M. Pharm. (Pharmacology)

I – SEMESTER

Theory
1. Advanced Pharmacology – I  3 Hours
2. Advanced Pharmacology – II  3 “
3. Advances in Preclinical Evaluation – I  3 “
4. Pharmacokinetics, Pharmacodynamics & Drug Metabolism (PPDM)  3 “

Practicals
1. Advanced Pharmacology  9 Hours
2. Pharmacokinetics, Pharmacodynamics & Drug Metabolism (PPDM)  9 “

II – SEMESTER

Theory
1. Clinical Pharmacology & Toxicology  3 Hours
2. Advances in Preclinical Evaluation – II  3 “
3. Clinical Research  3 “
4. Molecular and Biochemical Pharmacology Basis of Drug Discovery & Development  3 “

Practicals
1. Clinical Pharmacology & Toxicology  9 Hours
2. Advances in Preclinical Evaluation  9 “

III – SEMESTER

Comprehensive Viva-voce
Seminar on Dissertation Topic (Project Work)

IV – SEMESTER

Final Seminar of Dissertation (Results)
Dissertation
I - SEMESTER

M.PHARM. (PHARMACOLOGY)
M.I.COL.T.1. ADVANCED PHARMACOLOGY – I
(Theory) 3 Hrs per week

I. Drugs acting at synoptic and neuro effecto junctional sites.
   A. Autonomic & somatic nervous systems.
   B. Muscarinic receptor agonists & antagonists.
   C. Anticholinesterases
   D. Agents acting at NMJ and autonomic ganglia
   E. Sympathomimetic drugs. Catecholamine and adrenergic antagonists.

II. Drugs acting on the Central Nervous System.
   A. Neurotransmission and CNS.
   B. Drugs used in the treatment of
      1. Anxiety & Psychosis
      2. Depression & Mania
      3. Epilepsy
      4. Migraine
      5. CNS degenerative disorders
      6. Parkinson’s Disease
      7. Pain

III. Drugs affecting renal and cardiovascular function
    A. Diuretics
    B. Renin & Angiotensin
    C. Drugs used in the treatment of
       1. Myocardial Ischemia
       2. Hypertension
       3. CHF
       4. Hyperlipidemia

IV. Drugs acting on the blood & blood forming organs
   A. Growth factors
   B. Anticoagulants, thrombolytics & antiplatelet drugs.

M.I.COL.T.2. ADVANCED PHARMACOLOGY – II
(Theory) 3 Hrs per week

I. Autacoids; Drug therapy of Inflammation
   A. Histamine, Bradykinin & their antagonists
   B. Eicosanoids & PAF
   C. Anti-inflammatory, analgesic & antipyretic agents
D. Antiasthmatic agents.

II. Drugs affecting gastrointestinal function.
   A. Agents for control of acidity and antiulcer drugs
   B. Emetics & anti emetics

III. Chemotherapy of
   A. Malaria
   B. Microbial infections.
      (i) Fluoroquinolones
      (ii) Cephalosporins and other newer agents
      (iii) Antifungal and antiviral drugs including Anti HIV drugs.
   C. Neoplastic diseases

IV. Oral hypoglycemic agents, Thyroid and anti-thyroid agents.

V. Estrogens, Progestins and Androgens.

M.I.COL.T.3. Advances in Preclinical Evaluation -I
(Theory) 3 Hrs per week

1. Care, handling and breeding techniques of laboratory animals. Regulations for laboratory animal care and ethical requirement. Knowledge of the CPCSEA proforma for performing experiments on animals.

2. Organization of preclinical screening programme (Blind screening)


4. Preclinical and clinical models employed in the screening of new drugs belonging to following categories.
   I. Drugs acting on Autonomic nervous system: Sympathomimetics, Parasympathomimetics, Anticholinesterases, anticholinergics, adrenolytics. Muscle relaxants (peripheral)
   II. Cardiovascular Pharmacology: Cardiac glycosides, antiarrhythmics, antihypertensives, antiatherosclerotics.
   iii. Screening of free radical scavenging activity
   IV. Immunopharmacology: Specific (Cell and humoral mediated) and non-specific methods.
   v. Drugs for metabolic disorders: Anti-diabetic agents, Hepatoprotective agents, Anti-hyperlipidemic agents

5. Principles of Toxicological evaluations, ED 50, LD50 and TD values, acute, sub-acute and chronic toxicity studies.

6. Introduction to biostatistics, parametric and non parametric tests.
1. DRUG ABSORPTION
Factors affecting drug absorption.
Gastro intestinal, percutaneous and rectal absorpton
Absorption kinetics, Wagner Nelson & Loo Riegelman methods
BCS classification – significance

2. DRUG DISTRIBUTION
b. Kinetics of protein binding, use of different plots (Scatchard plots etc.,) in characterizing binding kinetics
c. Tissue binding.
d. Transfer of drugs through biological barriers, their therapeutic implication in drug action with emphasis on drug transporters.

3. EXCRETION OF DRUGS
a. Routes of excretion of drugs. Extensive study of contribution of each route with specific examples
b. The role of kidney and factors influencing excretion

4. BIOAVAILABILITY AND BIOEQUIVALENCE OF DRUG PRODUCTS
Factors affecting bioavailability & importance of bioequivalence studies.
Conduct of BE studies – Different approaches
US FDA, EMEA & DCGI guidance on BE studies in fasted, fed conditions
BE study waivers

5. METABOLISM OF DRUGS
a. Phase-I and Phase-II metabolic reactions, microsomal and non-microsomal biotransformation reactions.
b. Drug metabolism in liver, kidney, intestine and other extra-hepatic sites.
c. Drug metabolism in placenta, fetus, new born and aged.

6. FACTORS INFLUENCING DRUG METABOLISM
a. Stereochemical, physicochemical and biological factors.
b. Physiological and environmental factors, species, strain, sex, and age differences.
c. Pathological states.
d. Genetic factors – Introduction to the role of genetics in drug metabolism, Polymorphism in drug oxidation and other metabolic reactions.
7. CLINICAL PHARMACOKINETICS
   i. Revision of basic concepts
   ii. Dose – response in man
   iii. Influence of renal and hepatic disease on pharmacokinetics
   iv. Therapeutic drug monitoring
   v. Population pharmacokinetics

8. PHARMACODYNAMICS & PK/PD modeling
   a. Drug receptor interaction dynamics – Application of stoichometry principles
   b. Understanding of pharmacokinetics - pharmacodynamic relationships
   c. Different pharmacodynamic models: Linear, Emax, Biophase distribution & Indirect response models.

PRACTICALS
M.I.COL.P.1 Advanced Pharmacology Practicals based on M.I.COL.T.1 & T.2

M.I.COL.P.2 Pharmacokinetics, Pharmacodynamics & Drug Metabolism practicals
   based on (PPDM) theory M.I.COL.T.4
II - SEMISTER

Paper –1: Clinical Pharmacology & Toxicology
(Theory) 3 Hrs per week

PART 1. Clinical Pharmacology (70% weightage)

1. Adverse Drug Reactions, Drug Interactions and ADR monitoring. Mechanisms of ADR.

2. Pathophysiology and drug therapy of the following disorders.

   Schizophrenia, anxiety, depression, epilepsy, Parkinson’s, Alzheimer’s diseases, migraine hypertension, angina pectoris, arrhythmias, atherosclerosis, myocardial infaraction, TB, leprosy, leukemia, solid tumors, lymphomas, psoriasis, respiratory, urinary, g.i. tract infections, endocarditis, fungal and HIV infection, rheumatoid arthritis, glaucoma, menstrual disorders, menopause.

3. Drug therapy in special populations
   A. Geriatrics
   B. Pediatrics - neonate, infants & adolescents
   C. Pregnancy & Lactation

V. Pharmacogenomics: Interracial and individual variability in drug metabolism and drug action.

PART 2. Principles of Toxicology (30% weightage)

a. Physicochemical, biochemical and genetic basis of toxicity, principles of toxicokinetics, mutagenesis and carcinogenesis.

b. Guidelines and regulatory agencies – CPCSEA, OECD, FDA, ICH, FHSA, EPA, EEC, WHO etc.

c. Behavioural, Inhalation, cellular and sub-cellular toxicity hypersensitivity and immune response, range finding tests.

d. Acute, sub-acute and chronic toxicity studies according to guidelines.

e. Application of toxicology in clinical medicine.
Paper –2: Advances in Preclinical Evaluation - II  
(Theory) 3 Hrs per week


2. Preclinical evaluation of following categories of drugs.  
   i. CNS Pharmacology: Sedatives, hypnotics, anxiolytics, antidepressants, Muscle relaxants (Central), CNS stimulations, anticonvulsants, antipsychotics, Noortropics, antiparkinsonian agents,  
   ii. Analgesics, antipyretics, anti-inflammatory agents and local anesthetics.  
   iii. Gastrointestinal drugs: Antiulcer agents, laxatives  
   iv. Diuretics.  
   v. Histamine antagonists  
   vi. Reproductive pharmacology: antifertility agents  
   vii. Anticancer agents.

3. Cell culture technology:  
   Animal cell culture – General requirements for establishing the animal cell culture, media, conditions and methods for cell cultures. Applications in Pharmacy.

4. Alternatives to animal screening procedures, Cell-line, patch clamp technique, In-vitro models, molecular biology techniques.

5. Concept of transgenic animals, knockout animals, nude animals, receptor binding assays, principles of immunoassay, patch clamp techniques.
Paper – 3: Clinical Research
M.Pharm (Pharmacology / Pharmacy Practice)
(Theory) 3 Hrs per week

1. Introduction to Clinical Research
Definitions and terminology used in clinical trials
- Historical development in clinical research practice
- Drug development process

2. Research Design Methods
Planning and execution of clinical trials, Various Phases of clinical trials
Randomization techniques (Simple randomization, restricted randomization, blocking method and stratification)
Types of research designs based on Controlling Method (Experimental, Quasi experimental, and Observational methods) Time Sequences (Prospective and Retrospective), Sampling methods (Cohort study, case Control study and cross sectional study)
Health outcome measures (Clinical& Physiological, Humanistic and Economic)

2. Bioavailability and Bioequivalence studies

4. Ethics and Guidelines in Biomedical Research
- Ethical Issues in Biomedical Research – Principles of ethics in biomedical research,
- Ethical committee [institutional review board], its constitution and functions,
- Good clinical practice [ICH GCP guidelines, CDSCO regulations, MPA, European, Japan, Health Canada and MHRA guidelines, schedule Y and USFDA in the conduct of clinical trials]

5 Clinical research
- Establishing and functioning of Contract Research Organisation (CRO)
- Roles and responsibilities of clinical trial personnel
- Trial initiation, volunteer recruitment, trial supplies and site management,
- Designing of clinical trial documents
- Monitoring and auditing of clinical trials
- Trial report generation
- Site closure

6. Data Management
Medical Writing and Ethics of publication
Clinical data management (Data entry, data interpretation, data monitoring and auditing)

Reference books (Latest editions)
2. Designing Clinical Research. Edtd by Stephen B Hulley, Steven R Cummings
ASSIGNMENTS FOR CLINICAL RESEARCH

1. Design of Protocol for different types of studies
2. Correspondence procedures for constitution of IRB
3. Designing of informed consent process
4. Designing of CRF
5. Clinical data monitoring
Paper –4 : Molecular and Biochemical Pharmacology Basis of Drug Discovery & Development  
(Theory) 3 Hrs per week

This course primarily focuses on study of the following from molecular and biochemical perspective. The purpose is to enable the student to understand the trends in modern drug discovery.

**General Principles:**

1. A general treatment of the approaches to drug design: including the methods of variation, study of the use of biochemical and physiological information involving new drugs.
2. Drug Receptor theory:
   - Concept of receptors, theories of drug receptor interaction, forces involved in drug receptor interaction. Receptor polymorphism and dimerization and its importance in drug design.
   - A detailed study of Ion channel modulators, Tyrosine kinase and G-Protein coupled receptor, Cyclic neucleotides

**Drug Design:**

1. Physiochemical properties in relation to biological action and drug design.
   - a. Complex of events between drug administration and drug action.
   - b. Solubility & partition coefficient.
   - c. Rational drug design.
   - d. Selected physiochemical properties like isosterism, steric behaviour, ionization, hydrogen bonding, chelation, oxidation-reduction potential, surface actions.

2. Guidelines for drug and analog drug design:
   - a. Basic considerations of drug design, de- novo drug design, lead seeking methods, rational drug design.
   - b. Structural factors in drug design.
   - c. Prodrug concepts.


4. The quantitative analysis of structure activity relationships
   - b. QSAR parameters related to chemical structure, correlative methods and analysis of results.
5. Molecular & Biochemical Pharmacology Basis:

b. Introduction to cell structure and function.
c. Cell signaling, organization of signal transduction pathway and biosensors. A detailed study on:
   TNF, Apoptosis
   Neurosteroids and Cannabinoids
   Nitric oxide
   ANF, Anti oxidants: Melatonin
   Neuropeptide, Substance P
   Angiotensin II modulators
   Novel peptide based drugs
d. Protein structure prediction and molecular modeling.

PRACTICALS

**M.II.COL.P.1 Clinical Pharmacology & Toxicology** Practical
   based on theory M.II.COL.T.1.

**M.II.COL.P.2 Advances in Preclinical Evaluation** Practical
   based on theory M.I.COL.T.3 & M.II.COL.T.2.
REFERENCES

ADVANCED PHARMACOLOGY – I & II

2. Katzung BG, Basic and Clinical Pharmacology, Lange Medical Publication, California
8. Review articles from published journals.

Advances in Preclinical Evaluation – I & II

5. S K Gupta, Drug Screening Methods, Jaypee brothers, New Delhi.
13. Indian Pharmacopoeia and other pharmacopoeias.
14. The UFAW handbook on the care and management of laboratory animals by UFAW.

16. Review articles from published journals.

**Pharmacokinetics, Pharmacodynamics & Drug Metabolism (PPDM)**

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi


3. Pharmacokinetics: By Milo Glbaldi Donald, R. Merck Dekker Inc.

4. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.


14. Review articles from published journals

**Clinical Pharmacology & Toxicology**


3. Richard D Howlard, Mary J. Mycek, **Lippincott** Williams & wilkins, Lippincott’s illustrated reviewed, Pharmacology. New York


7. Derelanko and Holinger , CRC Hand book of toxicology

9. Hayes, Principles and Methods of toxicology
14. Review articles from published journals.

**Molecular and Biochemical Pharmacology Basis of Drug Discovery & Development**

1. A guide to chemical basis of drug design by Alfred Rurger (John Willey &Sons)
2. Introduction to the principles of drug design by John Smith and Hawel Williams (Wright PSG).
9. Current protocols in Molecular biology by Frederick m Ausbel.
10. Human molecular genetics by tomsracham & Andrew P Read.
12. The Cell – A molecular approach by Geoffrey M Cooper.
16. Review articles from published journals


7. Goodman & Gilman’s The Pharmacological basis of Therapeutics Ed. J.G.


11. Designing Clinical Research. Edtd by Stephen B Hulley, Steven R Cummings


13. Review articles from published journals