

JIS UNIVERSITY

81, Nilgunj Rd, Agarpara, Kolkata, West Bengal 700109
DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

BROAD RESEARCH AREAS

Pharmaceutics:

- New Drug Delivery Systems
- BA/BE Studies
- Nanotechnology Based Formulation Development
- Thermodynamic Approach to Drug-Excipient Interactions
- Exploration of Natural Gum as Pharmaceutical Adjuvants
- Standardization of Ayurvedic Drug/Polyherbal Formulations

Pharmaceutical Chemistry:

- In silico design, synthesis (conventional, microwave, development of combinatorial solution phase synthetic techniques) and evaluation of novel candidate compounds with special reference to heterocyclic moieties and small peptides in the field of antimicrobial, antiprotozoal, antiviral, anti HIV, anticancer, analgesic, antihistaminic, anticonvulsant, cardiovascular, antidiabetic and other activities.
- Natural products-chemistry/pharmacology/structure standardization/ using spectroscopic methods (UV-VIS/IR/NMR/MS etc.)
- Studies on synthetic nutraceuticals
- Molecular modeling, docking, QSAR and solution phase ADME studies using CADD based software like Sybyl 7.1, Glide, Flex X and Scigress Explorer.

Pharmacology:

- Anti tumor & immunomodulatory studies of compounds from synthetic and natural sources.
- General pharmacological screening of new moieties from synthetic and natural sources.
- Toxicological studies of bioactive molecules (natural and synthetic sources)
- Neuropharmacological studies of bioactive molecules
- Studies of bioactive molecules on experimentally induced urolithiasis, nephropathy, neuropathy and diabetes in animal models.
- Biochemical; and Molecular Pharmacological studies of bioactive molecules.

Pharmacognosy:

- Validation of traditional systems of medicine
- Validated methodologies for development of new herbal formulations.
- Microcomputerized identification of indigenous drugs & development of standards
- Development of Drug molecules from natural sources and their enhancement by biotechnological approaches.
- Exploring natural resources for novel drug delivery systems.

JIS UNIVERSITY

81, Nilgunj Rd, Agarpara, Kolkata, West Bengal 700109
DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

SYLLABUS FOR PH. D. ENTRANCE EXAMINATION

PART 1: RESEARCH METHODOLOGY

1. **Introduction to research:** Meaning, objective, motivation and types of research. Research and scientific method.
2. **Research problem:** Selection, Necessity and technique of defining the problem.
3. **Research Design:** Meaning and need for research design. Basic principles of research design.
4. **Sampling Design:** Criteria and characteristic of good sample design. Random sample design.
5. **Method of data collection:** Collection and observation. Different method of data collection.
6. **Processing and analysis of data:** Problem in data processing. Statistics in research.
7. **Testing of Hypothesis:** Basic concept and procedure for hypothesis testing.
8. **Analysis of variance and covariance:** What is ANOVA, Basic principle of ANOVA, ANOVA Technique, Coding method, Two way ANOVA. ANOVA in latin-square design, Analysis of Co-variance.
9. **Interpretation and Report Writing:** Meaning, Why, Technique, Precaution of interpretation. Significance of report writing, step involve in report writing, layout of research report.
10. **The computer and its role in research.**

PART 2: PHARMACEUTICAL TECHNOLOGY

1. General Principles involved in Organic Chemistry, Classification and Nomenclature of Organic Compounds, Aromaticity, Heterocyclic chemistry, General Chemistry of carbohydrates, Fats & Proteins. Stereoisomersim. Reaction mechanism and named reactions.
2. Different classes of therapeutic agents – Antiamoebic, Anthelmintic, Antibacterial sulpha drugs, Antimycobacterial, Antifungal and Antiviral. Thyroid & anti thyroid drugs. Antiallergic agents. Antiulcer agents & Proton Pump Inhibitors. Hypoglycemic agents. Antimalerials. Sedative-hypnotics. Antiepileptic agents. Neuroleptics. Anti-anxiety drugs. Diuretics. Antibiotics. Steroids. Anticancer agents. Narcotic analgesics, NSAIDS. Adrenergic drugs. Neurotransmitters. Cholinergic agents. Neuronal blockers. Drugs used in neuromuscular disorders. Drugs used in the treatment of Parkinson's

JIS UNIVERSITY

81, Nilgunj Rd, Agarpara, Kolkata, West Bengal 700109

DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

- disease. Central & peripheral muscle relaxants. Antihypertensive & antianginal agents. Eicosanoids. Prostaglandins, prostacyclins, & thromboxanes.
3. Introduction to quantitative structure activity relationship. [QSAR]. LFER. Hammett's equation. Use of substituent constants such as π , σ , E_s , & physicochemical parameters such as pK_a , partition coefficient, R_m , chemical shifts, molar refractivity, simple & valance molecular connectivity to indicate electronic effects, lipophilic effects, & steric effects. Hansch analysis. Basic concepts of drug design with reference to physicochemical parameters related to ligand and receptor design.
 4. Combinatorial chemistry. Introduction & basic terminology. Databases & libraries. Solid phase synthesis technique. Types of supports & linkers, Manual parallel & automated parallel synthesis. Houghton's tea bag method, micromanipulation, recursive deconvolution. Mix & split method for the synthesis of tripeptides. Limitations of combinatorial synthesis. High Throughput Screening.
 5. Spectroscopy of Organic Compounds, Structural Analysis. Theory and instrumentation, of the following: UV, IR, NMR and Mass Spectrometry, HPLC, HPTLC, GC and hyphenated techniques (LC-MS), TGA, DTA, DSC and XRD. Basic Principles of chromatography and separation.
 6. Biochemistry of carbohydrates, Proteins, Lipids, Vitamins. Enzymes and Nucleic acids. Fermentation Technology, Recombinant Technology. Genomics and proteomics.
 7. Microscopy and staining procedures. Sterilization and aseptic techniques. Immunology, Vaccines
 8. Organization of screening for the pharmacological activity of new substances with emphasis on evaluation using in-vivo, in-vitro, ex-vivo, in-situ, in silico toxicity evaluation and other possible animal alternative models.
 9. General Pharmacology, Pharmacology of Central and Peripheral Nervous System. Autacoids, Immunopharmacology, Principles of toxicology. Chemotherapy.
 10. Factors affecting quality of crude drugs. Standardization of herbal medicines. Adulterations and evaluation of crude drugs. Extraction and Isolation techniques. Herbal Cosmetics. Traditional herbal drugs.
 11. Fundamentals involved in Physical, Chemical and Biological evaluation of crude drugs. Monograph preparation of herbal drugs and standard tests involved thereof.

JIS UNIVERSITY

81, Nilgunj Rd, Agarpara, Kolkata, West Bengal 700109

DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

12. Approaches for enhancement of production of secondary metabolites using techniques like tissue culture, r-DNA technology and biotransformation. (b) Biological sources, method of preparation, active constituents, adulterants of antidiabetic, Anti-inflammatory, antiasthmatic, antibacterial and anticancer drugs.
13. Preformulation (Physical, Chemical and Biopharmaceutical Characteristics of Medicinal Agent). (b) Stability Testing and Dating. (c) Diffusion and Dissolution.
14. Product Development Approaches for the Conventional Dosage Form (Tablet, Capsule, Sustained Release Formulation, Injectables, and Ointment).
15. Fundamentals, Basic Concepts and Approaches involved in Newer Drug Delivery Systems.
16. Biopharmaceutics: Biopharmaceutical Consideration in drug Design (Factors influencing Dosage Form Design, Drug Dissolution & Bioavailability. Rate-limiting steps in Bioavailability). Bioavailability and Bioequivalence Studies.
17. Pharmacokinetics: Principle, Basic concept and Characteristics of Compartment Models. Nonlinear (Dose dependent) Pharmacokinetics.
18. Micromeritics and Powder rheology, Viscosity & rheology, dispersion system, Solubility studies

PhD COURSE WORK SYLLABUS

(COMMON PAPER 1)

RESEARCH METHODOLOGY

1. **Introduction to research:** Meaning, objective, motivation and types of research. Research and scientific method.
2. **Research problem:** Selection, Necessity and technique of defining the problem.
3. **Research Design:** Meaning and need for research design. Basic principles of research design.
4. **Sampling Design:** Criteria and characteristic of good sample design. Random sample design.
5. **Method of data collection:** Collection and observation. Different method of data collection.
6. **Processing and analysis of data:** Problem in data processing. Statistics in research.
7. **Testing of Hypothesis:** Basic concept and procedure for hypothesis testing.
8. **Analysis of variance and covariance:** What is ANOVA, Basic principle of ANOVA, ANOVA Technique, Coding method, Two way ANOVA. ANOVA in latin-square design, Analysis of Co-variance.
9. **Interpretation and Report Writing:** Meaning, Why, Technique, Precaution of interpretation. Significance of report writing, step involve in report writing, layout of research report.
10. **The computer and its role in research.**

(COMMON PAPER 2)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

1.
 - a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy.
 - b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.
 - c. Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analyzed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.
 - d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.
2. NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy.
3. Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, isotopic peaks and Applications of Mass spectroscopy.
4. Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:
 - a) Thin Layer chromatography

JIS UNIVERSITY

81, Nilgunj Rd, Agarpara, Kolkata, West Bengal 700109

DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

- b) High Performance Thin Layer Chromatography
 - c) Ion exchange chromatography
 - d) Column chromatography
 - e) Gas chromatography
 - f) High Performance Liquid chromatography
 - g) Ultra High Performance Liquid chromatography
 - h) Affinity chromatography
 - i) Gel Chromatography
- 5.
- a) Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:
 - a. Paper electrophoresis
 - b. Gel electrophoresis
 - c. Capillary electrophoresis
 - d. Zone electrophoresis
 - e. Moving boundary electrophoresis
 - f. Iso electric focusing
 - b) X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.
- 6.
- a) Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.
 - b) Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications.
Differential Thermal Analysis (DTA): Principle, instrumentation and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA).
TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

(SUBJECT SPECIFIC PAPER 3)

Pharmaceutics:

- New Drug Delivery Systems
- BA/BE Studies
- Nanotechnology Based Formulation Development
- Thermodynamic Approach to Drug-Excipient Interactions
- Exploration of Natural Gum as Pharmaceutical Adjuvants
- Standardization of Ayurvedic Drug/Polyherbal Formulations

(SUBJECT SPECIFIC PAPER 3)

Pharmaceutical Chemistry:

- In silico design, synthesis (conventional, microwave, development of combinatorial solution phase synthetic techniques) and evaluation of novel candidate compounds with special reference to heterocyclic moieties and small peptides in the field of antimicrobial, antiprotozoal, antiviral, anti HIV, anticancer, analgesic, antihistaminic, anticonvulsant, cardiovascular, antidiabetic and other activities.
- Natural products-chemistry/pharmacology/structure standardization/ using spectroscopic methods (UV-VIS/IR/NMR/MS etc.)
- Studies on synthetic nutraceuticals
- Molecular modeling, docking, QSAR and solution phase ADME studies using CADD based software.

JIS UNIVERSITY
81, Nilgunj Rd, Agarpara, Kolkata, West Bengal 700109
DEPARTMENT OF PHARMACEUTICAL TECHNOLOGY

(SUBJECT SPECIFIC PAPER 3)

Pharmacology:

- Anti tumor & immunomodulatory studies of compounds from synthetic and natural sources.
- General pharmacological screening of new moieties from synthetic and natural sources.
- Toxicological studies of bioactive molecules (natural and synthetic sources)
- Neuropharmacological studies of bioactive molecules
- Studies of bioactive molecules on experimentally induced urolithiasis, nephropathy, neuropathy and diabetes in animal models.
- Biochemical; and Molecular Pharmacological studies of bioactive molecules.

(SUBJECT SPECIFIC PAPER 3)

Pharmacognosy:

- Validation of traditional systems of medicine
- Validated methodologies for development of new herbal formulations.
- Microcomputerized identification of indigenous drugs & development of standards
- Development of Drug molecules from natural sources and their enhancement by biotechnological approaches.
- Exploring natural resources for novel drug delivery systems.