churchill Livingstone Publication.
- 5.Joseph T. Dipiro, Pharmacotherapy: A Patho-physiological Approach, Appleton Lange.
- 6.Cotran R.S., Kumar V., Collins T, Robbins Pathologic basis of disease, WB Saunders & Editd.
- 7.Green RJ, Harris ND, Pathology and Therapeutics for Pharmacist: A basis for clinical Pharmacy Practice, Chapman and Hall Publication.
- 8.Eric T Herfindal, Clinical Pharmacy and Therapeutics, William and Wilkins Publication.
- 9.Avery's Drug Treatment 4<sup>th</sup> Edn 1997, Adis International Ltd.,
- 10.Relevant review articles from recent medical and Pharmaceutical literature.