

## **RPQP19 (Ph.D. Pharmacy)**

**PART-A:** English, General Knowledge and Numerical Ability

**PART-B:** Two Sections, Section- I and Section-II. A candidate is required to answer either Section-I or Section-II as per eligibility.

### **SECTION-I**

**Pharmaceutical Chemistry:** Medicinal Chemistry of – Analgesics, Anticonvulsants, Antidepressants, Antihistamines, Anxiolytics, Cardiovascular Drugs, Adrenergic & Cholinergic drugs, Anticoagulants, Diuretics, Hypoglycemic agents, Hypnotics and Sedatives, local anesthetics, Neuroleptics, Chemotherapeutic agents (Antibacterial, Anticancer, and Antiviral), Diagnostic agents, Radiopharmaceuticals, Vitamins and Hormones.

General Principles of Drug Design: Lead Discovery and Lead Modifications, 2DQSAR, 3DQSAR.

Organic Chemistry covering: Stereochemistry, Reaction Intermediates, Nucleophilic substitution, electrophilic substitution, Addition Reactions, Elimination Reactions, Oxidation and Reduction Reactions.

**Pharmaceutics:** General Principles of new drug delivery system, Biopharmaceutics and Pharmacokinetics, Preformulation and Formulation, development and Evaluation of Tablets, Capsules, Suspension, Emulsion, ointments and Creams etc. Formulation and preparation of cosmetics: Creams, Shampoos, Lotions, Lipsticks etc. Pharmaceutical calculations, Physical Pharmacy: Complexation, Diffusion and dissolution, interfacial Phenomenon, Micrometrics, solubility and solubility distribution phenomenon.

**Pharmacology and Toxicology:** Bioassays, Immuno pharmacology, Drug Interactions, General pharmacological principles, Pharmacology of Autocoids , Chemotherapeutic agents , Hormones, and Hormone antagonists, Pharmacology of Drugs – Autonomic Nervous System, Peripheral Nervous System, Cardiovascular System, Central Nervous System, Gastro-intestinal System, General principles of toxicology.

**Pharmacognosy and Natural Products:** Tests of Alkaloids, Carbohydrates, Essential Oils, Glycosides, Lipids, Resins, Steroids, Tannins, Terpenoids, Indigenous Traditional Drugs. Nutraceuticals and functional foods. Probiotics and prebiotics, Plant Tissue Culture – Application in Drug Production, Standardization of Raw Materials and Herbal Products, Methods of extraction, Isolation and characterization of natural products, Introduction to Biosynthesis Pathways

**Pharmaceutical Analysis:** Principles, Theory, reactions, instrumentation, application and interpretation of UV, IR, NMR, Mass, X-Ray Diffraction, DSC and Thermal analytical

Techniques. Chromatography techniques-Column, Gel filtration, Ion exchange, Paper-TLC. Fluorimetry, Polarography, Pharmacopoeial assays.

## SECTION-II

**Pharmacognosy and Natural Products:** Phytopharmaceuticals – Characterization, Chemistry, Isolation, Source Tests of Alkaloids, Carbohydrates, Essential Oils, Glycosides, Lipids, Pharmaceutical enzymes, Resins, Steroids, Tannins, Terpenoids; Indigenous Traditional Drugs; Nutraceuticals and functional foods; Probiotics and prebiotics; Plant Tissue Culture – Application in Drug Production; Standardization of Raw Materials and Herbal Products; Methods of extraction, Isolation and characterization of natural products; Biosynthesis Pathways: Primary and Secondary Metabolites, various classes of secondary metabolites- Alkaloids (quinine and morphine), cardiac glycosides, flavonoids (rutin and quercetin), terpenoids (Zingiberene, Abietic acid), steroids (cholesterol); Dietary Antioxidants, Brief description of Marine Natural Products

**Pharmaceutical Organic Chemistry:** *Stereochemistry*- Optical activity, chirality, symmetry elements, chiral molecules-test and biological importance of chirality. Stereospecific and stereoselective synthesis. Resolution of racemic mixtures. Geometric isomerism and Conformational isomerism, *Reactive intermediates* - structure, generation, stability and reactivity of carbocations, carbanions, carbenes, nitrenes and free radicals. *Alkylation* - Alkylation of nucleophilic carbon; enolates and enamines: generation & reactions. *Pericyclic reactions*-Molecular orbital symmetry, Woodward-Hofmann rules. Electrocyclic (Diels-Alder reaction) and sigmatropic reactions-Cope, Benzidine rearrangements. Cycloaddition. *Rearrangements*-Carbon to carbon migration- Wagner-Meerwein, Pinacol-pinacolone, Benzilic acid, Favorskii. C to N migration -Hoffmann, Curtius, Beckmann, Schmidt, Lossen. C to O migration- Bayer-Villiger, hydroperoxides. Reduction reactions of carbonyl and other functional groups-Catalytic hydrogenation, reduction by Group III and Group IV hydride donors, dissolving metal reductions, reductive deoxygenation of carbonyl groups. *Synthon approach*- Concept, halfreactions, FGI, analysis of target molecule, synthetic strategies. Application to synthesis of benzocaine, propranolol, haloperidol, salbutamol and other drugs. *Miscellaneous reactions*. Electrophilic and Nucleophilic addition reactions. Electrophilic Aromatic Substitution – Nitration, halogenation, sulphonation, Friedel-Crafts reactions. Nucleophilic Aromatic Substitution and –via diazonium ions.

**Spectroscopy and Chromatography Techniques:** Theory, instrumentation and applications and interpretations of UV, IR, NMR, Mass spectrometry and X-ray diffraction. HPLC, UPLC, GC, HPTLC and hyphenated techniques such as GC-MS, LC-MS and LC-NMR.

**Drug design and action:** Receptors- Types, structures and functions of receptors, signal transduction and G-proteins, theories of drug-receptor interaction, detailed study of adrenergic,

cholinergic, histaminergic, dopaminergic and opiate receptors Nitric oxide- interplay of NO & biological systems. NO biosynthesis and cytotoxicity, NO synthetase inhibitors and their therapeutic significance. Autocoids-a) Enkephalins & endorphins b) Prostaglandins & other eicosanoids. Antiviral agents- DNA & RNA viruses, viral replication, retroviruses, strategies to design anti-HIV drugs, , antiviral drugs. Antineoplastic agents-molecular mechanism of cancer, oncogenes, alkylating agents, antimetabolites, antibiotics, natural products. Cardiovascular agents; Antiarrhythmics –basis of cardiac arrhythmias, classification of drugs used, mechanism of action, molecular features essential for antiarrhythmic activity. Antianginal agents; Pathophysiology of angina, classification and mode of action of drugs used, vasodilators. Antihypertensive agents-etiology of hypertension, basis of drug design, agents affecting sympathetic system, agents acting on smooth muscle, ACE inhibitors, diuretics. Antihyperlipidemic agents- classes of lipoproteins, hyperlipoproteinemia, development of antihyperlipidaemic agents, mode of action. Antifertility agents- methods of fertility control, steroidal and nonsteroidal antifertility agents, abortifacients. Anti-diabetics agents.

**General Principles of Drug Design:** Basics of Drug design and drug action; Effect of physico-chemical properties on pharmacokinetics and pharmacodynamics; Lead Discovery and Lead Modifications, Fragment based drug discovery, Structure and ligand based drug discovery, 2D and 3DQSAR, Docking, Virtual Screening.