

Syllabus & Drug List

Pharmacology and Therapeutics / Clinical Pharmacology BDS, Second Professional (2021)

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.
* *Transmembrane Signaling Mechanisms*

Basic & Clinical Pharmacology of the Following Systems

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.

Drugs used in:

- Glaucoma
- Paralytic Ileus, Atonic Bladder, etc.
- Alzheimer's Disease
- Myasthenia Gravis
- Organophosphorus Poisoning
- Smooth Muscles Spasmodic States, Mydriatic State & Parkinsonism, etc.
- Pheochromocytoma
- Prostatic Hyperplasia, etc

Drugs useful as Skeletal Muscle Relaxants:

- Pharmacokinetic & Pharmacodynamics of:
 - Neuromuscular blocking agents / Depolarizing & Non-depolarizing Agents.
 - 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 Arrhythmias.

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.
- Drugs for:
 - Drugs used in Deep Veins Thrombosis or Pulmonary Embolism
 - Drugs used in Hemophilias, Vitamin K Deficiency, Warfarin Bleeding. Postsurgical Gastrointestinal Bleeding, Postprostatectomy Bleeding and Bladder Hemorrhage.

Section – 5

Drugs useful / Pharmacological Effects in Neurology & Psychiatry.

- Introduction to Central Nervous System (CNS) and neurotransmitters of CNS.
- Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of:
 - Sedative-hypnotics.
 - Anti-Depressants & Mood Stabilizers
 - Anti-Epileptics
 - Local Anesthetics
 - General Anaesthetics
 - Opioids
 - Alcohols and drugs of abuse.
- Drugs used in:
 - Sleep Disorders (Insomnia, Hypersomnia – Excessive Sleepiness,
 - Generalized Anxiety Disorder (GAD) / Persistent Excessive Anxiety / Adjustment Disorders / Sadness/ Fear/ Rage/ Guilt/ and Shame, etc. Post-traumatic Stress Disorder (PTSD) / Post Severe Anxiety or Traumatic or Life-Threatening Events,
 - Epilepsy (Focal / Partial Seizures / Generalized Seizure,
 - Dementia / Alzheimer disease,
 - Bell Palsy,
 - Substance Use Disorders (Alcohol Use Disorder (Alcoholism): Minimal, Mild, Moderate and Severe withdrawal; Opioids (Overdosage, Withdrawal)
 - Local Anesthetics.
 - General Anaesthetics.
 - CNS stimulants.
 - Opioid's agonists and antagonists.

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.
- Drugs for
 - Rheumatology (Symptomatic and Progressive Treatment), Arthritis (Rheumatoid, Osteoarthritis, etc)
 - Chronic Pain Disorders,
 - Migraine,
 - Trigeminal Neuralgia.

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.
- Drugs for:

- Bronchial Asthma, COPD, Bronchiectasis, etc.
- Acute Respiratory Distress Syndrome / Acute Respiratory Failure / High-Altitude Illness
- Pulmonary Infections (Community-Acquired Pneumonia, Hospitalized and ICU Ventilator-Associated Patients / Nosocomial Pneumonia, Pleural Effusion, Pleuritis, etc).
- Pulmonary Tuberculosis (simple and complicated),
- Allergic & Immunologic Disorders.

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
- Drugs for:
 - Functional Dyspepsia,
 - Drugs Used in Acid Peptic Disease,
 - Drugs Stimulating Gastrointestinal Motility,
 - Nausea / Vomiting,
 - Hiccups,
 - Constipation.

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, COVID-19, etc. (Clinical Classification and Common Adverse Effects Only)

- Anti-Protozoal Drugs.
 - Anti- Malarial.
 - Anti-Amoebic.
- Anthelmintics
- Drugs for:
 1. Bacterial Infections:
 - Skin & Soft Tissue Infections:
 - Pharyngitis,
 - Enteric Fever (Typhoid Fever),
 - Cholera,
 - Urinary Tract Infection,
 - Gonococcal Infections,
 - Anaerobic Infections,
 - Diphtheria,
 - Pertussis Infection (Whooping Cough),
 - Meningitis,
 - Clostridial Myonecrosis (Gas Gangrene),
 - Tetanus,
 - Leprosy (Hansen Disease),
 - Chlamydial Infections,
 - Urethritis, etc.
 - Infections in the Immunocompromised Patient,
 - Fever of Unknown Origin (FUO):
 - Health Care–Associated Infections
 - Meningitis, Encephalitis, etc,
 - Infections in Drug Abusers,
 - Infectious & Traveler’s Diarrhea,
 2. Rickettsial Diseases:
 - Rocky Mountain Spotted Fever
 3. Spirochetal Infections:
 - Syphilis,
 - Rat-Bite Fever,
 4. Protozoal Infections:
 - Malaria like Chloroquine-sensitive or resistant P. Falciparum or P. Malariae, P. Vivax and P. Ovale infection
 - Amebiasis,
 - Giardiasis, Trichomoniasis,
 - Helminthiasis (Ascariasis, Hookworm, Enterobiasis, etc.
 5. Viral Infections:
 - Influenzae (Seasonal Influenza, Avian Influenza – Bird Flu, COVID-19,
 - Herpes Simplex,
 - Herpes Zoster (Shingles),
 - Varicella (Chickenpox),
 - Preventable Viral Infections (Measles, Mumps, Rubella, Poliomyelitis, Tetanus, Rabies, etc.
 - HIV infection,
 - Viral Hemorrhagic Fever, (Dengue, Ebola, Yellow Fever, etc)

- Cytomegalovirus,
- 6. Fungal Infections:
 - Candidiasis: Mucosal (Esophageal / Vulvovaginal Candidiasis), Invasive, Endocarditis,
 - Mucormycosis,
 - Mycetoma,
 - Other Opportunistic Mold Infections.

Section – 11

Drugs useful / Pharmacological Effects in Oncology.

- Basic & Brief Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of:
 - Methotrexate, Cyclophosphamide, Bleomycin,
- Drugs for:
 - The Leukemias,
 - Hodgkin's & Non-Hodgkin's Lymphomas,
 - Breast Cancer,
 - Prostate Cancer,
 - Secondary Malignancies & Cancer Chemotherapy.

Section – 12

Drugs useful / Pharmacological Effects in Endocrinology

- Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of:
 - Thyroid and anti-thyroid drugs.,
 - Pancreatic hormones (Insulin & Glucagon, etc) and oral anti diabetic drugs.
 - Adrenocorticoids and their antagonists.
 - Male & Female Sex Hormones.
- Drugs for:
 - Acromegaly (Jaw Involvement)
 - Inflammatory Systemic Diseases, Allergic Reactions, and Immunosuppression
 - Hypothyroidism, Hyperthyroidism
 - Diabetes Mellitus.
 - Drugs useful / Pharmacological Effects in Obstetrics & Gynaecology
 - Drugs contraindicated during Pregnancy (Teratogenic or Fetotoxic) & Lactation.
 - Drugs causing uterine contraction & relaxation.
 - Drugs for Contraception.
 - Anabolic steroids.
 - Vomiting of Pregnancy & Hyperemesis Gravidarum
 - Drugs for Neonates & Children:
 - Specific bioavailability in neonates,

- Specific elimination half-lives in neonates.
- Drug effects during lactation.
- Paediatric Dosage Calculation.
- Specific Problems during Pregnancy:
 - Anemia,
 - Diabetes Mellitus,
 - Chronic Hypertension & Heart Disease,
 - Asthma,
 - Thyroid Disease,
 - Seizure Disorders,
 - Urinary Tract Infection,
 - Tuberculosis,
 - HIV/AIDS During Pregnancy,
 - Maternal Hepatitis B & C Carrier State,
 - Herpes Genitalis, Syphilis, Gonorrhoea, etc

Section – 13

Drugs useful / Pharmacological Effects in Immune Response Disorders,

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

Section – 14

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, Antidepressant Drugs, Drugs Used in Alzheimer's Disease,
 - Antihypertensive Drugs,
 - Antimicrobial Therapy,
 - Anti-Inflammatory Drugs,
 - Drugs Used in Glaucoma,
- Adverse Drug Reactions in The Elderly
- Drugs for:
 - Dementia
 - Depression

- Delirium
- Involuntary Weight Loss

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.

ii. 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.

iii. 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 and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of:
 - Iron,
 - Vitamin B₁₂, and Folic Acid,
 - Vitamin B₁, Vitamin B₂, Vitamin B₆, Vitamin C, Vitamin D Vitamin D₃, Vitamin D₂, Vitamin E, Calcium, Phosphate, and Other Supplements
- Drugs for:
 - Anemia, Thalassemia, Sickle Cell Anemia, Aplastic Anemia.
 - Vit B₁₂ & Folic Acid Deficiency,
 - Neutropenia, Thrombocytopenia.

d) Drugs useful / Pharmacological Effects in Sports

- Drugs for:
 - Pain in Neck, Jaw, Cervical Disk Herniation, etc.

e) Antidotes.

- Dimercaprol, Ethylenediaminetetraacetic Acid, Penicillamine, Deferoxamine.

f) Drug Interactions.

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

Dental Pharmacology

- Antiseptics, Disinfectants
- Agents used for Dental Caries
- Agents used for the maintenance of Oral Hygiene
- Agents used for Root Canal Therapy
- Hemostatic agents used in dentistry
- Desensitizing agents
- Artificial Salivary Preparations.

Clinico-Pharmacological Scenario / Multidisciplinary Seminars

- Acid Peptic Disease
- Acute attack of asthma & Status Asthmaticus
- Status Epilepticus
- Rheumatoid Arthritis
- Acute Angina and Prophylaxis
- Hypertension and Acute Hypertensive Crisis
- Anaphylactic and Cardiogenic Shocks
- Tuberculosis,
- Malaria
- Typhoid Fever, with resistant cases management.
- Amoebiasis
- Urinary Tract Infection
- Acute watery diarrhea
- Bacillary dysentery
- Iron deficiency anemia
- Allergic rhinitis
- Migraine
- Hepatitis B / C
- Bird-Flu,
- Dengue,
- COVID - 19 etc.

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
- Poor Prescription Writing,
- Inappropriate Drug Prescriptions,
- E-Prescribing,
- Compliance,
- Legal Factors, Socioeconomic Factors (The Cost of Prescriptions, Generic Prescribing, Other Cost Factors).

Drug Treatment, Prescription Writing and P-drug for the following clinical scenario:

- Acid Peptic Disease
- Acute attack of asthma & Status Asthmaticus
- Acute Angina and Prophylaxis
- Mild & Moderate Hypertension
- Anaphylactic and Cardiogenic Shocks
- Tuberculosis
- Typhoid Fever
- Amoebiasis
- Urinary Tract Infection
- Bacillary dysentery
- Iron deficiency anemia
- Hepatitis B / C

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

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

PRACTICALS

Experimental Pharmacology

- 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:
 - a. Saline and Dextrose (different strengths) / Ringer's Lactate Solutions
 - b. ORS powder.
 - c. Sulphur ointment
 - d. Carminative mixture.
 - e. KMnO_4 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.

List of Drugs for teaching to MBBS students (for session 2022-24)

⇒ To be revised every 3 years (one year before the effective year)

Autonomic Nervous System

Cholinoceptor – activating & cholinesterase – inhibiting drugs:

- **Prototype:** Acetylcholine
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Pilocarpine, Methacholine, Carbachol, Nicotine, Cevimeline, Edrophonium, Neostigmine, Physostigmine, Parathion, Malathion.

Cholinoceptors Blocking Drugs:

- **Prototype:** Atropine
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Scopolamine, Dicyclomine, Oxybutynin, Ipratropium, Homatropine, Tropicamide, Pirenzepine, Pralidoxime.

Adrenoceptor Agonists & Sympathomimetic Drugs:

- **Prototype:** Epinephrine
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Norepinephrine, Dopamine, Dobutamine, Isoproterenol, Phenylephrine, Ephedrine, Amphetamines, Terbutaline, Albuterol (Salbutamol), Salmeterol, Apraclonidine, Clonidine, Methyldopa, Fenoldopam, Tizanidine.

Adrenoceptor antagonist drugs:

- **α - blocker: Prototype** Prazosin
Others: (only characteristic pharmacokinetic & pharmacodynamic points) of Tamsulosin, Yohimbine, Phentolamine, Phenoxybenzamine.
- **β - blocker: Prototype** Propranolol
Others: (only characteristic pharmacokinetic & pharmacodynamic points) of Pindolol, Timolol, Atenolol, Metoprolol, Bisoprolol, Labetalol, Carvedilol, Esmolol.
- **Adrenergic Neurons Blockers:** Reserpine, Guanethidine.
- **Ganglion Blocker:** Trimethaphan, Mecamylamine.

Cardiology

Diuretic agents:

- **Thiazides:** Hydrochlorothiazide, Indapamide.
- **Loop diuretics:** Furosemide, Ethacrynic Acid.
- **Potassium-Sparing Diuretics:** Spironolactone, Triamterene, Amiloride.
- **Carbonic Anhydrase Inhibitors:** Acetazolamide.
- **Osmotic Non-Electrolytes:** Mannitol

Vasodilators:

- **Direct:** Minoxidil, Diazoxide, Na-Nitroprusside, Hydralazine.
- **Calcium Channel Blockers:** Amlodipine, Felodipine, Nifedipine, Diltiazem, Verapamil.
- **ACE - Inhibitors & angiotensin receptor blockers:** Captopril, Enalapril, Losartan.
- **Renin inhibitors:** Aliskiren
- **Nitrates & Nitrites:** Nitroglycerin

Drugs used in Angina:

- **Nitrates:** Nitroglycerine, Isosorbide dinitrate & Isosorbide mononitrate (Short & Long-Acting Preparations)
- **Calcium Channel Blockers**
- **Beta Blockers**
- **Others:** Ranolazine, Ivabradine.

Anti-Hypertensives: Diuretics, Methyldopa, Clonidine, Guanethidine, β blockers, α blockers, Vasodilators, Calcium channel blockers, ACE inhibitors & ARBs.

Drugs used in CCF: Digoxin, Milrinone, Inamrinone, Dobutamine, Thiazides, Furosemide, Spironolactone, Captopril, Enalapril, Losartan, Isosorbide dinitrate, Hydralazine, Nitroprusside, Carvedilol, Metoprolol, Bisoprolol.

Drugs used in Cardiac Arrhythmias: Disopyramide, Procainamide, Quinidine, Lidocaine, β blockers, Amiodarone, Sotalol, Calcium channel blockers, Digoxin.

Haematology

Fibrinolytics (Thrombolytics): Streptokinase, Alteplase.

Drugs used in Bleeding Disorders: Vitamin K, Aminocaproic Acid, Tranexamic Acid, Desmopressin acetate

Anticoagulants: Heparin, Protamine Sulfate, LMWH (Enoxaprin), Rivaroxaban, Dabigatran, Lepirudin, Argatroban, Warfarin

Antiplatelet Agents: Aspirin, Clopidogrel, Ticlopidine, Abciximab, Eptifibatide, Tirofiban, Dipyridamole.

Anti-hyperlipedemics: Lovastatin, Niacin, Gemfibrozil, Fenofibrate, Cholestyramine, Ezetimibe.

Agents for Cytopenias: Iron Preparations, Deferoxamine, etc.

Agents used as Nutritional Supplements: Vitamins B Complex, Vit. C, D, E, etc.

Neurology & Psychiatry

Sedative (Anxiolytics) - Hypnotic agents:

- **Benzodiazepines:**
Prototype: Diazepam,
Others: (only characteristic pharmacokinetic & pharmacodynamic points) of Temazepam, Nitrazepam, Chlorazepate, Lorazepam, Oxazepam, Alprazolam, Chlordiazepoxide, Midazolam.
- **Newer agents:** Zolpidem, Eszopiclone.
- **Serotonin-Agonists:** Buspirone
- **Melatonin Receptors Agonists:** Ramelteon
- **Barbiturates:** Phenobarbitone

Anti-seizure drugs: Phenytoin, Carbamazepine, Primidone, Gabapentin, Lamotrigine, Ethosuximide, Valproic Acid, Diazepam, Clonazepam.

Opioid analgesics and antagonists:

- **Prototype:** Morphine,
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Heroin, Methadone, Meperidine, Fentanyl, Codeine, Nalbuphine, Buprenorphine, Pentazocine, Tramadol, Dextromethorphan, Diphenoxylate, Loperamide, Tramadol
- Naloxone, Naltrexone.

Drugs of Abuse: Alcohols, Morphine, Heroin, Marijuana, LSD, Nicotine, Ketamine, Phencyclidine, Cocaine, Amphetamines, Ecstasy (M-D-Methamphetamine)

Anesthesiology

Local Anesthetics: Cocaine, Benzocaine, Lidocaine, Prilocaine, Bupivacaine.

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

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.

Rheumatology and Gout

NSAIDs:

- **Prototype:** Aspirin

Others: (only characteristic pharmacokinetic & pharmacodynamic points) of Ibuprofen, Diclofenac, Naproxen, Mefenamic acid, Piroxicam, Indomethacin, Celecoxib, Meloxicam, Acetaminophen.

DMARDs: Methotrexate, Adalimumab, Etanercept, Leflunomide, Penicillamine, Hydroxychloroquine, Aurothiomalate.

Drugs used in Gout: Colchicine, Indomethacin, Probenecid, Allopurinol, Febuxostat, Glucocorticoids

Drugs useful in Pulmonology & acting on Smooth Muscle

- **Drugs used in Asthma:** Epinephrine, Albuterol, Terbutaline, Salmeterol, Theophylline, Aminophylline, Ipratropium, Cromolyn, Nedocromil, Ketotifen, Zafirlukast, Montelukast, Zileuton, Beclomethasone.
- **Anti-allergics & Decongestants:** Loratadine, Fexofenadine, Phenylephrine, Xylometazoline, Pseudoephedrine.
- **Antitussives:** Codeine, Dextromethorphan, Noscapine.
- **Expectorants and Mucolytics:** Ammonium Chloride, Guaiphenesin, Bromhexine.
- **H₁ Anti-histamines:** Chlorpheniramine, Diphenhydramine, Cyclizine, Meclizine, Fexofenadine, Loratadine, Cetirizine
- **Serotonin Agonists:** Sumatriptan
- **Serotonin Antagonists:** Cyproheptadine, Ketanserin, Ondansetron.
- **Ergot Alkaloids:** Ergotamine, Ergonovine.
- **Eicosanoids:** Alprostadil (PGE₁), PGE₂ and PGF₂, Prostacyclin (PGI₂), Misoprostol (PGE₁ derivative), Latanoprost, Lubiprostone, etc.

- **Leukotriene antagonists:** Montelukast, Zafirlukast, Zileuton.
- **Vasoactive Peptides:** Angiotensin II, Vasopressin, Bradykinin
- **Inhibitors of Endothelin:** Bosentan.

Gastroenterology

Anti-emetic Agents: Metoclopramide, Diphenhydramine, Dimenhydrinate, Meclizine, Hyoscine, Ondansetron, Prochlorperazine, Promethazine, Droperidol, Dronabinol, Dexamethasone, Lorazepam

Prokinetics: Domperidone, Metoclopramide, Neostigmine, Erythromycin

Drugs Used in Acid-Peptic Diseases:

- **Antacids:** Magnesium Hydroxide, Aluminum Hydroxide, Sodium Bicarbonate, Calcium Carbonate,
- **H₂-Receptor Antagonists:** Cimetidine, Ranitidine, Famotidine, Nizatidine.
- **Proton Pump Inhibitors (PPI):** Omeprazole, Lansoprazole.
- **Mucosal Protective Agents:** Sucralfate, Misoprostol, Bismuth salts.

For Eradication of H. Pylori: PPI, Bismuth Compounds, Clarithromycin, Amoxicillin, Metronidazole, Tetracycline.

Anti-diarrheal Agents: Loperamide, Diphenoxylate, Hydrated Magnesium Aluminum Silicate (Attapulgate), Kaolin plus Pectin

Laxatives: Psyllium (Ispaghul), Methylcellulose, Docusate, Lactulose, Senna, Bisacodyl, Liquid paraffin (mineral oil), Glycerin, Magnesium salts, Lubiprostone.

Chemotherapeutic Drugs

Beta lactam and other cell walls and membrane active antibiotics

Penicillins:

- **Prototype:** Penicillin G (Long acting: Procaine penicillin, Benzathine Penicillin),
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Ampicillin, Amoxicillin, Methicillin, Cloxacillin, Nafcillin, Carbenicillin, Piperacillin, Ticarcillin, Amoxicillin + Clavulanic Acid

Cephalosporins: Cefazolin, Cephadrine, Cephalexin, Cefaclor, Cefuroxime, Cefotetan, Ceftriaxone, Cefotaxime, Ceftazidime, Cefixime, Cefoperazone, Cefepime, Ceftaroline.

Monobactams: Aztreonam

Carbapenems: Imipenem, (Imipenem plus Cilastin) Meropenem, Ertapenem

Other cell walls synthesis inhibitors: Vancomycin, Bacitracin, Cycloserine.

Tetracyclines: Tetracycline, Demeclocycline, Doxycycline, Minocycline, Tigecycline.

Macrolides:

- **Prototype:** Erythromycin
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Clarithromycin, Azithromycin.

Clindamycin:

Quinupristin-dalfopristin:

Chloramphenicol:

Linezolid:

Aminoglycosides:

- **Prototype:** Streptomycin
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Gentamicin, Tobramycin, Amikacin, Neomycin.

Spectinomycin:

Anti-Folate drugs:

Sulfonamides: Sulfadiazine, Sulfacetamide, sulfasalazine, sulfadoxine

- Trimethoprim, Pyrimethamine
- Sulfamethoxazole + Trimethoprim (Co-trimoxazole)
- Sulfadoxine plus Pyrimethamine (Fansidar)

DNA Gyrase inhibitors:

Quinolones: Nalidixic Acid

Flouroquinolones:

- **Prototype:** Ciprofloxacin
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Norfloxacin, Ofloxacin, Levofloxacin, Gatifloxacin, Moxifloxacin

Urinary Antiseptics: Nitrofurantoin, Methenamine, Nalidixic acid.

Disinfectants/antiseptics (Topical): Ethanol, Chlorhexidine, Povidone, Na hypochlorite, Phenol.

Anti-mycobacterial Drugs:

- **Drugs used in tuberculosis:** Isoniazid (INH), Rifampin, Ethambutol, Pyrazinamide, Streptomycin, Amikacin, Ciprofloxacin, Linezolid, Ethionamide, Cycloserine, Rifabutin,

Antifungals: Amphotericin B, Ketoconazole, Fluconazole, Clotrimazole, Itraconazole, Flucytosine, Griseofulvin, Terbinafine, Nystatin, Caspofungin.

Antivirals: Acyclovir, Gancyclovir, Zidovudine, Interferon alpha - 2a & pegylated interferon alpha, Ribavirin, Amantadine, Oseltamivir, Sofosbuvir, Daclatasvir, Dasabuvir, Simeprevir, Raltegravir

Antiprotozoal drugs:

- **Anti-malarials:** Chloroquine, Amodiaquine, Artemether, Artesunate, Quinine, Quinidine, Mefloquine, Primaquine, Atovaquone, Halofantrine, Doxycycline
 - Sulfadoxine plus Pyrimethamine (Fansidar)
 - Atovaquone plus proguanil (Malarone)
- **Antiamoebics:** Metronidazole, Diloxanide furoate, Iodoquinol, Emetine & Dehydroemetine, Chloroquine, Paromomycin, Tetracycline, Erythromycin
- **Anthelmintics:** Albendazole, Ivermectin, Mebendazole.

Oncology

Cyclophosphamide, Methotrexate, Cisplatin, Procarbazine, Mechlorethamine, Mercaptopurine, Fluorouracil, Vincristine, Vinblastine, Bleomycin, Doxorubicin & Daunorubicin, Prednisolone, Radioactive Iodine, Tamoxifen, Interferon gamma, Antitumor MABs –Adalimumab.

Immunosuppressive Agents

Prednisolone, Cyclosporine, Hydroxychloroquine, methotrexate, Monoclonal Antibodies (MABS): Antitumor MABS –Adalimumab, Etanercept, Rituximab, Sirolimus, Tacrolimus

Endocrine Drugs

Thyroid & Anti-thyroid drugs: Levothyroxine, Liothyronine, Propylthiouracil, Methimazole, Carbimazole, Potassium iodide, Radioactive Iodine¹³¹

Adrenocorticosteroids and adrenocortical antagonists: Hydrocortisone, Prednisone, Triamcinolone, Betamethasone, Dexamethasone.

Pancreatic hormones and Anti-diabetic drugs:

Insulins:

- **Prototype:** Regular Insulin
- **Others:** (only characteristic pharmacokinetic & pharmacodynamic points) of Insulin Lispro, Insulin Aspart, Insulin Glulisine, NPH, Insulin Glargine, Insulin detemir

Other antidiabetic agents: Chlorpropamide, Glipizide, Repaglinide, Nateglinide, Metformin, Pioglitazone, Acarbose, Pramlintide, Exenatide, etc.

Glucagon:

The Gonadal Hormones & Inhibitors: Estradiol, Diethylstilbestrol, Progesterone, Methyltestosterone, Nandrolone, Tamoxifen, Raloxifene, Clomiphene, Danazol, Mifepristone.

Hormonal contraceptives: Combinations of estrogens and progestins

Drugs acting on uterus:

- **Uterine stimulants (*Ecbolics*):** Oxytocin, Dinoprostone, Misoprostol, Ergonovine (Ergometrine)
- **Uterine relaxants (*tocolytics*):** Albuterol (Salbutamol), Ritodrine.

Agents that affect bone mineral homeostasis:

- **Vitamin D preparations:** Cholecalciferol, Calcitriol
- **Calcium Preparations:** Calcium Gluconate, Calcium Chloride
- **Hormones:** Calcitonin, Teriparatide
- **Bisphosphonate:** Alendronate

Miscellaneous Topics

- **Antidotes.**
- **Vitamins:**
- **Paediatric Pharmacology**
- **Drugs useful during Pregnancy, Lactation, etc.**
- **Geriatric Pharmacology**
- **Sports Medicine**

Learning Objectives, Curriculum & Table of Specification

Pharmacology and Dental Pharmacology BDS, Second Professional (2021)

RATIONALE

1. Pharmacology is an essential component of the modern undergraduate medical curriculum.
2. There is however, a large gap between the basic science of pharmacology and its practical application in every day of medical practice.
3. Recently clinical pharmacology has developed both as an academic and as a service discipline to fill the gap in most developed countries; clinical pharmacology has become a permanent feature of their medical curricula and is an integral component of their qualifying examination system.
4. Undergraduate teaching programs in clinical pharmacology should seek to provide students with knowledge of the scientific basis of its application.
5. Students are required to know the pharmacokinetic and dynamic aspects of drugs detailed hereunder.
6. To prescribe a drug safely and effectively students need to know its pharmacological aspects including their common preparations. They also need to know the prescriptions for the common disorders.
7. Students should be familiar with the rational use of drugs, which includes cost-effectiveness, appropriate dosage regime and compliance.
8. The knowledge of classification of drugs as per syllabus.
9. The experimental work in pharmacology should aim at demonstration of actions of drugs in experimental animals and application of this knowledge in human beings.
10. The students should have an exposure to various formulations / preparations of the commonly used drugs.
11. Group actions with emphasis on the prototype drug and its variants should be taught.

LEARNING METHODOLOGIES

The teaching of the subject will consist of:

- a) Traditional Learning through Class Lectures and Interactive Sessions / Small Group Discussions
- b) Flipped Learning: Home Learnings through Videos / Online Lectures, etc followed by Interactive Learning during class and Self-Assessment.
- c) Clinico-Pharmacological Seminars.
- d) Scenario-Based Learning (SBL)
- e) Demonstrations and Experiments

LEARNING OBJECTIVES

General Objectives

It is expected that by the end of the course, the students should be able to:

- Know the general principles of the two major branches of Pharmacology: Pharmacokinetics and Pharmacodynamics
- Understand kinetics, mechanism of action, pharmacological actions, indications, contraindications, drug interactions and adverse drug reactions of the various drugs (especially protocol drugs or as a group) acting on different body systems
- Classify drugs as per syllabus based on their chemistry, mechanism of action, therapeutic uses or other means specified in the specific objectives
- Clinical Pharmacology of all the drugs useful in different systemic and non-systemic disease; so, describe rationale of prescribing of drugs for selected disorders of different body systems.
- Describe signs, symptoms and management of over-dosage of selected drugs
- Perform various Practicals conducted throughout the course
- Prescribe a drug safely and effectively, knowing students need to know its pharmacological & therapeutic aspects.

Specific Objectives

Section – 1

After the completion of this section, it is expected that the students should be able to know about **different aspects of General Pharmacology**, including:

A. Introduction to Pharmacology, and to

- 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*.
understanding routes of administration clinically through "observing the patient".
- Transport of Drugs across Cell Membranes
- Enlist the different processes by which drugs are transported across cell membranes
- Describe and differentiate each transport process

B. Absorption, and to

- 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*
Understanding clinically through "observing the patient".

C. Bioavailability, and to

- 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*.
understanding clinically through "patient demonstration".
- Explain bioequivalence and therapeutic equivalence

D. Distribution, and to

- 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

*How redistribution is clinically applicable, esp. in drugs acting on CNS?
understanding clinically through "patient during anesthesia".*

E. Metabolism & Biotransformation, and to

- 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.*

Understanding clinically through "patient drug study".

- Describe the *clinical significance of metabolism & biotransformation*
- Describe *clinical significance of enterohepatic recycling of drugs*

F. Plasma Half-Life, and to

- Understand the concept of plasma half life
- Describe factors affecting half life
- Explain *clinical significance of plasma half life*

Understanding clinically through "patient drug schedule".

G. Steady State Concentration

- Explain steady state plasma concentration
- Explain *Clinical Significance of Steady State plasma concentration*

H. Elimination and First & Zero Order Kinetics, and to

- Explain Elimination and Orders of Elimination – First & Zero Order Kinetics with examples
- Describe *Clinical Significance of First & Zero Order Kinetics*

Understanding elimination through "drug infusion".

- Tabulate differences between First order kinetics and Zero Order Kinetics

I. Maintenance Dose & Loading Dose, and to

- Explain Maintenance and Loading doses
- Calculate maintenance dose and loading dose using appropriate formula

- Describe *Clinical Significance of Maintenance Dose and Loading Doses* with examples

Understanding clinically through "Patient Drug Schedule".

J. Drug Excretion, and to

- 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*

K. Drug Clearance, and to

- Understand the concept of drug clearance
- Describe factors affecting drug clearance
- Explain the *Clinical Significance of different values of Drug Clearance*

L. Introduction to Pharmacodynamics and to

- Explain the term 'pharmacodynamics'
- Describe the general mechanisms by which drugs act and role of different types of "bonds" involved in drug-receptor complex.

M. Drug Receptor Interactions, and to

- 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*

Understanding clinically through "Patient Drug combinations".

- Receptor Transduction Mechanisms
- Describe the five receptor signaling mechanisms
- Describe the role of 2nd messengers in receptor signaling
- Describe the significance of receptor signaling
- Describe spare receptors, explain the temporal spareness of receptors
- Explain the significance of spare receptors

N. Graded Dose Response Curve, and to

- Describe Graded Dose response curve
- Describe the *Clinical Informations obtained from a Graded Dose Response Curve*

Understanding clinically through "Patient during Anesthesia".

- Compare efficacy and potency of two drugs on the graded dose response curve
- Explain the significance of the log-dose response curve

O. Quantal Dose Response Curve, and to

- 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

P. Abnormal Drug Responses, like

Drug Antagonism, and to

- 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 Drug Combinations".
- Describe Tolerance with clinical examples
- Explain mechanisms of development of tolerance
- Explain difference between Pharmacokinetic and Pharmacodynamic Tolerance
- Explain cross tolerance
- Describe Tachyphylaxis
- Explain mechanisms of development of Tachyphylaxis
- Tabulate differences between Tolerance and Tachyphylaxis and differences between Tolerance, and desensitization of receptors.
- Explain *Clinical Significance of Tolerance, Tachyphylaxis, Supersensitivity, Hypersensitivity, Idiosyncrasy, Iatrogenic effect; Down Regulation & Up-Regulation of Receptors.*
- Pharmacogenetics and Clinical Importance of Pharmacogenetics
- Explain examples of difference in response to drugs due to genetic variation
Understanding clinically through "patient drug effects study"

Q. Adverse Drug Reactions, and to

- 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*

Understanding clinically through "Patient Drug Effects Study".

- Describe different categories of drugs based on their teratogenic potential with examples

R. Factors Affecting Dose and Action of a Drug, and to

- 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*

Understanding clinically through "Patient Drug Combinations".

S. Drug Interactions, and to

- Enlist types of drug interactions
- Describe pharmacokinetic and pharmacodynamic interactions with examples
- Explain beneficial and harmful drug interactions with examples.

T. New Drug Development & Regulation, and to

- Describe approaches in drug discovery
- Describe screening of new drugs
- Describe the *4 Phases of Clinical Trials of a New Drug*

Section – 2

After the completion of this section, it is expected that the students should be able to know about the **drugs useful (or Role of Clinical Pharmacology) in different aspects of Autonomic Nervous System**, including:

I. 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.

II. Basic Pharmacology:

- a) Cholinomimetics / Parasympathomimetics / Cholinoceptor-activating & Cholinesterase-Inhibiting Drugs.

Direct and Indirect-acting Cholinoceptor Stimulants

- Describe the synthesis, storage, release and breakdown of acetylcholine, with the drugs that block each step of acetylcholine synthesis and release
- Identify the locations, functions, the signaling mechanisms of postreceptor subtypes of cholinoceptors.
- Classify parasympathomimetics
- 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.
- Describe the pharmacodynamic differences between direct-acting and indirect-acting cholinomimetics.
- Tabulate differences between neostigmine and physostigmine

- b) Anti-Muscarinics

- Classify anti-muscarinics
- Understand their structural differences, pharmacological actions on different organs and systems, uses, adverse effects, contraindications and drug interactions.

- c) Anti-Nicotinics:

Ganglion Stimulants & Ganglion Blockers:

- 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.
- Understand their pharmacological actions on different organs and systems, *clinical applications*, adverse effects, contraindications and drug interactions of Ganglion Blockers.

Neuromuscular Blockers:

- Classify Neuromuscular Blockers
- Understand their pharmacokinetic aspects, pharmacological actions on different organs and systems, uses, adverse effects, contraindications and drug interactions.

d) Sympathomimetics:

- 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 β -agonist, and a mixed α and β -agonist.
- Explain the actions of dopamine in various doses

e) Sympatholytics:

1. Alpha Blockers.

- Classify Alpha Blockers.
- Understand the pharmacological actions, uses, adverse effects, contraindications and drug interactions of alpha blockers
- Know, why non-selective alpha blockers cause more tachycardia than selective alpha-1 blockers.

2. Beta Blockers.

- Explain ISA and MSA.
- Classify Beta Blockers based upon ISA & MSA activity and their Receptor Selectivity.
- Understand the pharmacological actions, uses, adverse effects, contraindications and drug interactions of beta blockers
- Know the clinical significance of cardio-selective beta blockers.

III. Clinical Pharmacology:

a) Parasympathomimetics / Cholinomimetics.

- What and How the Cholinomimetics are Clinically Applicable for Glaucoma, Paralytic Ileus, Neurogenic / Atonic Bladder, Alzheimer's Disease,

Anticholinergic Toxicity / Organophosphorus Poisoning, and Myasthenia Gravis

Understanding clinically through "Patient related Problems".

- How Myasthenic & Cholinergic Crisis can be diagnosed and managed?
- Describe the clinical features and management of Organophosphorus Compound (OPC) Poisoning.

Understanding clinically through "such patient".

- What is the clinical significance of ageing? Explain the mechanism of action of Oximes
- Describe feature of acute nicotine toxicity

b) Anti-Muscarinics.

- How Antimuscarinics are Clinically Important in Parkinsonism, Motion Sickness, various Ophthalmological, Respiratory, Gastrointestinal, Urinary Problems, Other Smooth Muscles Spasmodic States and Cholinergic Poisoning?

Understanding clinically through "patient related problems".

- Describe atropine poisoning & its treatment

c) Anti-Nicotinics.

- How Antinicotinics are Clinically Important in hypertension, anesthesia, and other muscular painful states

Understanding clinically through "patient related problems".

d) Sympathomimetics.

- What and How the Direct and Indirect Sympathomimetics are Clinically Applicable for Shock, Anaphylaxis, Acute Heart Failure, Orthostatic Hypotension, Cardiac Arrest, Bronchial Asthma, & Ophthalmic, Genitourinary and Neurological Problems?

Understanding clinically through "patient related problems".

e) Sympatholytics.

- Alpha Receptors Blockers.

- What is the clinical pharmacology of alpha blockers in pheochromocytoma, hypertensive emergency, chronic hypertension, peripheral vascular diseases, urinary obstruction (esp. benign prostatic hyperplasia), and erectile dysfunction?

Understanding clinically through "patient related problems".

- What will be the Proper Approach to treat the Pheochromocytoma?
- Role of Alpha₂ Blockers in Type - 2 Diabetes Mellitus and Psychiatric depression.

- Beta Receptors Blockers.

- What and How the beta blockers are clinically applicable for hypertension, ischemic heart diseases, cardiac arrhythmias, cardiac failure, obstructive cardiomyopathy, dissecting aneurysm, glaucoma, hyperthyroidism, migraine, performance anxiety, esophageal varices and infantile hemangioma, etc?

Understanding clinically through "patient related problems".

- To choose the proper Beta Blockers after *assessing their safety and clinical state of the patient.*

Section – 3

After the completion of this section, it is expected that the students should be able to know about the **Drugs Useful (or Role of Clinical Pharmacology) in Cardiology** including introductory aspects of CVS, with role of the following groups in the control of CVS.

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 Channels 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-Dihydropyridines

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, including, classification of Diuretics, with:

1. Carbonic Anhydrase Inhibitors

- Enumerate Carbonic Anhydrase Inhibitors and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors
- Explain why Carbonic Anhydrase Inhibitors are not effective diuretics and hence are not used in treatment of Hypertension

2. Loop Diuretics

- Enumerate Loop Diuretics and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors
- Explain the term High-Ceiling Diuretics in regard to loop diuretics

3. Thiazide Diuretics

- 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
- Explain use of thiazide diuretics in treatment of Hypertension, Nephrogenic Diabetes Insipidus, Nephrolithiasis

4. Potassium Sparing Diuretics

- Enumerate Potassium Sparing Diuretics and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors
- Explain the use of Potassium Sparing Diuretics in Hyperaldosteronism states

5. Osmotic Diuretics

- Enumerate Osmotic Diuretics and describe their Mechanism of Action, Pharmacological Effects, Uses, Adverse Effects, Contraindications and Drug Interactions of Carbonic Anhydrase Inhibitors
- Explain the use of mannitol in cerebral edema
- 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:

a) 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

Understanding IHDs clinically through "these patient assessment"

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?*

Acute Coronary Syndrome / Acute Myocardial Infarction;

- What will be the outline pharmacological approach?

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.
 - Improvement in survival with ACE Inhibitors & AR Blockers.
 - Reduced mortality rate of advanced heart failure patients with Aldosterone Antagonists (Spironolactone) -
 - When to use Calcium Channel Blockers?
- What is the Pharmacological approach in to manage Post – MI Complications:
 - Recurrent Ischemia

- Acute Left Ventricular Failure & Acute Pulmonary Edema: Role of Morphine, Intravenous diuretic, Nitrate, Aminophylline and inhaled Beta-Adrenergic Agonists.
- Hypotension or Shock
- Arrhythmias
- Prophylactic Therapy against Gastrointestinal Bleeding

Section – 4

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Haematology**, including:

I. Basic Pharmacology.

a) Anti-Anemic Drugs

- Enumerate the anti-anemic drugs
- Enlist the different oral & parenteral iron preparations, their Pharmacokinetics, Uses, Adverse Effects and Drug Interactions.
- Describe features and treatment of Acute and Chronic Iron Toxicity
- Enlist the Vitamin B₁₂ preparations, and therapeutic uses of vitamin B₁₂
- Why folic acid alone is contraindicated in the treatment of pernicious anemia
- Enlist uses of folic acid

b) Anti-Coagulants

- Classify Anti-coagulants
- Describe their mechanism of Action, Uses, Adverse Effects, Contraindications and Drug Interactions
- Tabulate differences between HMWH & LMWH and differences between Heparin and Warfarin.
- Enlist advantages and disadvantages of newer oral anti-coagulants like Rivaroxaban.

c) Anti-Platelet Drugs

- Classify Anti-platelet Drugs
- Describe their Anti-Platelet Mechanism, Uses and Adverse Effects.
- Describe differences between Clopidogrel and Ticlopidine

d) Fibrinolytics (Thrombolytics)

- Enumerate Fibrinolytics
- Describe their Mechanism of Action Uses and Adverse Effects
- Tabulate differences between Streptokinase & recombinant tissue plasminogen activators

e) Drugs Used in Bleeding Disorders

- Classify drugs used in treatment of Bleeding Disorders
- Describe their Mechanism of Action and Adverse

f) Anti-Hyperlipidemics / Anti-Dyslipidemics

- Classify Anti-Hyperlipidemics
- Describe their Mechanism of Action, Uses, Adverse Effects and Drug Interactions
- Enlist combination therapies for treatment of hyperlipidemias

II. Clinical Pharmacology in Blood Disorders

Understanding clinically through "patient related problems".

- Iron Deficiency Anemia.
 - Use of Oral Iron (Ferrous Sulfate) and reason of its refractoriness and intolerance.
 - Parenteral Iron (Iron Dextran, Ferric pyrophosphate citrate)
- Chronic Severe Anemia.
 - Red Blood Cell Transfusions or Parenteral Recombinant Erythropoietin (Epoetin Alfa Or Darbepoetin).
- Vit B₁₂ Deficiency Macrocytic anemias.
- Folic Acid Deficiency Macrocytic anemias (Normal Vit B₁₂ levels)
- 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?
- 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

- Atorvastatin in persons with risk factors.
- Statins in reductions of cardiovascular events, deaths, in men and women with coronary artery disease, or
- Statins in Patients with cardiovascular disease without disturbed lipid levels.
- Statins in women with known heart disease, prevent recurrent myocardial infarctions.
- Statins in Prevention of Cardiovascular Diseases.

Section – 5

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Neurology & Psychiatry** including:

I. Basic Pharmacology.

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-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

d) 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):
- Anxiety Disorder:
 - Generalized Anxiety Disorder (GAD) / Persistent Excessive Anxiety or Chronic Fear and associated Behavioral Disturbances:
 - Panic Disorders: Panic Attacks: (intense surges of anxiety with marked physiologic manifestations); Agoraphobia, Sleep Panic Attacks, Anticipatory Anxiety.
 - Phobic Disorders: Social and Specific Phobias
- Epilepsy:
 - Focal (Partial Onset) Seizures
 - Generalized Onset Seizures
 - Generalized Absence Seizures
 - Myoclonic Seizures
 - Atonic Seizures
 - Severe Myoclonic Epilepsy of Infancy
 - Infantile Spasms
 - Status Epilepticus Convulsive / Nonconvulsive / Focal
- Bell Palsy:
- Chronic Pain Disorders, Migraine, Trigeminal Neuralgia:
- Dementia / Alzheimer disease:

Section – 6

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in**

Anaesthesiology

I. Basic Pharmacology.

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

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:
 - 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.

II. Clinical Pharmacology.

a) Local Anesthetics:

- Effect of adding (epinephrine like) vasoconstrictors,
- Agents for
 - Short-Duration Procedures
 - Topical (Mucosal),
 - Intravenous, Infiltration,
 - Spinal, Epidural,
 - Minor and Major Peripheral Blocks
 - 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, and anesthetic agents.

Section – 7

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Rheumatology & Pain.**

Basic and Clinical Pharmacology of:

a) NSAIDS

- Classify NSAIDs
- Describe their mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
- Differentiate between Selective and Non-Selective COX Inhibitors.
- Differentiate between Aspirin and other non-selective NSAIDs and differentiate between Paracetamol and Aspirin

b) 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.

c) Gout

- Classify Drugs used in the treatment of Gout
- Describe the role of NSAIDs, Corticosteroids 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

Section – 8

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Pulmonology & Smooth Muscles** including:

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

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

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:

- 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.
- 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.
- 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) Pulmonary Infections:

- Community-Acquired Pneumonia:
- Hospitalized and ICU Ventilator-Associated Patients / Nosocomial Pneumonia:

d) Pulmonary & Extrapulmonary Tuberculosis:

- Directly Observed Therapy (DOT).
- In Pregnant & Lactating Women:
- Drug-Resistant Tuberculosis:
- TB in HIV-Positive & Negative Persons; Latent Tuberculosis / Close Contacts:

III. Clinical Pharmacology of Autacoids & Autacoid Antagonists.

a) Allergic & Immunologic Disorders:

- Anaphylaxis & Allergic Rhinitis (Hay Fever):
- Food / Food / Venom allergy reactions:
- Radiocontrast Media Reactions:
- Nausea & Vomiting of Pregnancy, Motion Sickness & Vestibular Disturbances:

c) Serotonin Agonists in Anxiety, Appetite Suppression, Migraine Headache

d) Ergot Alkaloids in Migraine, Postpartum Hemorrhage.

Section – 9

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Gastroenterology**, including:

I. Basic Pharmacology.

- a) Antacids
 - Classify Antacids
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Describe the milk-alkali syndrome
 - Explain acid-rebound phenomenon caused by antacids
 - Differentiate between the different antacids
- b) H₂ Receptor Blockers
 - 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
 - Enumerate PPIs; describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Tabulate differences between PPIs and H₂ receptor blockers
- d) Mucosal Protective Agents & Eradication of H. Pylori
 - Enumerate Mucosal Protective Agents and the drugs used for eradication of H. Pylori.
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Describe triple regimen, quadruple regimen & sequential therapy for eradication of H. Pylori
- e) Emetics & Anti-Emetics
 - Classify anti-emetics.
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Tabulate differences between metoclopramide and Domperidone
- f) Prokinetic Agents
 - Classify prokinetic agents
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
- g) Laxatives
 - Classify Laxative, Purgative, Cathartic stool, Softeners & Stimulant Purgatives
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Explain the role of lactulose in the treatment of Hepatic Encephalopathy
- h) Anti-Diarrheal Drugs
 - Classify anti-diarrheal drugs

- 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:
 - 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 Stress-Related Mucosal Injury):
 - Classify drugs used in the treatment of peptic ulcer
 - Explain the strategies used in the treatment of peptic ulcer
 - Agents That Reduce Intra-gastric 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:
 - Remove the cause if possible
 - Role of Serotonin 5-HT₃-receptor antagonists, Corticosteroids, Neurokinin Receptor Antagonists, Dopamine Antagonists, Antihistamines / Anticholinergics and Cannabinoids.
- d) Hiccups:
- e) Constipation:
 - Adequate Dietary Fluid
 - Role of Fiber Diet, Stool surfactants, Osmotic laxatives, Stimulant laxatives, Enemas: and
 - Acute Purgative: (to clean bowel prior to medical procedures) Polyethylene, Magnesium citrate.
- f) Variceal Hemorrhage:
 - Somatostatin & Octreotide, Vasopressin & Beta-Receptor-Blocking Drugs.

Section – 10

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Chemotherapy**, including:

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

- Enlist Macrolides
- Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
- 4. Chloramphenicol, Streptogramins and Oxazolidinones
 - 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) Fluoroquinolones
 - 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) Anti-Fungal Drugs
 - Classify antifungal drugs
 - Describe their pharmacokinetics, mechanism of action, anti-bacterial spectrum, uses, mechanisms of resistance. adverse effects, drug interactions
- j) 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
- k) 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

a) Bacterial Infections:

- Pharyngitis, Diphtheria, Pertussis Infection (Whooping Cough):
- Enteric Fever (Typhoid Fever):
- Cholera:
- Skin & Soft Tissue Infections:
- Urinary Tract Infection: role of Urinary Antiseptics, Urinary Analgesic and Antibacterial Drugs; which drugs will be useful in UTI during Lactation:
- Gonococcal Infections:
- Anaerobic Infections:
- Tetanus:
- Syphilis:
- 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?
- 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.

b) Protozoal Infections

- Malaria:
 - Chloroquine-Sensitive P. Falciparum P. Malariae Infection, Non-Falciparum / P. Vivax and P. Ovale Infection, Un-Complicated Chloroquine-Resistant P. Falciparum Infection, Severe / Complicated Chloroquine-Resistant P. Falciparum Infection,
 - Drugs for the prevention of malaria in travelers with Chloroquine sensitive P. Falciparum; Chloroquine-Resistant P Falciparum, Multidrug-Resistant P falciparum, Terminal Prophylaxis of P Vivax & P Ovale Infections.
- Amebiasis:
 - Asymptomatic Intestinal Infection:
 - Mild to Moderate Intestinal Infection:
 - Severe Intestinal Infection:
 - Hepatic Abscess, Ameboma, and Other Extraintestinal Disease:
- Giardiasis & Trichomoniasis:

c) Viral Infections:

- Dengue:
- Coronaviridae: COVID - 19
- Herpes Simplex / Zoster Virus (HSV / HZV):
Mucocutaneous Disease / Orolabial Herpes, Keratitis, Neonatal Disease, Bell Palsy, Genital Herpes.
- Cytomegalovirus (CMV) Infections:

End-Organ Disease like Retinitis, Colitis, Esophagitis, Central Nervous System Disease, and Pneumonitis.

- HIV Infection & AIDS and Prophylaxis for Complications of HIV Infection:
Tuberculosis, Syphilis, Pneumocystis Pneumonia Toxoplasmosis
- Anti-Hepatitis Agents:
Acute Hepatitis and Chronic Hepatitis A, B & C Virus Infection:
- Yellow Fever:

Immunization Against Infectious Diseases:

- For Adults:
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:
Tuberculosis, Poliomyelitis, Measles, Mumps, Rubella, Tetanus, Diphtheria, and Pertussis.
- For Travelers:
Yellow Fever, Meningococcus, Cholera, Plague, and Typhoid.
- Contraindications of Immunization:
H/O Allergic reactions, acute illnesses, etc.

d) Fungal Infections:

- Mucosal (Esophageal / Vulvovaginal Candidiasis) and Invasive Candidiasis:

Section – 11

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Oncology** including:

I. Basic Pharmacology.

- Pharmacokinetic & Pharmacodynamics of different anticancer groups.

II. Clinical Pharmacology

- Specific role of drugs used for:
 - The Leukemias,
 - Hodgkin's & Non-Hodgkin's Lymphomas,
 - Breast Cancer,
 - Prostate Cancer,
 - Secondary Malignancies & Cancer Chemotherapy.

Section – 12

After the completion of this section, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in Endocrinology**, including:

Basic and Clinical Pharmacology of:

- Corticosteroids:
 - Classify corticosteroids
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Justify the tapering off of corticosteroids
 - Corticosteroid Antagonists
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
- Thyroid Preparations & Anti-Thyroid Drugs
 - Describe different Thyroid Preparations
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Classify Anti-thyroid drugs
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Describe the Jod-Basedow phenomenon caused by iodides
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Explain the use of Beta Blockers in the treatment of Hyperthyroidism
 - Explain the rationale for use of different drugs in thyroid storm.
- Diabetes Mellitus:
 - Insulins
 - Classify Insulins
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
 - Describe insulin resistance
 - 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:
 - Female Sex Hormones
 - Enumerate estrogen & progestogen preparations

- Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
- Contraceptives
 - Classify Contraceptives
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.
- Calcium & Bone Metabolism
 - Enumerate vitamin D preparations & drugs used for treatment of hypercalcemia
 - Enlist Bisphosphonates
 - Describe their pharmacokinetics, mechanism of action, pharmacological effects, uses, adverse effects, drug interactions and contraindications.

II. Clinical Pharmacology of Endocrinology.

- Corticosteroids
- Thyroid Preparations & Anti-Thyroid Drugs
 - Sex Hormones: Female and Male Sex Hormones, Contraceptives, SERMs, Infertility, Oxytocin: to induce Labor, Progestogen Antagonists, Androgens & Anti-androgens and Anabolic Steroids
- Diabetes Mellitus:
 - Role of Insulins & Oral Anti-Diabetic Drugs
- Obstetrics & Gynaecology
 - Drugs for Contraception.
 - Anabolic steroids.
- Drugs for Obstetric Problems:
 - Prenatal Medication,
 - Spontaneous Abortion (Threatened Abortion),
 - Vomiting of Pregnancy & Hyperemesis Gravidarum
- Specific Problems during Pregnancy:
 - Anemia,
 - Diabetes Mellitus,
 - Chronic Hypertension & Heart Disease,
 - Asthma,
 - Thyroid Disease,
 - Urinary Tract Infection, Tuberculosis & other infections
- Drugs for Gynaecological Problems:
 - Pelvic Inflammatory Disease (Salpingitis, Endometritis),
 - Menopausal Syndrome & Contraception,
 - Male & Female Infertility,
- List of Drugs having:
 - Significant Teratogenic or Other Adverse Effects on the Fetus,
 - Minimal Effects on Neonates during lactation,
 - Significant Effects on Neonates during lactation,
- Paediatric Dosage Calculation

List of Drugs having:

 - Specific bioavailability in neonates & children,
 - Specific elimination half-lives in neonates & children.
- Calcium & Bone Metabolism
 - Drugs useful in Osteoporosis, Bone Metastases, Hypercalcemia.

Section – 13

Immune Response Disorders:

Basic and Clinical Pharmacology (Pharmacokinetic & Pharmacodynamics) of:

- Antihistamines:
- Corticosteroids:
 - Hypersensitivity, and Allergic Reactions: Anaphylaxis, Food Allergy, Drug Allergy, Venom Allergy, Drug-Induced Hypersensitivity,
 - Atopic Disease,
- Immunosuppressants:
 - Autoimmune Disorders,
 - Immunodeficiency.

Section – 14

Miscellaneous:

After the completion of the syllabus, it is expected that the students should be able to know about **the Drugs Useful (or Role of Clinical Pharmacology) in:**

a. 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,
 - Antimicrobial Therapy,
 - Anti-Inflammatory Drugs,
 - Drugs Used in Glaucoma,
- Adverse Drug Reactions in The Elderly
- Practical Aspects of Geriatric Pharmacology.
- Drugs for:
 - Dementia
 - Depression
 - Delirium
 - Urinary Incontinence
 - Involuntary Weight Loss

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:
 - Iron,
 - Vitamin B₁₂, and Folic Acid,
 - Vitamin B₁, Vitamin B₂, Vitamin B₆, Vitamin C, Vitamin D Vitamin D₃, Vitamin D₂, Vitamin E, Calcium, Phosphate, Gallium Nitrate, Strontium, etc.) and Other Supplements
- Drugs for:
 - Anemia;
 - Vit B₁₂ & Folic Acid Deficiency,
 - Thalassemia, Sickle Cell Anemia, Aplastic Anemia,
 - Neutropenia, Thrombocytopenia,

d. Sports

- Drugs for Pain in Neck, Jaw, and Cervical Disk Herniation,

e. Antidotes.

Dimercaprol, Ethylenediaminetetraacetic Acid, Penicillamine, Deferoxamine, etc.

f. Drug Interactions.

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

ToS Theory / BDS, Second Professional Examination Pharmacology and Dental Pharmacology

Topics	Total SEQs 15 Total Marks 45		Total MCQs 45 Each MCQ 1 mark
	SEQ. Nos.	Marks allocated	MCQs. Nos.
General Pharmacology: Pharmacokinetics;	1	3	1-2
General Pharmacology: Pharmacodynamics	2	3	3-4
ANS: Cholinergic Agonists & Cholinergic Antagonists.	3		5-6
ANS: Adrenergic Agonists & Adrenergic Blockers.	4	3	7-8
Neurology, Psychiatry Anxiolytics, Typical Sedative / Hypnotics & Newer Drugs; Opioids.	5	3	9-11
Neurology, Psychiatry Antiepileptics, Central & Peripheral Skeletal Muscles relaxants.	6	3	12-14
Anesthesiology: Local & General Anesthetics;	7	3	15-17
Rheumatology & Gout: NSAIDs; Corticosteroids, Antigout Drugs.	8	3	18-21
Cardiology & Hematology: Diuretics, ACE Inhibitors & Receptors Blockers; Calcium Channels Blockers; Vasodilators, Antihypertensives, Antianginals. Drugs used in Cardiac Failure; Classification of Anti-arrhythmic; Coagulants, Anticoagulants, Thrombolytics, Antiplatelets, Antihyperlipidemics.	9	3	22-26
Pulmonology / Endocrinology: Drugs used in Bronchial Asthma; Antitussives, Expectorants. Antihistamines, Anti-Diabetics, Thyroxin, Antithyroid drugs.	10	3	27-30
Gastroenterology: Anti-emetics, Prokinetics; Antacids; Drugs used in Acid Peptic Disease; Nitroimidazoles.	11	3	31-34
Chemotherapy: Inhibitors of Cell Wall synthesis; Inhibitors of Nucleic Acid synthesis; Antifolates.	12	3	35-37
Chemotherapy: Inhibitors of Protein synthesis; Anthelmintics, Anti-mycobacterials.	13	3	38-40
Chemotherapy: Antivirals, Antifungal & Dermatological Drugs; Anticancers.	14	3	41-43
Dental Pharmacology: Antiseptics, Disinfectants, Desensitizing Agents, Oral Hygiene. Drugs Used in Root Canal Therapy & Dental Caries, etc.	15	3	44-45

ToS VIVA & OSPE

BDS, Second Professional Examination

Pharmacology and Therapeutics

Total Marks = 100

(Viva & OSPE 90 + Internal Assessment 10 marks)

- | | |
|--|------------|
| a) Viva Voce Structured
(Internal & External Examiners, equal distribution) | = 60 Marks |
| b) OSPE | = 25 Marks |
| c) Practical Notebook | = 05 Marks |

OSPE (25 Marks) (Objectively Structured Performance Evaluation)

Total stations = 07

I. Non-Observed Stations (Total Marks: 16) = 04

(04 Marks & 04 minutes for each station)

Station No.

1. Dosage forms; rate calculation of IV infusion, Dose calculations according to age, weight, body surface area
2. Calculations of Pharmacy Practical
3. Clinical Scenario (patient / mock / video, etc) for Prescription Writing and P drug
4. Interpretation of Given Data, Graph &/or Table

II. Observed Stations*(Total Marks: 09) = 02

1. Biostatistics Practicals = **01** (4 Marks for performance; 20 minutes' duration)
2. Pharmacy Practicals = **01** (5 Marks for performance; 30 minutes' duration)

* (Assigned by the Internal / External Examiner from the practical list provided by the UHS)