

## Syllabus for Pharmacy (PGQP24)

### **PHARMACEUTICS-I (INTRODUCTION TO PHARMACEUTICS)**

1. History of pharmaceutical practice through ages
2. Pharmacopoeias with special reference to Indian, British, United States, International and Extra Pharmacopoeias and various systems of medicines.
3. Routes of administration and classification of pharmaceutical dosage forms.
4. Definition, general formulation and manufacturing procedures.
5. Methods employed in the preparation of plant extracts.

### **PHARMACEUTICAL CHEMISTRY-I (ORGANIC-I)**

1. Fundamentals and classification of organic reaction.
2. Reaction intermediates
3. Stereochemistry
4. Study of reaction mechanism, reactivity and orientation, effect of substituent groups of following categories of reactions:
  - 4.1 Addition reactions
  - 4.2 Elimination reactions
  - 4.3 Substitution reactions
  - 4.4 Condensation and rearrangement reactions

### **PHARMACEUTICAL CHEMISTRY-II (INORGANIC)**

1. The occurrence of impurities in pharmaceutical preparations
2. A systematic study of the following pharmaceutical inorganic compounds with reference to their preparations, properties, tests for identity and purity, pharmaceutical uses and assay methods as given in Indian Pharmacopoeia (IP).
3. Group IA: Sodium and potassium compounds
4. Group IIIA and IIIB: Boron and aluminium compounds Group IVA and IVB: Bentonite, light and heavy kaolins and kaolin poultice.
5. Group VA and VB: Nitrogen, antimony, and bismuth compounds
5. Group VIB: Sulphur, selenium compounds
6. Group VIIA and VIIB: Hydrogen, oxygen and halogen compounds
7. Group VIII: Iron compounds
8. A study of major intra and extra cellular electrolytes, essential and trace elements and their physiological role.
7. Selected case studies in medicinal inorganic chemistry from the following topics: a) Biomedical uses of lithium b) Application of platinum compounds in medicine c) Gold compounds as therapeutic agents d) Ruthenium, titanium and gallium compounds in medicine
8. Metal compounds as contrast agents for MRI and medicinal applications of radio-active compounds.

### **ADVANCE MATHEMATICS**

1. Differential equations and its applications
2. Laplace transforms
3. Biometrics
4. Probability
5. Correlation and regression analysis

### **PHARMACEUTICS-II (PHYSICAL PHARMACY)**

1. Matter: State and selected properties
2. Micromeritics: Particle size and size distribution
3. Surface and Interfacial phenomenon
4. Rheology: Newtonian systems
5. Dispersed systems: Colloids
6. Complexation and protein binding: Classification of complexes, Methods of preparation and analysis, Pharmaceutical applications, Protein binding, Factors affecting complexation and protein binding.
7. Chemical kinetics: General considerations and concepts, Half-life determination, Factors affecting rate of reaction, Order of reaction, Determination of order of reaction.

### **PHARMACEUTICAL CHEMISTRY-III (ORGANIC-II)**

1. Nomenclature of heterocyclic compounds
2. Classification of heterocyclic compounds
3. Chemistry, preparation, properties and pharmaceutical applications of following heterocyclic rings: Monocyclic rings; Bicyclic rings; Tricyclic rings.
4. Pericyclic reactions, Conservation of orbital symmetry, Orbital symmetry rules, Mechanism and stereochemistry of electro cyclic, cycloaddition and sigma tropic reactions
5. Applications of reagents used in organic syntheses
6. Oxidation and hydrogenation/reduction
7. Chemistry of bio-macromolecules

### **PHARMACEUTICAL MICROBIOLOGY**

1. Introduction and scope of microbiology.
2. Classification of microbes and their taxonomy
3. Identification and cultivation of microbes
4. Control of microbes by physical and chemical methods
5. Immunity, primary and secondary defensive mechanisms of body, microbial resistance, interferon.
6. Food spoilage and preservation of food.
7. Microbial assay of antibiotics, vitamins and amino acids.

### **ANATOMY PHYSIOLOGY & HEALTH EDUCATION-I**

1. Scope of anatomy & physiology and basic terminology used in the subject.
2. Structure of Human Cell, its components and their functions
3. Elementary Tissues of the Human Body
4. Osseous System
5. Haematopoiesic System
6. Lymph and Lymphatic System
7. Cardiovascular System
8. Health Education
  - a. Classification of food requirements and importance of balanced diet
  - b. Demography and family planning
  - c. First Aid

### **PHARMACEUTICS-III (PHARMACEUTICAL ENGINEERING)**

1. Unit Operations
2. Material of Construction
3. Size Reduction.
4. Size Separation
5. Mixing
6. Filtration
7. Centrifugation
8. Crystallization
9. Refrigeration, Air Conditioning and Humidity Control
10. Evaporation
11. Distillation
12. Drying
13. Corrosion

### **PHARMACEUTICS I**

#### **(DISPENSING, COMMUNITY AND HOSPITAL PHARMACY)**

1. Prescription
2. Pharmaceutical calculations
3. Principle involved and procedures adopted in dispensing of mixtures, solutions, emulsions, lotions, liniments, powders, capsules, tablets, tablet triturates, pastilles, lozenges, pills, ointments, creams, pastes, suppositories, jellies, inhalations, paints, sprays and ophthalmic preparations.
4. Incompatibility
5. Community pharmacy
6. Hospital pharmacy

### **PHARMACEUTICAL ANALYSIS-I**

- A. Theoretical aspects of quantitative analysis
- B. Oxidation-Reduction titrations
- C. Precipitation titrations
- D. Gravimetric analysis
- E. Non-aqueous titrations

### **PHARMACOGNOSY-I**

1. Definition, history, scope and development of pharmacognosy, sources of crude drugs and methods of their classification.
2. Plant hormones and their applications, influence of mutation and hybridization with reference to medicinal plants.
3. Pest control and natural pest control agents.
4. Quality control of crude drugs
5. Introduction of various types of primary and secondary metabolites as active constituents of crude drugs, general methods of their isolation, classification, properties and systematic pharmacognostic study of:
  - a) Carbohydrates
  - b) Lipids
  - c) Resins and Tannins
  - d) Pharmaceutical aids

### **ANATOMY, PHYSIOLOGY AND HEALTH EDUCATION – II**

1. Central Nervous System
2. Autonomous Nervous System
3. Respiratory System
4. Endocrine System
5. Digestive System
6. Reproductive System
7. Urinary System
8. Sense Organs

### **PHARMACEUTICS -V (DOSAGE FORM DESIGN)**

1. Pre-formulation studies
2. Study of different types of formulation additives
3. Stability studies
4. Polymers
5. Dissolution technology
6. Solubilization

### **PHARMACEUTICAL ANALYSIS-II**

1. Conductometry
2. Potentiometry
3. Polarography
4. Amperometry
5. Coulometry
6. Radioimmunoassay
7. Thermal methods of analysis
8. X-ray diffraction
9. Miscellaneous methods of analysis

### **PHARMACEUTICAL CHEMISTRY- IV (BIOCHEMISTRY)**

1. Enzymes
2. Co-enzymes
3. Carbohydrates metabolism
4. Lipid metabolism
5. Biological oxidation
6. Metabolism of ammonia and nitrogen containing monomers
7. Genetic code and protein synthesis

## PHARMACOGNOSY II

1. Classification, cultivation, collection, commercial varieties, chemical constituents, substitutes, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides:
  - a. Saponins
  - b. Cardio active sterols
  - c. Anthraquinone cathartics etc.
2. Volatile oils
3. Plant bitters and sweeteners.
4. Studies of following drugs
5. Biological sources, preparation, identification tests and uses of the following enzymes

## PHARMACEUTICAL JURISPRUDENCE & ETHICS

1. Pharmaceutical Legislations  
Drugs and pharmaceutical industry with special reference to India  
Code of pharmaceutical ethics  
Pharmacy Act 1948, Drugs and Cosmetics Act 1940 and Rules 1945, Medicinal & Toilet Preparations (excise duties) Act 1955.
2. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules, Drugs Price Control Order 1995, Drug Policy 2002.
3. A brief study of the following with special reference to the main provisions.
  - a) Poisons Act 1919.
  - b) Drugs and Magic Remedies (objectionable advertisements) Act 1954.
  - c) Medical Termination of Pregnancy Act 1970 & Rules 1975.
  - d) Prevention of Cruelty to Animals Act 1960.
  - e) States Shops & Establishments Act & Rules.
  - f) Insecticides Act 1968.
  - g) AICTE Act 1987.
  - h) Factories Act 1948.
  - i) Minimum Wages Act 1948.
  - j) Introduction to Intellectual Property Rights and Indian Patent Act 1970 with patents rules 1972.
4. A brief study of the various marketed pharmaceutical products from the following categories: (i) Antibiotics (ii) Vitamins (iii) Antihypertensive (iv) Anti-diabetics (v) NSAIDs

## PHARMACEUTICS- VI (COSMETIC TECHNOLOGY)

Fundamental of cosmetic science. Formulation considerations, preparation, packaging and evaluation of the following cosmetic preparation:

1. Face Preparation
2. Colored make-up preparations
3. Skin preparation
4. Shaving preparation
5. Shampoos
6. Hair Preparations
7. Dental Preparation.
8. Manicure Preparation
9. Herbal Cosmetics
10. Cosmetic for babies: Baby cream, lotion and powders.

## PHARMACEUTICS-VII (PHARMACEUTICAL TECHNOLOGY-I)

1. Liquid Dosage Forms: Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavors and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.
2. Semisolid Dosage Forms: Definition, types and mechanisms of drug penetration. Factors influencing penetration. Semisolid bases and their selection. General formulation of semisolids, clear gels, manufacturing procedure, evaluation and packaging.
3. Suppositories: Ideal requirements, bases, manufacturing procedures, packaging and evaluation.
4. Solid Dosage Forms
5. Solid Dosage Forms
6. Pharmaceutical aerosols
7. A brief introduction of blood products, plasma substitutes and surgical products.

## PHARMACEUTICAL CHEMISTRY-V (MEDICINAL CHEMISTRY-I)

1. Introduction and basic principles of Medicinal Chemistry
2. Drugs affecting neuro transmission:
  - a. Drug acting on cholinergic neurotransmission
  - b. Drug acting on adrenergic neurotransmission
  - c. Drug acting on serotonergic neurotransmission
  - d. Local Anesthetic agents
3. Drugs affecting the Immune System
4. Drugs affecting the Respiratory System
5. Miscellaneous agents:
  - a. Diagnostic and Medicinal Green and Fluorescein
  - b. Pharmaceutical aids.

## PHARMACOGNOSY III

1. Systematic study of source, cultivation, collection, processing, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following Alkaloid containing drugs: Tropane, Quinoline, isoquinoline, Indole, Steroidal, Steroidal amine and Purines
2. A brief account of plant-based industries and institutions involved in work on medicinal and aromatic plants in India
3. Utilization of aromatic plants and derived products.
4. Marine pharmacognosy novel medicinal agents from marine sources.
5. Introduction, classification and study of different chromatographic methods and their applications in evaluation of herbal drugs.
6. Holistic concept of drug administration in traditional systems of medicine, introduction to ayurvedic preparations like arishtas, asavs, gutikas, tailas, churans, lehyas and bhasmas.

## PHARMACOLOGY-I

1. General Pharmacology
  - a. Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, combined effects of drugs, factors modifying drug action, tolerance and dependence, pharmacogenetics.
  - b. Absorption, distribution, metabolism and excretion of drugs, principle of basic and clinical pharmacokinetics adverse drug reactions and treatment of poisoning, ADME drug interactions, receptors, bioassay of drugs and biological standardization, discovery and development of new drugs. Introduction to clinical trials, bioavailability and bioequivalence studies.
2. Pharmacology of peripheral nervous system
  - a. Neurohumoral transmission (autonomous and somatic)
  - b. Para-sympathomimetic, para-sympatholytic and sympathomimetics.
  - c. Adrenergic receptors and neuron blocking agents, ganglionic stimulants and blocking agents.
  - d. Neuromuscular blocking agents.
  - e. Local anaesthetic agents.
3. Pharmacology of drugs acting on gastrointestinal tract
  - a. Antacids, anti-secretory and anti-ulcer drugs (pathophysiology of ulcer).
  - b. Laxatives and anti-diarrhea drugs.
  - c. Appetite stimulants and suppressants.
  - d. Emetics and anti-emetics.
  - e. Carminatives, demulcents, protectives, adsorbents, astringents, digestants, enzymes and mucolytics.
4. Autacoids:
  - a. Histamine, bradykinin, 5-HT and their antagonists.
  - b. Prostaglandins, leukotrienes and platelet activating factors.
  - c. Pentagastrin, cholecystokinin, angiotensin, bradykinin and substance
5. Analgesic, antipyretic, anti-inflammatory (vascular and cellular events of acute inflammation, chemical mediators of inflammation, pathogenesis of chronic inflammation), anti-gout and anti rheumatic drugs (pathophysiology of gout and rheumatoid arthritis)
6. Pharmacology of drugs used for respiratory system: Anti-asthmatic drugs (pathophysiology of asthma) including bronchodilators, antitussives, expectorants and respiratory stimulants.

## PHARMACEUTICS -VIII (PHARMACEUTICAL TECHNOLOGY-II)

1. Microencapsulation: Types of microcapsules, importance of microencapsulation in pharmacy, microencapsulation by phase separation, co-accervation, multiorifice centrifugal, spray drying, spray congealing, polymerization complex emulsion, air suspension technique, coating pan and other techniques, evaluation of microcapsules.
2. Parenteral products:
  - a. Preformulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicles, and isotonicity.
  - b. Aseptic techniques: Sources of contamination and methods of prevention, design of aseptic area, laminar flow bench services and maintenance.
  - c. Formulation details, containers and closures and their selection.
  - d. Pre-filling treatment, washing of containers and closures, preparation of solution and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization and preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.
3. Design, development, production and evaluation of controlled released formulations.
4. Novel drug delivery systems: Drawbacks and deficiencies of conventional drug delivery systems, introduction to novel drug delivery systems, e.g., transdermal drug delivery patches, ocular inserts and osmotic pumps, introduction of liposomes and pro drugs.
5. Ophthalmic preparations: Requirements, formulation and methods of preparations, containers, and evaluation.

## PHARMACEUTICAL BIOTECHNOLOGY

1. Introduction, historical perspective, genomics, proteomics and other biotechnology related techniques, scope and future of pharmaceutical biotechnology.
2. Enzyme immobilization: Introduction, factor affecting enzyme kinetics, Technique of immobilization of enzymes, immobilization of plant and bacterial cell, study of enzymes.
3. rDNA technology: Introduction, transformation, conjugation, transduction, protoplast fusion and plasmid mediated gene transfer, gene cloning including enzymes acting on DNA, cloning vectors, insertion of target DNA into vector, transformation and growth of cells, selection of recombinant clones and their applications, techniques of genetic engineering, study of drugs produced by biotechnology such as activase, humulin, human tropic, HB etc.
4. Vaccine technology: Introduction, immunological principles, conventional vaccines, modern vaccine technologies, development of hybridoma for monoclonal antibodies and monoclonal antibody based pharmaceuticals, pharmaceutical considerations of vaccines.
5. Fermentation: Introduction to fermentation, fermenters and types of fermenters, factors affecting design of fermenter, the fermentation process and its optimization with special reference to ethyl alcohol, riboflavin, cephalosporin and ascorbic acid.
6. Production and downstream processing of biotech products: Introduction, production, downstream processing, issues to consider in production and purification of proteins, formulation of biotech products and its biopharmaceutical considerations, pharmacokinetics and pharmacodynamics of peptide and protein drugs.
7. Plant tissue culture: Introduction, laboratory requirements, cellular totipotency, types of cultures, protoplast fusion and somatic hybridization, transgenic plants and application of transgenic plants, cryopreservation and application of PTC in Pharmacy.

## PHARMACEUTICAL CHEMISTRY-VI (MEDICINAL CHEMISTRY-II)

Classification, synthesis of selective drugs, Structure-activity relationship, Pharmacological/Biochemical mechanism of action, Therapeutic uses of following category of agents: (special emphasis should be given to specified drugs)

1. Drugs affecting central nervous system:
  - General Anesthetics
  - Anti Parkinsonian agents and Spasmolytic agents
  - Psychopharmacological Agents
2. Drugs affecting Hormonal System:
  - a. Thyroid hormones and Antithyroid agents
  - b. Insulin and Oral Hypoglycaemic agents
  - c. Steroidal agents:
3. Drugs affecting Haematopoietic System.
4. Chemistry and physiological importance of water & lipid soluble Vitamins.

### **PHARMACEUTICS -IX (PACKAGING TECHNOLOGY)**

1. Packaging of pharmaceutical dosage form
2. Packaging of solid oral dosage form
3. Packaging of semisolids and topical
4. Glass packaging materials.
5. Plastic packaging materials
6. Metal packaging materials
7. Tamper-resistant packaging
8. Child resistant package.

### **PHARMACOLOGY-II**

1. Pathophysiology of CNS diseases and pharmacology of drugs used to treat them a) Neuro humoral transmission in CNS b) General anesthetics, alcohol and disulfiram.c) Hypnotics, sedatives, anti- anxiety agents, and centrally acting muscle relaxants. d) Psychopharmacological agents e) Antiepileptic drugs f) Narcotic analgesics and antagonists g) Drugs used in neurodegenerative diseases: Parkinson's disease and Alzheimer's disease h) Drug addiction and drug abuse i) CNS stimulants
2. Pathophysiology of diseases of endocrine system and pharmacology of drugs used for their treatment: a) Hypothalamic and pituitary hormones. b) Thyroid hormones and anti thyroid drugs. c) Insulin, oral hypoglycemic agents and glucagons. d) Corticosteroids. e) Androgens, anabolic steroids and drugs for erectile dysfunction. f) Estrogens, progestins and oral contraceptives. g) Oxytocin and drugs acting on the uterus. h) Parathormone, calcitonin and vitamin D, ACTH and corticosteroids.
3. Drug acting on Haematopoietic system: a. Haematinics (pathophysiology of anaemia) b. Anticoagulants c. Fibrinolytic and antiplatelet drugs d. Blood and plasma volume expanders.

### **PHARMACEUTICS-X (BIOPHARMACEUTICS AND PHARMACOKINETICS)**

#### **Bio pharmaceuticals**

1. Introduction: Definition and significance of Bio pharmaceuticals in formulation development.
2. Gastrointestinal absorption of Drugs
3. Factor affecting Drug absorption
4. Methods of studying gastrointestinal absorption
5. Drug Disposition
6. Drug Excretion
7. Drug Biotransformation

#### **Pharmacokinetics**

1. Definition and need of pharmacokinetic and clinical pharmacokinetics.
2. Introduction to pharmacokinetic parameters, biological half-life, volume of distribution, clearance, rate constants for elimination.
3. One compartment model: Single dosing-intravenous injection and oral absorption, determination of pharmacokinetic parameters from plasma and urine data, measurements of C<sub>max</sub>, T<sub>max</sub>, and AUC.
4. Bioavailability and Bioequivalence: Definition and detailed protocol, Significance of Bioavailability and Bioequivalence studies. Regulatory requirements.

### **PHARMACEUTICAL CHEMISTRY-VII (MEDICINAL CHEMISTRY-III)**

1. Drug Design and Development
2. Modern Medicinal Chemistry
3. Drugs affecting the Cardiovascular System: a) Anti-anginal and Vasodilators b) Anti-arrhythmic agents c) Antihypertensive agents d) Antihyperlipidemic agents
4. Drugs affecting the Urinary System
5. Chemotherapeutic agents: a) Antibiotics and Antibacterial agents b)Antibiotics c) Antiparasitic agents d) Antiamoebic agents f) Antifungal agents g)Anticancer agents, Immunosuppressants and Immunostimulants g)Antiviral including anti-HIV agents.

### **PHARMACOLOGY-III**

1. Pathophysiology of microbial diseases (Tuberculosis, leprosy, fungal diseases, urinary tract infections, sexually transmitted diseases) and pharmacology of drugs used for their treatment: a) General principles of Chemotherapy, b) Sulfonamides and cotrimoxazole, c) Antibiotics d) Anti-mycobacterial drugs, e) Anti-viral and anti-HIV drugs, f) Anti-malarial drugs, g) Drugs for amoebiasis and other protozoal infections, h) Anthelmintics

2. Pathophysiology of Cardiovascular and pharmacology of drugs used for their treatment. a) Cardiac glycosides, b) Antiarrhythmic drugs, c) Antianginal drugs, d) Antihypertensive drugs, e) Anti- hyper lipidemic drugs
3. Anti-neoplastic drugs (pathophysiology of cancer), immune-stimulants and immunosuppressive agents.
4. Drugs acting on urinary system

#### **PHARMACOLOGY-IV**

1. Principles of Clinical Pharmacology
2. Drugs used during infancy, neonates, in the elderly persons and their bio-pharmaceutics.
3. Drugs used during pregnancy and drug induced diseases.
4. The principles, mechanism and clinical evaluation of drug interactions.
5. Common clinical laboratory tests and their interpretation.
6. General principles of Clinical toxicology.
7. Therapeutic Drug Monitoring, Concept of Essential Drugs and Rational Drug use.
8. Principles of Toxicology

#### **PHARMACEUTICAL INDUSTRIAL MANAGEMENT AND ACCOUNTANCY**

1. Concept of Management: Administrative Management, Entrepreneurship development, Operative Management, Principles of Management, Identification of Key Points to give maximum thrust for development and perfection.
2. Economics: Principles of economics
3. Materials Management
4. Production Management
5. Accountancy

#### **PHARMACEUTICAL ANALYSIS- IV (QUALITY ASSURANCE)**

1. Quality assurance: Concept, Scope, quality control, audit, total quality management.
2. Development of new analytical methods.
3. Validation: Definition, types, validation of manufacturing and analytical equipment, validation of analytical procedures, importance and limitations of validation, organization for validation.
4. Pharmaceutical manufacturing documentation (PMD): Introduction, guidelines for designing and implementation of PMD programs.
5. Documentation: Protocols, forms and maintenance of records in pharmaceutical industries, preparation of documents for new drug approval and export registration to United States, United Kingdom, Europe and Africa.
6. Patent processing and its applications.
7. Requirement of GMP, GLP, ISO 9000, WHO and U.S. F.D.A.
8. In-process quality control tests, IPQC problems in pharmaceutical industries, sources and control of quality variation, total quality management.
9. Sampling plans, sampling and operating characteristics curves, interpretation of analytical data.
10. Regulatory control and regulatory drug analysis.

#### **DRUG DESIGN**

- 1 Drug Discovery, Design and Development
- 2 Quantum Mechanics and Molecular Dynamics
- 3 Ligand Based Drug Design
- 4 Structure Based Drug Design
- 5 Comparative Protein Modeling

#### **PHARMACEUTICAL SALES AND MARKETING**

1. Introduction to Pharmaceutical Marketing Management
2. Marketing Task: Demand States & Marketing task, Scope of Marketing and Different Markets
3. Concept of Marketing
4. Marketing Opportunities Market Oriented Strategic Planning
5. Developing Market Strategies & Marketing Mix, Product Strategy Positioning & Differentiating the Market Offering.
6. Managing & Delivering Marketing Programs.
7. Value Net-Work & Marketing Channels
8. Managing Sales Force: Recruitment & Selecting Representative, Training Sales Representative, Supervising, Norms for Customer Calls, Motivating Sales Representative, Evaluating Sales Representative.

**FOOD SCIENCE TECHNOLOGY**

1. Food Chemistry
2. Food Microbiology
3. Food Process Principles
4. Food Technology
5. Food laws and standards