Admission Brochure for Ph.D. Admission Test: 2018

Programmes Offered

Applications are invited for admission to Ph.D. programme at **JIS University** under 'Full Time' and 'Part Time' schemes in the following Departments during the Autumn Semester 2017-18

Departments	**At JIS University**	
	Full Time	Part Time
Oral and Dental Sciences	Yes	Yes
Biological Sciences	Yes	Yes
Chemistry	Yes	No
Physics	Yes	Yes
Law	Yes	Yes
Pharmaceutical Technology,	Yes	Yes
Business Management	Yes	Yes

Yes- A department does intend to admit student under specific scheme

No/NA- A department does not intend to admit student under specific scheme

Eligibility Criteria for Admissions

Any Higher Degrees such as M.E./M.Pharm./MBA/M.Phil./M.Sc./MDS/LLM or its equivalent with a minimum of 55% aggregate marks in the qualifying examination are generally eligible. Candidates with a M.Sc./B.E./B.Pharm. or an equivalent degree with a minimum of 55% aggregate may also be considered for Ph.D. admission subject to their suitability and competence. Shortlisted candidates will be called for a written test/interview for selections as per UGC guidelines.

Full time students: Candidates are required to devote their full time towards Ph.D. research. Short listed candidates will be required to come to JIS University campus for test and/or interview. The seats under the full time schemes are limited and so preference will be given to candidates working in ongoing sponsored projects in the University, and the CSIR-UGC-NET/UGC-NET/SET/ICMR, NET/ICAR, NET/DBT, NET/GATE etc. qualified candidates.

Part time students: Candidates working in organizations situated in close vicinity of campus of JIS University will be admitted under this scheme.

Some Important Dates

1	Last date for submission of completed application form in the University	August 16, 2018
2	Declaration of shortlisted candidates (through JIS University website) for test/interview.	August 23, 2018
3	Admission Test	August 27, 2018
4	Interview	August 29, 2018
5	Announcement of admission offers to Ph.D. Programmes (through JIS University website).	September 03, 2018
6	Last date of admission of selected students	September 17, 2018

TEST

- **Based on the test result & academic performance, the candidates will be shortlisted and called for Interview.**
- **All notices/shortlisting will be put on admission website of www.jisuniversity.ac.in**
- **Candidates are advised to check this website regularly. No written communication will be sent to the candidates.**

FEES

- **Application Fee of Rs. 2000/** in the form of bank draft in favor of JIS University payable at Kolkata should be paid along with the application.

Syllabus for Test

CHEMISTRY

INORGANIC CHEMISTRY

Atomic structure, Chemical bonding, Transition & Inner Transition elements and coordination compounds: structure, bonding theories, spectral and magnetic properties, reaction mechanisms, Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics in homogeneous catalysis. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transfer reactions; nitrogen fixation, metal complexes in medicine. Characterization of inorganic compounds by spectroscopic and microscopic techniques.

PHYSICAL CHEMISTRY

Thermodynamics: First, second and third law of thermodynamics, concept of partial molar quantities. Thermodynamic probability and entropy, distribution laws: Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac, concept of partition function: rotational, translational, vibrational and electronic partition functions of diatomic molecule, Gibb's paradox. Chemical kinetics: Empirical rate laws and temperature dependence; complex reactions; steady state approximation; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; catalysis; unimolecular and bimolecular surface reaction. Electrochemistry: Nernst equation, redox systems, electrochemical cells; Debye-Huckel theory; electrolytic conductance, Kohlrausch's law and its applications; conductometric and potentiometric titrations. Quantum mechanics: Postulates; operator algebra; exactly-solvable systems: particle-in-a-box, harmonic oscillator and the hydrogen atom, tunneling. Approximate methods of quantum mechanics: Variational principle; perturbation theory up to second order in energy; applications. Chemical bonding in diatomics; elementary concepts of MO and VB theories; Huckel theory for conjugated π-electron systems. Group theory: symmetry elements; point groups; character tables; selection rules. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities–selection rules; basic principles of NMR. Polymer chemistry: Molar masses; kinetics of polymerization, Controlled polymerization techniques.

ORGANIC CHEMISTRY

Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereogenicity, stereoselectivity, enantioselectivity, diastereoselectivity and asymmetric induction. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions. Common named reactions and rearrangements. Organic transformations and reagents: Functional groups inter conversion including oxidations and reductions; common catalysts and reagents, Chemo, regio and stereoselective transformations. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups. Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction, determination of enantiomeric and diastereomeric excess; enantio-discrimination. Pericyclic reactions: electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry. Synthesis and reactivity of common heterocyclic compounds, structure determination of organic compounds by IR, UV-Vis, ^{1}H & ^{13}C NMR and Mass spectroscopic techniques.

BIOLOGICAL SCIENCES

UNIT I - CELLULAR ORGANIZATION

A) Membrane structure and function

(Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport,electrical properties of membranes).

B) Structural organization and function of intracellular organelles (Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility).

C) Organization of genes and chromosomes (Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons).

D) Cell division and cell cycle (Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle).

E) Microbial Physiology (Growth yield and characteristics, strategies of cell division, stress response)

UNIT II - FUNDAMENTAL PROCESSES

A) DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination).

B) RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of

different types of RNA, RNA transport).

C) Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proof-reading, translational inhibitors, Post- translational modification of proteins).

D) Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

UNIT III - Cell communication and cell signaling

A) Host parasite interaction Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

B) Cell signaling Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant twocomponent systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

C) Cellular communication Regulation of hematopoiesis, general principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation.

D) Cancer Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

E) Innate and adaptive immune system Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cellmediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell-mediated effector functions,= inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies, vaccines.

UNIT IV - INHERITANCE BIOLOGY

A) Mendelian principles : Dominance, segregation, independent assortment.

B) Concept of gene : Allele, multiple alleles, pseudoallele, complementation tests

C) Extensions of Mendelian principles : Codominance, incomplete dominance, gene interactions,

pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters.

D) Gene mapping methods : Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

E) Extra chromosomal inheritance : Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

F) Microbial genetics : Methods of genetic transfers – transformation, conjugation, transduction and sex-duction, mapping genes by interrupted mating, fine structure analysis of genes.

G) Human genetics : Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

H) Quantitative genetics : Polygenic inheritance, heritability and its measurements, QTL mapping.

I) Mutation : Types, causes and detection, mutant types – lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.

J) Structural and numerical alterations of chromosomes : Deletion, duplication, inversion, translocation, ploidy and their genetic implications.

K) Recombination : Homologous and non-homologous recombination including transposition.

UNIT V - METHODS IN BIOLOGY

A. Molecular Biology and Recombinant DNA methods: Isolation and purification of RNA , DNA (genomic and plasmid) and proteins, different separation methods. Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors. Isolation of specific nucleic acid sequences. Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms. Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques. Isolation, separation and analysis of carbohydrate and lipid molecules RFLP, RAPD and AFLP techniques

B. Histochemical and Immunotechniques : Antibody generation, Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, fluocytometry and immunofluorescence microscopy, detection of molecules in living cells, in situ localization by techniques such as FISH and GISH.

C. Biophysical Method: Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy Molecular structure determination using X-ray diffraction and NMR, Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods.

D. Radiolabeling techniques: Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular

imaging of radioactive material, safety guidelines.

E. Microscopic techniques: Visulization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze fracture methods for EM, image processing methods in microscopy.

F. Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT.

PHYSICS

PART 'A' CORE

I. Mathematical Methods of Physics

Dimensional analysis. Vector algebra and vector calculus. Linear algebra, matrices, Cayley-Hamilton Theorem. Eigenvalues and eigenvectors. Linear ordinary differential equations of first & second order, Special functions (Hermite, Bessel, Laguerre and Legendre functions). Fourier series, Fourier and Laplace transforms. Elements of complex analysis, analytic functions; Taylor & Laurent series; poles, residues and evaluation of integrals. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

II. Classical Mechanics

Newton's laws. Dynamical systems, Phase space dynamics, stability analysis. Central force motions. Two body Collisions - scattering in laboratory and Centre of mass frames. Rigid body dynamics-moment of inertia tensor. Non-inertial frames and pseudoforces. Variational principle. Generalized coordinates. Lagrangian and Hamiltonian formalism and equations of motion. Conservation laws and cyclic coordinates. Periodic motion: small oscillations, normal modes. Special theory of relativity-Lorentz transformations, relativistic kinematics and mass–energy equivalence.

III. Electromagnetic Theory

Electrostatics: Gauss's law and its applications, Laplace and Poisson equations, boundary value problems. Magnetostatics: Biot-Savart law, Ampere's theorem. Electromagnetic induction. Maxwell's equations in free space and linear isotropic media; boundary conditions on the fields at interfaces. Scalar and vector potentials, gauge invariance. Electromagnetic waves in free space. Dielectrics and conductors. Reflection and refraction, polarization, Fresnel's law, interference, coherence, and diffraction. Dynamics of charged particles in static and uniform electromagnetic fields.

IV. Quantum Mechanics

Wave-particle duality. Schrödinger equation (time-dependent and time-independent). Eigenvalue problems (particle in a box, harmonic oscillator, etc.). Tunneling through a barrier. Wave-function in coordinate and momentum representations. Commutators and Heisenberg uncertainty principle. Dirac notation for state vectors. Motion in a central potential: orbital angular momentum, angular momentum algebra, spin, addition of angular momenta; Hydrogen atom. Stern-Gerlach experiment. Time-independent perturbation theory and applications. Variational method. Time dependent perturbation theory and Fermi's golden rule, selection rules. Identical particles, Pauli exclusion

principle, spin-statistics connection.

V. **Thermodynamic and Statistical Physics**

Laws of thermodynamics and their consequences. Thermodynamic potentials, Maxwell relations, chemical potential, phase equilibria. Phase space, micro- and macro-states. Micro-canonical, canonical
and grand-canonical ensembles and partition functions. Free energy and its connection with thermodynamic quantities. Classical and quantum statistics. Ideal Bose and Fermi gases. Principle of detailed balance. Blackbody radiation and Planck's distribution law.

VI. **Electronics and Experimental Methods**

Semiconductor devices (diodes, junctions, transistors, field effect devices, homo- and hetero-junction devices), device structure, device characteristics, frequency dependence and applications. Opto-electronic devices (solar cells, photo-detectors, LEDs). Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators and similar circuits). A/D and D/A converters. Microprocessor and microcontroller basics. Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors. Least squares fitting,

PART 'B' ADVANCED

I. **Mathematical Methods of Physics**

Green's function. Partial differential equations (Laplace, wave and heat equations in two and three dimensions). Elements of computational techniques: root of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, Solution of first order differential equation using Runge-Kutta method. Finite difference methods. Tensors. Introductory group theory: SU(2), O(3).

II. **Classical Mechanics**

Dynamical systems, Phase space dynamics, stability analysis. Poisson brackets and canonical transformations. Symmetry, invariance and Noether's theorem. Hamilton-Jacobi theory.

III. **Electromagnetic Theory**

Dispersion relations in plasma. Lorentz invariance of Maxwell's equation. Transmission lines and wave guides. Radiation- from moving charges and dipoles and retarded potentials.

IV. **Quantum Mechanics**

Spin-orbit coupling, fine structure. WKB approximation. Elementary theory of scattering: phase shifts,
partial waves, Born approximation. Relativistic quantum mechanics: Klein-Gordon and Dirac equations.
Semi-classical theory of radiation.

V. **Thermodynamic and Statistical Physics**

First- and second-order phase transitions. Diamagnetism, paramagnetism, and ferromagnetism. Ising model. Bose-Einstein condensation. Diffusion equation. Random walk and Brownian motion. Introduction to nonequilibrium processes.

VI. **Electronics and Experimental Methods**

Linear and nonlinear curve fitting, chi-square test. Transducers (temperature, pressure/vacuum,

magnetic fields, vibration, optical, and particle detectors). Measurement and control. Signal conditioning and recovery. Impedance matching, amplification (Op-amp based, instrumentation amp, feedback), filtering

and noise reduction, shielding and grounding. Fourier transforms, lock-in detector, box-car integrator, modulation techniques. High frequency devices (including generators and detectors).

VII. **Atomic & Molecular Physics**

Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects. Electron spin resonance. Nuclear magnetic resonance, chemical shift. Frank-Condon principle. Born-Oppenheimer approximation. Electronic, rotational, vibrational and Raman spectra of diatomic molecules, selection rules. Lasers: spontaneous and stimulated emission, Einstein A & B coefficients. Optical pumping, population inversion, rate equation. Modes of resonators and coherence length.

VIII. **Condensed Matter Physics**

Bravais lattices. Reciprocal lattice. Diffraction and the structure factor. Bonding of solids. Elastic properties, phonons, lattice specific heat. Free electron theory and electronic specific heat. Response and relaxation phenomena. Drude model of electrical and thermal conductivity. Hall effect and thermoelectric power. Electron motion in a periodic potential, band theory of solids: metals, insulators and semiconductors. Superconductivity: type-I and type-II superconductors. Josephson junctions. Superfluidity. Defects and dislocations. Ordered phases of matter: translational and orientational order, kinds of liquid crystalline order. Quasi crystals.

IX. **Nuclear and Particle Physics**

Basic nuclear properties: size, shape and charge distribution, spin and parity. Binding energy, semi-empirical mass formula, liquid drop model. Nature of the nuclear force, form of nucleon-nucleon potential, charge-independence and charge-symmetry of nuclear forces. Deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitations. Rotational spectra. Elementary ideas of alpha, beta and gamma decays and their selection rules. Fission and fusion. Nuclear reactions, reaction mechanism, compound nuclei and direct reactions.

Classification of fundamental forces. Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.). Gellmann-Nishijima formula. Quark model, baryons and mesons. C, P, and T invariance. Application of symmetry arguments to particle reactions. Parity non-conservation in weak interaction. Relativistic kinematics.

ORAL AND DENTAL SCIENCES

A) ORAL ANATOMY, HISTOLOGY, PHYSIOLOGY & BIOCHEMISTRY

1. Structure of the Oral Tissues
2. General Embryology
3. Embryology of the Head, Face and Oral Cavity
4. Head & Neck Anatomy
5. Cytoskeleton, Cell junctions, Fibroblasts, and Extracellular Matrix
6. Development of the Tooth and Its Supporting Tissues
7. Bone
8. Enamel: Composition, Formation, and Structure
9. Dentin-Pulp Complex

10. Periodontium
11. Physiologic Tooth Movement: Eruption and Shedding
12. Salivary Glands
13. Oral Mucosa
14. Temporomandibular Joint
15. Facial Growth and Development
16. Repair and Regeneration of Oral Tissues

B) SYLLABUS FOR DENTAL BIO MATERIALS

I) ***General Classes and Properties of Dental Materials***

1. Overview of Preventive and Restorative Materials
2. Structure of Matter and Principles of Adhesion
3. Physical and Chemical Properties of Solids
4. Mechanical Properties of Dental Materials
5. Structure and Properties of Cast Dental Alloys
6. Dental Polymers
7. Biocompatibility

II) ***Auxiliary Dental Materials***

8. Impression Materials
9. Gypsum Products
10. Dental Waxes, Casting Investments, and Casting Procedures
11. Materials and Processes for Cutting, Grinding, Finishing, and Polishing

III) ***Direct Restorative Materials***

12. Bonding and Bonding Agents
13. Resin-Based Composites
14. Dental Cements
15. Dental Amalgams

IV) ***Indirect Restorative Materials***

16. Dental Casting Alloys and Metal Joining
17. Wrought Metals
18. Dental Ceramics
19. Prosthetic Polymers and Resins
20. Dental Implants
21. Emerging Technologies

In addition, the respective MDS course to which the applicant belongs is also included.

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

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. Anabolic 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 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, Es, & physicochemical parameters such as pKa, partition coefficient, Rm, chemical shifts, molar refractivity, simple & valance molecular connectivity to indicate electronic effects, lipophillic 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, Vaccinces

8. Basic principles of cell injury and cell adaptation. Pathophysiology of common diseases.

9. 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.

10. General Pharmacology, Pharmacology of Central and Peripheral Nervous System. Autacoids, Immunopharmacology, Principles of toxicology. Chemotherapy.

11. 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.

12. Fundamentals involved in Physical, Chemical and Biological evaluation of crude drugs. Monograph preparation of herbal drugs and standard tests involved thereof.

13. 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.

14. Preformulation (Physical, Chemical and Biopharmaceutical Characteristics of Medicinal Agent). (b) Stability Testing and Dating. (c) Diffusion and Dissolution.

15. Product Development Approaches for the Conventional Dosage Form (Tablet, Capsule, Sustained Release Formulation, Injectables, and Ointment).

16. Fundamentals, Basic Concepts and Approaches involved in Newer Drug Delivery Systems.

17. Biopharmaceutics: Biopharmaceutical Consideration in drug Design (Factors influencing Dosage Form Design, Drug Dissolution & Bioavailability. Rate-limiting steps in Bioavailability). Bioavailability and Bioequivalence Studies.

18. Pharmacokinetics: Principle, Basic concept and Characteristics of Compartment Models. Nonlinear (Dose dependent) Pharmacokinetics.

19. Micromeretics and Powder rheology, Viscosity & rheology, dispersion system, Solubility studies.

20. General Principles involved in Organic Chemistry, Classification and Nomenclature of Organic Compounds, Aromaticity, Heterocyclic chemistry, General Chemistry of carbohydrates, Fats & Proteins. Stereoisomersim

21. 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. Anabolic 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 disease. Central & peripheral muscle relaxants. Antihypertensive & antianginal agents. Eicosanoids. Prostaglandins, prostacyclins, & thromboxanes.

22. Introduction to quantitative structure activity relationship. [QSAR]. LFER. Hammett's equation. Use of substituent constants such as π, σ, Es, & physicochemical parameters such as pKa, partition coefficient, Rm, chemical shifts, molar refractivity, simple & valance molecular connectivity to indicate electronic effects, lipophillic effects, & steric effects. Hansch analysis. Basic concepts of drug design with reference to physicochemical parameters related to ligand and receptor design.

23. 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.

24. 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.

25. Biochemistry of carbohydrates, Proteins, Lipids, Vitamins. Enzymes and Nucleic acids. Fermentation Technology, Recombinant Technology. Genomics and proteomics.

26. Microscopy and staining procedures. Sterilization and aseptic techniques. Immunology, Vaccinces

27. Basic principles of cell injury and cell adaptation. Pathophysiology of common diseases.

28. 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.

29. General Pharmacology, Pharmacology of Central and Peripheral Nervous System. Autacoids, Immunopharmacology, Principles of toxicology. Chemotherapy.

30. 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.

31. Fundamentals involved in Physical, Chemical and Biological evaluation of crude drugs. Monograph preparation of herbal drugs and standard tests involved thereof.

32. 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.

33. Preformulation (Physical, Chemical and Biopharmaceutical Characteristics of Medicinal Agent). (b) Stability Testing and Dating. (c) Diffusion and Dissolution.

34. Product Development Approaches for the Conventional Dosage Form (Tablet, Capsule, Sustained Release Formulation, Injectables, and Ointment).

35. Fundamentals, Basic Concepts and Approaches involved in Newer Drug Delivery Systems.

36. Biopharmaceutics: Biopharmaceutical Consideration in drug Design (Factors influencing Dosage Form Design, Drug Dissolution & Bioavailability. Rate-limiting steps in Bioavailability). Bioavailability and Bioequivalence Studies.

37. Pharmacokinetics: Principle, Basic concept and Characteristics of Compartment Models. Nonlinear (Dose dependent) Pharmacokinetics.

38. Micromeretics and Powder rheology, Viscosity & rheology, dispersion system, Solubility studies

SYLLABUS FOR Ph.D. ADMISSION TEST IN LAW

RESEARCH METHODS, LEGAL WRITING, RESEARCH METHODOLOGY

1. **RESEARCH TOOLS AND DATA PROCESSING**
2. a) Observation
3. b) Interview and schedule
4. c) Questionnaire
5. d) Socio-metrics and jurimetrics
6. e) Data processing (deductions and Inductions) analysis and interpretation of data
7. f) Online Legal Research – Use of Electronic Databases

1. **LEGAL WRITING**
2. a) Report/Article writing & legal research
3. b) Use of definitions, maxims, concepts, principles, doctrines in legal research
4. c) Plagiarism & its consequences.
5. d) Citation methodology
6. e) Book review and case comments

Indian Constitutional law: The new challenges

Module : Introduction to the Constitution and Constitutional Law

- Historical background to the Making of the Constitution of India
- Constituent Assembly and the Passing of the Constitution
- The Objectives Resolution and the Preamble to the Constitution of India
- Elucidating Key Concepts-
- ‘Sovereign Socialist Secular’
- ‘Democratic Republic’

- ‘Separation of Powers’
- ‘Rule of Law’
-

SUBJECT: HUMAN RIGHTS AND CRIMINAL JUSTICE
Module: Impact and implementation of international human rights norms in India

- Human rights norms reflected in fundamental rights in the Constitution
- Directive Principles: legislative and administrative implementation of international human rights norms
- Implementation of international human rights norms through judicial process

Enforcement of Human Rights in India

- Role of courts: the Supreme Court, High Courts and other courts
- Statutory commissions- human rights, women's, minority and backward class

SYLLABUS FOR COMPUTER SCIENCE AND ENGINEERING

Section1: Engineering Mathematics

Discrete Mathematics: Propositional and first order logic. Sets, relations, functions, partial orders and lattices. Groups. Graphs: connectivity, matching, coloring. Combinatorics: counting, recurrence relations, generating functions.

Linear Algebra: Matrices, determinants, system of linear equations, eigenvalues and eigenvectors, LU decomposition.

Calculus: Limits, continuity and differentiability. Maxima and minima. Mean value theorem. Integration.

Probability: Random variables. Uniform, normal, exponential, Poisson and binomial distributions. Mean, median, mode and standard deviation. Conditional probability and Bayes theorem.

Computer Science and Information Technology

Section 2: Digital Logic
Boolean algebra. Combinational and sequential circuits. Minimization. Number representations and computer arithmetic (fixed and floating point). Section 3: Computer Organization and Architecture Machine instructions and addressing modes. ALU, data- path and control unit. Instruction pipelining. Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode).
Section 4: Programming and Data Structures

Programming in C. Recursion. Arrays, stacks, queues, linked lists, trees, binary search trees, binary heaps, graphs.

Section 5: Algorithms

Searching, sorting, hashing. Asymptotic worst case time and space complexity. Algorithm design techniques: greedy, dynamic programming and divide- and- conquer. Graph search, minimum spanning trees, shortest paths.

Section 6: Theory of Computation

Regular expressions and finite automata. Context-free grammars and push-down automata. Regular and contex-free languages, pumping lemma. Turing machines and undecidability.

Section 7: Compiler Design

Lexical analysis, parsing, syntax-directed translation. Runtime environments. Intermediate code generation.

Section 8: Operating System

Processes, threads, inter- process communication, concurrency and synchronization.Deadlock. CPU scheduling. Memory management and virtual memory. File systems.

Section 9: Databases

ER- model. Relational model: relational algebra, tuple calculus, SQL. Integrity constraints, normal forms. File organization, indexing (e.g., B and B+ trees). Transactions and concurrency control.

Section 10: Computer Networks

Concept of layering. LAN technologies (Ethernet). Flow and error control techniques, switching. IPv4/IPv6, routers and routing algorithms (distance vector, link state). TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Basics of Wi-Fi. Network security: authentication, basics of public key and private key cryptography, digital signatures and certificates, firewalls.

Syllabus for PhD Admission in Business Administration

Part A – Basics of Management

Functions of managers in business organizations; Managerial skills and levels; Meaning Power and authority; Functions of human resource managers; Fundamentals of human resource management-recruitment, selection, training and appraisal; Functions of marketing managers.

Concepts and components of marketing mix; Functions of finance mangers; Indian financial systems; Basic accounting concepts; Balance sheet and its components; Globalization of business; Functions of operations managers; Statistical quality control techniques; Inventory costs and simple models; Elements of business environment.

Part B – Research Fundamentals and Aptitude

Basics of research ; Steps in research; Primary and secondary data;

Research and teaching aptitude; Research ethics; Overview of higher education

system in India.