

## **Medicinal chemistry and Bulk Drugs (Pharmaceutical Technology)**

IUPAC nomenclature, R and S nomenclature, E and Z isomerism, atropisomerism, Conformations

Hybridization, aromaticity, Huckel's rule reaction mechanisms- Electrophilic, Nucleophilic, SN1, SN2, SNi, Elimination E1 E2 etc.

Ester hydrolysis, Aac1 Aac2.....all eight mechanisms (Jerry march) Markovnikov's rule, Bredt's rule, Stereoselectivity, stereospecificity, regioselectivity, chemoselectivity, chirality, stereochemistry, conformations, rearrangements, acids and bases.

Imine-enamine Tautomerism, keto-enol tautomerism, pericyclic reactions, racemic mixture, resolution methods.

Amino acids proteins, various methods for amino acid detection, Ninhydrin test, peptide sequencing, structures of amino acids, essential and nonessential amino acids,

Introduction to thermal methods of analysis like, TGA, DSC, DTA etc.

Carbohydrates classification, osazone test, mutarotation, etc,

Various Heterocycles, Heterocycle synthesis, reactions.

Introduction to Redox reactions.

Spectroscopy: (basics specially): Very very IMP topic. NMR, and C-NMR ranges from Morrison & Boyd or Pavia Mass -Basic concepts about various peaks M+1, molecular ion, base peak etc. (Silverstein) IR - Frequencies of various groups specially carbonyls. UV

Chromatography: Details of every chromatographic method.

Reaction kinetics, first second third and pseudo first order reactions, radio labeling for determination of mechanism.

Common condensation reactions like Aldol, Claisen Perkin, Dickmann, Darzen etc.

Other reactions like Cannizzaro's reaction, Prins reaction, especially reactions of carbonyl compounds.

### **References:**

1. Jerry March
2. Morrison and Boyd (ESPECIALLY Peptide and Carbohydrate chemistry)
3. I. L. Finar Vol-I and Vol-II (Heterocyclic chemistry and organic synthesis)
4. Eliel

### **Natural Products:**

In natural products more stress should be given on phytochemistry part rather than biological aspects.

Methods of extraction, isolation and characterization of natural products. Various separation techniques used for isolation of natural products.

Biosynthetic pathways.

Primary metabolites, their examples.

Secondary metabolites, various classes of secondary metabolites (e.g. Alkaloids, glycosides, tannins, lignans, saponins, lipids, flavonoids, coumarins, anthocyanidines etc.). Here most imp. Part is chemistry of these classes.

Important therapeutic classes: antidiabetics, hepatoprotectives, immunomodulators, nutraceuticals, natural products for gynecological disorders, anti-cancer, anti-viral (mainly anti-HIV), adaptogens etc.

Dietary antioxidants, Marine natural products, Plant growth regulators.

Spectroscopy: Basic concepts of UV, NMR, IR and Mass spectroscopy. Give more stress on IR and NMR.

**Stereochemistry:** Basic concepts.

Fischer, sawhorse and Newman projection formulae.

Biological sources of important classes of natural products. (Selected ones only)

Standardization of natural products.

What is difference between natural products and pharmacognosy?

**References:**

1. For various therapeutic classes: Trease and Evans

2. For spectroscopy: Silverstein, Pavia, Kemp.

3. For stereochemistry: I.L. Finar vol-II

**Pharmacology and toxicology:**

Pharmacokinetics, pharmacodynamics, pharmacological effect, desired, undesired, toxic, adverse effects.

Bioavailability, bioequivalence, various factors of ADME. (From Bramhankar)

Drug metabolism: various pathways and other details.

Drug interactions, agonist, antagonist, partial agonist, protein binding, drug distribution, distribution volume, excretion pathways etc.

Pharmacological screening: general principles, various screening models, screening methodologies (in vitro and in vivo tests).

Mechanism of drug action, drug-receptor interaction.

Various adrenergic, cholinergic and other receptors

Detailed study of CNS pharmacology

Study of basis of threshold areas of work in NIPER in pharmacology dept. mentioned in brochure.

Diseases: study of the pharmacology of the diseases and drugs used with mode of action especially of diabetes, malaria, leishmaniasis, TB, hypertension, myocardial ischemia, inflammation, and immunomodulation.

Chemotherapy and pathophysiology- knowledge of antibiotics, their mode of action and the microorganisms responsible for various common diseases.

Bioassay methods, various requirements. Brief knowledge of the statistical tests.

**References:**

1. Rang and Dale (ALL CHEMOTHERAPY CLASSES OF DRUGS. IF YOU READ THE WHOLE BOOK, then nothing else is needed)

2. F. S. K. Barar

3. Wilson and Griswold (for Mechanism)

4. Kasture (for Bioassay and Screening)

**Pharmaceutics and formulation (Pharmaceutical Technology)**

**Drug delivery systems (DDS):** NDDS models, osmotic pumps, various release patterns eg. Controlled release, delayed release. Sustained release etc., order of release. Oral controlled DDS, factors affecting controlled release.

Carriers in DDS: polymers and their classification, types, carbohydrates, surfactants, proteins, lipids, prodrugs etc.

Transdermal drug delivery systems (TDDS): principles, absorption enhancers, evaluation

of TDDS.

Parenterals: requirements, advantages, disadvantages, release pattern, route of drug delivery.

Drug targeting: microspheres, nano particles, liposomes, monoclonal antibodies, etc. Preformulation detailed.

Complexation, solubilization, polymerization, viscosity measurements.

Dosage form development- stages, implications of dosage form.

Additives of formulation, types, examples, advantages, disadvantages, drug excipient interaction, incompatibility, various types of incompatibilities.

Dosage forms: solid (tablets, capsules, pills etc), liquid (emulsion, suspension etc), sterile (injectables), aerosols. Principles, advantages, disadvantages and problems.

Coating - in detail.

Packaging: materials, labeling etc. Types of containers (e.g. Tamper-proof containers)

In process controls, Product specification, documentation.

Compartmental modeling. (From Bramhankar)

Bioavailability, bioequivalence studies. Methods of improvement of oral bioavailability.

Evaluation of formulation, principles and methods of release control in oral formulations.

#### **References:**

1. Lachmann (ALL new and old techniques in Pharmaceutical Industry)
2. Alfred Martin (ALL physical chemistry BASICS)
3. Remington's Pharmaceutical Sciences
4. Notes of Gudsurkar Sir (Most important)
5. Banker series.
6. other: Bramhankar, , Liberman Series

#### **Pharmaceutical analysis:**

Stability testing of pharmaceuticals, various stability tests, kinetic studies, shelf life determination, thermal stability, formulation stability.

Various analytical techniques

Tests: physical and chemical tests, limit tests, microbiological tests, biological tests, disintegration and dissolution tests.

Spectroscopic methods; UV, NMR, IR, MS, FT-IR, FT-NMR, ATR (Attenuated Total Reflectance), FT-Raman- basics and applications.

Thermal techniques: DSC, DTA, TGA, etc.

Particle sizing: law of diffraction.

Electrophoresis: capillary electrophoresis.

Chromatography- detailed.

QA and QC: GLP, TQM, ISO system.

Preformulation, cyclodextrin inclusion compounds

Solubility: pH, pka, surfactant HLB values, Rheology.

Crystallinity, polymorphism, solvates and hydrates, crystal habits, porosity, surface area flow properties.

Dosage forms, Stages of dosage form development

Osmolality, osmolarity, osmotic pressure, conductivity, Preservatives, Media for bioassay.

#### **References:**

1. Willard
2. Silverstein (Mass Spectroscopy)
3. William Kemp (NMR)
4. Pavia (for spectroscopy)
5. Others like Alfred Martin, Chatwal (UV), Garry Christen (Chemical Methods)

**Biotechnology:** Pharmaceutical technology biotechnology

Genetic Engg: Gene expression, mutation, replication, transcription, translation, recombination, bacteriophages.

Cloning: methods, isolation of nucleic acids, enzymes in cloning (restriction endonucleases, DNA ligase, DNA gyrase, polymerases etc...), functions of these enzymes, Pallindromes.

Fermentation: fermenters, fermentation process, its regulation, conditions, bioprocessors, various enzymes in fermentation technology. Fermentation of Antibiotics, vitamins, amino acids, hydroxy acids such as lactic acid etc. Chemical engg. aspects related to fermentation

Gene therapy: methods and applications.

Monoclonal antibodies, insulin, interferons, enkephalins, angiotensin analogues and other peptides.

**References:**

1. Vyas and Dixit
2. IP Appendices

**Practice of Pharmacy:**

The best part for the preparation for this best reference for this would be Remington's Pharmaceutical Sciences. This branch is quite new here, so till dates students of branch used to do case study of prescriptions in Fortis hospital, PGI Chandigarh and govt. college chd... This is much like pharmacology and drug-drug interactions and different interactions are emphasized. Diabetes, heart diseases are main area of study.....

**Pharmacoinformatics:**

Terminologies related with new emerging informatics e.g. proteomics, genomics, QSAR (2D, 3D, regression, correlation).

**References:**

Foye, Williams and Lemke, Medicinal chemistry, 5th/6th edition, chapter 1-6. (Computational drug design and molecular modeling).

**Others:**

Statistics, general mathematics and aptitude questions. Use MBA entrance test books like CET or CAT in MBA. Additionally some general awareness questions.

NIPER's thrust areas are:

Microbial and viral diseases: Yeast, and fungi.

Parasitic and tropical diseases: Malaria, Leishmaniasis, amoebiasis, etc.

Metabolic Disorders: Diabetes

Strokes

Peptide and carbohydrate chemistry.

Genomics and proteomics: yeast and fungi  
Hormonal disorders: TRH related diseases.