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 Nervours 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 .Eicasonoids & PAF
- C. Anti-inflammatory, analgesic & antipyretic agents

D. Antiasthmatic agents.

II .Drugs affecting gastro intestinal function.

A. Agents for control of acidity and antiulcer drugs

B. Emetics & anti emetics

III. Chemotherapy of

A. Malaria

B. Microbial infections.

(i) Fluroquinolones

(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)

3. Drug discovery process: Principles, techniques and strategies used in drug discovery .High throughput screening, human genomics.

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, Anticholinesterages, 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.

M.I.COL.T.4. (Theory) –Pharmacokinetics, Pharmacodynamics & Drug Metabolism (PPDM)

(Theory) 3 Hrs per week

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

a. Plasma Protein binding – factors affecting plasma protein binding.
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. EXECRETION 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 stoichmetry 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.1.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 toxicokinectics, 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

1. Bioassays: Basic principles of bioassays,official bioassays,experimental models and statistical designs employed in biological standardization : Acetylcholine, Adrenaline, Digitalis, Heparin, Insulin, d-tubocurarine, Histamine,HCG, Corticotrophine, Vasopressin, oxytocin Biological standardization of vaccines and sera: Pertussis vaccine ,rabies vaccine and Plague vaccine

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.
   ii. Gastrointestinal drugs: Antiulcer agents, laxatives
   iii.Respiratory pharmacology: bronchodilators, antitussives,
   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)

1. Avery's Drug Treatment, 4th Edn, 1997, Adis International Limited.

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.

3. Principles of Computer aided drug design.

4. The quantitative analysis of structure activity relationships
   a. Fundamentals of QSAR- objectives, expressions of biological activity.
   b. QSAR parameters related to chemical structure, correlative methods and analysis of results.

5. Molecular & Biochemical pharmacology Basis:

a. Application of molecular & biochemical pharmacology to drug design.
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 Practicals based on theory M.1I.COL.T.1.

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

REFERENCES

ADVANCED PHARMACOLOGY – I & II

1. Goodman & Gilman's The Pharmcological basis of Therapeutics Ed. J.G. Hardman, L.E. Limbird, P.B. Molinoff and R. W. Ruddon. International Edition. McGraw Hill.
2 Katzung BG, Basic and Clinical Pharmacology, Lange Medical Publication,California
3. H.P.Rang , M.M. Dale, J.M Ritter, P K Moore, Pharmacology, Churchill Livingstone, New York.
4. Roger Walker, Clive Edward, Clinical pharmacy & therapeutics, Churchill Livingstone, New York.
5. Richard D Howlard, Mary J. Mycek, Lippincott Williams & wilkins, Lippincott's illustrated reviewed, Pharmacology. New York
6. Herfindal & Gourtey,Text book of therapeutics-drug,disease and management,Williums and Wilkins publications.
7. Craig, C.R. and Stitzel, R.E. Modern Pharmacology. Latest edition. Publisher: Little Brown and company.
8. Review articles from published journals.

Advances in Preclinical Evaluation – I & II

1. Vogel HG, Drug Discovery and Evaluation, Springer, Germany
2. Turner RA, Screening Methods in Pharmacology, Academic Press, London
3. Lawrence DR and Bacharach AL, Evaluation of Drug Activities:Pharmacometrics, Academy Press, London.
4. N S Parmar and Shiv Prakash,Screening methods in Pharmacology,Narosa publishing house,New Delhi.
5. S K Gupta, Drug Screening Methods,Jaypee brothers,New Delhi.
6. J H Burn, D.J.Finney and I G Goodwin, Biological Standardisation,Blackwell Scientific Publications, Oxford.
7. Ghosh M N, Fundamentals of experimental Pharmacology,Hilton & Company,Kolkata.
8. M.C.Prabhakar, Experimental Pharmacology, Orient Longman, Chennai
9. SK Kulkarni, Handbook of Experimental Pharmacology, Vallabh Prakashan,New Delhi.
10. R.K.Goel, Practicals in Pharmacology, B.S.Shah Prakashan, Ahmedabad
11. Shayne Cox Gad and Christopher p ,Animal models in toxicology .
12. Hayes, Principles and methods of toxicology.
13. Indian Pharmacopoeia and other pharmacopoeias
14. The UFAW handbook on the care and management of laboratory animals by UFAW.
15. Nodine Siegler, Animal and Clinical Pharmacological Techniques in Drug evaluation.

16. Pharmaceutical Statistics- Practical and Clinical Applications, Sanford Bolton, 3rd Edition, Published by Marcel Dekker Inc. New York, 1997.
16. Review articles from published journals.

Pharmacokinetics, Pharmacodynamics & Drug Metabolism (PPDM)

1. Biopharmaceutics and Clinical Pharmacokinetics by, Milo Gibaldi
2. Applied Biopharmaceutics & Pharmacokinetics, Eds Leon Shargel et al, Prentice Hall International.
3. Pharmacokinetics: By Milo Glbaldi Donald, R. Mercel Dekker Inc.
4. Hand Book of Clinical Pharmacokinetics, By Milo Gibaldi and Laurie Prescott by ADIS Health Science Press.
5. Hand Book of Basic Pharmacokinetics. Wolfgang A. Ritschel, Gregory L. Kearns.Fifth Edition
6. Biopharmaceutics and Pharmacokinetics -A treatise. DM Brahmankar, Sunil B. Jaiswal: Vallabh Prakashan Pitampura, Delhi
7. Cilincal Pharmacokinetics, Concepts and Applications: By Malcolm Rowland and
8. Thomas, N. Tozen, Lea and Febrger, Philadelphia, 1995.
9. Dissolution, Bioavailability and Bioequivalence, By Abdou H.M, Mack, Publishing Company, Pennsylvania 1989.
10. Biopharmaceutics and Clinical Pharmacokinetics-An introduction ,by Rebort F
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12. Encyclopedia of Pharmaceutical Technology, Vol 13, James Swarbrick, James, C.
13. Roylan, Marcel Dekker Inc, New York 1996.
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2. Textbook of therapeutics, Drug and disease management: Eric T Herfindal, 7th Edn. Williams & Wilkins Publications, 2000
3. Richard D Howlard, Mary J. Mycek, **Lippincott** Williams & wilkins, Lippincott's illustrated reviewed, Pharmacology. New York
4. Goodman & Gilman's The Pharmcological basis of Therapeutics Ed. J.G. Hardman, L.E. Limbird, P.B. Molinoff and R. W. Ruddon. International Edition. McGraw Hill.
5. G Katzung, Basic and Clinical Pharmacology. Bertram, 9th edn Lange Publications, 2004
6. Gupta, P.K. and Salunkhe, D.K. Modern Toxicology. Volume I, II and III. Latest edition. Publisher: B.V. Gupta, Metropolitan Book Co. (p) Ltd, New Delhi.
7. Derelanko and Holinger , CRC Hand book of toxicology
8. Principles of drug action the basis of Pharmacology by Goldstein A, Arrow L. and Kalman ,S.M. 2nd edition. John Wiley & Sons. Incl. New York. 1974 Edition. McGraw Hill.

9. Hayes, Principles and Methods of toxicology
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12. V V Pillay. Handbook of Forensic Medicine and Toxicology. Thirteenth edition 2003 Publication, Hyderabad
13. Ellenhorn's "Text book of Toxicology", Eds; Mathew J Ellenhorn et al, 2nd edition, Williams and Wilkins Publications, 1997.
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).
3. Burgers Medicinal Chemistry – The basis of Medicinal Chemistry by Manfred E.Wolff-1 (John Willey & Sons).
4. Computer assisted drug design by Edward O Olson (American Chemical Society-ACS symposium series 112).
5. Wilson & Giswold's text book of Organic, Medicinal &Pharmaceutical Chemistry.
6. Goodman & Gilman's The Pharmcological basis of Therapeutics Ed. J.G. Hardman, L.E. Limbird, P.B. Molinoff and R. W. Ruddon. International Edition. McGraw Hill.
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8 .Principles of Medicinal Chemistry by Willium Foye.
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10. Human molecular genetics by tomstracham & Andrew P Read.
11. Bioinformatics:Genes ,Proteins & Computers by Cristine Orengo.
12. The Cell – A molecular approach by Geoffrey M Cooper.
13. Genotherapy,Therapeutic mechanism and strategies by Nanoysmith,Tampleton Danilo D Lassic.
14. Fundamentals of Biochemical Pharmacology by Bacq ZM, Capek.
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