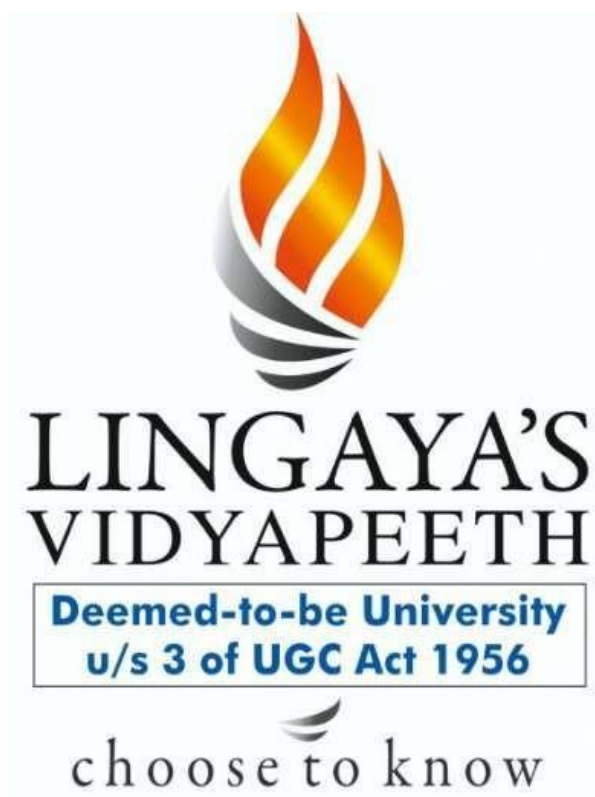


LINGAYA'S VIDYAPEETH

FARIDABAD



Ph.D. Admission

Entrance Examination Syllabus

January 2024

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RESEARCH METHODOLOGY: PAPER-I COMMON TO ALL CANDIDATES

1. RESEARCH METHODOLOGY: AN INTRODUCTION

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods Versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India

2. DEFINING THE RESEARCH PROBLEM

What is a Research Problem? Selecting The Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem

3. RESEARCH DESIGN

Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs

4. PUBLICATIONS, PLAGIARISM, INTELLECTUAL PROPERTY RIGHTS

Quality of research work and papers –indexing, impact factor, H Index, citation index Meaning and principles of plagiarism, methods of plagiarism check, plagiarism checking software, Principles of intellectual property rights, patents, copyrights, trademarks and their importance.

5. INTERPRETATION AND REPORT WRITING

Meaning of Interpretation, Why Interpretation? Technique of Interpretation, Precautions in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports

REFERENCE BOOK:

Research Methodology-Methods and Techniques, Kothari CR, New Age International, 2nd ed. / 2004.

SCHOOL OF ENGINEERING & TECHNOLOGY

COMPUTER SCIENCE & ENGINEERING: PAPER-II

1. COMPUTER ARCHITECTURE & ORGANIZATION

Combinational Circuit: adder, subtractor, decoder, MUX etc. Sequential Circuit: Flip-flops, Registers, Counters, Machine Instructions and Addressing Modes, ALU & Data path, Memory interface, I/O Interface, Instruction pipeline, Cache, Main and secondary storage.

2. COMPUTER NETWORKS

ISO/OSI stack, LAN technologies, Flow and error control techniques, IPV4, IPV6, TCP/UDP, Routing algorithms, Congestion control, Application layer protocols, Basic concepts of Switches, Bridges, Gateway & Routers, Basic concepts of Network security: Public and private key cryptography, Firewall, Digital signature etc.

3. OPERATING SYSTEM

Process, Thread, Inter process Communication, CPU Scheduling, Concurrency control, synchronization, Deadlock, Memory management and Virtual Memory, File system, I/O System Protection and Security.

4. DATA STRUCTURES

Overview of Programming in C/C++, Recursion, Parameter Passing, Scope, Binding, Array, Stacks, Queues, Link list, Searching & Sorting Techniques, Lists and their Applications, Trees: Binary Tree, Properties & Representation, ADT Binary Tree, Binary search Trees, AVL Trees & Applications, Graphs: Representations & Properties, Directed and Undirected graphs, Graph search methods, Path finding Algorithms, Asymptotic notations, Greedy, Dynamic Approach, Branch and Bound techniques.

5. THEORY OF COMPUTATION AND COMPILER DESIGN

Regular Language and Finite Automata, Context free Grammar, Context sensitive Grammar, push down automata, Turing Machine, Undecidability, Lexical Analyzer, Parsing Syntax, Direct translation, Runtime environment, Immediate and Target code generation, Code optimization.

6. DATABASE MANAGEMENT SYSTEM

Basic concept, ER model, Relationship Model, Relational algebra, Tuple Calculus, Data Base design, Integrity constraint, Normal Forms, Query languages (SQL), File structure, Concurrency Control and Transactions.

7. SOFTWARE ENGINEERING AND WEB DEVELOPMENT

Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, planning and managing the project, design, coding testing, implementation, maintenance. HTML, XML, Scripting and Basic Concept of Client and server side programming.

8. PROBABILITY THEORY AND DISCRETE MATHEMATICS

Conditional Probability, Mean, Median, Mode and Standard Deviation, Exponential, Sets, Relations, Functions, Group, Partial Order, Boolean algebra, Propositional and Predicate Logic.

9. ADVANCE COMPUTING

Artificial intelligence, Heuristic and blind search, Knowledge base system, Fuzzy logic, fuzzy membership function, Neural network, ANN, Learning rules. Single layer and multilayer neural network, Back Propagation network, Genetic algorithm, Fundamentals, basic concepts, working principle, encoding and fitness function.

ELECTRONICS AND COMMUNICATION ENGINEERING: PAPER-II

1. BASIC ELECTRONICS

PN Junction diode, Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers, PN junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, PIN and avalanche photo diode, Basics of LASERS. Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor; FET amplifiers.

2. DIGITAL ELECTRONICS

Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR; Boolean algebra, Error detection and correction codes, Karnaugh map, Multiplexers and Demultiplexers, BCD arithmetic circuits, Encoders and Decoders, Flip Flops: S-R, J-K, T, D, master-slave, edge triggered; Switching mode operation of p-n junction, D/A and A/D converters.

3. MICROPROCESSOR

Introduction to microprocessor, 8085/8086 microprocessor: Architecture & Block Diagram; Instruction Set of 8085/8086 microprocessor: data transfer instructions, arithmetic instructions, branch instructions, looping instructions; The 8255 PPI Chip Architecture; The 8259 Programmable Interrupt Controller, The 8237 DMA controller.

4. DIGITAL SIGNAL PROCESSING

Discrete-Time Signals, Discrete-Time Systems, Sampling of Time Signals, Digital Filters, Multirate Digital Signal Processing, ADSP 2100, DSP processors, Applications of DSP in: Communications, speech processing, image processing, Biomedical and Radars

5. INDUSTRIAL DRIVES

Components of electrical drives; choice of electrical drive; dynamics of electrical drives; calculation of time and energy; loss in transient operations; steady state stability and load equalization. closed loop control phase-locked-loop (PLL) control; Thermal model of motor heating and cooling; classes of motor duty and motor rating. D.C. motors and induction motors etc. starting; braking and speed control of motors; quadrant drives; types of loads; torque and associated controls used in process industries; choice of motors and relays. Brushless DC motor, Stepper Motor, Switched Reluctance Motor

6. POWER SYSTEM

General layout & main components of thermal power station (in brief). Available hydropower; selection of site for hydroelectric power stations; their classifications; layout and main components (in brief). Nuclear power plants – fission energy; general layout and main components (in brief); waste disposal; types of nuclear reactors (in brief); general layout and main components (in brief); types of nuclear radiations & their effect.

7. TRANSMISSION SYSTEM

Calculations of resistance, inductance, capacitance of a single conductor, multi conductor, single phase and three phase transmission lines; transposition; double circuit lines; skin and proximity effect; Generalized ABCD constants; representation & steady state analysis of short and medium lines; regulation and efficiency; nominal-T and pi circuits; Long line: current – voltage relationship, hyperbolic solution; surge impedance; Surge impedance loading; lumped circuit equivalent representation; Ferranti effect; power flow through a transmission line; reactive power generation / absorption of a line; power transfer capability; shunt and series compensation (in brief). Improvement of powerfactor of the system using synchronous condensers.

MECHANICAL ENGINEERING: PAPER-II

(A) APPLIED MECHANICS AND DESIGN

1. ENGINEERING MECHANICS

Free body diagrams and equilibrium; kinematics and dynamics of particles and of rigid bodies in plane motion

2. MECHANICS OF SOLIDS

Stress and strain, force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; springs; thin walled sections; Euler's theory of columns; strain energy methods; thermal stresses; mechanical properties; material testing.

3. VIBRATIONS

Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance; critical speeds of shafts.

4. DESIGN

Design for static and dynamic loading; failure theories; principles of the design of machine elements such as shafts, spur gears, rolling and sliding contact bearings, brakes, clutches and various joints.

(B) PRODUCTION ENGINEERING

Unconventional Machining Processes, Computer controlled machines, CAD/CAM, CNC, Mechanics of Metal Cutting, Tool wear and Machinability, Economics of Metal cutting, Metal Forming, Casting Processes, Powder Metallurgy, Joining Processes, Finishing operations and super finishing processes, Measurement.

(C) THERMAL ENGINEERING

1. THERMODYNAMICS

Basic Laws of Thermodynamics, Availability, Irreversibility, Concept of Exergy, Thermodynamic cycles related to energy conversion.

2. I.C. ENGINES

Air Standard cycles, Normal and Abnormal Combustion in S.I. engines and C.I. Engines., Engine performance, Alternative Fuels for I.C. Engines.

3. FLUID MECHANICS AND MACHINES

Fluid properties, Bernoulli's equation, flow through pipes, Hydraulic machines.

CIVIL ENGINEERING: PAPER-II

1. ENGINEERING MECHANICS

System of Coplanar Forces, Centroids and Moment of Inertia, Friction, Kinematics of a particle, Kinematics of rigid bodies, Kinetics of particles and kinetics of rigid bodies, Momentum and Energy principles, Belt Friction.

2. STRENGTH OF MATERIALS

Shear force and bending moment, Simple Stresses and strains, Shear stresses in beams, Principal stresses and strains, Direct and bending stresses, Columns and struts, Thin cylinders.

3. FLUID MECHANICS

Fluid statics, pressure measurement, buoyancy & floatation, fluid kinematics, fluid dynamics, flow measurement, orifices, mouth pieces, notches, weirs, flow through pipes, dimensional analysis and models, laminar flow, turbulent flow in pipes, boundary layer theory, flow through channels, rapidly varied flow.

4. SURVEYING

Measurement of Horizontal distances, Chain surveying, Measurement of angles, Measurement of elevations, Theodolite Surveying, Tacheometric Surveying, Curves, Hydrographic surveying,

5. THEORY OF STRUCTURES

Fixed Beams, Continuous Beams, Moving Load, influence lines, Strain

6. CONCRETE TECHNOLOGY

Cement, Aggregates, Water, Admixtures, Fresh Concrete, Properties of Hardened Concrete, Concrete Mix Design.

7. GEOTECHNICAL ENGINEERING

Structure of soil, The Three Phase System, Index Properties of soils, Classification of Soils, Soil Water and Effective stress principal, Permeability of soils, Compressibility, Compaction, Shear strength, Exploration and in situ soil measurements.

8. WATER RESOURCES ENGINEERING

Hydrology, Precipitation, Infiltration, Evaporation and evapotranspiration, Run-off, Hydrographs, Floods, Ground water hydrology, Irrigation.

9. ENVIRONMENTAL ENGINEERING:

(i) **WATER SUPPLY ENGINEERING:** Introduction to Water Supply, Quality of Water, Sources of Water, Raw Water Conveyance, Treatment of Water, Distribution of Water.,

(ii) **SANITARY ENGINEERING:** Sewage and Sewerage, Sewer Design, Sewer Appurtenances, Sewer Pumping, Waste Water Characteristics, Sewage Treatment, Effluent Disposal.

SCHOOL OF BASIC & APPLIED SCIENCES

PHYSICS: PAPER-II

1. General information on science with special reference to Physics and its interface with society to test the candidate's awareness of science, aptitude of scientific and quantitative reasoning.
2. **BASIC MATHEMATICAL METHODS**
Calculus, Vector algebra and vector calculus, Linear algebra, matrices, Linear differential equations, Fourier - series, Elementary complex analysis.
3. **CLASSICAL DYNAMICS**
Basic principles of classical dynamics. Lagrangian and Hamiltonian formalisms. Symmetries and conservation laws. Motion in the central field of force. Collisions and scattering. Mechanics of a system of particles. Small oscillations and normal modes. Wave motion - wave equation, phase velocity, group velocity, dispersion. Special theory of relativity - Lorentz transformations, addition of velocities, mass - energy equivalence.
4. **ELECTROMAGNETICS**
Electrostatics - Laplace and Poisson equations, boundary value problems. Magnetostatics - Ampere's theorem, Biot - Savart Law, electromagnetic induction. Maxwell's equations in free space and in linear isotropic media. Boundary conditions on the fields at interfaces. Scalar and vector potentials. Gauge invariance. Electromagnetic waves - reflection and refraction, dispersion, interference, coherence, diffraction, polarization. Electrodynamics of a charged particle in electric and magnetic fields. Radiation from moving charges, radiation from a dipole. Retarded potential.
5. **QUANTUM PHYSICS AND APPLICATIONS**
Wave - particle duality. Heisenberg's uncertainty Principle. The Schrodinger equation Particle in a box, Harmonic Oscillator, Tunnelling through a barrier. Motion in a central potential, Orbital angular momentum. Angular momentum algebra, spin. Addition of angular momenta. Time - independent perturbation theory. Fermi's Golden Rule. Elementary theory of scattering in a central potential. Phase shifts, partial wave analysis, Born approximation, identical particles, spin - statistics connection.
6. **THERMODYNAMIC AND STATISTICAL PHYSICS**
Laws of thermodynamics and their consequences, Thermodynamic potentials and Maxwell's relations. Chemical potential, phase equilibria. Phase space, microstates and macrostates. Partition function. Free Energy and connection with thermodynamic quantities. Classical and quantum statistics, Degenerate electron gas. Blackbody radiation and Planck's distribution law, Bose-Einstein condensation. Einstein and Debye models for lattice specific heat.
7. **EXPERIMENTAL DESIGN**
Measurement of fundamental constants: e , h , c , Measurement of High & Low Resistances, L and; Detection of X - rays, Gamma rays, charged particles, neutrons etc: Ionization chamber, proportional counter, GM counter, Scintillation detectors, Solid State detectors. Emission and Absorption Spectroscopy. Measurement of Magnetic field, Hall effect, magnetoresistance. X-ray and neutron Diffraction. Vacuum Techniques: basic idea of conductance, pumping speed etc. Pumps; Mechanical Pump, Diffusion pump; Gauges; Thermocouple, Pirani, Hot Cathode. Low Temperature: Cooling a sample over a range up to 4 K and measurement of temperature; Measurement of Energy and Time using electronic signals from the detectors and associated instrumentation: Signal processing, A/D conversion, multichannel analyzers, Time-of-flight technique; Coincidence Measurement; true to chance ratio, correlation studies.
8. **ELECTRONICS**
Physics of p n junction. Diode as a circuit element; clipping, clamping; Rectification, Zener regulated power supply; Transistor as a circuit element: CC, CB and CE configuration. Transistor as a switch, OR, AND, NOT gates. Feedback in Amplifiers. Operational amplifier and its applications: inverting, non inverting amplifier, adder, integrator, differentiator, wave form generator, comparator & Schmidt trigger. Digital integrated circuits NAND & NOR gates as building blocks, X OR Gate, simple Combinational circuits, Half & Full adder, Flip-flop, shift register, counters. Basic principles of A/D & D/A converters; Simple applications of A/D & D/A converters.

9. ATOMIC & MOLECULAR PHYSICS

Quantum states of an electron in an atom. Hydrogen atom spectrum. Electron spin. Stern-Gerlach experiment. Spin-orbit coupling, fine structure, relativistic correction, spectroscopic terms and selection rules, hyperline structure. Exchange symmetry of wave functions. Pauli's exclusion principle, periodic table alkali type spectra, LS & JJ coupling, Zeeman, Paschen Back and Stark effects. X-Rays and Auger transitions, Compton effect. Principles of ESR, NMR. Covalent, ionic and Van der Waals interaction. Rotation Vibration spectra. Raman Spectra, selection rules, nuclear spin and intensity alternation, isotope effects, electronic states of diatomic molecules, Frank Condon principle. Lasers spontaneous and stimulated emission, optical pumping, population inversion, coherence (temporal and spatial) simple description of Ammonia maser, CO₂ and He-Ne Lasers.

10. CONDENSED MATTER PHYSICS

Crystal classes and systems, 2d & 3d lattices, Bonding of common crystal structures, reciprocal lattice, diffraction and structure factor, elementary ideas about point defects and dislocations. Lattice vibrations, Phonons, specific heat of solids, free electron theory Fermi statistics; heat capacity. Electron motion in periodic potential, energy bands in metals, insulators and semi-conductors; tight binding approximation; impurity levels in semiconductors, Electronic transport from classical kinetic theory, electrical and thermal conductivity, Hall effect and thermoelectric power transport in semiconductors. Dielectric Polarization mechanisms, Clausius equation, Piezo, Pyro and ferroelectricity. Dia and Para magnetism; exchange interactions, magnetic order, ferro, anti ferro and ferrimagnetism. Super conductivity basic phenomenology; Meissner effect, Type 1 and Type 2 Super conduction, Josephson junction mechanism.

CHEMISTRY: PAPER-II

INORGANIC CHEMISTRY:

1. CO-ORDINATION COMPOUNDS OF METALS

Step wise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH metry and spectrophotometry.

2. BORON COMPOUNDS

Higher boranes, carboranes and metallo boranes, compounds with metalmetal multiple bonds, metal carbonyls and halide clusters.

MATERIALS CHEMISTRY

1. MULTIPHASE MATERIALS

Two component phase equilibria, eutectic phase formation (Pb-Sn), Solid solution, Cu-Ni, peritectic phase formation: Fe -Ni, Fe-C phase diagram, phase transformation in Fe -C alloys, Solid solutions and intermetallic compound.

2. HIGH TC MATERIALS

Defect perovskites, high Tc superconductivity in cuprates, preparation and characterization of 1, 2, 3, and 2, 1, 4, materials, normal state properties, anisotropy, temperature dependence of electrical resistance, optical phonon modes, superconductivity state, heat capacity, coherence length, elastic constants, position life times, microwave absorption pairing and multigap structure in high Tc materials, applications of high Tc materials.

3. CORROSION

Definition, Classification, Units and rate of corrosion, Electrochemical corrosion reaction, Rusting, Polarization, Activation Polarization, Concentration Polarization, Passivity, Inhibitors, Electrochemical series of metals, Galvanic series of metals and Alloys, Galvanic corrosion, Ceramic corrosion, Pitting corrosion, Intergranular corrosion, Stress corrosion.

4. POLYMER CHEMISTRY

General characteristics of chain growth polymerization, alkene polymerization by free radical, anionic and cationic initiators, ring opening polymerization of ethers, lactones and lactams. General characteristics of stepgrowth polymerization, synthesis of polymers by step polymerization, polyesters, polycarbonates, polyamides, polyphenylene oxide, polysulphones, polysiloxanes Zeigler-Natta co-ordination polymerization Copolymerisation, general characteristics, copolymer equation and its application, monomer reactivity ratio and copolymer structure, block copolymer and graft copolymer.

ORGANIC CHEMISTRY:

1. NAME REACTIONS AND THEIR MECHANISMS

Formations and stabilities of carbonium ions, carbanions, carbenes, nitrenes, radicals and arynes, Reactive intermediates, Nucleophilic, Electrophilic, Radical substitution, Addition and Elimination reactions. Barton, Baeyer -villiger, Birch, Chichi babin, Clemmensen Diels-alder, Friedel crafts, Hoffmann, Hofmann -Löffler-Freytag, Hydroboration, Lossen, Mannich, Michael addition, Meerwein - Ponnendorf-Verley, Perkin, Grignard, Reimer -Tiemann, Reformatsky, Stork enamine, Wittig, Wolff -Kishner. Oppenauer oxidations, Robinson annulations, Routine functional group transformations and inter - conversions of simple functionalities, Aldol, Claisen, Stobbe and Dieckmann, Schmidt, Condensations, Beckmann and Fries, Favorski, Curtius Rearrangements.

2. STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS

Concept of chirality, Asymmetric synthesis (including enzymatic and catalytic nexus) enantio and diastereo

-selective synthesis, racemization, resolution, Walden inversion. Effects of conformation on reactivity in acyclic compounds and cyclohexanes, Conformational analysis of cyclohexane.

PHYSICAL CHEMISTRY:

1. SPECTROSCOPY

Theoretical treatment of rotational, vibrational and electronic spectroscopy. Principles of NMR, EPR, Mössbauer and photoelectron spectroscopy.

2. CHEMICAL EQUILIBRIUM

Free energy and entropy of mixing, partial molar quantities, Gibbs -Duhem equation. Equilibrium constant, temperature -dependence of equilibrium constant, phase diagram of one-and two-component systems, phase rule.

MATHEMATICS: PAPER-II

1. LINEAR ALGEBRA

Vector spaces, subspaces, linear dependence, basis, dimension, algebra of linear transformations. Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms. Inner product spaces, orthonormal basis. Quadratic forms, reduction and classification of quadratic forms.

2. COMPLEX ANALYSIS

Algebra of complex numbers, the complex plane, polynomials, Power series, transcendental functions such as exponential, trigonometric and hyperbolic functions. Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Liouville's theorem, Maximum modulus principle, Schwarz lemma, Open mapping theorem. Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations.

3. ORDINARY DIFFERENTIAL EQUATIONS (ODES)

Existence and Uniqueness of solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs. General theory of homogenous and non-homogeneous linear ODEs, variation of parameters, Sturm- Liouville boundary value problem, Green's function.

4. PARTIAL DIFFERENTIAL EQUATIONS (PDES)

Lagrange and Charpit methods for solving first order PDEs, Cauchy problem for first order PDEs. Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations.

5. NUMERICAL ANALYSIS

Numerical solutions of algebraic equations, Method of iteration and Newton-Raphson method, Rate of convergence, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods, Finitedifferences, Lagrange, Hermite and spline interpolation, Numerical differentiation and integration, Numerical solutions of ODEs using Picard, Euler, modified Euler and Runge-Kutta methods.

6. LINEAR PROGRAMMING PROBLEM

Simplex methods, duality. Elementary queuing and inventory models. Steady-state solutions of Markovian queuing models: $M/M/1$, $M/M/1$ with limited waiting space, $M/M/C$, $M/M/C$ with limited waiting space, $M/G/1$.

7. CALCULUS OF VARIATIONS

Variation of a functional, Euler-Lagrange equation, Necessary and sufficient conditions for extrema. Variational methods for boundaryvalue problems in ordinary and partial differential equations.

8. LINEAR INTEGRAL EQUATIONS

Linear integral equation of the first and second kind of Fredholm and Volterra type, Solutions with separable kernels. Characteristic numbers and eigenfunctions, resolvent kernel.

9. CLASSICAL MECHANICS

Generalized coordinates, Lagrange's equations, Hamilton's canonical equations, Hamilton's principle and principle of least action, Two -dimensional motion of rigid bodies, Euler's dynamical equations for the motion of a rigid body about an axis, theory of small oscillations.

SCHOOL OF COMMERCE & MANAGEMENT

COMMERCE & MANAGEMENT: Paper-II

1. MANAGERIAL ECONOMICS

Nature and scope of Managerial Economics. Importance of Managerial decision—making; Marginal analysis; Objective of a firm, Demand function, Elasticity of demand and its significance in Managerial decision-making; Consumer equilibrium-utility and indifference curve approach; Price, income and substitution effects; Fundamentals of demand estimation and forecasting; Short-run and long-run production functions; Cost curves and economics of scale; Price and output determination under perfect competition, monopoly, monopolistic, competition, and oligopoly; Pricing strategies and tactics; National Income— alternative concepts aid measurement of National income; Inflation—types, measurement and control; Balance of Payments; Monetary and Fiscal Policies.

2. ORGANIZATIONAL BEHAVIOR AND ETHICS

The concept and significance of organizational behavior- Skills and roles in an organization- classical, Neo-classical and modern theories of organizational structure-Organizational design- Understanding and Managing individual behavior personality-Perception-Values- Attitudes-Learning-Motivation, Understanding and managing group behavior, process-Inter-personal and group dynamics-communication- leadership-managing change-managing conflicts, Organizational development.

Ethics and management system; ethical issues and analysis in management; Value based organizations; Personal framework for ethical choices; Ethical pressure on individual in organizations; Gender issues; Ecological consciousness; Environmental ethics; Social responsibilities of business; Corporate governance and ethics.

3. BUSINESS STATISTICS

Univariate Analysis: An overview of central tendency, dispersion, skewness. probability Theory; Classical, relative and subjective probability, - Addition and multiplication probability models; Conditional probability and Baye's Theorem. Probability Distributions: Binomial, Poisson, and normal distributions; Sampling and sampling methods; Sampling and non-s Sampling; Law of Large Number and Central Limit Theorem; Sampling distributions and their characteristics. Statistical Estimation and Testing; Point and interval estimation of population mean, proportion, and variance; Statistical testing of hypothesis and errors; Large and small sampling tests- Z, t and F tests. Non-Parametric Tests: Chi- square tests; Sign tests; Wilcoxon Signed— Rank tests; Kruskal-Wallis test. Correlation and Regression Analysis: Two variables case.

Index Numbers: Meaning and types; Weighted aggregative indices- Laspeyre's and Paasch's indices; Laspeyre's and Paasch's indices compared, indices of weighted average of (price and quantity) relatives; Tests of adequacy Special problems- shifting the base; splicing, overlapping index series; Uses and problems of Index number; Time Series Analysis; Trend Analysis.

Statistical Quality Control: Causes of variations in quality characteristics, Quality control charts, - purpose and logic; Constructing a control chart computing the control limits (X and R charts); Process under control and out of control, Warning limits; Control charts for attributes -fraction defectives and number of defects Acceptance sampling.

4. HUMAN RESOURCE MANAGEMENT

Concepts and perspectives in HRM; HRM in changing environment, Human resource planning- Objectives, process and techniques, Job analysis- job description, Selecting human resources, Induction, training and development, Exit policy and implications, Performance appraisal and evaluation, Potential assessment, Job evaluation, Wage determination, Industrial relations and Trade unions, Dispute resolution and grievance management, Labour welfare and social security measures.

5. FINANCIAL MANAGEMENT

Financial management- nature and scope, Valuation concepts and valuation of securities, Capital budgeting decisions- risk analysis, Capital structure and cost of capital, Dividend policy-determinant, Long-term and short-term financing instruments, Mergers and Acquisitions.

6. MARKETING MANAGEMENT

Marketing Environment and Environment scanning; Marketing information systems and marketing research; understanding consumer and industrial markets; demand measurement and forecasting; market segmentation - targeting and positioning; product decisions, product mix, product life cycle; new product development; branding and packaging; pricing methods and strategies. Promotion mix; advertising; Personal selling; channel management; vertical marketing systems; Evaluation and control of marketing effort; Marketing of services; Customer relation management, Uses of internet as a marketing medium- other related issues like branding, market development, advertising and retailing on the net.

7. PRODUCTION MANAGEMENT

Role and scope of production management; Factory location; Layout planning and analysis; Production Planning and control - production process analysis; Demand forecasting for operations; Determinations of product mix; Production scheduling; Work measurement ; Time and motion study; Statistical Quality Control; Role and scope of operations research; linear programming; sensitivity analysis; duality; transportation model; inventory control; Queueing Theory; decision theory; Markov Analysis; PERT/CPM.

8. ENTREPRENEURSHIP

Concepts- types, characteristics; motivation; competencies and development; innovation and entrepreneurship; small business - concepts government policy for promotion of small and tiny enterprises; process of business opportunity identification; detailed business plan preparation; managing small enterprises; planning for growth; sickness in small enterprises; rehabilitation of sick enterprises; Entrepreneurship (organizational entrepreneurship).

SCHOOL OF EDUCATION

EDUCATION: Paper-II

1. PHILOSOPHY OF EDUCATION

Meaning of philosophy, scope of Philosophical inquiry, meaning of education with reference to individual growth and development, origin and purpose of human existence as the common denominator between Philosophy and Education, need for philosophy of education.

2. SOCIOLOGY OF EDUCATION

Development and scope, difference with Educational Sociology, sociological approach, researches in the area of Sociology of Education.

3. LEARNING

Concept, Levels of learning, Gagne's types of learning. Theories of Learning- Thorndike's Connectionism, Pavlov's Classical Conditioning, Skinner's Operant Conditioning, Learning by Insight, Hull's Needs Reduction Theory, Tolman's Sign-Gestalt Theory, Kurt-Lewin's Field Theory and their Educational implications. Factor influencing Learning.

4. PERSONALITY

Concept, development, structure and dynamics of personality. Theories of Personality: Allport, Eysenck; Psychoanalytic approach of Freud, Erickson; Behavioural approach – Miller and Dollard and Bandura and Walter; Humanistic approach – Roger, Maslow; Indian Theories: Vedic, Rabindra Nath Tagore, Mahatma Gandhi, and Sri Aurobindo.

5. METHODS OF EDUCATIONAL RESEARCH

Experimental; Normative Survey; Historical; Case Study; Developmental; Fundamental, Applied, Evaluative and Action Research; Qualitative Research: Phenomenological, Ethnomethodical and Naturalistic Enquiry.

6. DATA ANALYSIS

Measures of central tendency, measures of variability, correlations, properties and uses of normal distribution, standard uses, difference between Means, Hypothesis testing, ANOVA.

7. COMPARATIVE EDUCATION

Scope and major concepts of Comparative Education, Methods in Comparative Education, Role of UNO in improving educational opportunities among the member countries, various organs of the UNO and their educational activities, Primary Education: U.S.A, U.K., Japan and India, Secondary Education: U.S.A., U.K. Japan and India, Erosion of Moral values and Ethics.

8. DEVELOPING A RESEARCH PROPOSAL

Problem and its sources; Selection and definition of problem; Objectives – Primary, secondary and concomitant; Hypothesis: Nature, definition, types, sources; Characteristics of a good hypothesis; Directional and non-directional hypothesis.

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

ENGLISH: PAPER-II

1. ENGLISH LITERATURE FROM 14TH CENTURY TO 16TH CENTURY

Characteristic features of the literary works of this period; Basic information about the prominent works and their authors

2. 17TH CENTURY ENGLISH LITERATURE

Characteristics of the Restoration period; Prominent writers and their contributions; Major features of the literary works; Significance of this period

3. ROMANTIC PERIOD IN ENGLISH LITERATURE

Characteristics of the period; Prominent writers and their works; dominating features of the literary works of this period

4. VICTORIAN AGE

Characteristics of the period; Literature as a mirror to the social life; Prominent works and their significance

5. MODERN & POST-MODERN LITERATURE

Characteristic features of the period; Prominent works and authors of the age; Salient features of the literary works of this period

6. LITERARY TOOLS

Literary terms; Figures of speech; Literary forms & genres

7. USAGE OF ENGLISH GRAMMAR

Remedial English; Summarization; Comprehension; Editing the passage

MASS COMMUNICATION: Paper-II

1. PRINCIPAL OF MASS COMMUNICATION

Media systems and theories: authoritarian, libertarian, socialistic, social-responsibility, development, participatory. Mass media: public opinion and democracy. Media culture and its production. Media organizations, media content, market-driven media content- effects, skyvasion, cultural integration and cultural pollution. Issue of media monopoly- cross-media ownership

2. HISTORY OF MEDIA

Early communication systems in India- development of printing- early efforts to publish newspapers in different parts of India. Newspapers and magazines in the nineteenth century- first war of Indian Independence and the press- issue of freedom, both political freedom and press freedom. Birth of the Indian language press- contribution of Raja Ram Mohan Roy; birth of the Indian news agencies. The Indian press and freedom movement-Mahatma Gandhi and his journalism; social, political and economic issues before independence and the Indian press; historical development of important newspapers and magazines in English; important personalities of Indian journalism. The press of India after Independence; social, political and economic issues and the role of the Indian press problems and prospects.

3. PRINT MEDIA AND ELECTRONIC MEDIA

Investing reporting- purposes, sources, styles, techniques.

Columns- development, criticism, reviews, feature writing, news analysis, backgrounding.

Political reporting -Legislative reporting -Diplomatic reporting. Evolution and growth of electronic media: radio, television and internet. Characteristics of radio, television and Internet as medium of communication- spoken, visual and multiple versions of information through links. Principles and techniques of audio-visual communication thinking audio and pictures, grammar of sound, visuals and web production.

4. PUBLIC RELATION AND CORPORATE COMMUNICATION

Evolution and history of public relations-definitions of PR, PR and allied disciplines (publicity, propaganda, public affairs, lobbying, etc.). Interface of PR with various management disciplines (human resource development, finance, marketing, law, etc.)- publics in PR, PR tools (interpersonal, mass media and selective media)-PR in industry (public sector, private sector and multinational)- PR in central and state governments and the functioning of various media units of the State and Union governments.

5. COMMUNICATION RESEARCH

Definition- elements of research- scientific approach- research and communication theories- role-function- scope and importance of communication research-basic and applied research. Research design components- experimental, quasi-experimental, benchmark, longitudinal studies- simulation- panel studies- content analysis. Methods of communication research- census method, survey method, observation method- clinical studies-case studies- content analysis. Tools of data collection: sources, media source books, questionnaire and schedules, people's meter, diary method, field studies, logistic groups, focus groups, telephone, surveys, online polls. Random sampling methods and representativeness of the samples, sampling errors and distributions in the findings.

6. MEDIA LAW AND ETHICS MEDIA LAW

Constitution of India: fundamental rights- freedom of speech and expression and their limits- provisions of declaring emergency and their effects on media- provisions for amending the constitution; provisions for legislature reporting; parliamentary privileges and media; theory of basic structure; union and states; and election commission and its machinery. Specified press laws in India-Contempt of Courts Act 1971- civil and criminal law of demotion- relevant provisions of Indian Penal Code with reference of sedition, crime against women and children; laws dealing with obscenity; Official Secrets Act, 1923, vis-à-vis right to information- Cinematograph Act, 1953; Prasar Bharati Act; WTO agreement and intellectual

propertyright legislations, including Copyright Act, Cable Television Act. Media's ethical problems including privacy, right to reply, communal writing and sensational and yellow journalism; freebies, bias, coloured reports; ethical issues related with ownership of media- role of press and/or media councils and press ombudsmen in the world-Press Council of India and its broad guidelines for the press- codes suggested for the press by Press Council and Press Commissions and other national and international organizations- and codes for radio, television, advertising and public relations.

7. INTERNATIONAL COMMUNICATION

Impact of new communication technology on news flow-satellite communication- its historical background- status- progress- effects- information super highways- international telecommunication and regulatory organizations- UNESCO's efforts in removal imbalance in news flow- debate on new international Information and Economic Order- MacBride Commission's report- non- aligned news agencies news pool- its working, success, failure. Issues in international communication- democratization of information flow and media systems- professional standards; communication research- telecommunication tariffs; information- prompted cultural imperialism- criticisms; violence against media persons;-effects of globalization on media systems and their functions; transnational media ownership and issues of sovereignty and security; international intellectual property rights; international media institutions and professional organizations; code of conduct.

8. INTER-CULTURAL COMMUNICATION

Culture- definition- process- culture as a social institution- value systems- primary- secondary- eastern and western perspectives. Inter- cultural communication-definition- process- philosophical and functional dimensions-cultural symbols in verbal and non-verbal communication. Perception of the world- Western and Greek (Christian)- varied eastern concepts (Hindu, Islamic, Buddhist, others)- retention of information- comparison between eastern and western concept. Communication as a concept in western and eastern cultures (Dwaitha- Adwaitha- Vishishtadwaitha- Chinese (DaoTsu and Confucius- Shinto Buddhism) and also Sufism. Culture, communication and folk media- character, content and functions- dance and music as instruments of inter-cultural communication; UNESCO's efforts in the promotion of inter-cultural communication- other organizations- code of ethics.

SCHOOL OF PHARMACY

CLINICAL RESEARCH: PAPER-II

1. CLINICAL PHARMACOLOGY

Principles of Basic Pharmacology, Pharmacokinetics (ADME), Pharmacodynamics (mechanism of Action), Toxicity Studies, Dose Response relationship, Therapeutic index, Neurological disorders, malignant diseases, Infectious diseases,

Reference Book: Essentials of Medical Pharmacology- K.D Tripathi, Basic Principles of Internal Medicine by Harrison, Mc Graw Hills publishers

2. FUNDAMENTALS OF CLINICAL RESEARCH

Drug Discovery and Development, History of Clinical Research, Indian Regulation (Schedule Y), Drug and Cosmetic Act, ICMR Guidelines, Worldwide Regulations (ICH-GCP, US FDA), Introduction to Clinical Data Management, Process of Data management, Data Validation, Medical Coding

Reference Book: Basic Principles of Clinical research and Methodology by S.K Gupta
ICMR, FDA and CDSCO websites.

3. BIOSTATISTICS

Basic Definition and Application, Types of Data (Nominal Data, Ordinal data, Ranked Data, Discrete Data, Continuous Data), Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Variance, Standard Deviation, Coefficient Of variance), Parametric and Non-Parametric Tests, Hypothesis Testing, Probability, Frequency Distribution

Reference Book: Principles of Biostatistics by Marcello Pagano

4. PHARMACOGENOMICS

Importance of Study in Pharmacogenomics, Pharmacogenetic Phenotypes, Gene Therapy, Classification of Enzymes, Basic aspects of Enzyme Kinetics, Recombinant DNA Technology, Cellular organization, DNA Replication, Immunity, Analytical Techniques

Reference Books: Pharmacogenomics introduction and Clinical perspective by Joseph.S.Bertino
Concepts in Pharmacogenomics by Zdanowicz

5. CLINICAL RESEARCH METHODOLOGY

Epidemiological Studies, Clinical Trial Design, Phases of Clinical Research, Aim of different Phases, Intellectual Property Rights (TRIPS and GATT), Indian Patent Law, Endpoints in Clinical Trials, Quality of Life Studies, Pharmacoeconomic studies

Reference Books: Guide to Clinical Trials by Bert Spilker, Lippincott Williams and Wilkins
Basic Principles of Clinical research and Methodology by S.K Gupta

6. BIOETHICS

Background of ethics in Clinical Research, Ethical Principles, Ethics Committees- Roles and Responsibilities, Privacy and Confidentiality, Importance of Informed Consent Form in Clinical Research, use of placebo

Reference Books: Protecting Study Volunteers in research by C.MDunn, Thomson Centre watch, Boston

7. CLINICAL TRIAL MANAGEMENT

Basics of Project Management, Steps involved in Project Development, Managing the project Team, Tracking Management of Project, Clinical Research Outsourcing, Offshoring, Monitoring of Clinical Trials, Audits and Inspection

REFERENCE BOOKS

Project Management by Gray, Larson, Desai

The CRA's guide to Monitoring Clinical Research by Karen E. Woodin and John C. Schneider

Basic Principles of Clinical research and Methodology by S.K Gupta

PHARMACY: PAPER-II

1. PHARMACEUTICS

Development, manufacturing standards Q.C. limits, labeling, as per the pharmacopoeal requirements. Storage of different dosage forms and newdrug delivery systems. Biopharmaceutics and Pharmacokinetics and their importance in formulation. Formulation and preparation of cosmetics. Pharmaceutical calculations. Therapeutic Drug Monitoring Dosage regimen in Pregnancy and Lactation, Paediatrics and Geriatrics. Renal and hepatic impairment. Drug - Drug interactions and Drug - food interactions, Adverse Drug reactions. Medication and Patient counselling.

2. PHARMACOLOGY

General Pharmacology & Toxicology principles. Drug interaction. Pharmacology of drugs acting on Central nervous system, Cardiovascular system, Autonomic nervous system, Gastro intestinal system and Respiratory system. Pharmacology of Autocoids, Hormones, Hormone antagonists, chemotherapeutic agents including anticancer drugs. Bioassays, Immuno Pharmacology. Drugs acting on the blood & blood forming organs. Drugs acting on the renal system.

3. PHARMACEUTICAL ANALYSIS

Principles, instrumentation and applications of the following: Absorption spectroscopy (UV, visible & IR). Fluorimetry, Flame photometry, Potentiometry. Conductometry and Polarography. Pharmacopoeial assays. Principles of NMR, Mass spectroscopy. X-ray diffraction analysis. Basic Principle instrumentation, Methodological Techniques and Quantitative Analysis of drugs and their Metabolites using Column, Paper chromatography, TLC, Ion- exchange chromatography, GC, HPLC and HPTLC.

4. PHARMACEUTICAL CHEMISTRY

Structure, nomenclature, classification, synthesis, SAR and metabolism of the category of drugs, which are official in Indian Pharmacopoeia and British Pharmacopoeia. Introduction to drug design. Stereochemistry of drug molecules. Hypnotics and Sedatives, Analgesics, NSAIDS, Neuroleptics, Antidepressants, Anxiolytics, Anticonvulsants, Antihistaminics, Local Anesthetics, Cardio Vascular drugs - Antianginal agents Vasodilators, Adrenergic & Cholinergic drugs, Cardiotonic agents, Diuretics, Antihypertensive drugs, Hypoglycemic agents, Antilipidemic agents, Coagulants, Anticoagulants, Antiplatelet agents. Chemotherapeutic agents - Antibiotics, Antibacterials, Sulphadugs. Antiprotozoal drugs, Antiviral, Antitubercular, Antimalarial, Anticancer, Antiamoebic drugs. Diagnostic agents.

5. PHARMACOGNOSY & PHYTOCHEMISTRY

Chemistry, tests, isolation, characterization and estimation of phytopharmaceuticals belonging to the group of Alkaloids, Glycosides, Terpenoids, Steroids, Bioflavonoids, Purines, Guggul lipids. Pharmacognosy of crude drugs that contain the above constituents. Standardization of raw materials and herbal products. WHO guidelines. Quantitative microscopy including modern techniques used for evaluation. Biotechnological principles and techniques tissue culture.

6. BIOCHEMISTRY

Biochemical role of hormones, Vitamins, Enzymes, Nucleic acids, Bioenergetics. General principles of immunology, Metabolism of carbohydrate, lipids, proteins. Methods to determine, kidney & liver function. Lipid profiles.

7. PHARMACEUTICAL JURISPRUDENCE

Drugs and Cosmetics Act and rules there under with respect to manufacture, sales and storage. Pharmaceutical ethics. Pharmacy Act and any other acts and rules pertaining to the field of Pharmacy applicable in India.

SCHOOL OF LAW

LAW: PAPER-II

1. JURISPRUDENCE

Nature and sources of law, Schools of jurisprudence, Law and morality, Concept of rights and duties, Legal personality, Concepts of property, ownership and possession

2. CONSTITUTIONAL AND ADMINISTRATIVE LAW

Preamble, fundamental rights and duties, directive principles of state policy, Union and State executive and their interrelationship, Union and State legislature and distribution of legislative powers, Judiciary, Emergency provisions, Nature, scope and importance of administrative law, Principle of natural justice, Judicial review of administrative actions – Grounds

3. PUBLIC INTERNATIONAL LAW

International law – Definition, nature and basis, Sources of International law, Recognition of states and governments, Nationality, immigrants, refugees and internally displaced persons (IDPs), Extradition and asylum, United Nations and its organs, Settlement of international disputes

4. LAW OF CRIME

General principles of criminal liability – *Actus reus* and *mens rea*, individual and group liability and constructive liability, Stages of crime and inchoate crimes - Abetment, criminal conspiracy and attempt, General exceptions, Offences against human body, Offences against property, Offences against women and children, Offences against public tranquility, Theories and kinds of punishments, compensation to the victims of crime

5. LAW OF TORTS AND CONSUMER PROTECTION

Nature and definition of tort, General principles of tortious liability, General defenses, Specific torts – Negligence, nuisance, trespass and defamation, Remoteness of damages, Strict and absolute liability, Tortious liability of the State, The Consumer Protection Act 2019 - Definitions, consumer rights and redressal mechanism

6. COMMERCIAL LAW

Essential elements of contract and e-contract, Breach of contract, frustration of contract, void and voidable agreements, Standard form of contract and quasi-contract, Specific contracts - Bailment, pledge, indemnity, guarantee and agency, Sale of Goods Act, 1930, Partnership and limited liability partnership, Negotiable Instruments Act, 1881, Company law – Incorporation of a company, prospectus, shares and debentures

7. FAMILY LAW

Sources and schools, Marriage and dissolution of marriage, Matrimonial remedies - Divorce and theories of divorce, Changing dimensions of institution of marriage – *Live-in* relationship, Recognition of foreign decrees in India on marriage and divorce, Maintenance, dower and *stridhan*, Adoption, guardianship and acknowledgement, Succession and inheritance, Will, gift and *wakf*, Uniform Civil Code

8. INTELLECTUAL PROPERTY RIGHTS & CYBER LAW

Concept and meaning of intellectual property, Theories of intellectual property, Copyright and neighboring rights – Subject matters, limitations and exceptions, Law of patent – Patentability, procedure for grant of patent, limitations and exceptions, Law of trademark – Registration of trademarks, kinds of trademarks, infringement and passing off, Protection of Geographical Indications, Bio-diversity and Traditional Knowledge, Information technology law- digital signature and electronic signature, electronic governance, electronic records and duties of subscribers, Cyber Crimes, Kinds of cybercrimes, Penalties and adjudication