

## **NIPER JEE Syllabus (NOT official)**

National Institute of Pharmaceutical Education and Research (NIPER) has been created as a center of excellence for higher training, research and development in pharmaceutical sciences and technology and its first institute of this kind in the country. The institute has been declared as an institute of national importance by Government of India and established by an act of Parliament.

For general information go to NIPER web site [www.niper.nic.in](http://www.niper.nic.in)

The institute offers the students various courses viz. M. Pharm, M. Tech. (Pharm), M.S. (Pharm.) and Ph.D. Programmes in various departments every year.

First bring good RANK in entrance.

Specialization branch you can select at time of counseling.....

Departments in the institute:-

- Medicinal chemistry
- Natural products
- Pharmacology and toxicology
- Pharmaceutics
- Pharmaceutical analysis
- Pharmaceutical technology (Bulk drugs) (chemistry)
- Pharmaceutical technology (Formulation) (Pharmaceutics)
- Pharmaceutical technology Biotechnology (PTBT)
- Biotechnology
- Pharmacy Practice
- Pharmacoinformatics
- M. B. A. (Pharm)
- M. Pharm. in Clinical Research
- M. S. (Pharm.) Toxicology.

Dear fellows

To live with success is to have healthier intellect. NIPER is one of the targets to achieve success. We are sure you all have a very good perception of the importance of NIPER and we are proud of being here in NIPER. We have not seen many institutes but of the much we have seen and the much we have heard, NIPER is amongst the best. We are sure most of you would be aspiring of being in NIPER. And those who are sure of their capability and

competence should prove their metal here. Those who are determined find their way at their own but if footprints are there, probability of success are higher. So this is the small attempt to help those aspiring for a career in pharmaceutical research in NIPER. We have compiled sets of certain points for each subject. These are just grids for the study and are helpful for the entrance exam. You need not to be thorough of it but if not thoroughly, at least you should be aware of it. None of it should be something heard first. By the way most of these are covered in B. Pharm syllabus. In general, our experience is that one should revise the GATE preparation. Most of the questions in the entrance paper are quite easy. But be sure you are well prepared for it.

**Entrance pattern:**

- Well entrance consists of 200 questions in 2 hours. (Please check it in Brochure).
- 200 mark paper
- 120 min. time
- objective type paper (MCQ- multiple choice questions only)
- Negative marking (0.25)/Q

Well questions will be very easy so no need to go in depth of the topic. Basic concepts based questions are asked. M. Pharma branches and M.B.A. has a common entrance paper. So read some general knowledge aspects also.....

This syllabus is just like GATE entrance but more specific in Basic Chemistry instead of medicinal chemistry.

## What to study?

### 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
- 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:**
  - Jerry March (Stereochemistry with special attention )
  - Morrison and Boyd (Do the Whole Book, ESPECIALLY Peptide and Carbohydrate chemistry)
  - I. L. Finar Vol-I and Vol-II (Heterocyclic chemistry and organic synthesis)

## **Spectral analysis (Most imp part)**

### **UV & visible spectroscopy :**

- Basic principle, characteristic regions of spectrum, energy levels & selection rules,
- woodward – fieser , fieser-kuhn & nelson rule. Influence of substituent, ring size & strain on spectral characteristics, solvent effect, non-conjugated interaction ,spectral correlation with structure , UV- values . (ref. Pavia )

### **Infrared spectroscopy:-**

- Characteristic regions of spectrum, influence of substituents, ring size, hydrogen bond, vibrational coupling & field effect on frequency . Spectral interpretation, IR value. (ref. Pavia)
- Nuclear magnetic resonance spectrum:-
- Magnetic nuclei, chemical shift & shielding, relaxation, processes, chemical & magnetic non equivalence, local diamagnetic shielding, magnetic anisotropy, spin –
- Spin splitting, pascal triangle, coupling constant. (ref. Pavia )
- 4. Mass Spectroscopy - Fragmentation Pattern and fragments formed. (ref. Pavia or Silverstein)

### **Chromatography:-**

Details of every chromatographic method.

#### 1. chromatography :

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

Types:

- Column chromatography .
  - Flash chromatography .
  - Vacuum liquid chromatography .
  - Hplc
  - Tlc, hptlc, oplc (over pressure layer chromatography )
  - Centrifugal chromatography .
  - Counter – current chromatography .
  - Droplet – counter current chromatography .
  - Ion exchange , affinity , size exclusion & ion pair chromatography, perfusion , fast protein liquid chromatography, supercritical chromatography.
  - Gc, GC-MS, LC- MS .
2. Thermal techniques : DSC, DTA, TGA .ORD , CD .
3. Electrophoresis : capillary, gel .
4. other : crystallography , spectrofluorimetry (ref-trease& e'van / A .chatwal )

## **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 (Parenterals)
4. Banker series.
5. other: Bramhankar(Dissolution chapter), , 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

### **Pharmacy Practice:-**

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). Specially which software is used for what purpose? (QSAR chapter from Bothra)

#### **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.
- TUBERCULOSIS

### **Biostatistics:- (No need to stress)**

#### 1. Introduction

data collection, organization, central tendency dispersion , sampling techniques , sample size, coefficient of variation , mean error, relative error, precision , accuracy .

2. Probability definition , normal, binominal polynominal distribution ,fiducial limits , profit & loss analysis.

3. Regression linear, multiple regression ,correlation concept . parametric / non parametric test :chi-square , sign , wilcoxon sign rank, goodness of fit. mann-whitney test .

4. Experimental design factorial design, Latin square design ,crossover & parallel design

### **General study**

1. English L- synonyms, antonyms, phrases etc. (No need to study. Are very easy)

2. I.Q. Test- problem fig, numerical etc. (No need to study. Just apply logic)

3. General Knowledge – Read current affairs in Pharma

### **NUTSHELL**

Do whole books – Morrison and Boyd, Rang and Dale, PAVIA.

Do – QSAR chapter from Bothra, Stereochemistry from Jerry March and CSIR lab and their location (which I have mentioned in the following page)

GATE material is very important.

Reading this much will surely take you into top 50. And to reach the top 10, do all the things mentioned above thoroughly.