NIPER JEE Syllabus

(There is NO OFFICIAL syllabus provided for NIPER-JEE exam, but things outside this are rarely asked)

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. What is difference between natural products and pharmacognosy?

9. Some knowledge about types and preparation of ayurvedic formulations like asava, arista etc.

10. 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
For spectroscopy: Silverstein, Pavia, Kemp
For stereochemistry: I.L. Finar Vol-II

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 and Dale
F. S. K. Barar
K.D. Tripathi (for tables)
Lippincott's review by Pamela Champe and Ian Harvey
Wilson and Griswold (for Mechanism)
Kasture (for Bioassay and Screening)
Foye's Medicinal Chemistry.
Roger Walker for some Adverse Drug Reactions and some tables

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:
Roger Walker for some Adverse Drug Reactions and some tables
Remington's Pharmaceutical Sciences.

Pharmacoinformatics:

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

2. Specially, which software is used for what purpose?

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

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:
Vyas and Dixit
IP Appendices
U. Satyanarayana
See some intro chapters from Tortora and Industrial Microbiology also.
Kokare is best.

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. Electrophoresis: capillary electrophoresis.

6. Chromatography- detailed.

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

8. Preformulation, cyclodextrin inclusion compounds

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

10. Crystallinity, polymorphism, solvates and hydrates, crystal habits, porosity, surface area flow properties. Dosage forms, Stages of dosage form development

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

Spectral analysis:

a) 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)
b) 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)
c) 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)
d) Mass Spectroscopy: Fragmentation pattern, and fragments formed. (ref. Pavia or Silverstein)

Details of every chromatographic method:

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

Types:

a) Column chromatography.
b) Flash chromatography.
c) Vaccum 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.

Knowledge of:

DSC, DTA, TGA, ORD, CD, Capillary and Gel Electrophoreses, Crystallography, and Spectrofluorimetry.

References:
Willard
Silverstein (Spectroscopy)
Kemp (IR)
Pavia (for spectroscopy)
Others like Alfred Martin, Chatwal (UV, IR), Garry Christen (Chemical Methods).

Medicinal chemistry and Bulk Drugs (Pharmaceutical Technology):

1. IUPAC nomenclature, R and S nomenclature, E and Z isomerism, atropiisomerism, Conformations, Hybridization, aromaticity, Huckel's rule reaction mechanisms- Electrophilic, Nucleophilic, SN1, SN2, SNi, Elimination E1 E2 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. Introduction to thermal methods of analysis like, TGA, DSC, DTA etc.

6. Carbohydrates classification, osazone test, mutarotation, etc

7. Various Heterocycles, Heterocycle synthesis, reactions.

8. Introduction to Redox reactions.

9. 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

10. Chromatography: Details of every chromatographic method.

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

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

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

References:

Jerry March
Morrison and Boyd (Especially Peptide and Carbohydrate chemistry)
I. L. Finar Vol-I and Vol-II (Heterocyclic chemistry and organic synthesis)
Eliel

Pharmaceutics and Formulation:

1. Drug delivery systems (DDS): NDDS models, osmotic pumps, various release patterns eg. 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 detailed.

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. Coating- in detail.

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

11. In process controls, Product specification, documentation.

12. Compartmental modeling.

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

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

References:

1. Remington's Pharmaceutical Sciences
2. Lachmann,
3. Alfred Martin,
4. Notes of Gudsurkar Sir (Most important)
5. Banker series.
6. Others: Bramhankar, Liberman Series

Pharmaceutics further reading:

1. Lachman– Milling, mixing, emulsion, suspension, parentrals, liquids, compression and consolidation, aerosols, basic understanding of suspension emulsion, sterilization, kinetics, regulatory, tablets, capsules, coating, suppositories, semisolids. Tables that we have mentioned earlier are very important (all tables of lachman), microencapsulation.

2. Martin – martin is preferred over subramanyam. But you can do one thing, see both books and that not given in subramanyam you can see from martin. Moreover chapter 1 and last two chapters are very important. (e:g question was asked how many H-bonds water can make, who invented polymorphism, no of polymorphs of particular drug , xerogels are, solubility of b-cyclodextrin).

3. Brahmankar- best book you can prefer to read do only general things (e:g which peptide is absorbed from GIT, unit of AUC). NDDS chapter very imp (use NK Jain also for NDDS), compartment modelling like wegner nelson all units etc

4. R. M Mehta – do general things like calculations, posology, weights and measures and latin names and read small things from dosage forms (not details – e:g dentrifice in tooth paste is?)

5. Cosmetics – Whatever we have provided to u is enough (postal subscribers). Others use BM Mitthal only general concepts)

6. Regulatory - NDA, ANDA, commercial NDA, emergency NDA, supplemenatary NDA. DMF, IPEC, Market authorization, specifications, SUPAC guidelines, BCS guidelines, etc.

7. Solid state- what is amorphous, crystalline, mesophase, unit cells, their characterization techniques, Polymers (from MARTIN)

8. Particle size, particle shape, porosity, surface area. Bulk level –bulk density compressibility, flow properties, cohessivity, aggregation, agglomeration.

9. Dosage form design parameter: a) physicochemical aspect- pka, partition coefficient solubility, b) dissolution – theories of dissolution, conventional release, controlled released mechanism, dissolution equipments, invitro-invivo correlation c) disintegration concept. d) biological aspect- impact of parameter on drug absorption ,routes of administration, first pass metabolism . conc.-time profile , fluid compartment ,protein binding concept , drug disposition, drug clearance, absortion rate constant concept : lag – time ,flip-flop model , wagner–nelson model ,loo-reigelman method. Drug distribution, nonlinear pharmacokinetics, chronopharmacokinetics concept, pharmacokinetice in – child, elderly, pregenancy.

Thrust areas of NIPER:
Microbial and viral diseases: Tuberculosis, 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.