Ph.D. Entrance Examination
Syllabus

Department: Pharmaceutical Chemistry

1. **Basic Aspects of Organic Chemistry**:

   Organic intermediates: Carbocations, carbanions, free radicals, carbenes and nitrenes their method of formation, stability and synthetic applications. Detailed knowledge regarding the reactions, mechanisms and their relative reactivity and orientations. Nucleophilic uni- and bimolecular reactions (SN1 and SN2), Elimination reactions (E1 & E2), Hoffman & Saytzeff's rule, Rearrangement reaction.

2. **Stereochemistry & Asymmetric Synthesis:**

   Basic concepts in stereochemistry: optical activity, specific rotation, racemates and resolution of racemates, the Cahn, Ingold, Prelog (CIP) sequence rule, meso compounds, pseudo asymmetric centres, axes of symmetry, Fischers D and L notation, cis-trans isomerism, E and Z notation. Methods of asymmetric synthesis using chiral pool, chiral auxiliaries and catalytic asymmetric synthesis, enantiopure separation and Stereo selective synthesis with examples

3. **Study of mechanism and synthetic applications of following named reactions**:

   Sandmeyer Reaction, Mitsunobu reaction, Mannich reaction, Vilsmeyer-Haack Reaction, Sharpless asymmetric epoxidation, Baeyer-Villiger oxidation, Shapiro & Suzuki reaction, Ozonolysis and Michael addition reaction, cannizaro reaction, Reimer Tiemann reaction.

4. **Rational Design of Enzyme Inhibitors:**

   Enzyme kinetics & Principles of Enzyme inhibitors, Enzyme inhibitors in medicine, Enzyme inhibitors in basic research.

5. **Study of Natural products as leads for new pharmaceuticals for the following:**

   Alkaloids, Flavonoids, Steroids and Terpenoids.

6. **Green Chemistry:**

   Introduction, principles of green chemistry and Merit and demerits of its use, increased reaction rate.

7. **Synthon approach and retrosynthesis applications:**

   Basic principles, terminologies and advantages of retrosynthesis; guidelines for dissection of molecules.

8. Catalysis:

Types of catalysis, heterogeneous and homogenous catalysis, advantages and disadvantages.

9. Photochemical Reactions:

Basic principles of photochemical reactions. Photo-oxidation, photo-addition and photo-fragmentat.

10. Heterocyclic Chemistry:

Mechanism and application involved in synthesis of drugs containing five, six membered and fused hetrocyclics such as Debus-Radziszewski imidazole synthesis, Knorr Pyrazole Synthesis Pinner Pyrimidine Synthesis, Combes Quinoline Synthesis, Bernthsen Acridine Synthesis, Smiles rearrangement and Traube purine synthesis

11. Instrumentation and Characterization of compounds:

Structural Characterization of compounds using IR, 1HNMR, 13CNMR and MS Spectroscopy and Chromatographic techniques, electrochemical method of analysis.

12. Drug discovery:

Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets. Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonist's vs antagonists, and artificial enzymes. Rational Design of Enzyme Inhibitors Enzyme kinetics & Principles of Enzyme inhibitors, Enzyme inhibitors in basic research, rational design of non-covalently and covalently binding enzyme inhibitors.

13. Introduction to Computer Aided Drug Design:

History, different techniques and applications. Quantitative Structure Activity Relationships: Basics History and development of QSAR and its application Applications, Molecular Properties and Drug Design, Pharmacophore Mapping and Virtual Screening.