# Punjab Technical University, Jalandhar
## M. Pharm (Pharmacology)
### Scheme of Examination

#### 1st Semester

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Course Code</th>
<th>Subject</th>
<th>Exam Hours</th>
<th>Maximum Marks</th>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>Int.</td>
<td>Ext.</td>
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<tr>
<td>1</td>
<td>PHM- 511</td>
<td>Systemic Pharmacology</td>
<td>3</td>
<td>20</td>
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<tr>
<td>2</td>
<td>PHM- 513</td>
<td>Drug Therapy and Pharmacotherapeutics</td>
<td>3</td>
<td>20</td>
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<tr>
<td>3</td>
<td>PHM- 515</td>
<td>Drug Evaluation and Advanced Pharmacological Techniques</td>
<td>3</td>
<td>20</td>
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<tr>
<td>4</td>
<td>PHM- 517</td>
<td>Pharmacology Laboratory- I</td>
<td>12</td>
<td>20</td>
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<td>Total</td>
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#### 2nd Semester

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<td>Int.</td>
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<tr>
<td>1</td>
<td>PHM- 512</td>
<td>Pharmaceutical Medicine</td>
<td>3</td>
<td>20</td>
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<tr>
<td>2</td>
<td>PHM- 514</td>
<td>Clinical Evaluation and Molecular Biology</td>
<td>3</td>
<td>20</td>
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<tr>
<td>3</td>
<td>PHM- 516</td>
<td>Recent Advances in Pharmacology</td>
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<td>4</td>
<td>PHM- 518</td>
<td>Pharmacology Laboratory – II</td>
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<tr>
<td>Total</td>
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<td></td>
<td>80</td>
<td>320</td>
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#### 3rd & 4th Semester

*(Research work for one year)*

The thesis shall be presented by the candidate at the end of record academic year. The thesis shall be evaluated as under:

- Evaluation of written thesis: Maximum Marks: 200
- Presentation of Seminar on thesis: Maximum Marks: 100
- & Viva Vice: Total Marks: 300
PHM-511 SYSTEMIC PHARMACOLOGY

External Marks: 80
Internal Marks: 20
Total Marks: 100


2. Pharmacology of the Autonomic Nervous System:
   2.1. Physiology of autonomic nervous system
   2.2. Muscarinic receptor agonists and antagonists
   2.3. Anticholinesterase agents
   2.4. Agents acting at neuromuscular junction and autonomic ganglia
   2.5. Adrenergic agonists and antagonists
   2.6. 5-Hydroxytryptamine receptor agonists and antagonists

3. Pharmacology of Autacoids:
   3.1. Histamine, bradykinin, and their antagonists
   3.2. Lipid derived autacoids: Eicosanoids and platelet activating factor

4. Drugs Acting on the Central Nervous System:
   4.1. Neurotransmission in central nervous system
   4.2. General anesthetics
   4.3. Local anesthetics
   4.4. Hypnotics and sedatives
   4.5. Opioid analgesics
   4.6. Pharmacology of ethanol
   4.7. Drug addiction and drug abuse

5. Analgesic, Antipyretic, and Anti-Inflammatory Agents

6. Drugs Affecting Renal and Cardiovascular Function:
   6.1. Diuretics
   6.2. Vasopressin and other agents affecting the renal conservation of water
   6.3. Renin, angiotensin, and their modulators
   6.4. Calcium channel blockers

7. Pharmacology of Chemotherapeutic and Antimicrobial Agents:
   7.1. General considerations of antimicrobial therapy
   7.2. Sulfonamides, trimethoprim, quinolones, other related agents
   7.3. Penicillins, cephalosporins, and other beta-lactam antibiotics
   7.4. Aminoglycosides
   7.5. Protein synthesis inhibitors and miscellaneous antibacterial agents
   7.6. Antifungal agents
   7.7. Antiviral agents (Non-retroviral)

8. Antineoplastic Agents

9. Immunosuppressants, Tolerogens, and Immunostimulants

10. Hormones and Their Antagonists:
    10.1. Pituitary hormones and their hypothalamic releasing factors
    10.2. Thyroid and antithyroid drugs
    10.3. Estrogens and progestins
    10.4. Androgens
    10.5. Adrenocortical steroids and their synthetic analogs, inhibitors of synthesis and actions of adrenocortical hormones
    10.6. Agents affecting mineral ion homeostasis and bone turnover

11. Drugs Acting on the Blood and Blood-Forming Organs:
    11.1. Hematopoietic agents: Growth factors, minerals, and vitamins
    11.2. Blood coagulation and anticoagulant, thrombolytic, and antiplatelet drugs

12. Pharmacology of Dermatological Agents

13. Ocular Pharmacology

BOOKS RECOMMENDED

PHM-513 DRUG THERAPY AND PHARMACOTHERAPEUTICS

External Marks: 80
Internal Marks: 20
Total Marks: 100

1. Basic Principles of Clinical Pharmacology:
   Monitoring of drug therapy, patient compliance, principles of pediatric and geriatric pharmacology, drug therapy in pregnant and lactating mothers.

2. Drug Therapy of Cardiovascular Disorders:
   Pathophysiology and drug therapy of congestive cardiac failure, hypertension, cardiac arrhythmias, ischemic heart disease, hyperlipidemia, and atherosclerosis.

3. Drug Therapy of Neurological Disorders:
   Pathophysiology and drug therapy of epilepsy, Parkinson's disease, migraine, and myasthenia gravis.

4. Drug Therapy of Psychiatric Disorders:
   Pathophysiology and drug therapy of anxiety, schizophrenia, Alzheimer's disease, mood and sleep disorders, and memory.

5. Drug Therapy of Endocrine Disorders:
   Pathophysiology and drug therapy of diabetes mellitus, contraception, and infertility.

6. Drug Therapy of Inflammatory Disorders:
   Biology of inflammation, pathophysiology and drug therapy of osteoarthritis, rheumatoid arthritis, and gout.

7. Drug Therapy of Respiratory Diseases:
   Pathophysiology and drug therapy of asthma.

8. Drug Therapy of Gastrointestinal Diseases:
   Pathophysiology and drug therapy of peptic ulcers, emesis, irritable bowel syndrome, and inflammatory bowel disease.

9. Drug Therapy of Metabolic and Sexual Disorders:
   Pathophysiology and drug therapy of obesity and erectile dysfunction

10. Drug Therapy of Infectious Diseases:
    Pathophysiology and drug therapy of tuberculosis, leprosy, HIV and related opportunistic infections, malaria, amoebiasis, and helminth infections.

BOOKS RECOMMENDED


PHM-515 DRUG EVALUATION AND ADVANCED PHARMACOLOGICAL TECHNIQUES

External Marks: 80  
Internal Marks: 20  
Total Marks: 100

1. **Principles of Experimental Pharmacology:**
   Common laboratory animals in pharmacological research, limitations of animal tests, alternatives to animal use, anesthetics used in laboratory animals, some standard techniques used in laboratory animals, euthanasia of experimental animals. Regulations for the care and use of laboratory animals.

2. **Drug Discovery:**
   Strategies and approaches employed in drug discovery. Basic concept of combinatorial chemistry, high throughput screening, cell lines, and their application in drug discovery. Transgenic animal models in the development of new drugs.

3. **Receptor-Radioligand Binding Assays:**
   General principles and techniques of radioligand binding assays. Specific assay design for adrenoceptors, dopamine receptors, histamine receptors, GABA and benzodiazepine receptors.

4. **Pharmacological Techniques to Evaluate the following Class of Drugs:**
   - 4.1. Antihypertensive agents
   - 4.2. Antianginal agents
   - 4.3. Antiarrhythmic agents and agents used in sudden cardiac death
   - 4.4. Drugs used in cardiac failure and cardiomyopathies
   - 4.5. Drugs used in hyperlipidemia and atherosclerosis
   - 4.6. Anti-infarct agents
   - 4.7. Antiplatelet and thrombolytic agents
   - 4.8. Antiepileptics
   - 4.9. Antiparkinsonian agents
   - 4.10. Antimigraine agents
   - 4.11. Antianxiety agents and drugs used in mood and sleep disorders
   - 4.12. Antipsychotics
   - 4.13. Drugs affecting memory
   - 4.14. Drugs used in Alzheimer’s disease
   - 4.15. Local anesthetics
   - 4.16. Skeletal muscle relaxants and neuromuscular blockers
   - 4.17. Antidiabetic agents
   - 4.18. Antifertility agents
   - 4.19. Analgesics and drugs used in arthritis and neuropathic pain
   - 4.20. Anti-inflammatory agents
   - 4.21. Antiasthmatic agents
   - 4.22. Antiulcer agents
   - 4.23. Antiemetics
   - 4.24. Drugs used in inflammatory bowel disease
   - 4.25. Hepatoprotective agents
   - 4.26. Antiobesity agents
   - 4.27. Drugs used in erectile dysfunction
   - 4.28. Antiviral agents
   - 4.29. Antimalarial agents
   - 4.30. Dermatological agents and experiment models in skin pharmacology

**BOOKS RECOMMENDED**

PHM-517 PHARMACOLOGY LABORATORY – I
16 Hrs/Week

External Marks: 80
Internal Marks: 20
Total Marks: 100

1. Experiments to study pharmacology of receptors (competitive and non-competitive antagonists) using isolated rectus abdominus muscle of frog, guinea pig ileum, and rat colon preparations.

2. Experiments to calculate $pA_2$ and $pA_{10}$ using isolated rectus abdominus muscle of rat, vas deferens, muscle of rat, rat colon, and rat fundus preparations.

3. Experiments in intact animals to evaluate local anesthetics, mydriatics, miotics, analgesics, anti-inflammatory agents, hypnotics, antianxiety agents, antiepileptic agents, antidepressants, antipsychotics, antiparkinsonian agents, nootropics, and antiulcer agents

4. Design and statistical analysis of experimental data.

BOOKS RECOMMENDED


PHM-512 PHARMACEUTICAL MEDICINE

External Marks: 80
Internal Marks: 20
Total Marks: 100

1. Definition and development of scope of pharmaceutical medicine.

2. New Drug Development Process:
   - Preclinical evaluation: Pharmacological evaluation of acute, subacute, and chronic toxicity studies.
   - IND, NDA, and ANDA applications. Concept of drug master files (DMF).


5. Clinical Research: Basic concept of Good Laboratory Practice (GLP) and Good Clinical Practice (GCP). Contract Research Organization (CRO) and relationship of marketing to clinical research.

6. Pharmacoepidemiology: Types, methods, and factors affecting drug utilization, applications of pharmacoepidemiology in health care and rational use of drugs.

7. Pharmacovigilance: Definition, scope, and epidemiology of adverse events, product recall and withdrawal of drugs with specific examples, and drug related deaths.

8. Pharmcoeconomics: Principles, methods, and applications of pharmcoeconomics to pharmacotherapy and managed health care.

9. Nutraceuticals: Concept, regulatory requirements, and clinical uses of various nutraceuticals.

BOOKS RECOMMENDED


PHM-514 CLINICAL EVALUATION AND MOLECULAR BIOLOGY

1. **Clinical Evaluation:**
   Clinical evaluation of antihypertensive agents, drugs for heart failure, antianginal agents, antiarrhythmic agents, antiepileptics, anxiolytics and hypnotics, antidepressants, antipsychotics, antiparkinsonian agents, drugs used in Alzheimer’s disease, and other dementias, analgesics, anti-inflammatory agents, antiulcer agents, diuretics, antidiabetics, and antiviral agents.

2. **Recombinant DNA Technology:** DNA structure and functions, restriction endonucleases, plasmid cloning, methods of creating and screening gene library, cloning DNA sequences that encode eukaryotic proteins, vectors for cloning large pieces of DNA, genetic transformation, and selection of prokaryotes.

3. **Molecular Diagnostics:** DNA diagnostic systems, hybridization probes, diagnosis of malaria, fluorescent in situ hybridization procedure, molecular diagnosis of genetic diseases – PCR/OLA procedures, ligase chain reaction (LCR),

4. **Monoclonal Antibodies:** Scope and limitation of monoclonal antibodies, formation and selection of hybrid cells, identification of specific antibody producing hybrid cell lines. Applications of monoclonal antibodies in clinical, treatment, and biomedical research. Monoclonal antibodies as therapeutic agents, preventing rejection of transplanted organs, treatment of bacterial blood infections. Chemically linked monoclonal antibodies, human monoclonal antibodies, and hybrid human-mouse monoclonal antibodies.

5. **Biopharmaceuticals:** Basic principles of development of protein pharmaceuticals with special reference to human insulin, human interferons, human growth hormone, erythropoietin, variants of t-PA, immunoadhesions, and chimeric proteins.

**BOOKS RECOMMENDED**


PHM-516 RECENT ADVANCES IN PHARMACOLOGY

External Marks: 80
Internal Marks: 20
Total Marks: 100


   1.1. Pharmacology of receptors: Classification, cellular signaling systems, and pharmacology of agonists and antagonists of the following receptor types:
   (a) Excitatory Amino Acid receptors
   (b) Purinoreceptors
   (c) GABA and Benzodiazepine receptors
   (d) Neurosteroid receptors
   (e) Cannabinoid receptors
   (f) Melatonin receptors

   1.2. Ion Channels and Their Modulators: Classification and biology of potassium ionic channels, and pharmacology of their modulators

   1.3. Novel Target Sites: Physiological functions, pharmacological implications, and therapeutic potential of the following target sites:
   (a) Rho kinase (ROCK)
   (b) Phosphoinositide 3-kinase (PI3K)
   (c) Akt (Protein kinase B)
   (d) Caspases
   (e) Poly (ADP-ribose) polymerase (PARP)
   (f) Peroxisome proliferator activator receptors (PPAR)-α and γ
   (g) AMP activated protein kinases
   (h) Protein kinases
   (i) Phosphodiesterases

2. Neuropeptides: Biological functions, pharmacological implications, their agonists and antagonists, and therapeutic potentials of the following neuropeptides:
   2.1 Neuropeptide Y
   2.2 Calcitonin gene-related peptide (CGRP)
   2.3 Substance P
   2.4 Cholecystokinin

3. Transporter Proteins: Classification and biology of ATP binding cassette (ABC) transporter superfamily
   3.1 Multidrug resistance (MDR) proteins
   3.2 Cystic fibrosis transmembrane regulator (CFTR)


5. Cytokines and Chemokines: Classification, physiology, pharmacology, pathological, and therapeutic implications of various cytokines and chemokines.

6. Cell Adhesion Molecules and Matrix Proteins: Biology of cell adhesion molecules and matrix proteins, their role in various disease processes, and potential target sites to develop newer agents. Glycoprotein IIb/IIIa receptor antagonists and anti-integrin therapy.

8. **Biology of Vascular Endothelium:** Biology of EDRF, EDCF, and EDHF. Pharmacology of endothelins and nitric oxide. Clinical implications of endothelial dysfunction.

9. **Chronobiology and Chiral Pharmacology:** Basic concepts and clinical potentials of chronobiology and chiral configuration.

10. **Nucleic Acid Therapies:** Basic concepts and clinical potentials of gene therapy, oligonucleotide therapy, aptamer therapy, and ribozyme therapy.

11. **Genomics:** Impact of human genome sequence on the discovery of newer pharmacological agents. Basic concept and applications of bioinformatics and proteomics in drug discovery.

12. **Stem Cell Therapeutics:** Biology of stem cells and their potentials in various disorders.

13. **Immunotoxins:** Biology, pharmacology, therapeutic potentials of immunotoxins.

14. **Ethical Issues:** Ethical issues related to stem cells, human cloning, genetic counseling, foeticide, and surrogated parenthood.

**BOOKS RECOMMENDED**

1. Annual Review of Pharmacology and Toxicology
2. Annual Review of Medicine
3. Trends in Pharmacological Sciences
4. Advances in Pharmacology
5. Trends in Biotechnology
6. Advances in Drug Therapy
7. Drug Discovery Today.

**PHM-518 PHARMACOLOGY LABORATORY – II**

**External Marks: 80**

**Internal Marks: 20**

**Total Marks: 100**

1. Four-point bioassays of various agonists using rectus abdominus muscle of frog, guinea pig ileum, rat uterus, rat fundus. Calculate log fiducial limits of error.
2. To study the effect of various agonists on isolated guinea pig tracheal chain, isolated phrenic nerve-diaphragm, isolated rat aorta, isolated rabbit atria and gastrocnemius muscle of rabbit.
3. Identification of unknown drug using anesthetized dog by recording mean arterial blood pressure, respiration, gastrointestinal motility, nictitating membrane, and spleen volume.
4. Effect of various agents on rat blood pressure.
5. Effect of various pharmacological agents on heart rate, coronary flow rate, and force of contraction on isolated mammalian heart.
6. Exercises to calculate pharmacokinetic parameters, bioavailability and bioequivalence using serum/plasma and urine excretion data.
7. Study of hepatoprotective agents using various experimental models.
8. Calculation of LD$_{50}$ and experiments related to toxicity.

**BOOKS RECOMMENDED**

2. Edinburg University Pharmacology Staff (ed.) Pharmacological Experiments on Isolated Preparations, Livingstone, U.K.