STUDY GUIDE
PHARMACOLOGY

MBBS THIRD YEAR
PHARMACOLOGY
(2022-2023)

TABLE OF CONTENTS

1. DEPARTMENT TEAM

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2. SYLLABUS

Section – 1

General Pharmacology:

- Definition of pharmacology and therapeutics, definition of a drug, Pro-drug, etc. and drug nomenclature.
- General principles of pharmacology i.e., of pharmacokinetic & pharmacodynamic.
- Branches /divisions of pharmacology.
- Sources of drugs with examples.
- Active principles of drugs and pharmacopoeias with characteristics and examples.
- Posology, Dose calculations.
- Formulations / preparations of drugs

Pharmacokinetics:

ADME (Absorption, Distribution, Metabolism & Excretion of drugs)

- Different Routes of Drug Administration with their Merits and Demerits
- Transport of drugs across cell-membrane.
- Absorption of drugs and processes involved in drug absorption
- Factors Modifying Absorption of Drugs.
- First-Pass Effect, and use of alternative routes of administration.
- Bio-availability, its clinical significance and factors affecting bio- availability.
- Distribution, redistribution of drugs, plasma protein binding, volume of distribution and drug reservoirs.
- The time course of drug effect; the target concentration & a rational dosage regimen; dose individualization- application of pharmacological parameters.
- Metabolism & biotransformation of drugs, enzyme induction, enzyme inhibition, clinical relevance of drug metabolism and entero-hepatic circulation.
- Excretion, elimination, and clearance of drugs.
- Plasma half-life of drugs, steady state concentration, its clinical importance and factors affecting Pharmacodynamics:

- Definition and various types of receptors
- Mechanisms of drug action (receptor-mediated* & nonreceptor-mediated), second messengers; regulation of receptors.
- Various types of ligands (agonists and antagonists); types of antagonisms
- Plot and explain dose response curves in respect of affinity, potency, efficacy, spare receptors; therapeutic index, therapeutic window; clinical selectivity: beneficial versus toxic effects of drugs.
- Factors modifying action and doses of drugs.
- Relation between Drug Dose & Clinical Response.
- Variation in drug responsiveness
- Pharmacogenetics of Isoniazid, Succinylcholine, Primaquine, Hydrogen peroxide, Warfarin and Vitamin D, etc.
- Outline of development of new drugs.

Section – 2

Drugs useful in Autonomic Nervous System (Pharmacological Effects of Drugs on Autonomic Nervous System)

- Introduction to Autonomic Pharmacology with brief Anatomy, Neurotransmitter's Chemistry, Autonomic Receptors, Functional Organization of Autonomic Activity, Pharmacologic Modification of Autonomic Functions.
- Pharmacokinetic & Pharmacodynamics of Cholinoceptor Activating Drugs (Direct acting and Indirect-acting Cholinoceptor activating Drugs / Parasympathomimetics (including Organophosphorus Compounds).
- Pharmacokinetic & Pharmacodynamics of Cholinoceptor Blocking Drugs, and Anticholinergic like Groups
- Pharmacokinetic & Pharmacodynamics of Adrenoceptor Agonists and Sympathomimetic Drugs.
- Pharmacokinetic & Pharmacodynamics of Adrenoceptor Antagonist Drugs (Sympatholytics).
- Pharmacokinetic & Pharmacodynamics of Ganglion Stimulants and Blockers

- Pharmacokinetic & Pharmacodynamics of Adrenergic Neuron Stimulants and Blockers.
- Pharmacokinetic & Pharmacodynamics of Neuromuscular blocking agents / Depolarizing & Non-depolarizing Agents.
- Pharmacokinetic & Pharmacodynamics of Spasmolytics / Centrally Acting Muscle Relaxants

Section – 3

Drugs useful / Pharmacological Effects in Cardiology

- Introduction to the Pharmacology of CVS Drugs and Neurotransmitters involved in CVS effects.
- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
    - Diuretics and Antidiuretic Hormone (Agonists and Antagonists),
    - Vasodilators
    - Calcium Channels Blockers
    - Renin Angiotensin Aldosterone System (RAAS),
    - Central Sympathoplegics (Revisit to) Alpha & Beta Blockers
- Drugs used in:
    - Hypertension
    - Ischemic Heart Diseases (Angina, Acute Coronary Syndrome, Myocardial Infarction).
    - Cardiac Failure, Acute Cardiac Failure & Acute Pulmonary Edema:
    - Coma.
    - Syncope.
    - Cardiac Arrythmias.

Section – 4

Drugs useful / Pharmacological Effects in Haematology.

- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:

- Anticoagulants and drug used in bleeding disorders.
- Antiplatelet agents.
- Fibrinolytics / Thrombolytics esp. use in Acute Myocardial Infarction.
- Anti-Hyperlipidemics / Anti-Dyslipidemics.

Section – 5

Drugs useful / Pharmacological Effects in Neurology & Psychiatry

- Introduction to Central Nervous System (CNS) and neurotransmitters of CNS.
- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
  - Sedative-hypnotics.
  - Anti-Depressants
  - Mood Stabilizers
  - Anti-psychotics
  - Anti-Epileptics
  - Anti-Parkinsonism
  - Local Anesthetics
  - General Anaesthetics
  - Opioids
  - Alcohols and drugs of abuse.

Section – 6

Drugs Useful / Pharmacological Effects in Anaesthesiology:

- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:

a) Local Anesthetics:
   Articaine, Benzocaine, Bupivacaine, Lidocaine, Mepivacaine, Prilocaine, Chloroprocaine, Cocaine (for procedures requiring high surface activity and vasoconstriction); EMLA (Eutectic Mixture of Local Anesthetics); advantage of Sustained-Release Delivery System.

b) General Anesthetics:
Nitrous Oxide, Halothane, Isoflurane, Sevoflurane, Thiopental, Midazolam, Propofol, Ketamine, Dexmedetomidine, Etomidate, Fentanyl & Droperidol.

c) Skeletal Muscle Relaxants:

- Non-depolarizing neuromuscular blocking agents: Prototype: Tubocurarine & Others (only characteristic pharmacokinetic & pharmacodynamic points) of Atracurium, rocuronium, Cisatracurium, Pancuronium, vecuronium.
- Reversal Agents: Neostigmine, Sugammadex
- Depolarizing Neuromuscular Blocking Agents: Succinylcholine.
- Centrally Acting Spasmolytic Drugs: Baclofen, Diazepam, Orphenadrine, Cyclobenzaprine, Tizanidine.
- Direct Acting Muscle Relaxants: Dantrolene.

Section – 7

Drugs useful / Pharmacological Effects in Rheumatology & Painful States

- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
    - Prostaglandins,
    - Eicosanoids,
    - Non-Steroidal Anti-Inflammatory Drugs (NSAIDs),
    - Disease Modifying Anti-Rheumatic Drugs (DMARDs),
    - Anti-Gout Drugs.

Section – 8

Drugs useful / Pharmacological Effects in Pulmonology & on Smooth Muscles

- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
    - Autacoids (Histamine & Anti-Histamines, Serotonin Agonists and Serotonin Antagonists, Ergot Alkaloids, etc)
    - Eicosanoids.

- Vasoactive peptides.
- Nitric oxides.
- Expectorants, Mucolytics, Antitussives – Drugs used for Cough (Dry & Productive) etc.

Section – 9

Drugs useful / Pharmacological Effects in Gastroenterology

- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
  - Antacids
  - H2 Receptor Blockers
  - Proton Pump Inhibitors & Eradication of H. Pylori
  - Mucosal Protective Agents
  - Prokinetic Agents
  - Emetics & Anti-Emetics
  - Laxatives
  - Anti-Diarrheal Drugs
  - Inflammatory Bowel Disease (IBD) & Crohn's Disease.

Section – 10

Drugs useful / Pharmacological Effects as Chemotherapy

- Introduction to chemotherapy
- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
  - Beta Lactam and Other Cell Wall Synthesis Inhibitors
  - Protein Synthesis Inhibitors
  - Nucleic Acid Synthesis Inhibitors
  - Folic Acid Synthesis Inhibitors
  - Anti-Mycobacterial Drugs.
  - Antifungal Drugs.
  - Antiviral Drugs, esp. Used in Herpes, Hepatitis B & C, AIDS, Bird Flu, COVID19, etc. (Clinical Classification and Common Adverse Effects Only)

- Anti-Protozoal Drugs. ▪ Anti- Malarial. ▪ Anti-Amoebic. ▪ Anti-Leishmaniosis.
- Anthelmintics

Section – 11

Drugs useful / Pharmacological Effects in Oncology

- Classification, common therapeutic uses and adverse effects of the following groups.
- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
    - Alkylating Agents, Platinum Analogs,
    - Antimetabolites: Antifolates, Fluoropyrimidines, Deoxycytidine Analogs, Purine Antagonists,
    - Natural Chemotherapy Drugs: Vinca Alkaloids, Texans & Other Anti-Microtubule Drugs, Epipodophyllotoxins, Camptothecins,
    - Antitumor Antibiotics: Anthracyclines, Mitomycin, Bleomycin,
    - Miscellaneous Anti-Cancer Drugs: Imatinib & Other Tyrosine Kinase Inhibitors, Growth Factor Receptor Inhibitors

Section – 12

Drugs useful / Pharmacological Effects in Endocrinology

- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
    - Pituitary and hypothalamic drugs.
    - Adrenocorticoids and their antagonists.
    - Thyroid and anti-thyroid drugs.,
    - Parathyroid drugs and drugs affecting bone-mineral homeostasis.
    - Pancreatic hormones (Insulin & Glucagon, etc) and oral anti diabetic drugs.
    - Male & Female Sex Hormones.

Section – 13

Drugs useful / Pharmacological Effects in Ophthalmology.

- Revision of Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of drugs for:
    - Allergic / Bacterial / Viral Conjunctivitis,
    - Dacryocystitis,
    - Viral Keratitis,
    - Glaucoma,
    - Hordeolum and Blepharitis,
    - Chorioretinitis;
    - Cyclitis;
    - Endophthalmitis,
    - Miosis in surgery,
    - Post-Operative Inflammation.

Section – 14

Drugs useful / Pharmacological Effects in Otorhinolaryngology.

- Revision of Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of drugs for:
    - Cerumen Impaction: Detergent Ear Drops (3% Hydrogen Peroxide / 6.5% Carbamide Peroxide) and Irrigation.
    - External Otitis: Otic Antibiotic Solution or Suspension (Aminoglycoside - Neomycin/Polymyxin B) or Fluoroquinolone – Ciprofloxacin, with or without a Corticosteroid – Hydrocortisone.
    - Pruritus of the External Auditory Canal: Topical Corticosteroid –Triamcinolone.
    - Eustachian Tube / Serous Otitis Media:
    - Blocked: Systemic & Intranasal Decongestants – Pseudoephedrine, Oxymetazoline, combined with Auto-inflation.

- Allergy: Intranasal Corticosteroids – Beclomethasone Dipropionate
- Acute Otitis Media. Amoxiclav / Erythromycin + Sulfonamide
- Chronic Otitis Media: Ofloxacin / Ciprofloxacin + Dexamethasone

Section – 15

Drugs useful / Pharmacological Effects in Dermatology

- Revision of Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
  - Topical Corticosteroids
  - Demulcents, emollients, irritants, counter irritants, astringents.
  - Antiseptics and disinfectants.
  - Keratolytic & Destructive Agents
  - Antiseborrheic Drugs.
  - Anti-Scabies and Anti-Lice.
  - Antipruritic Agents
- Topical Antibacterial Drugs for:
  - Wounds,
  - Acne,
- Topical Antifungal Drugs for:
  - Dermatophytes (Epidermophyton, Microsporum, and Trichophyton)
  - Yeasts (Candida albicans and Pityrosporum orbiculare),
- Topical Antiviral Drugs For:
  - Herpes Simplex,
  - External Genital and Perianal Warts – Immunomodulators
- Topical Ectoparasiticides for:
  - Pediculosis,
  - Scabies,
- Topical Drugs affecting Pigmentation

- Sunscreens,
- Acne Preparations,
- Drugs for Psoriasis,
- Androgenic Alopecia – Trichogenic & Antitrichogenic Agents,
- Treatment of Melanoma – Antineoplastic Agents.

Section – 16

Drugs useful / Pharmacological Effects in Immune Response Disorders,

- Allergies/Allergic Disorders/ Reactions: Anaphylaxis, Food Allergy, Drug Allergy, Venom Allergy, Drug-Induced Hypersensitivity,
- Atopic Disease,
- Autoimmune Disorders,
    - Immunosuppressive agents' esp. useful in organ transplants. (classification and common therapeutic uses and adverse effects only).
- Hypersensitivity,
- Immunodeficiency.

Section – 17

Miscellaneous Topics

a) Drugs useful / Pharmacological Effects in Geriatric Problems

- Importance of pharmacokinetic and pharmacodynamic changes with aging.
- Precautions in administering medications for:
    - Sedative-Hypnotics, Analgesics, Antipsychotic & Antidepressant Drugs, Drugs Used in Alzheimer's Disease,
    - Antihypertensive Drugs, Positive Inotropic Agents, Antiarrhythmic Agents,
    - Antimicrobial Therapy,
    - Anti-Inflammatory Drugs,

- Drugs Used in Glaucoma,
- Macular Degeneration.

- Adverse Drug Reactions in The Elderly

b) Drugs useful / Pharmacological Effects in Surgery

i. Pre surgical.

- Pre-anesthetic Medication:
  - Acepromazine – for psychic sedation primarily.
  - Atropine – to minimize secretions.
  - Diazepam – to fortify impotent anesthetics
  - Scopolamine – for prophylaxis for suppression of vagal and other autonomic reflex activity.
- Specific control of comorbid diseases like Diabetes Mellitus, Cardiac Problems, etc.

a. During Surgery.

- Local Anesthetics:
  - Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of Esters & Amides.
- General Anesthetics:
  - Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of Neuromuscular Blockers.
  - Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of Gaseous & Parenteral General anesthetics.
- Special care for infective surgeries, etc.

ii. Post-surgical

- Opioids – Postoperative Pain.
- Diphenhydramine, Dimenhydrinate – Postoperative Nausea & Vomiting,
- Avoid NSAIDs, Warfarin, or Antiplatelets, etc. – to avoid Postoperative Bleeding.

c) Drugs useful / Pharmacological Effects as Nutritional Supplements.

- Basic (Pharmacokinetic & Pharmacodynamics) and Clinical Pharmacology of:
  - Iron,

- Vitamin B12,
- Folic Acid
- Hematopoietic Growth Factors (Erythropoietin Alfa and Beta, Granulocyte Colony-Stimulating Factor (G-CSF), Granulocyte-Macrophage ColonyStimulating Factor (GM-CSF), Interleukin 11 (IL-11), and Thrombopoietin Receptor Agonists (Romiplostim and Eltrombopag),
- Myeloid Growth Factors (G-CSF and GM-CSF),
- Megakaryocyte Growth Factors
- Different types of Vitamins (Vitamin B1, Vitamin B2, Vitamin B6, Vitamin C, Vitamin D Vitamin D3, Vitamin D2, Vitamin E, Vitamin K, Vitamin K1), Minerals (Calcium, Phosphate, Gallium Nitrate, Strontium, etc.) and Other Supplements

d) Drugs useful / Pharmacological Effects in Sports

- Drugs for:
    - Pain in Neck, Shoulder, Knee, Low Back, etc
    - Shoulder Dislocation & Instability,
    - Adhesive Capsulitis ("Frozen Shoulder"),
    - Spinal Stenosis,
    - Lumbar Disk Herniation,
    - Carpal Tunnel Syndrome,
    - Bursitis,
    - Hip Osteoarthritis,
    - Inversion Ankle Sprains.

e) Heavy Metals and Antidotes.

- Pharmacokinetic & Pharmacodynamics of Heavy Metals:
    - Lead,
    - Arsenic & Arsine Gas,
    - Mercury,
    - Cadmium,
    - Chromium,
- Antidots:

- Heavy Metal Chelators: Dimercaprol, Unithiol, Succimer, Calcium Disodium Ethylenediaminetetraacetic Acid,
- Copper Chelators: Penicillamine, Trientine,
- Iron Chelators: Deferoxamine, Deferasirox, Deferiprone, Ferric Hexacyanoferrate.

f) Drug Interactions.

- Predictability of Drug Interactions:
- Pharmacokinetic Mechanisms,
- Pharmacodynamic Mechanisms,
- Combined Toxicity.

Rational Prescribing, P-drug & Prescription Writing

- General Principles and Guideline for Prescription Writing & Drugs Rational Use
- Elements of the Prescription,
- Prescribing Errors,
- Omission of Information Omission of Information Omission of Information,
- Poor Prescription Writing,
- Inappropriate Drug Prescriptions,
- E-Prescribing,
- Compliance,
- Legal Factors,
- Classification of Controlled Substances (Risk Evaluation and Mitigation Strategy),
- Labeled & Off-Label Uses of Drugs,
- Socioeconomic Factors (The Cost of Prescriptions, Generic Prescribing, Other Cost Factors).

Clinico-Pharmacological Scenario

- Acid Peptic Disease
- Acute attack of asthma & Status Asthmaticus
- Status Epilepticus
- Rheumatoid Arthritis

- Acute Angina and Prophylaxis
- Hypertension and Acute Hypertensive Crisis
- Left Ventricular Failure
- Anaphylactic and Cardiogenic Shocks
- Tuberculosis, Primary and complicated (like in HIV patients, etc.)
- Malaria
- Typhoid Fever, with resistant cases management.
- Amoebiasis
- Glaucoma
- Urinary Tract Infection
- Round Worm Infestation
- Acute watery diarrhea
- Bacillary dysentery
- Acute streptococcal pharyngitis
- Iron deficiency anemia
- Allergic rhinitis
- Migraine
- Hepatitis B / C
- Bird-Flu,
- Dengue,
- COVID - 19

2.1. LEARNING OBJECTIVES

Theme	Topic	Learning Objectives
UNIT-1: General Pharma-cology	1. Introduction to Pharmacology	• Define pharmacology • Define drug • Describe the different branches of pharmacology • Describe different Pharmacopoeias and their clinical usefulness. • Describe drug nomenclature • Identify the Sources & Active Principles of Drugs with Clinical Applications of Active Principles. • Describe different sources of drugs • Tabulate differences between fixed oils and volatile oils as sources of drugs • Routes of Drug Administration; enlist different routes of drug administration with their merits & demerits. • Describe the factors that influence the route of administration of a drug • Understand the Clinical Relevance of the Selection of Routes of Administration
	2. Absorption	Describe drug absorption • Describe drug-based factors affecting rate and extent of drug absorption • Predict the relative permeation of a clinically useful weak acid or a weak base from knowledge of its pKa, the pH of the medium using the Henderson-Hasselbalch equation. • Determine percentage of drug ionized or unionized when placed in a certain pH media • Explain ion trapping • Describe patient-based factors affecting rate and extent of drug absorption • Describe the Clinical Significance of Drug Absorption

	3. Bioavailability	Explain bioavailability • Describe factors affecting bioavailability • Explain first pass elimination • Explain extraction ratio • Understand that how bioavailability and the first pass effect, affect the different clinical conditions
	4. Distribution	Explain drug distribution • Describe the distribution of a drug through various body compartments • Describe drug reservoirs • Explain selective distribution • Describe factors affecting distribution of a drug • Explain volume of distribution (Vd) and how to calculate Vd. • Understand the clinical significance of Vd • Explain the characteristics of a drug that is bound to plasma proteins • Describe the clinical consequences of displacement of a drug from plasma protein binding
	5. Metabolism & Bio-transformation	Explain metabolism and biotransformation • Describe the aims and outcomes of metabolism and biotransformation • Explain a 'prodrug' • Enlist phase I and phase II metabolic & biotransformation reactions • Describe characteristics of Phase 1 reactions • Describe characteristics of Phase 2 reactions • Describe microsomal and non-microsomal biotransformation reactions • Describe the microsomal oxidation system • Explain Hoffman's elimination

		• Describe factors effecting metabolism & biotransformation • Describe the clinical significance of enzyme induction and enzyme inhibition with their examples.
	6. Plasma Half-Life	Understand the concept of plasma half life
		• Describe factors affecting half life
		• Explain clinical significance of plasma half life
	6. Steady State Concentration	Explain steady state plasma concentration • Explain Clinical Significance of Steady State plasma concentration
	7. Elimination and First & Zero Order Kinetics	Explain Elimination and Orders of Elimination – First & Zero Order Kinetics with examples • Describe Clinical Significance of First & Zero Order Kinetics
	8. Maintenance Dose & Loading Dose	Explain Maintenance and Loading doses • Calculate maintenance dose and loading dose using appropriate formula
	9. Drug Excretion	Describe drug excretion • Enlist routes of drug excretion • Describe processes of drug excretion through the kidneys • Describe factors effecting glomerular filtration & tubular reabsorption • Describe the Clinical Significance of Glomerular Filtration, Active Tubular Secretion and Passive Tubular Reabsorption of Drugs
	10. Drug Clearance,	Understand the concept of drug clearance • Describe factors affecting drug clearance • Explain the Clinical Significance of different values of Drug Clearance

	11. Introduction to Pharmaco-dynamics	Explain the term 'pharmacodynamics' • Describe the general mechanisms by which drugs act and role of different types of "bonds" involved in drug-receptor complex.
	12. Drug Receptor Interactions	Explain the terms affinity, efficacy, intrinsic activity & potency • Describe the different types of ligands • Explain Clinical Effects of a Partial Agonist in presence and absence of a Full Agonist
	13. Graded Dose Response Curve,	Describe Graded Dose response curve • Describe the Clinical Informations obtained from a Graded Dose Response Curve
	14. Quantal Dose Response Curve	Explain Quantal Dose Response Curve • Describe the Clinical Informations obtained from a Quantal Dose Response Curve • Tabulate differences between Graded and Quantal Dose Response Curve • Explain Clinical Significance of Therapeutic Index and Therapeutic Window
	15. Abnormal Drug Responses	Describe the different types of antagonism with examples • Explain difference between Inverse Agonist and Pharmacological Antagonist Describe reversible and irreversible pharmacological antagonism with help of dose response curves • Tabulate differences between reversible and irreversible pharmacological antagonism • How Drug-Antagonism is Clinically Useful? Understanding clinically through "Patient

	16. Adverse Drug Reactions	Define adverse drug reaction, adverse and side effects • Identify differences between adverse effect and side effect • Tabulate differences between Type A and Type B adverse drug reactions. • Describe relationships between toxic & therapeutic effects of drugs • Explain the Clinical Importance of Adverse Drug Reaction, Adverse and Side Effects
	17. Factors Affecting Dose and Action of a Drug	Enumerate the factors affecting dose and action of a drug • State the formulae for calculating the dose of a drug according to age and weight • Explain Synergism, Summation and Potentiation • Explain Clinical Significance of Drug Interaction, Contraindication, and Drug Accumulation
	18. Drug Interactions	Enlist types of drug interactions • Describe pharmacokinetic and pharmacodynamic interactions with examples • Explain beneficial and harmful drug interactions with examples.
	19. New Drug Development & Regulation	Describe approaches in drug discovery • Describe screening of new drugs • Describe the 4 Phases of Clinical Trials of a New Drug
UNIT-2: Auto-nomic Nervous System,	1. Introduction to ANS	Explain the term 'Autonomic Pharmacology' and Describe brief related Anatomy and Physiology of ANS • Understand Neurotransmitter substances of Autonomic Nervous System, Enteric Nervous System, Somatic Nervous System, and other Non-adrenergic, Non-cholinergic Neurons with their Sites and Functions and their

		Signaling Mechanisms • Describe steps in cholinergic & adrenergic synaptic transmissions. • Identify the differences in sympathetic & parasympathetic nervous system • Understand the major sites and functions of Autonomic Presynaptic & Post-Synaptic Receptors with Auto-Receptors and Hetero-Receptors, and their Regulation. • Integration and regulation of autonomic function at central and peripheral levels, esp. at cardiovascular and ophthalmic levels. • Identify the effects of some drugs at different steps of autonomic transmission.
	2. Direct and Indirect-acting Cholino-ceptor Stimulants	Describe the synthesis, storage, release and breakdown of acetylcholine, with the drugs that block each step of acetylcholine synthesis and release o Identify the locations, functions, the signaling mechanisms of postreceptor subtypes of cholinoceptors. o Classify parasympathomimetics o Understand the structural differences, pharmacological actions on different organs and systems, uses, adverse effects, contraindications and drug interactions of parasympathomimetics, esp. acetylcholine as a prototype substance. o Describe the pharmacodynamic differences between direct-acting and indirect-acting cholinomimetics. o Tabulate differences between neostigmine and physostigmine
	3. Anti-Muscarinics	Classify anti-muscarinics o Understand their structural differences, pharmacological actions on different organs and systems, uses, adverse effects, contraindications and drug interactions

	4. Anti-Nicotinics:	Ganglion Stimulants & Ganglion Blockers: o Classify Ganglion Stimulants & Ganglion Blockers Understand their structural differences, pharmacological actions on different organs and systems, uses, adverse effects, contraindications and drug interactions of a prototype stimulants. o Understand their pharmacological actions on different organs and systems, clinical applications, adverse effects, contraindications and drug interactions of Ganglion Blockers
	5. Neuromuscular Blockers:	Classify Neuromuscular Blockers Understand their pharmacokinetic aspects, pharmacological actions on different organs and systems, uses, adverse effects, contraindications and drug interactions.
	6. Sympatho-mimetics:	Describe the synthesis, storage, release, breakdown & reuptake of catecholamines, with the drugs that block each step of noradrenaline synthesis, release & reuptake. • Identify the locations, functions, the signaling mechanisms of postreceptor subtypes of adrenoceptors. • Classify Sympathomimetics • Understand the structure activity relationship of different sympathomimetics • Understand the pharmacological actions on different organs and systems, uses, adverse effects, contraindications and drug interactions of “endogenous sympathomimetics”, - adrenaline, noradrenaline and dopamine. • Describe the pharmacodynamic differences between direct-acting and

		indirect-acting sympathomimetics. • Explain the vasomotor reversal phenomena of Dale • Tabulate differences in CVS actions of a pure α-agonist, a pure ß-agonist, and a mixed α and ß-agonist. • Explain the actions of dopamine in various doses
	7. Sympatholytics:	1. Alpha Blockers. o Classify Alpha Blockers. o Understand the pharmacological actions, uses, adverse effects, contraindications and drug interactions of alpha blockers o Know, why non-selective alpha blockers cause more tachycardia than selective alpha-1 blockers. 2. Beta Blockers. o Explain ISA and MSA. o Classify Beta Blockers based upon ISA & MSA activity and their Receptor Selectivity. o Understand the pharmacological actions, uses, adverse effects, contraindications and drug interactions of beta blockers o Know the clinical significance of cardio-selective beta blockers.
UNIT-3: Drugs acting on Cardio-vascular System	I. Basic Pharmacology of: a) Vasodilators	• Identify the various groups of vasodilators; describe their mechanisms of vasodilation production, and their common actions, uses and adverse effects with their role in the treatment of hypertension.

		• Identify the compensatory responses to antihypertensive drugs.
	b) Calcium Channel blockers	• Classify Calcium Channel Blockers; explain their hemodynamic effects, uses, adverse effects with the rationale for their use in Hypertension • Explain / tabulate differences between Dihydropyridines & Non_x005fDihydropyridines
	c) Drugs affecting Renin Angiotensin Aldosterone System (RAAS)	Classify drugs affecting the RAAS; describe the mechanism of action of Angiotensin Converting Enzymes Inhibitors (ACEIs) and Angiotensin Receptors Blockers (ARBs). • Rationalize the uses, adverse effects & contraindications of ACEIs & ARBs with their role in hypertension, cardiac failure, and diabetic nephropathy • Explain why ACE inhibitors cause dry cough, wheezing and angioedema • Tabulate differences between ACE Inhibitors & ARBS
	d) Central Sympathoplegics.	• Enlist the centrally acting Sympathoplegics; identify their uses, and adverse

	e) Renal Pharmacology,	1. Carbonic Anhydrase Inhibitors o Enumerate Carbonic Anhydrase Inhibitors and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors o Explain why Carbonic Anhydrase Inhibitors are not effective diuretics and hence are not used in treatment of Hypertension 2. Loop Diuretics o Enumerate Loop Diuretics and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors o Explain the term High-Ceiling Diuretics in regard to loop diuretics 3. Thiazide Diuretics o Enumerate Thiazide and Thiazide-like Diuretics and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors o Explain use of thiazide diuretics in treatment of Hypertension, Nephrogenic Diabetes Insipidus, Nephrolithiasis 4. Potassium Sparing Diuretics o Enumerate Potassium Sparing Diuretics and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors o Explain the use of Potassium Sparing

		Diuretics in Hyperaldosteronism states 5. Osmotic Diuretics o Enumerate Osmotic Diuretics and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors o Explain the use of mannitol in cerebral edema o Describe mechanism of action, uses & adverse effects of ADH agonists and ADH antagonists
	f) Anti-Hypertensive Drugs.	• Understand the relationship of hypertension and normal regulation and etiology of blood pressure. • Know the rational of drugs affecting the cardiac output, and peripheral resistance. • Classify Anti-Hypertensive Drugs and enlist the sites where anti-hypertensive drugs act to understand their pharmacological strategies in hypertension. • Know the basic pharmacology of diuretics, beta blockers, ACEIs / ARBs, vasodilators, central & peripheral sympathoplegics.
	II. Clinical Pharmacology of: vasodilators	• Rationalize the clinical applications and the reflex adverse effects of different types of vasodilators? Understanding Vasodilators clinically through “patient related problems”. • Rationalize the drug combinations used with vasodilators to address the compensatory responses? Understanding clinically through “patient related problems”.

		How One person's toxicity may become another person's therapy in relation to drugs like minoxidil and diltiazem
	b) Calcium Channels Blockers (CCB).	• Rationalize the clinical applications and the related adverse effects of calcium channels blockers? Understanding CCB clinically through "patient related problems". • Rationalize the drug combinations used with calcium channels blockers in ischemic heart disease and hypertension? Understanding clinically through "patient related problems
	c) Drugs affecting the Renin Angiotensin Aldosterone System (RAAS).	• Rational of the clinical applications of ACEIs & ARBs esp. with their role in the microvascular damages. Understanding ACEIs / ARB clinically through "patient related problems". • Why ACE inhibitors cause dry cough, wheezing and angioedema? What is the alternative approach to ACEIs & ARBS?
	d) Central Sympathoplegics.	• What is the current role of central Sympathoplegics in hypertension?
	e) Diuretics	,• Explain the Role of diuretics in cardiovascular Problems
	III. Clinical Pharmacology & Cardiovascular Problems a) hypertension	• Develop the stepwise approach in treatment and management of hypertensive patients in OPD clinics. Understanding clinically through "Hypertensive Patient Assessment". • What special pharmacological considerations are taken in hypertensive emergencies, malignant hypertension, IHDs, cardiac failure, cardiomyopathies, coarctation of aorta, diabetes mellitus, chronic renal diseases, Cerebrovascular Disease, Dementia, and pregnancy, etc.

		Understanding clinically through "Patient related Problems". • How the hypertension is managed in relation to elders, females, and blacks? • How the non-responding / resistant hypertension is managed?
	b)Coma	• What is the general approach to manage such patient and what is the medical treatment of Coma, Hypotension, Circulation and Hypothermia? Understanding Shock clinically through management of "such Patient"
	c) Syncope.	How to avoid predisposing situations? And what counterpressure maneuvers may help in symptomatic atrial or ventricular arrhythmias; what is the role of Permanent Pacemaker Implantation. Understanding Syncope clinically through "such Patient Assessment".
	d) Ischemic Heart Diseases	Angina: • How the antianginal drugs address the pathophysiology of different types of angina by decreasing preload & afterload. • Explain strategies used in pharmacological treatment of angina • Classify anti-anginal drugs and describe the mechanism of action, uses, adverse effects and interactions of nitrates and nitrites, Beta Blockers, and Calcium Channel Blockers. • Explain the role of Fatty Acid Oxidation Inhibitors in the treatment of Angina. • How the Coronary Steal Phenomenon is addressed? 1. What will be the pharmacological approach in Acute Coronary Syndrome with (STEMI – ST Elevation MI) and without

		ST-Segment Elevation (NSTEMI – Non_x005fST Elevation MI; and What will be the Role of? o Antiplatelets Anticoagulant Therapy Nitroglycerin, Beta-Blockers Calcium Channel Blockers Statins, etc. 2. What is the Pharmacological approach in Acute Myocardial Infarction; What will be the Role of? o Analgesia, Reperfusion Therapy, Fibrinolytic Therapy, Low-MolecularWeight Heparin, Unfractionated Heparin, How Assessment of Myocardial Reperfusion, Recurrent Ischemic Pain, & Reinfarction is done? 3. What is the Pharmacological approach in Post MI Long Term Management?
		Understanding clinically through "Post MI Patient Assessment" Role of Antithrombotic Therapy, • in Post MI - Patients with Coronary Stent: • Dual Therapy with Aspirin & Clopidogrel or • Triple Therapy with Aspirin, Clopidogrel & Warfarin / Rivaroxaban or Dabigatran. • ACE Inhibitors & AR Blockers for short- and long-term improvement in survival • Aldosterone Antagonists (Spironolactone) - reduce the mortality rate of patients with advanced heart failure • Calcium Channel Blockers only if Nitrates & Beta Blockers fail to respond and if not contraindicated. 4. What is the Pharmacological approach in to manage Post – MI Complications:

		• Recurrent Ischemia • Acute Left Ventricular Failure • Hypotension or Shock • Prophylactic Therapy against Gastrointestinal Bleeding • Arrhythmias
	e) Cardiac Arrythmias:	• Explain strategies used in pharmacological treatment of cardiac arrhythmias. • Classify drugs used in cardiac arrhythmias; describe their mechanism of action, uses, adverse effects and drug interactions. Understanding clinically through "Arrhythmic Patient Assessment". Specific Antiarrhythmic Approach for: • Sinus bradycardia, Supraventricular Tachyarrhythmias, Supra Ventricular Tachycardia / Atrial Tachycardia, Atrial Fibrillation, Atrial Flutter, Premature Ventricular Contractions (PVCs), Ventricular Tachycardia, Ventricular Fibrillation, or AV block: • Hemodynamically Unstable Patient (Shock or Severe Hypotension, Pulmonary Edema, or Ongoing Myocardial Infarction or Ischemia), • Hemodynamically Stable Patient; • Anticoagulant Therapy to avoid thromboembolism events like stroke:

	f) Cardiac Failure.	Understanding Cardiac Failure clinically through “such Patient Assessment”. • Explain strategies used in pharmacological treatment of cardiac failure (CCF). • Classify drugs used in cardiac failure and describe their mechanism of action, pharmacological effects, uses, adverse effects, interactions and contraindications. • Describe the cardiovascular effects of Dopamine, Dobutamine, Phosphodiesterase Enzyme Inhibitors, ACE Inhibitors and ARBs, Beta Blockers, directly acting vasodilators in Cardiac Failure. • How the drugs used in cardiac failure address the pathophysiology of cardiac failure by decreasing preload & afterload and increasing force of contraction. • Role of: o Diuretics, Renin–Angiotensin–Aldosterone System Inhibitors, Betablockers, Digitalis glycosides, Nitrates and Hydralazine, Ivabradine and their combination; Anticoagulation, Antiarrhythmic therapy, and Statin, etc. • Which Treatments may cause harm in heart failure with reduced LVEF, • Nonpharmacologic Treatment: o Implantable Cardioverter Defibrillators. o Biventricular Pacing. o Coronary Revascularization. o Cardiac Transplantation o Other Surgical Treatment Options (Like Continuous Flow Devices). o Palliative Care.

	g) Acute Cardiac Failure & & Acute Pulmonary Edema:	Understanding Acute Cardiac Failure & Pulmonary Edema clinically through "Patient Assessment & Management". • Role of: o Morphine, Intravenous diuretic, Nitrate, Nesiritide, Aminophylline and inhaled Beta-Adrenergic Agonists.
Unit-4: Drugs acting in Haematology:	I. Basic Pharmacology of: a) Vasodilators basic pharmacology) Anti-Anemic Drugs	o Enumerate the anti-anemic drugs o Enlist the different oral & parenteral iron preparations, their Pharmacokinetics, Uses, Adverse Effects and Drug Interactions. o Describe features and treatment of Acute and Chronic Iron Toxicity o Enlist the Vitamin B12 preparations, and therapeutic uses of vitamin B12 o Why folic acid alone is contraindicated in the treatment of pernicious anemia o Enlist uses of folic acid
	b) Haematopoietic Growth Factors	o Explain the term 'Hematopoietic Growth Factor' o Enumerate hematopoietic growth factors, their mechanism of action, uses and adverse effects of different hematopoietic growth factors
	c) Anti-Coagulants	o Classify Anti- coagulants o Describe their mechanism of Action, Uses, Adverse Effects, Contraindications and Drug Interactions o Tabulate differences between HMWH & LMWH and differences between Heparin and Warfarin o Enlist advantages and disadvantages of newer oral anti-coagulants

	d) Anti-Platelet Drugs	o Classify Anti-platelet Drugso Describe their Anti-Platelet Mechanism, Uses and Adverse Effects. o Describe differences between Clopidogrel and Ticlopidine
	e) Fibrinolytics (Thrombolytics)	o Enumerate Fibrinolytics o Describe their Mechanism of Action Uses and Adverse Effects o Tabulate differences between Streptokinase & recombinant tissue plasminogen activators
	f) Drugs Used in Bleeding Disorders	o Classify drugs used in treatment of Bleeding Disorders o Describe their Mechanism of Action and Adverse
	g) Anti-Hyperlipidemics / Anti-Dyslipidemics	o Know the brief biochemistry of Lipoproteins and different types of Hyperlipidemias o Classify Anti-Hyperlipidemics o Describe their Mechanism of Action, Uses, Adverse Effects and Drug Interactions o Enlist combination therapies for treatment of hyperlipidemias

	II. Clinical Pharmacology in Blood Disorders	Understanding clinically through “patient related problems”. • Iron Deficiency Anemia. o Use of Oral Iron (Ferrous Sulfate) and reason of its refractoriness and intolerance. o Parenteral Iron (Iron Dextran, Ferric pyrophosphate citrate) • Chronic Severe Anemia. o Red Blood Cell Transfusions or Parenteral Recombinant Erythropoietin (Epoetin Alfa Or Darbepoetin). • Thalassemia. o Alpha Thalassemia Trait o Thalassemia H o Beta-Thalassemia Major • Vit B12 Deficiency Macrocytic anemias. • Folic Acid Deficiency Macrocytic anemias (Normal Vit B12 levels) • Sickle Cell Anemia. • Aplastic Anemia • Deep Veins Thrombosis or Pulmonary Embolism: treatment and Primary or Secondary Prevention? • Fibrinolytics in Acute Myocardial Infarction: Role of Alteplase, Reteplase, Tenecteplase and Streptokinase and the Post-fibrinolytic Management?

		o von Willebrand Disease (vWD) - increase in vWF and factor VIII o Vitamin K Deficiency, Warfarin Bleeding, Postsurgical Gastrointestinal or Postprostatectomy Bleeding. • Lipid Disorders with or without Cardiovascular Diseases. Understanding clinically through "Patient Related Problems". Role of o Atorvastatin in persons with risk factors. o Statins in reductions of cardiovascular events, deaths, in men and women with coronary artery disease, or o Statins in Patients with cardiovascular disease without disturbed lipid levels. o Statins in women with known heart disease, prevent recurrent myocardial infarctions. o Statins in Prevention of Cardiovascular Diseases.
Unit-5: Drugs acting in CNS:	I. Basic Pharma-cology. a. sedative hypnotics	• Define Sedative, Hypnotic & Anxiolytic • Classify Sedative/Hypnotics • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Tabulate differences between benzodiazepines and barbiturates, benzodiazepines and imidazopyridines and benzodiazepines and Buspirone

	b) Opioids	• Classify Opioids • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Describe peripheral actions, stimulatory and inhibitory actions of opioids and their antagonists. • Describe symptoms and pharmacological management of opioid withdrawal and the Opioid Poisoning. • Describe opioid antagonists Compare pethidine with morphine
	c) Anti-Depressants	• Classify Anti-depressants. • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Differentiate between typical & atypical anti-depressants
	d) Mood Stabilizers	Enumerate mood stabilisers Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
	e) Anti-psychotics	• Classify Anti-Psychotics • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Tabulate the differences between High potency & Low potency anti-psychotics and typical and atypical anti-psychotics
	f) Anti-Epileptics	• Classify Anti-epileptics based on their mechanism of action • Describe their mechanism of action, pharmacological effects, uses, adverse

		effects, drug interactions and contraindications. • Enlist differences between Na Valproate, Phenytoin, Carbamazepine, Gabapentin, Lamotrigine and Ethosuximide
	g) Drugs for Treatment of Parkinsonism	• Classify Drugs used in the Treatment of Parkinson's Disease • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Describe the advantages and disadvantages of adding Carbidopa to Levodopa • Describe the On-Off Phenomena and its treatment
	h) Alcohol	• Describe the mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications of Ethyl Alcohol. • Describe the fetal alcohol syndrome caused by alcohol • Describe pharmacological treatment of acute alcohol intoxication, alcohol withdrawal syndrome and alcoholism • Describe treatment of methanol poisoning with alcohol • Describe the Disulfiram reaction, which drugs produce disulfiram-like effect when taken with alcohol.
	II. Clinical Pharmacology in Disorders of Central Nervous System.	Understanding clinically through the following "Patient Related Problems". • Sleep Disorders: Insomnia, Hypersomnia (Excessive Sleepiness): • Chronic Pain Disorders. • Adjustment Disorders / Acute Anxiety / Sadness/ Fear/ Rage/ Guilt/ and Shame, etc. • Post-traumatic Stress Disorder (PTSD)

		/ Post Severe Anxiety or Traumatic or Life-Threatening Events (usually occur with comorbid depression or panic disorder): Role of Psychotherapy & Pharmacotherapy: • Anxiety Disorder: o Generalized Anxiety Disorder (GAD) / Persistent Excessive Anxiety or Chronic Fear and associated Behavioral Disturbances: o Panic Disorders: Panic Attacks: (intense surges of anxiety with marked physiologic manifestations); Agoraphobia, Sleep Panic Attacks, Anticipatory Anxiety. o Phobic Disorders: Social and Specific Phobias • Schizophrenia o Delusional Disordeo Schizophreniform Disorders (schizophrenic symptoms are from 1 – 6 months) o Brief (Acute) Psychotic Disorders. • Obsessive-Compulsive Disorder & Related Disorders. o Role of SSRIs, Clomipramine and Antipsychotics, Topiramate Deep Brain Stimulation in refractory OCD patients. • Mood Disorders (Depression & Mania). o Adjustment Disorder with Depressed Mood o Major Depressive & Bipolar Disorder: Bipolar-I (Manic Episodes); Bipolar-II (Hypomanic Episodes): Mania, Cyclothymic Disorders. o Bipolar Disorder, Manic & Depressive Episodes: o Secondary Mood Disorders o Psychotic Depression o Major Depression with Atypical Features or Seasonal Onset

		o Melancholic Depression • Attention-Deficit/Hyperactivity Disorder: • Migraine: • Trigeminal Neuralgia: • Epilepsy: o Focal (Partial Onset) Seizures o Focal Seizures & Certain Generalized Onset Seizure Types o Generalized Onset Seizures o Generalized Absence Seizures o Myoclonic Seizures o Atonic Seizures o Severe Myoclonic Epilepsy of Infancy o Infantile Spasms o Status Epilepticus Convulsive / Nonconvulsive / Focal o Acute Repetitive Seizures (Seizure Clusters) • Movement Disorders: o Essential (Familial) Tremor: o Parkinson Disease: • Ischemic Attacks of CNS: o Transient Ischemic Attacks (TIAs): o Stroke: • Dementia / Alzheimer disease: • Multiple Sclerosis: • Bell Palsy: • Psychosexual Disorders o Penile Erectile Dysfunction o Female Hyposexual Desire Disorder • Substance Use Disorders o Alcohol Use Disorder (Alcoholism): Minimal, Mild, Moderate and Severe withdrawal:opiods overdosage and withdrawl

	I. Basic Pharmacology. a sedative hypnotics a) Local Anesthetics	• Classify local anesthetics • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Tabulate differences between amide and ester local anesthetics • Describe the advantages & disadvantages of adding a vasoconstrictor to a local anesthetic
Unit-6: Drugs acting in Anaesthesiology	b) General Anaesthetics:	• Classify General anesthetics • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
	c) Skeletal Muscle Relaxants:	• Non-depolarizing neuromuscular blocking agents: o Prototype: Tubocurarine o Others: (only characteristic pharmacokinetic & pharmacodynamic points) of Atracurium, rocuronium, Cisatracurium, Pancuronium, vecuronium. o Reversal Agents: Neostigmine, Sugammadex • Depolarizing Neuromuscular Blocking Agents: Succinylcholine. • Centrally Acting Spasmolytic Drugs: Baclofen, Diazepam, Orphenadrine, Cyclobenzaprine, Tizanidine. • Direct Acting Muscle Relaxants: Dantrolene.

	II. Clinical Pharmacology. a) Local Anesthetics:	• Effect of adding (epinephrine like) vasoconstrictors, • Agents for o Short-Duration Procedures o Topical (Mucosal), o Intravenous, Infiltration, o Spinal, Epidural, o Minor and Major Peripheral Blocks o Longer-Duration Procedures (but not used topically or intravenously).
	b) General Anesthetics:	
	c) Role of Analgesics in Anesthesia:	
	d) Role of Skeletal Muscle Relaxants:	• Surgical Relaxation, Endotracheal Intubation, Control of Ventilation, Treatment of Convulsions • Interactions with Inhaled Anesthetics (Isoflurane; Sevoflurane, Desflurane, Halothane; and Nitrous Oxide) which potentiate the neuromuscular blockade produced by nondepolarizing muscle relaxants in a dose-dependent fashion.
	e) Reversal of Anesthesia:	Reversal of Nondepolarizing Neuromuscular Blockade Nitrous oxide, Halothane, Isoflurane, Sevoflurane, Thiopental, Midazolam, Propofol, Ketamine, Dexmedetomidine, Etomidate, Fentanyl & Droperidol.
	Role of Eicosanoids in Pharmacology including: III. Basic Pharmacology.	a) Prostaglandins • Describe the actions of Prostaglandins • Describe the uses of Prostaglandin Analogs • Classify prostaglandin analogs Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.

Unit-7: Drugs acting in Rheumatology & Pain.	b) NSAIDS	• Classify NSAIDs • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Differentiate between Non-Selective COX Inhibitors and Selective COX-2 Inhibitors • Differentiate between Aspirin and other non-selective NSAIDs and differentiate between Paracetamol and Aspirin
	c) Rheumatoid Arthritis-DMARDs	• Enlist DMARDs • Describe the mechanism of action & rationale of use of important DMARDs • (Methotrexate, Azathioprine, Cyclophosphamide, Hydroxychloroquine, Sulfasalazine & TNF-blocking agents) in the treatment of RA.
	d) Gout	• Classify Drugs used in the treatment of Gout • Describe the role of Corticosteroids in the treatment of Gout • Describe the role of NSAIDs in the treatment of Gout • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Explain why allopurinol or probenecid should not be given in acute gout
	IV. Clinical Pharmacology of The Eicosanoids.	Understanding clinically through "patients suffering from related problems". • Rheumatology (Symptomatic and Progressive Treatment), Arthritis (Rheumatoid, Osteoarthritis, etc) • Chronic Pain Disorders, • Migraine, • Trigeminal Neuralgia. • Female Reproductive System: Abortion,

		Facilitation of Labor, Dysmenorrhea • Male Reproductive System: Erectile Dysfunction • Cardiovascular System: Pulmonary Hypertension (Epoprostenol, Iloprost, Treprostinil, Selexipag Treprostinil.), Peripheral Vascular Disease, Patent Ductus Arteriosus • Blood: Platelet Aggregation • Immune System: Inflammation, Rheumatoid Arthritis. • Respiratory System: Leukotriene-Receptor Inhibitors (eg, Zafirlukast, Montelukast) are effective in Asthma; a Lipoxygenase Inhibitor (Zileuton) • Glaucoma: Bimatoprost, Travoprost • Gastrointestinal System: Misoprostol • Hypotrichosis: Bimatoprost
	I. Basic Pharmacology. a) Anti-asthmatic Drugs	• Classify drugs used in the treatment of Bronchial Asthma • Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Explain how increase in cAMP results in bronchodilation • Describe the treatment of status asthmaticus • Describe the treatment protocol of chronic asthma
Unit-8: Drugs acting in Pulmo-nology & Smooth Muscles	b) Anti-Tussives, Expectorants and Mucolytics	• Classify Anti-tussives mucolytics & expectorants • Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.

	c) Anti-Histamines:	• Classify Anti-Histamines • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Differentiate between first & 2nd Generation Anti-Histamines
	d) Serotonin Agonists and Serotonin Antagonists:	• Enlist serotonin agonists and serotonin antagonists • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
	e) Ergot Alkaloids:	• Enlist Ergot Alkaloids. • Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
	II.Clinical Pharmacology of Respiratory Pharmacology. a) Asthma:	Role of: • Beta-adrenergic agonists: (Short-Acting & Long-Acting Beta-Agonists), Corticosteroids, Mediator Inhibitors, Inhaled Long-Acting Anticholinergic, Leukotriene Modifiers: (Leukotriene Receptor Antagonists, 5-Lipoxygenase Inhibitor), Methylxanthines (Phosphodiesterase Inhibitor), Immunomodulators and Vaccination (Pneumococcal and annual Influenza).
	b) Chronic Obstructive Pulmonary Disease (COPD):	Role of: o Smoking Cessation, supplemental O2, Inhaled Long -acting Bronchodilators, Anticholinergics, Beta-2 Agonists, Inhaled Corticosteroids (in combination with inhaled long-acting Beta Blockers /Anticholinergics), Oral Theophylline & / or Phosphodiesterase - 4 Inhibitor and

		Antibiotics. o Other Measures: Pulmonary Rehabilitation by Graded Aerobic Physical Exercise Programs, Adequate Systemic Hydration, Effective Cough Training Methods, use of a Handheld Flutter Device, Postural Drainage, Sometimes with Chest Percussion or Vibration. o Morphine or Oxycodone in Severe Dyspnea, Sedative-Hypnotic in Very Anxious Patients. Trans-nasal Positive-Pressure Ventilation, Hospitalization in acute exacerbation of COPD (for Supplemental O2, Inhaled Ipratropium Bromide, Beta-2-Agonists diluted with saline, Corticosteroids, Broad-Spectrum Antibiotics with Chest Physiotherapy if needed).
	c) Bronchiectasis:	o In Acute Exacerbations, role of Antibiotics (after culture & sensitivity), Daily Chest Physiotherapy with Postural Drainage and Chest Percussion, and Inhaled Bronchodilators.
	d) Pulmonary Infections:	o Community-Acquired Pneumonia: o Hospitalized and ICU Ventilator-Associated Patients / Nosocomial Pneumonia: o Pleuritis & Pleural Effusion:
	e) Pulmonary Tuberculosis:	o Directly Observed Therapy (DOT). o In HIV-Positive or Negative Persons: o In Pregnant & Lactating Women: o Drug-Resistant Tuberculosis: o Extrapulmonary Tuberculosis: o Latent Tuberculosis / Close Contacts: o Non-tuberculous Mycobacteria / Atypical Mycobacteria

	f) Pulmonary Hypertension:	
	g) Pulmonary Venous Thromboembolism :	o Role of Anticoagulation, Thrombolytic Therapy.
	h) Acute Respiratory Distress Syndrome / Acute Respiratory Failure:	
	i) High-Altitude Illness:	
	III. Clinical Pharmacology of Autacoids & Autacoid Antagonists. a) Allergic & Immunologic Disorders:	• IgE mediated – Allergic Reactions o Anaphylaxis: o Allergic Rhinitis (Hay Fever): o Angioedema, Urticaria, Atopic Dermatitis: o Food / Food / Venom allergy reactions: o Motion Sickness and Vestibular Disturbances: o Nausea and Vomiting of Pregnancy (Morning Sickness). • Non – IgE Allergic Reactions: o Radiocontrast Media Reactions: o Red Man Syndrome:(acute infusion reaction – by vancomycin, opioids, etc.). o Serum Sickness (and serum sickness-like syndromes):
	b) Immuno-deficiency Disorders	IgA deficiency
	c) Serotonin Agonists	in Anxiety, Appetite Suppression, Migraine Headache, Hypoactive Sexual Desire in Women, Gastroesophageal Reflux and Motility Disorders, and Irritable Bowel Syndrome with Constipation.
	d) Ergot Alkaloids	in Migraine, Hyperprolactinemia, Postpartum Hemorrhage, Diagnosis of Variant Angina, and Senile Cerebral Insufficiency:
	a) Antacids	o Classify Antacids o Describe their pharmacokinetics,

		mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Describe the milk-alkali syndrome o Explain acid-rebound phenomenon caused by antacids o Differentiate between the different antacids
Unit-9: Drugs acting in GIT Disorders	b) H2 Receptor Blockers	o Classify H2 receptor blockers and PPIs Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications
	c) Proton Pump Inhibitors	o Enumerate PPIs; describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Tabulate differences between PPIs and H2 receptor blockers
	d) Mucosal Protective Agents & Eradication of H. Pylori	o Enumerate Mucosal Protective Agents and the drugs used for eradication of H. Pylori. o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Describe triple regimen, quadruple regimen & sequential therapy for eradication of H. Pylori
	e) Emetics & Anti-Emetics	o Classify anti-emetics. o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Tabulate differences between metoclopramide and Domperidone

	f) Prokinetic Agents	o Classify prokinetic agents o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
	g) Laxatives	o Classify Laxative, Purgative, Cathartic stool, Softeners & Stimulant Purgatives o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Explain the role of lactulose in the treatment of Hepatic Encephalopathy
	h) Anti-Diarrheal Drugs	o Classify anti-diarrheal drugs o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
	i) Inflammatory Bowel Disease (IBD) & Crohn's Disease	o Classify Drugs Used for treatment of Irritable Bowel Syndrome (IBS) & Crohn's Disease o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
	II.Clinical Pharmacology of GIT Pharmacology. a) Functional Dyspepsia / Atypical GERD:	o Role of: Proton Pump Inhibitors, Low doses of Antidepressants, Metoclopramide, Psychotherapy, Hypnotherapy and Herbal Therapies.
	b) Acid Peptic Diseases	(Gastroesophageal Reflux, Peptic Ulcer – Gastric and Duodenal, and StressRelated Mucosal Injury): o Classify drugs used in the treatment of peptic ulcer o Explain the strategies used in the treatment of peptic ulcer ▪ Agents That Reduce Intragastric

		Acidity: Antacids, PPIs, H2 Receptor Blockers ▪ Mucosal Protective Agents: Sucralfate, Prostaglandin Analogs (Misoprostol), Bismuth Compounds. ▪ H pylori eradication Quadruple Therapy: A Proton Pump Inhibitor &/or a Bismuth salt, Clarithromycin &/or Amoxicillin &/or Metronidazole &/or Tetracycline.
	c) Nausea / Vomiting:	o Remove the cause if possible o Role of Serotonin 5-HT3-receptor antagonists, Corticosteroids, Neurokinin Receptor Antagonists, Dopamine Antagonists, Antihistamines / Anticholinergics and Cannabinoids.
	d) Hiccups:	
	e) Constipation:	o Adequate Dietary Fluid o Role of Fiber Diet, Stool surfactants, Osmotic laxatives, Stimulant laxatives, Enemas: and o Acute Purgative: (to clean bowel prior to medical procedures) Polyethylene, Magnesium citrate.
	f) Variceal Hemorrhage	o Somatostatin & Octreotide, Vasopressin & Terlipressin, Beta-ReceptorBlocking Drugs.
	I. Basic Pharmacology. a) General Principles of Chemotherapy	• Classify anti-microbial drugs based on mechanism of action • Explain bacteriostatic & bactericidal activity of anti-microbial drugs • Classify antibiotics into bacteriostatic and bactericidal drugs • Explain the terms broad spectrum, narrow spectrum, expected spectrum & reverse spectrum antibiotics with examples • Explain empirical therapy with its clinical significance

		• Describe the mechanisms by which resistance develops to antibiotics • Explain cross-resistance • Describe rationale use of antibiotics • Describe superinfection with examples • Explain concentration-dependent & time-dependent killing • Explain post-antibiotic effect with examples • Explain Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) • Explain clinical significance of MIC/MBC • Describe advantages & disadvantages of combination antimicrobial therapy • Describe the factors affecting selection of an anti-microbial • Explain the principles of prophylactic empirical antibiotic therapy • Describe the causes of failure of anti-microbial therapy

Drugs acting in Chemotherapy,	b) Cell Wall Synthesis Inhibitors Enlist drugs/groups of drugs that are Cell Wall Inhibitors Enlist Beta Lactam Antibiotics	1. Penicillins o Classify Penicillins. o Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions and contraindications. 2. Cephalosporinso Classify Cephalosporins. o Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions and contraindications. 3. Others. o Enlist monobactams and carbapenems o Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions and contraindications.
	c) Protein Synthesis Inhibitors Enlist drugs/groups of drugs that are protein synthesis inhibitors	1. Aminoglycosides o Classify aminoglycosides o Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions and contraindications. o Explain role of neomycin in treatment of hepatic encephalopathy o Explain the use of aminoglycosides with penicillins 2. Tetracyclines o Classify tetracyclines o Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions 3. Macrolides & Clindamycin

		o Enlist Macrolides o Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions 4. Chloramphenicol, Streptogramins and Oxazolidinones o Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
	d) Sulfonamides & Antifolates (Trimethoprim, Cotrimoxazole)	• Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
	e) Fluoro-quinolones	• Classify fluoroquinolones • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
	f) Anti-Tuberculosis Drugs	• Classify drugs used for treatment of tuberculosis • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
	g) Anti-Malarial Drugs	• Know the life cycle of the major forms of the malaria parasite • Explain Schizonticide, Gametocide, Sporontocide, Radical cure, Suppressive Prophylaxis, Terminal Prophylaxis and Causal Prophylaxis • Classify anti-malarial drugs • Describe their pharmacokinetics,

		mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions • Describe Cinchonism and Black-Water Fever • Enlist drugs used for treatment of uncomplicated, severe chloroquine sensitive and chloroquine resistant acute malaria
	h) Anti-Amebic Drugs	• Classify anti-amebic drugs • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
	i) Other Anti-Protozoal Drugs	• Classify drugs used for treatment of other protozoal infections (Leishmaniasis, Toxoplasmosis, Pneumocystitis Jiroveci, Trypanosomiasis and Trichomoniasis) • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
	j) Anti-Helminthics	• Classify Anti-Helminthics • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions.
	k) Anti-Fungal Drugs	• Classify antifungal drugs • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions

	l) Anti-Viral Drugs	• Classify anti-viral drugs based on the viral disease and mechanism of action • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions • Enlist adverse effects of anti-retroviral drugs (NRTIs, NNRTIS and PIs) • Describe mechanism of action of Ribavirin • Enlist uses and adverse effects of ribavirin • Enlist drugs used for treatment of Hepatitis B
	m) Hepatitis C	• Describe drugs to treat Hepatitis C. • Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
	II. Clinical Pharmacology of Chemotherapy 1. Bacterial Infections:	o Pharyngitis: o Enteric Fever (Typhoid Fever): o Cholera: o Skin & Soft Tissue Infections: o Urinary Tract Infection: role of Urinary Antiseptics, Urinary Analgesic and Antibacterial Drugs; which drugs will be useful in UTI during Lactation: o Gonococcal Infections: o Anaerobic Infections: o Infective Endocarditis:o Diphtheria: o Pertussis Infection (Whooping Cough): o Meningitis: o Clostridial Myonecrosis (Gas Gangrene): o Tetanus: o Anthrax: o Brucellosis: o Tularemia:

		o Plague: o Actinomycosis: o Leprosy (Hansen Disease): o Chlamydial Infections: ▪ Lymphogranuloma Venereum, Chlamydial Urethritis & Cervicitis and Chlamydophila Pneumoniae: o Syphilis: ▪ Primary / Secondary / Latent Syphilis; Neurosyphilis / Syphilis in Pregnancy: o Lyme Disease: o Fever of Unknown Origin (FUO): ▪ Illness of at least 3 weeks duration, Fever over 38.3°C on several occasions, Diagnosis has not been made after three outpatient visits or 3 days of hospitalization. ▪ What is the Empiric Course? o Infections in the Immunocompromised Patient: ▪ What is the Empiric Antibacterial Therapy? o Health Care–Associated Infections: ▪ Fever in an intensive care unit patient, Catheter-Associated Infections, Fever in the Postoperative Patient (Immediate fever, in the first few hours after surgery and Acute fever, within 1 week of surgery and Subacute fever, at least 1 week after surgery. o Infections of The Central Nervous System: ▪ Purulent Meningitis ▪ Chronic Meningitis ▪ Aseptic Meningitis ▪ Encephalitis ▪ Partially Treated Bacterial Meningitis ▪ Noninfectious Meningeal Irritation

		(Carcinomatous meningitis, sarcoidosis, systemic lupus erythematosus, chemical meningitis, and Drug Induced). ▪ Brain Abscess ▪ Health Care Associated Meningitis (invasive neurosurgical procedures (eg, craniotomy, internal or external ventricular catheters, external lumbar catheters), complicated head trauma, or from hospital-acquired bloodstream infection). o Animal & Human Bite Wounds: o Sexually Transmitted Diseases: ▪ Genital Ulcers, Urethritis with or without Urethral Discharge and Vaginal Discharge o Infections in Persons Who Inject Drugs ▪ Skin infections, Aspiration pneumonia, Tuberculosis, Hepatitis, Pulmonary Septic Emboli, Syphilis, Gonorrhea, And Chancroid, HIV/AIDS, Infective Endocarditis, Septic Thrombophlebitis and Mycotic Aneurysms, Osteomyelitis and Septic Arthritis. o Acute Infectious Diarrhea: Inflammatory & Non-Inflammatory Diarrhea o Traveler's Diarrhea: o Infectious Diseases in The Returning Traveler ▪ Dengue, Ebola, Chikungunya, and Zika viruses, viral hemorrhagic fever, leptospirosis, meningococcemia, yellow fever, typhus, Salmonella typhi, and acute HIV infection. ▪ Pulmonary Infiltrates Tuberculosis, Ascaris, Paragonimus, and Strongyloidiasis ▪ Meningoencephalitis: N meningitidis,

		leptospirosis, arboviruses, rabies, and (cerebral) malaria ▪ Jaundice Consider hepatitis A, yellow fever, hemorrhagic fever, leptospirosis, and malaria.
	2. Protozoal Infections	• Malaria: o Chloroquine-Sensitive P. Falciparum P. Malariae Infection, NonFalciparum / P. Vivax and P. Ovale Infection, Un-Complicated Chloroquine-Resistant P. Falciparum Infection, Severe / Complicated Chloroquine-Resistant P. Falciparum Infection, o Drugs for the prevention of malaria in travelers with Chloroquine sensitive P. Falciparum; Chloroquine-Resistant P Falciparum, MultidrugResistant P falciparum, Terminal Prophylaxis of P Vivax & P Ovale Infections. • Amebiasis: o Asymptomatic Intestinal Infe ction: o Mild to Moderate Intestinal Infection: o Severe Intestinal Infection: o Hepatic Abscess, Ameboma, and Other Extraintestinal Disease: • Giardiasis: • Trichomoniasis: • Worms Infestations: Ascariasis, Hookworm Disease and Enterobiasis: • Others: Lymphatic Filariasis, Leishmaniasis (Visceral, Cutaneous / Mucocutaneous), African Trypanosomiasis.

	3. Viral Infections:	• Dengue: • Coronaviridae: COVID - 19 • Herpes Simplex / Zoster Virus (HSV / HZV): o Mucocutaneous Disease / Orolabial Herpes, Keratitis, Neonatal Disease, Encephalitis and CNS Meningitis, Disseminated Disease, Bell Palsy, Esophagitis and Proctitis, Erythema Multiforme, Genital Herpes. • Cytomegalovirus (CMV) Infections:o End-Organ Disease like Retinitis, Colitis, Esophagitis, Central Nervous System Disease, and Pneumonitis. o CMV Retinitis o Colitis, Esophagitis, Encephalitis and Pneumonitis o Post-transplant CMV Disease o Prophylaxis against CMV infections • HIV Infection & AIDS: • Prophylaxis for Complications of HIV Infection: o Tuberculosis, Syphilis, Pneumocystis Pneumonia Toxoplasmosis • Anti-Hepatitis Agents: o Acute Hepatitis A: o Chronic Hepatitis B Virus Infection: o Acute Hepatitis C Virus Infection: o Chronic Hepatitis C Virus Infection: • Yellow Fever: • Rickettsial Diseases: o Louse-Borne Typhus, Murine Typhus, Scrub Typhus and Rocky Mountain Spotted Fever and in pregnancy

	Immunization Against Infectious Diseases:	• For Adults: o Influenza, esp. COVID-19; Tetanus (esp. during gestational weeks 27–36), Hepatitis A & B in specific risk; MMR if no evidence of immunity to rubella, after pregnancy and before discharge from health care facility), Meningococcal Meningitis, in pandemic. • For Children: o Tuberculosis, Poliomyelitis, Measles, Mumps, Rubella, Tetanus, Diphtheria, and Pertussis. • For Travelers: o Yellow Fever, Meningococcus, Cholera, Plague, and Typhoid. • Contraindications of Immunization: o H/O Allergic reactions, acute illnesses, etc
	4. Fungal Infections:	• Mucosal Candidiasis (Esophageal / Vulvovaginal Candidiasis): • Invasive Candidiasis: • Candidal Endocarditis:
	I. Basic Pharmacology.	• Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of different anticancer groups.
Unit – 11: Drugs acting in Oncology	II. Clinical Pharmacology	• Specific role of drugs used for: o The Leukemias, o Hodgkin's & Non-Hodgkin's Lymphomas, o Breast Cancer, o Prostate Cancer, o Gastrointestinal Cancers, o Lung Cancers, o Ovarian Cancer, o Testicular Cancer, o Malignant Melanoma, o Brain Cancer, o Secondary Malignancies & Cancer Chemotherapy.

	I. Basic Pharmacology.	• Pituitary & Hypothalamic Hormones o Classify pituitary and hypothalamic hormones o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Prolactin: o Enlist Prolactin Antagonists (Dopamine agonists) o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Oxytocin: o Describe its pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Vasopressin (Antidiuretic Hormone, ADH) o Describe its pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Enumerate Vasopressin Antagonists: Describe its pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Corticosteroids: o Classify corticosteroids o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Justify the tapering off of

		corticosteroids o Corticosteroid Antagonists o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Thyroid Preparations & Anti-Thyroid Drugs o Describe different Thyroid Preparations o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Classify Anti-thyroid drugs o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Describe the Jod-Basedow phenomenon caused by iodides o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Explain the use of Beta Blockers in the treatment of Hyperthyroidism o Explain the rationale for use of different drugs in thyroid storm. • Diabetes Mellitus: o Insulins ▪ Classify Insulins ▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. ▪ Describe insulin resistance o Oral Anti-Diabetic Drugs ▪ Classify Oral Hypoglycemics ▪ Enlist hypoglycemic & Euglycemic drugs

		▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. ▪ Tabulate differences between First- and Second-Generation sulfonylureas, sulfonylureas and meglitinides/D-Phenylalanine derivatives, Sulfonylureas and Biguanides ▪ Enlist drugs used for prevention/delay the onset of type 2 diabetes mellitus ▪ Describe uses of Oral Anti-diabetics ▪ Rationalize use of drugs for control of postprandial & basal glucose levels • Gonadal Hormones: o Female Sex Hormones ▪ Enumerate estrogen & progestogen preparations ▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Contraceptives ▪ Classify Contraceptives ▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o SERMs ▪ Enlist estrogen antagonists including SERMs ▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Infertility: ▪ Describe use of clomiphene in treatment of infertility ▪ Tabulate differences between Clomiphene and Raloxifene

		▪ Classify drugs used for treatment of infertility o Progestogen Antagonists ▪ Enlist progestogen antagonists ▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Androgens & Anti-androgens ▪ Enumerate androgen preparations ▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. o Anabolic Steroids ▪ Enumerate anabolic steroids ▪ Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Uterine stimulants & Uterine Relaxants o Classify Uterine Stimulants / Tocolytics o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications. • Calcium & Bone Metabolism o Enumerate vitamin D preparations & drugs used for treatment of hypercalcemia o Enlist Bisphosphonates o Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.

Unit – 12 Drugs acting in Endo-crinology	II.Clinical Pharmacology of Endocrinology	• Pituitary & Hypothalamic Hormones o Diabetes Insipidus (Central): o Acromegaly & Gigantism: • Prolactin: • Oxytocin: • Vasopressin (Antidiuretic Hormone, ADH) • Corticosteroids • Thyroid Preparations & Anti-Thyroid Drugs o Sex Hormones: Female and Male Sex Hormones, Contraceptives, SERMs, Infertility, Oxytocin: to induce Labor, Progestogen Antagonists, Androgens & Antiandrogens and Anabolic Steroids • Diabetes Mellitus: o Role of Insulins & Oral Anti-Diabetic Drugs • Obstetrics & Gynaecology Basic and Clinical Pharmacology: o Drugs contraindicated during Pregnancy (Teratogenic or Fetotoxic). o Drugs contraindicated during Lactation. o Drugs causing uterine contraction & relaxation. o Gonadal hormones and their antagonists. o Drugs for Contraception. o Anabolic steroids. • Drugs for Obstetric Problems: o Prenatal Medication, o Spontaneous Abortion (Threatened Abortion), o Preterm Labor o Labor Induction o Postpartal Hemorrhage o Eclampsia & Pre-Eclampsia. o Conception, o Vomiting of Pregnancy & Hyperemesis Gravidarum

		• Specific Problems during Pregnancy: o Anemia, o Diabetes Mellitus, o Chronic Hypertension, o Heart Disease, o Asthma, o Thyroid Disease, o Seizure Disorders, o Urinary Tract Infection, o Tuberculosis, o HIV/AIDS During Pregnancy, o Maternal Hepatitis B & C Carrier State, o Herpes Genitalis, o Syphilis, Gonorrhea, & Chlamydia Trachomatis Infection. • Drugs for Gynaecological Problems: o Pelvic Inflammatory Disease (Salpingitis, Endometritis), o Pelvic Pain, o Premenstrual Syndrome (Premenstrual Tension, Etc), o Vaginitis, o Endometriosis, o Premenopausal Abnormal Uterine Bleeding, o Postmenopausal Vaginal Bleeding, o Oligomenorrhea / Amenorrhea, Hypermenorrhagia, o Polycystic Ovary Syndrome. o Menopausal Syndrome & Contraception, o Male & Female Infertility, • List of Drugs having: o Significant Teratogenic or Other Adverse Effects on the Fetus, o Minimal Effects on Neonates during lactation, o Significant Effects on Neonates during lactation,

		• Paediatric Dosage Calculation List of Drugs having: o Specific bioavailability in neonates, o Specific elimination half-lives in neonates, • Calcium & Bone Metabolism o Drugs useful in Osteoporosis, Bone Metastases, Hypercalcemia
	Ophthalmology.	• Drugs for: o Allergic / Bacterial / Viral Conjunctivitis, o Dacryocystitis, o Viral Keratitis, o Glaucoma, o Hordeolum and Blepharitis, o Chorioretinitis; o Cyclitis; o Endophthalmitis, o Miosis in surgery, o Post-Operative Inflammation.

Unit – 13	Otorhino-laryngology.	• Drugs for: o Cerumen Impaction: o External Otitis: o Pruritus of the External Auditory Canal: Topical Corticosteroid – Triamcinolone. o Eustachian Tube / Serous Otitis Media: ▪ Blocked: ▪ Allergy: o Acute Otitis Media. o Chronic Otitis Media:
Unit – 14	Dermatology Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of: • Topical Corticosteroids, • Demulcents, emollients, irritants, counter irritants, astringents. • Antiseptics and disinfectants. • Keratolytic & Destructive Agents • Antiseborrheic Drugs. • Anti-Scabies and Anti-Lice. • Antipruritic Agents	a) Topical Antibacterial Drugs for: o Wounds,o Acne, b) Topical Antifungal Drugs for: o Dermatophytes (Epidermophyton, Microsporum, and Trichophyton) o Yeasts (Candida albicans and Pityrosporum orbiculare), c) Topical Antiviral Drugs For: o Herpes Simplex, o External Genital and Perianal Warts – Immunomodulators d) Topical Ectoparasiticides for: o Pediculosis, o Scabies, e) Others: o Topical Drugs affecting Pigmentation o Sunscreens, o Acne Preparations, o Drugs for Psoriasis, o Androgenic Alopecia – Trichogenic & Antitrichogenic Agents, o Treatment of Melanoma – Antineoplastic Agents.

Section – 15	Immune Response Disorders:	Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of: • Antihistamines: • Corticosteroids: • Immunosuppressants: o Allergies/Allergic Disorders/ Reactions: Anaphylaxis, Food Allergy, Drug Allergy, Venom Allergy, Drug-Induced Hypersensitivity, o Atopic Disease, o Autoimmune Disorders, o Hypersensitivity, o Immunodeficiency.
Unit – 16	a. Geriatric Problems	• Importance of Pharmacokinetic and Pharmacodynamic changes with aging. • Precautions in Administering Medications for: o Sedative-Hypnotics, Analgesics, Antipsychotic & Antidepressant Drugs, Drugs Used in Alzheimer's Disease,o Antihypertensive Drugs, Positive Inotropic Agents, Antiarrhythmic Agents, o Antimicrobial Therapy, o Anti-Inflammatory Drugs, o Drugs Used in Glaucoma, Macular Degeneration. • Adverse Drug Reactions in The Elderly • Practical Aspects of Geriatric Pharmacology. • Drugs for: o Dementia, Depression, Delirium o Urinary Incontinence o Involuntary Weight Loss o Pressure Injury o Hearing Impairment o Falls & Gait Disorders

Unit – 17 Drugs acting in Misce-llaneous Disorders	b. Surgery	i. Pre surgical. • Clinical applications of different groups used as Pre-anesthetic Medication: • Specific management of comorbid diseases like Diabetes Mellitus, Cardiac Problems, etc. ii. During Surgery. • Selection and prerequisite of Local Anesthetics for minor and other selected surgeries: • Selection of different General Anesthetics for specific surgeries, esp. taking care of infective surgeries, etc. iii. Post-surgical. • Opioids – Postoperative Pain. • Diphenhydramine, Dimenhydrinate – Postoperative Nausea & Vomiting, • Avoid NSAIDs, Warfarin, or Antiplatelets, etc. – to avoid P during Postoperative Bleeding.
	c. Nutritional Supplements.	• Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of: o Iron, o Vitamin B12, o Folic Acid, o Hematopoietic Growth Factors (Erythropoietin Alfa and Beta, Granulocyte Colony-Stimulating Factor (G-CSF), Granulocyte-Macrophage ColonyStimulating Factor (GM-CSF), Interleukin 11 (IL-11), and Thrombopoietin Receptor Agonists (Romiplostim and Eltrombopag), o Myeloid Growth Factors (G-CSF and GM-CSF), o Megakaryocyte Growth Factors

		o Different types of Vitamins (Vitamin B1, Vitamin B2, Vitamin B6, Vitamin C, Vitamin D Vitamin D3, Vitamin D2, Vitamin E, Vitamin K, Vitamin K1), Minerals (Calcium, Phosphate, Gallium Nitrate, Strontium, etc.) and Other Supplements • Drugs for: o Anemia; Haematopoietic Growth Factors; o Thalassemia. o Sickle Cell Anemia. o Aplastic Anemia, o Vit B12 & Folic Acid Deficiency, o Neutropenia, o Thrombocytopenia,
	d. Sports	• Drugs for: o Pain in Neck, Shoulder, Knee, Low Back, etc o Shoulder Dislocation & Instability, o Adhesive Capsulitis (“Frozen Shoulder”), o Spinal Stenosis, o Lumbar Disk Herniation, o Carpal Tunnel Syndrome, o Bursitis, o Hip Osteoarthritis, o Inversion Ankle Sprains,

	e. Heavy Metals and Antidotes.	• Pharmacokinetic & Pharmacodynamics of Heavy Metals: o Lead, Arsenic & Arsine Gas, o Mercury, Cadmium, Chromium, • Antidots: o Heavy Metal Chelators: Dimercaprol, Unithiol, Succimer, Calcium Disodium Ethylenediaminetetraacetic Acid, o Copper Chelators: Penicillamine, Trientine, o Iron Chelators: Deferoxamine, Deferasirox, Deferiprone, Ferric Hexacyanoferrate.
	f. Drug interactions.	• Predictability of Drug Interactions: • Pharmacokinetic Mechanisms, • Pharmacodynamic Mechanisms, • Combined Toxicity.

2.2. PRACTICALS

Experimental Pharmacology

- Experiments designed to observe the action of drugs on intact animals and isolated tissue.
  1. Effects of a known drugs on frog's heart in situ.
  2. Effects of drugs on rabbit's eye.
  3. Dose Response Curve with acetylcholine on isolated rabbit's ileum
  4. Effects of agonists & antagonist (Acetylcholine, Atropine) on isolated rabbit ileum.
  5. To find out unknown drug having stimulatory or inhibitory effect on frog heart (ACh, Atropine, Epinephrine, Propranolol).
  6. Effects of neuromuscular blocking agents on frog rectus abdominus.
  7. Biostatistics including calculation of mean, mode, median, range, standard deviation, standard error of mean and Student t-test and their significance (Heart Rate, BP, Wt. & Height).

Pharmacy

1. Weights and measures used clinically.
2. Abbreviations used clinically.
3. Definitions with examples of various dosage forms available for clinical use.
4. Routes of Drug Administration.
5. Calculations for preparation of:
   - Saline and Dextrose (different strengths) / Ringer's Lactate Solutions
   - ORS powder.
   - Sulphur ointment
   - Carminative mixture.
   - KMnO4 lotion.

6. Dose calculation for clinical uses, according to age, weight, body surface area.
7. Pharmacokinetic calculations – Loading Dose and Maintenance Dose, Half-Life and Volume of Distribution.
8. Calculation of rate of IV infusions.

3. LEARNING METHODOLOGIES

The comprehensive teaching plan is designed according to the UHS and PM&DC syllabus and guidelines to direct the students towards achievement of the desired goals.

- **Lectures**: This comprises of lecture sessions in which the instructor uses traditional teaching techniques using multimedia interspersed with interactive sessions to help students acquire clear concepts of the learning objectives.
- **Tutorials:** The students have been exposed to small group discussions during the tutorial sessions in which they come prepared after they have read through the topics covered in the lectures. The learning objectives for the tutorial sessions of the following week will be posted on the department notice board on Thursday–Friday of the preceding week to give students ample time during the weekend to thoroughly prepare the topic. Instructors will clarify and explain any difficulties in understanding the concepts and identify and fill any gaps in knowledge. The last 15 minutes of each class will comprise of a small quiz to help assess how much the student has been benefited from the discussion. 5 marks will be allocated for performance/participation during discussions and 5 marks for the quiz.
- **Practical Sessions**: The course of the practical sessions has been designed in line with accordance to UHS/PMDC syllabus. In the portion of experimental pharmacology, some of the key pharmacological concepts learnt in theory classes will be demonstrated and performed using experimentation on animals. The students will also be exposed to common clinical case scenarios in which they will learn to diagnose the case and write a suitable prescription based on the recent treatment guidelines and also keeping the dose required in view, the duration of treatment and drug interactions in mind. The pharmacy section of the course will enable students to prepare and dispense some commonly used solutions, creams, ointments and lotions.

- **Case based discussion:** A 90 minutes time slot every week has been allocated to case based discussion where the students and teachers indulge in discussing clinical scenarios, which cover the overview of disease, signs and symptoms, diagnosis, treatment options and drug regimens.
- **Class Discussions**: A 45 minutes time slot every month has been allocated to class discussion where the students are given a feed-back on their monthly test performances. They are guided with the proper approach to solving MCQs and short essay questions. Whenever required students are divided in small groups to help, guide and explain allocated topic to each other. Instructors are present to guide the course of discussions in these discussions.

4. ASSESSMENT METHODOLOGIES

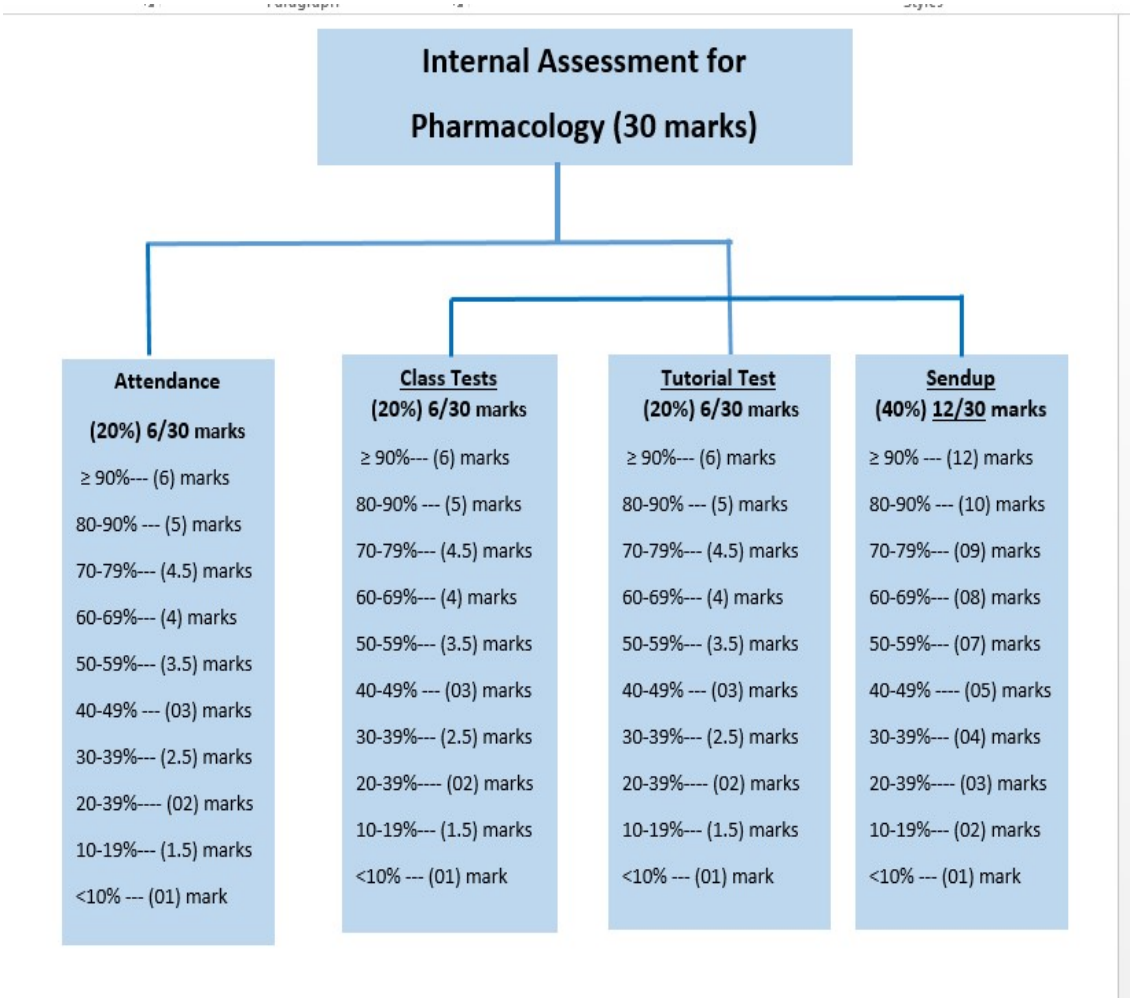
Regular assessments both formative and summative are made throughout the year in order to evaluate achievement of learning objectives, identify weaknesses and difficulties and improve instructional designs. The assessment tools are based on table of specifications from UHS in order to give students ample practice and confidence while attempting the final exams.

- **Short quizzes** comprising multiple short questions and brief answers at the end of each tutorial class.
- Evaluation of participation/performance during the tutorial sessions.
- **Monthly tests** of 90 minutes duration, conducted every month on the unit covered previously. This will be on the MCQ and short essay format.
- **Send up Exams (theory)** at the end of the academic year covers all the units included in the syllabus. It is a mock exams designed on the pattern of the final professional exams.
- **Send up Exams (practical)** are conducted following the send up theoretical exams and comprise of unobserved OSPE (6 stations), performance of observed experimental and pharmacy practical and an oral viva test**.**
    - Marks allocated during the send up tests follow the same pattern of distribution as provided in ToS of UHS. **Attaining least 50% marks are mandatory in order to qualify for admission to UHS final exams.**
- Students are required to maintain a **Practical Journal of Pharmacology** which they complete during the practical classes and have it checked and signed by the instructor. 5 marks are allocated to the journal.

Calculation of Internal Assessment

- Internal assessment sent to UHS is for **30 marks** which includes 6/30 marks (20%) calculated from average monthly attendance

+12/30 marks (40%) calculated from average monthly assessment results + 12/30 marks (40%) calculated from send-up exam results



5. TABLE OF SPECIFICATIONS (Theory)

	CONTENTS	MCQs	SEQs
1	General Pharmacology	8	2
2	Autonomic nervous system	8	2
3	Cardiology & Hematology	10	2
4	Central nervous system	10	2
5	Pulmonology & Gastroenterology	5	1
6	Chemotherapy	10	2
7	Rheumatology & Gout	4	1
8	Endocrinology	5	1
9	Miscellaneous	5	1
TOTAL ITEMS		**65**	**14**
TOTAL MARKS		**65**	**70**

TABLE OF SPECIFICATIONS (Practical)

Total Marks =150 (Viva & OSPE 135 + Internal Assessment 15)

- Viva Voce Structured = 80 Marks (Internal & External Examiners)
- OSPE = 50 Marks
- Practical Notebook = 05 Marks

OSPE (Objectively Structured Performance Evaluation)

Total stations = 08 (50 marks)

I. Non-Observed Stations = 06 stations (30 marks: 05 Marks & 05 min. /each)

Station distribution:

1. Clinical Scenario (patient / mock / video, etc) will be provided to write dosage form, dose calculations (initial, loading & maintenance dosages) according to age, weight, body surface area; and also, calculation of rate IV infusion

2. Capability to identify abbreviations / weights & measures
3. Clinical Scenario (patient / mock / video, etc) for Prescription Writing and P drug
4. Clinical Scenario (patient / mock / video, etc) for Prescription Writing and P drug
5. Pharmacy Calculations
6. Interpretation of Given Data / Graphs / Tables; Biostatistics

II. Observed Stations = 02 stations (20 marks)

1. Experimental pharmacology = 14 Marks (10 marks for performance and 4 marks for seat viva; 90 minutes' duration)
2. Pharmacy Practicals = 06 Marks (3 marks for performance and 3 marks for seat viva; 30 minutes' duration)

6. TIME - TABLE

Date	1	2	3	4	5	6	7	8
Monday	Monthly test		Practical				Lecture	
Tuesday					Lecture			
Wednesday	Lecture							
Thursday		Lecture	Tutorial					
Friday						Case based discussion		
Saturday					Lecture			

7. RECOMMENDED BOOKS

1. Basic and Clinical Pharmacology by Katzung, Latest Edition, Mc Graw-Hill.
2. Pharmacology Examination and Board Review by Katzung and Trevor, Latest Edition, Mc Graw-Hill. (for MCQs)
3. Pre-test pharmacology – self assessment and review. (for MCQs)
4. Current Medical Diagnosis & Treatment, Latest Edition (for Clinical Pharmacology).

Reference Book

1. Goodman & Gilman's The Pharmacology Basis of Therapeutics, Latest Edition.