NIPER JEE – Examination Syllabus

Natural Products:

1. In natural products more stress should be given on Phytochemistry part rather than biological aspects but you should know about biological sources and chemical constituents of important ones.

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

3. Biosynthetic pathways.

4. Primary metabolites, their examples.

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

6. Important therapeutic classes: antidiabetics, hepatoprotectives, immmunomodulators, neutraceuticals, natural products for gynecological disorders, anti-cancer, anti-viral (mainly anti-HIV), adaptogens etc. dietary antioxidants, marine natural products, plant growth regulators.

7. Standardization of natural products.

8. Stereochemistry and spectroscopy applied to some phytochemical constituents/ pure natural products- NMR, IR. Stereochemistry: Fischer, Sawhorse and Newman projection formulae.

References:

For various therapeutic classes:

- *Trease and Evans' Pharmacognosy, 16th Edition., Elsevier*

For spectroscopy:

- *Spectrometric Identification of Organic Compounds by Robert M. Silverstein, 8th Edition, Willey Publication.*
- *Organic Spectroscopy by William Kemp, Pelgrave Publication.*
- *Introduction to Spectroscopy By Donald L. Pavia, 4th Edition, Brooks/Cole Publication.*

For stereochemistry:

- *Organic Chemistry. Vol. 2 by I.L. Finar., 3rd Edition, Longmans Green & Co. Publication.*

Pharmacology and toxicology:

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

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

3. Drug metabolism: various pathways and other details.

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

5. Mechanism of drug action, Receptor-theories, types, spare, silent, orphan, pre & post synaptic, drug-receptor interaction- Various adrenergic, cholinergic and other receptors. Detailed study of CNS pharmacology, especially opioid receptors.

6. Diseases: Especially diabetes, malaria, leishmaniasis, TB, hypertension, myocardial ischemia, inflammation, and immunomodulation.

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

8. Mechanism of Action, toxicity and specific use of every class of drugs.

9. Pharmacological screening: general principles, various screening models, screening methodologies (in vitro and in vivo tests). Detailed study of anti- malarial, anti-tubercular, anti-leishmanial, anti diabetic bioassays. Bioassay methods, various requirements. Brief knowledge of the statistical tests.

10. Concept of CGMP, CAMP, desensitization, tachyphylaxis, drug dependence and drug interaction.

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

References:

- *Rang & Dale's Pharmacology 8th Edition, Elsevier Publication.*
- *Essentials of Medical Pharmacology By K. D. Tripathi, 7th Edition, Jaypee Brothers Medical Publishers*

Practice of Pharmacy:

1. Adverse Drug Reactions.

2. Rational drug use as well as some typical case studies in diabetes and hypertension and some case study regarding

Anti-infective therapy, Diabetes, Heart diseases are important.

3. Therapeutic drug monitoring

4. Hospital pharmacy

5. Clinical pharmacy

References:

- Clinical Pharmacy and Therapeutics By Roger Walker, 5th Edition, Churchill Livingstone.
- Remington: The Science and Practice of Pharmacy (Remington the Science and Practice of Pharmacy), 21st Edition, Lippincott Williams & Wilkins (LWW).

Pharmacoinformatics:

1. Terminologies related with new emerging informatics e.g. proteomics, genomics, QSAR (2D, 3D, regression, correlation) and application of every 3D QSAR software.

Biotechnology:

1. General knowledge and understanding of cycles, carbohydrates, mucopolysaccharides, proteins, lipids, amino acid their metabolism.

2. Enzymes- types of enzymes, allosteric inhibition and enzyme kinetics etc.

3. General understanding of Vitamins.

4. Staining.

5. Understanding of HIV, Influenza, Cancer (Role of DNA and Telomerase).

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

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

8. Fermentation: fermenters, fermentation process, its regulation, conditions, bioprocessors, various enzymes in fermentation technology. Fermentation of Antibiotics (fermentation of penicillin, cephalosporins, streptomycin- organisms used), vitamins (B12), amino acids, organic acid production- hydroxy acids such as lactic acid etc. Chemical engineering aspects related to fermentation

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

10. Gene therapy: methods and applications.

11. Vaccines and their storage.

12. Use of microorganisms in pharmaceutical industries.

13. Haematic diseases- anaemia, thalassemia, porpyhyrins.

14. DNA purification, mutation.

15. Electrophoresis.

16. Tests of biochemistry

References:

- *Pharmaceutical Biotechnology By S.P. Vyas and V.K. Dixit, CBS Publishers & Distributors Pvt. Ltd.*
- *Indian Pharmacopoeia 2014, 7th Edition, Appendix Section*
- *Biochemistry By U.Satyanarayana & U. Chakrapani, 4th Edition, Books and Allied (P) Ltd.*

Pharmaceutical analysis:

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

2. Various analytical techniques

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

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

5. Thermal techniques: DSC, DTA, TGA, etc. Particle sizing: law of diffraction.

6. Chromatography- detailed.

7. QA and QC: GLP, TQM, ISO system.

Details of every chromatographic method:

General principles, classification, normal & reversed phase, bonded phase, separation mechanisms.

Types:

a) Column chromatography.

b) Flash chromatography.

c) Vacuum liquid chromatography.

d) TLC, HPTLC, OPLC (over pressure layer chromatography)

e) HPLC.

f) Centrifugal chromatography.

g) Counter - current chromatography.

h) Droplet - counter current chromatography.

i) Ion exchange chromatography.

j) Affinity chromatography.

k) Size exclusion & Ion Pair chromatography,

l) Perfusion chromatography.

m) Fast protein liquid chromatography.

n) Supercritical chromatography.

o) GC, GC-MS, LC-MS, LC-MS/MS.

References:

- *Spectrometric Identification of Organic Compounds by Robert M. Silverstein, 8th Edition, Willey Publication.*
- *Organic Spectroscopy by William Kemp, Pelgrave Publication.*
- *Introduction to Spectroscopy By Donald L. Pavia, 4th Edition, Brooks/Cole Publication.*
- *Instrumental Methods Of Chemical Analysis by G.R. Chatwal, S.K. Anand, Himalaya Publication House.*
- *Analytical Chemistry by Gary D. Christian,7th Edition, Willey.*

Pharmaceutical Chemistry :

1. IUPAC nomenclature, R and S nomenclature, E and Z isomerism, atropiisomerism, Conformations, Hybridization, aromaticity, Huckel's rule reaction mechanisms- Electrophilic, Nucleophilic, SN_1, SN_2, SNi, Elimination E_1 E_2 etc.

2. Ester hydrolysis, Aac1, Aac2 all eight mechanisms (Jerry march) Markovnikoves rule, Bredts rule, Stereoselectivity, stereospecificity, regioselectivity, chemoselectivity, chirality, stereochemistry, conformations, rearrangements, acids and bases.

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

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

5. Carbohydrates classification, osazone test, mutarotation, etc

6. Various Heterocycles, Heterocycle synthesis and name reactions involve in it.

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

8. Common name reactions like Aldol, Claisen, Perkin, Dickmann, Darzen Cannizarro's reaction, Prins reaction, Wolfkishner and Clemenson reduction.

References:

- *March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure, 6th Edition, Willey.*
- *Organic Chemistry by by Morrison Boyd & Bhattacharjee, 7th Edition, Pearson.*
- *Organic Chemistry. Vol. 1/ 2 by I.L. Finar., 3rd Edition, Longmans Green & Co. Publication.*

Pharmaceutics and Formulation:

1. Drug delivery systems (DDS): NDDS models, osmotic pumps, various release patterns e g. Controlled release, delayed release, sustained release etc., and order of release. Carriers in DDS: polymers and their classification, types, carbohydrates, surfactants, proteins, lipids, prodrugs etc. Oral controlled DDS, factors affecting controlled release. Transdermal drug delivery systems (TDDS): principles, absorption, enhancers, and evaluation of TDDS.

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

3. Drug targeting: microspheres, nanoparticles, liposomes, monoclonal antibodies, etc. and some idea on polymers used in this field.

4. Preformulation study and application.

5. Complexation, solubilization, polymerization, viscosity measurements.

6. Dosage form development- stages, implications of dosage form.

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

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

9. Packaging: materials, labeling etc. Types of containers (eg. Tamper-proof containers)

10. In process controls, Product specification, documentation.

11. Compartmental modeling,Bioavailability, bioequivalence studies, Methods of improvement of oral bioavailability.

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

References:

- *Remington: The Science and Practice of Pharmacy (Remington the Science and Practice of Pharmacy), 21st Edition, Lippincott Williams & Wilkins (LWW).*
- *The Theory and Practice of Industrial Pharmacy by Lachman/Liebermans, 4th Edition, CBS Publishers.*
- *Physical Pharmacy: Physical Chemical Principles in the Pharmaceutical Sciences by Alfred N. Martin. Lippincott Williams & Wilkins.*
- *Biopharmaceutics and Pharmacokinetics by By Brahmankar DM Jaiswal SB, Vallabh Prakashan.*
- *Modern Pharmaceutics by Gilbert S. Banker, Juergen Siepmann, Christopher Rhodes, 4th Edition, CRC Press.*

Thrust areas of NIPER:

1. Microbial and viral diseases: Tuberculosis, Yeast and Fungi.

2. Parasitic and tropical diseases: Malaria, Leishmaniasis, Amoebiasis.

3. Metabolic Disorders: Diabetes.

4. Strokes, Peptide and carbohydrate chemistry.

5. Genomics and proteomics: Yeast.

6. Fungi, Hormonal disorders: TRH related.