

SAGE UNIVERSITY, BHOPAL

(SANGEEV AGRAWAL GLOBAL EDUCATIONAL UNIVERSITY, BHOPAL)



Information Brochure

PhD Admissions

2020-21

A. IMPORTANT GUIDELINES FOR PHD APPLICATION

1. Please read the instructions given in the brochure carefully before filling up the application form.
2. Online Application Form & Information Brochure (including the admission schedule along with the important dates) is available on the University website.
3. You are required to submit the application ONLINE only.
4. The application fee is Rs. 2000/-. **(APPLICATION FEE IS NOT REFUNDABLE)**
5. The fee is to be paid by Internet Banking / Online Payment Gateway.
6. You should complete the application form in all respects. Incomplete application will not be considered.
7. You MUST upload the following documents submitting the PhD Application.
 - i. Scanned photograph in jpg.
 - ii. Scanned signature in jpg.
 - iii. Mark-sheet of the last semester/ consolidated mark-sheet of the qualifying degree. Result awaited candidates have to upload their latest / previous semester mark-sheet.
 - iv. Score card of GATE/NET or any other equivalent exam passed (if any).
8. You should check the Institute website for results / important announcements.
9. You should check emails sent to the email address provided in your application for all important communications and announcements.
10. Download and print dully filled application.
11. For interview candidate shall bring the following documents with them.
 - i. Photo ID Card,
 - ii. Printed copy of the application submitted online,
 - iii. Thesis / dissertation / report / publications,
 - iv. Self attested copy of certificates and mark-sheets.
12. For any further details you may contact at 0755-6614400 or email at phdcell@sageuniversity.edu.in

B. SCHEDULE OF PHD ADMISSION - APPLICATION FORM THROUGHOUT THE YEAR

Important Dates

No.	Particulars	Dates
1	Advertisement (in all leading Newspapers and on website)	20 /01/2021
2	Available of online application forms	20/01/2021
3	Last date for submission of completed application forms	28/02/2021
4	Date of Entrance Test (for all Disciplines)	13/03/2021 (02:30 – 04:00 P.M.)

C. GENERAL

SAGE University Bhopal with its impeccable academia, colossal campus, leading-edge educational framework and extensive façade in the beautiful city of lakes Bhopal propound world-class setup for transforming passion into profession. With its thought-provoking learning and exceptional infrastructure, the university offers the best in class facilities for students to

secure their future. Adherent to the legacy of SAGE University Indore, SAGE University Bhopal also thrives for the same goal were we make students industry-ready with world-class education to make them match the pace of this fast-moving society.

We make lives better by producing leaders of society and equipping our people with leadership qualities so they can serve our communities at every level. SAGE University Bhopal is just another feather in the cap of The SAGE Group. With the experience of over 15 years in the Education sector with Sagar Institute of Research and Technology, the conglomerate business group of Central India; The SAGE Group has introduced SAGE University Bhopal, after the massive success of SAGE University Indore.

Why Join SAGE University

- A world-class education in research / real-world environment.
- Best academic set-up promoting student-driven course choice.
- Advice, guidance, support and mentoring for its student.
- Well defined academic program and assessment.
- Attractive Scholarships and financial support.
- An up-to-date framework for study, learning and research.
- Respect & contribute to the SAGE community as well as the society.
- Wide range of co-curricular activities to choose from with appropriate infrastructure.
- Highly scrutinized, clear and fair academic regulations, policies and procedures

Programs Offered by SAGE University, Bhopal

More than 80 Undergraduate, Post Graduate and PhD Program are being offered by SAGE University Bhopal under the following faculty

- Faculty of Agriculture
- Faculty of Sciences
- Faculty of Design
- Faculty of Management
- Faculty of Computer Applications
- Faculty of Commerce
- Faculty of Engineering and Technology
- Faculty of Advanced Computing
- Faculty of Journalism and Mass Communications
- Faculty of Art and Humanities
- Faculty of Performing Arts

D. PhD PROGRAMME

With extensive infrastructural facilities and a sound research base, the SAGE University offers PhD programme in a wide range of areas.

- (a) Agriculture
- (b) Engineering and Technology
- (c) Management
- (d) Commerce
- (e) Sciences
- (f) Arts , Humanities and Social Sciences
- (g) Journalism and Mass Communication

(h) Design and Performing Arts

The broad objectives of the PhD programme are to contribute to expanding the frontiers of knowledge and to provide research training. The academic programme leading to the PhD degree is broad-based and involves a course credit requirement and a research project leading to thesis submission. The University also encourages research in interdisciplinary areas through a system of joint supervision and interdepartmental group activities.

E. ELIGIBILITY

A candidate for the degree of Doctor of Philosophy must, at the time of application, hold M.Phil / Master's degree with at least 55% marks or an equivalent grade of the University / Deemed University or any other University incorporated by any law for the time being in force and recognized by the University (Five percent marks will be relaxed for SC/ST and handicapped candidates) as per prevalent directions of state Govt.

A candidate shall ordinarily be permitted to work for Ph D Degree in the subject/ discipline in which he/she obtained Masters Degree. Provided that research work leading to PhD Degree may be allowed in all allied subjects of interdisciplinary nature of the same Faculty / School.

Provided further that whether a subject in which the candidate has done Masters Degree, shall be decided by the Academic Council / VC of the University.

F. ADMISSION PROCEDURE

Application Form

Candidate should apply online office of the University by the date notified by the University in news paper/website.

Entrance Test

The admission shall be made by the University, through an entrance test followed by personal interview.

PhD Entrance Test syllabus is enclosed in *Annexure -I*. The entrance test will consist of Multiple Choice Questions related to 50% of Research Methodology, and 50% subject-specific. There will be a total of 100 objective type questions of one mark each. No negative marking will be done for wrong answers. The duration of Entrance Test will be of 90 minutes.

The shortlisted candidates as per the merit of entrance test will be eligible for personal interview. During personal interview candidates should mention their interest in broad area of research.

Candidates who have qualified the UGC/CSIR/DST/State Level Examination SLET/NET/M.Phil shall be exempted from entrance test and will be required to present themselves for personal interview.

FEES

Registration fee, Enrollment Fee and Tuition Fee as prescribed by the University for PhD programme in any case must be paid before the submission of PhD Thesis.

S.No.	Particular	Fee (Rs.)
1	Entrance Exam fee	Rs. 2000/-
2	Admission fee	Rs. 1,00,000/- per year
4	Thesis Submission	Rs. 25,000/-

COURSE WORK

After admission to PhD program each candidate has to complete the course work successfully in the concerned School.

The Scheme of Examination for the Course work is given below.

S.No.	Course Code	Course Name	L	T	P	Credit offered	Exam Duration	Exam Marks
1	UC20D101	Research Methodology and Data Analysis Tools	4	-	-	4	3	100
2	-	Discipline Specific Course	4	-	-	4	3	100
3	UC20D103	Research And Publication Ethics	4	-	-	4	3	100
4	UC20D104	Seminar / Presentation*	8			4	-	100
						16	-	-

** Candidate needs to make two presentations to the Panel of Experts.*

SECTION A: RESEARCH METHODOLOGY

- 1. Basic Concept of Research Problem:** Rationale of research, Identification of research problem, Research objective and Types of research- fundamental/ applied/ action/ quantitative/ qualitative.
 - 2. Review of literatures:** Primary source, Secondary source, Searching e- resources, using search engines, Searching data base and writing literature review.
 - 3. Methods of Research:** Concept and formulation of hypothesis, Survey method, Experimental method (variable, designs), Historical methods and Content analysis
 - 4. Sampling of Data:** Concept of sampling, Probability sampling techniques, Non probability sampling techniques and sampling error
 - 5. Collection of Data:** Primary data generation, Secondary data collection, Methods of data generation/ collection – by experiments, questionnaire, interview schedule, focus groups etc
 - 6. Analysis of Data:** Statistical analysis techniques, Qualitative analysis techniques Application of computer in research data analysis
 - 7. Report Preparation:** Structure and component of research report, Organization of data, Indexing of journal and research output, Citation, references, bibliography Copyright, plagiarism and originality of research work
 - 8. Research Ethics:** Ethics in research, National and International regulations/ laws/ ethics related to research on Human, Animals and Environments.
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**SECTION B : CIVIL ENGINEERING
(ENGINEERING & TECHNOLOGY)**

CIVIL ENGINEERING

(A) Structural Engineering

Mechanics: Bending moment and shear force in statically determinate beams. Simple stress and strain relationship, Stress and strain in two dimensions, principal stresses, stress transformation, Mohr's circle. Simple bending theory, bending and shear stresses, combined and direct bending stresses, unsymmetrical bending, shear centre. Thin walled pressure vessels, torsion, torsional buckling, buckling of columns. Two dimensional problems in rectangular and polar coordinates Structural Analysis: Analysis of statically determinate trusses, arches, beams, cables and frames, displacements in statically determinate structures and analysis of statically indeterminate structures by force or energy methods, and displacement methods (slope deflection and moment distribution methods), influence lines for determinate and indeterminate structures. Basic concepts of matrix methods of structural analysis. Compatibility equations. Finite element method, shape functions, isoparametric elements and its formulation numerical integration. Gaussian eliminations, Numerical Integration.

Structural Dynamics: Single Degree of freedom system, Multi degree of freedom system. Free and forced vibration, Response to harmonic excitation, Eigen value problem, Eigen vector. Concrete Structures: properties of concrete, basics of mix design. Nondestructive testing of concrete, special concretes Concrete design- basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Water tanks, silos and bunkers. Basic elements of prestressed concrete, prestressing system and losses of prestressing. Steel Structures: Basic limit state method, Analysis and design of tension and compression members, beams and beam- columns, column bases. Connections- simple and eccentric, beam column connections, plate girders and trusses. Plastic method of analysis of beams and frames.

(B) Geotechnical Engineering

Soil Mechanics: Origin of soils, soil classification, three-phase system, fundamental definitions, relationship and interrelationships, permeability & seepage, effective stress principle, consolidation, compaction, shear strength. Foundation Engineering: Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, and plate load test. Earth pressure theories, effect of water table, layered soils. Stability of slopes-infinite slopes, finite slopes. Foundation types-foundation design requirements. Shallow foundations-bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sands & clays. Deep foundations pile types, dynamic & static formulae, load capacity of piles in sands & clays, negative skin friction. Machine foundation

(C) Environmental Engineering

Water requirements: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, sludge disposal, effluent discharge standards. Domestic wastewater treatment processes, quantity of characteristics of domestic wastewater, primary and secondary treatment, sludge disposal. Air Pollution and Noise Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits. Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution. Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

(D) Water Resources Engineering

Fluid Mechanics and Hydraulics: Properties of fluids, principle of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, critical flow and gradually varied flow in channels, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling. Kinematics of flow, velocity triangles and specific speed of pumps and turbines. Hydrology: Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

Irrigation: Duty, delta, estimation of evapo-transpiration. Crop water requirements. Design of: lined and unlined canals, waterways, head works, gravity dams and spillways. Design of weirs on permeable foundation. Types of irrigation system, irrigation methods. Water logging and drainage

(E) Transportation Engineering

Highway Planning: Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements. Traffic Engineering: Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity. Surveying: Importance of surveying, principles and classifications, mapping concepts, coordinate system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying, Electronic Distance measurement errors and adjustments, curves.

(F) Computer Applications

Basics of C and C++ programming, loops functions array, object oriented programming, 2D and 3-D Modeling software .

(G) Statistics & Research Aptitude

Mean, median, mode, basic concepts of probability, coefficient of variance, standard error, standard deviation, and correlation and regression analysis. Student t-test, F-test, analysis of variance (ANOVA), data graphics and data interpretation. Principles and various models of statistical optimization techniques, optimization softwares. National and international scenario of scientific research, literature reviewing, reference citation, scientific, engineering and research journals, impact valuation, research article and patent drafting, various scientific websites, abstracts.

**SECTION B: COMPUTER SCIENCE AND ENGINEERING
(ENGINEERING & TECHNOLOGY)**

High Performance Computer Architecture: Basic Computer architecture. Performance Analysis, Architectural classification schemes, Memory models, Pipelining, RISC CISC, VLIW architectures, data dependency and interconnection network. Fault Tolerance and Scalability. Modeling Performance. Pipelined Systems. Interconnection Networks. Processor Array. Multi-computers. Multiprocessors. Systolic Array. Vector Processors. Structured Memory Design for Parallel Systems - Symmetric Shared, Distributed Shared and Synchronization. Grid computing.

Software Systems: Data structures and Algorithms: the notion of abstract data types, stack, queue, list, set, string, tree, binary search tree, heap, graph, tree and graph traversals, connected components, spanning trees, shortest paths, hashing, sorting, searching, design techniques (greedy, dynamic, divide and conquer, Algorithm design by induction), asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes P, NP, NP-hard, NP-complete.

Concepts of object-oriented programming - Basic Concept of OOP Benefit of OOP Object Oriented language Structure of C++ Program Compiling and Linking Operators and expressions Looping Concepts Arrays and Structure, Functions Class Object Constructor and Destructors Polymorphism Functions Overloading Operators Overloading Inheritance pointer and Virtual Function Life I/O and Templates

Operating Systems : Synchronization Mechanisms. Process Deadlocks. Resource Models. Local and Global states. Distributed Operating Systems. Event Ordering. Timestamps. Distributed Mutual Exclusion. Token and Non-token based Algorithms. Comparative Performance Analysis. Concurrency Control. Shared Memory. File Systems. Agreement Protocols for handling Processor Failures. Coordination of Processes and related Algorithms. Failure Handling and Recovery Mechanisms. Multiprocessor Operating Systems and related Thread Handlings.

Software Engineering: SDLC, planning and managing the project, design, coding, testing, implementation, maintenance. Personal Software Process. Team Software Process. Usability. Agile Methods. Process Models- Iterative, Scrum, XP, and Evo. Requirements Engineering. Advanced UML, Petri net. Domain specific modeling. Systems Modeling Language. Meta modeling. Software architecture and design patterns. Software metrics. Software reliability. Advanced testing techniques.

Database Systems: Review of Database Systems. Web-enabled Database Systems. Storage and File Structures. Indexing and Hashing. Concurrency. Recovery. Query Processing. Query Optimization. Object Oriented DBMS. Extended Relational Model. Spatial databases. Multimedia Databases. Distributed Databases. Active Databases. Temporal Databases. Deductive Databases. Mobile Databases.

Data Communication and Computer Networks: Seven Layer OSI Model. TCP/IP details. IPv4 and IPv6 Protocols and its Applications. Real Time Communication Protocols. High speed local and wide area networks. Virtual networks. Network security. Broadband networks. Introduction to intelligent networking. Performance analysis of networks. Transmission media, data encoding, Multiplexing, Flow and error control, Network devices switches, Gateways, Routers, Network security cryptography, Digital signature, Firewalls, Routing concepts, ATM, Poisson and other distributions.

SECTION B : MECHANICAL ENGINEERING

(ENGINEERING & TECHNOLOGY)

1. Fluid Mechanics

Basic Concepts and Properties of Fluids, Manometry, Fluid Statics, Buoyancy, Equations of Motion, Bernoulli's equation and applications, Viscous flow of incompressible fluids, Laminar and Turbulent flows, Flow through pipes and head losses in pipes.

2. Thermodynamics and Heat Transfer

Thermodynamic systems and processes; properties of pure substance; Zeroth, First and Second Laws of Thermodynamics; Entropy, Irreversibility and availability; analysis of thermodynamic cycles related to energy conversion: Rankine, Otto, Diesel and Dual Cycles; ideal and real gases; compressibility factor; Gas mixtures.

Modes of heat transfer, Steady and unsteady heat conduction, Thermal resistance, Fins, Free and forced convection, Correlations for convective heat transfer, Radiative heat transfer – Radiation heat transfer co-efficient; boiling and condensation, Heat exchanger performance analysis.

3. IC Engines, Refrigeration and Air Conditioning

SI and CI Engines, Engine Systems and Components, Performance characteristics and testing of IC Engines; Fuels; Emissions and Emission Control. Vapour compression refrigeration, Refrigerants and Working cycles, Compressors, Condensers, Evaporators and Expansion devices, Other types of refrigeration systems like Vapour Absorption, Vapour jet, thermo electric and Vortex tube refrigeration. Psychometric properties and processes, Comfort chart, Comfort and industrial air conditioning, Load calculations and Heat pumps.

4. Turbo Machinery

Reciprocating and Rotary pumps, Pelton wheel, Kaplan and Francis Turbines, velocity diagrams, Impulse and Reaction principles, Steam and Gas Turbines, Theory of Jet Propulsion – Pulse jet and Ram Jet Engines, Reciprocating and Rotary Compressors – Theory and Applications

5. Power Plant Engineering

Rankine and Brayton cycles with regeneration and reheat, Fuels and their properties, Flue gas analysis, Boilers, steam turbines and other power plant components like condensers, air ejectors, electrostatic precipitators and cooling towers – their theory and design, types and applications;

6. Renewable Sources of Energy

Solar Radiation, Solar Thermal Energy collection - Flat Plate and focusing collectors their materials and performance. Solar Thermal Energy Storage, Applications – heating, cooling and

Power Generation; Solar Photovoltaic Conversion; Harnessing of Wind Energy, Bio-mass and Tidal Energy – Methods and Applications, Working principles of Fuel Cells.

7. Engineering Mechanics

Analysis of System of Forces, Friction, Centroid and Centre of Gravity, Dynamics; Stresses and Strains-Compound Stresses and Strains, Bending Moment and Shear Force Diagrams, Theory of Bending Stresses- Slope and deflection-Torsion, Thin and thick Cylinders, Spheres.

8. Engineering Materials

Basic Crystallography, Alloys and Phase diagrams, Heat Treatment, Ferrous and Non Ferrous Metals, Non metallic materials, Basics of Nano-materials, Mechanical Properties and Testing, Corrosion prevention and control

9. Mechanisms and Machines

Types of Kinematics Pair, Mobility, Inversions, Kinematic Analysis, Velocity and Acceleration Analysis of Planar Mechanisms, CAMs with uniform acceleration and retardation, cycloidal motion, oscillating followers; Vibrations –Free and forced vibration of undamped and damped SDOF systems, Transmissibility Ratio, Vibration Isolation, Critical Speed of Shafts. Gears – Geometry of tooth profiles, Law of gearing, Involute profile, Interference, Helical, Spiral and Worm Gears, Gear Trains- Simple, compound and Epicyclic; Dynamic Analysis – Slider – crank mechanisms, turning moment computations, balancing of Revolving & Reciprocating masses, Gyroscopes – Effect of Gyroscopic couple on automobiles, ships and aircrafts, Governors.

10. Design of Machine Elements

Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as riveted, welded and bolted joints. Shafts, Spur gears, rolling and sliding contact bearings, Brakes and clutches, flywheels.

11. Manufacturing ,Industrial and Maintenance Engineering

Metal casting-Metal forming, Metal Joining, Machining and machine tool operations, Limits, fits and tolerances, Metrology and inspection, computer Integrated manufacturing, FMS, Production planning and Control, Inventory control and operations research - CPMPERT.

Failure concepts and characteristics-Reliability, Failure analysis, Machine Vibration, Data acquisition, Fault Detection, Vibration Monitoring, Field Balancing of Rotors, Noise Monitoring, Wear and Debris Analysis, Signature Analysis, NDT Techniques in Condition Monitoring.

12. Mechatronics and Robotics

Microprocessors and Microcontrollers: Architecture, programming, I/O, Computer interfacing, Programmable logic controller. Sensors and actuators, Piezoelectric accelerometer, Hall effect

sensor, Optical Encoder, Resolver, Inductosyn, Pneumatic and Hydraulic actuators, stepper motor, Control Systems- Mathematical modeling of Physical systems, control signals, controllability and observability. Robotics, Robot Classification, Robot Specification, notation; Direct and Inverse Kinematics; Homogeneous Coordinates and Arm Equation of four Axis SCARA Robot.

**SECTION B: ELECTRICAL ENGINEERING
(ENGINEERING & TECHNOLOGY)**

Electric Circuits and Fields: KCL, KVL, node and mesh analysis; sinusoidal steady-state analysis, resonance, Thevenin's, Norton's and Superposition and Maximum Power Transfer theorems, two-port networks, three phase circuits: Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions; Ampere's and Biot- Savart's laws; inductance; dielectrics; capacitance.

Electrical Machines: Single phase transformer, tests, regulation and efficiency; three phase transformers, parallel operation; autotransformer; DC machines, armature reaction and commutation, starting and speed control of motors; three phase induction motors, performance characteristics, starting and speed control; synchronous machines, regulation and parallel operation of generators, motor starting, characteristics.

Power Systems: Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference: distribution systems; voltage control; power factor correction; symmetrical components; fault analysis; circuit breakers; system stability concepts, swing curves; HVDC transmission.

Control Systems: Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Niquist techniques: Bode plots: lag, lead and lead-lag compensation; controllability and observability.

Electrical and Electronic Measurements: Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy; instrument transformers; digital voltmeters and multimeters; phase, time and frequency measurement.

Analog and Digital Electronics: Characteristics of diodes, BJT, FET; amplifiers; oscillators and feedback amplifiers: operational amplifiers - characteristics and applications; timers; combinational and sequential logic circuits; multiplexer; Schmitt trigger; multi-vibrators; sample and hold circuits; A/D and D/A converters.

Power Electronics and Drives: Thyristors, triacs, GTOs, MOSFETs and IGBTs; phase control rectifiers; bridge converters - fully controlled and half controlled; principles of choppers and inverters; basic concepts of adjustable speed dc and ac drives.

Advanced Topics in Electrical Engineering: Artificial Neural Network, Fuzzy systems, Neuro-fuzzy systems and genetic algorithms, Simulation tools used in Electrical Engineering.

SECTION B: INFORMATION TECHNOLOGY

(ENGINEERING & TECHNOLOGY)

Computer Organization and Architecture-Computer Architecture System Inter Connection Structure Addressing modes Arithmetic Processor Design Control Unit Organism Storage and Memory Hierarchy and I/O Organization Parallel Computer Models and Program Parallelism Classification of Machine SISD, SIMD and MIND Synchronous Parallel Processing .

Soft Computing :Journal Issues and our view of AI Search and Control Strategies Heuristic Search Techniques Knowledge Representation AI Programming Languages LISP Prolog Natural language Processing Parsing Techniques RTN, ATN, Fuzzy System Expert Systems Artificial Neural Network .

Object Oriented Concept and Programming Using C++:Basic Concept of OOP Benefit of OOP Object Oriented language Structure of C++ Program Compiling and Linking Operators and expressions Looping Concepts Arrays and Structure, Functions Class Object Constructor and Destructors Polymorphism Factions Overloading Operators Overloading Inheritance pointer and Virtual Function Life I/O and Templates.

Information Systems and Software Engineering Software Engineering Paradigm Life Models S/W Requirements Design Concepts and Principles Testing and Maintenance S/W project management Internet and Web technology Internet protocol -TCP/IP,UDP,HTTP Telnet,SMTP,FTP,SNTP.Internet addressing IP V4 And IPV6 HTML,DHTML,SGML,XML,JAVA Scripts Internet Security and Firewalls web site planning and hosting.

Database Management System :Type of Data Models , DBMS, Architecture, Object Orientated Database Relationship Model , Storage and File Organization The Relational Data Model database Design Data Replication and Query Processing and Recovery, Security Management, Parallel and Distributed Database.

Telecomm Switching and Computer Network :Basic Concepts of telephony System and Topology, Switching, Wearing and Routing, PHTN, ISDN, DSL, ADSL, Switched Packets Data Services ISDN,ATN, Network, Seven Layer of OSI Model, TCP/IP Protocol Suit Cryptography and Digital Signature GSN,CDMA,Mobile IP Frequency Management and Channel Assignment.

SECTION B: ELECTRONICS AND COMMUNICATION

(ENGINEERING & TECHNOLOGY)

NETWORKS:

Network graphs: matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's maximum power transfer, Wye-Delta transformation. Steady state sinusoidal analysis using phasors. Linear constant coefficient differential equations; time domain analysis of simple RLC circuits, Solution of network equations using Laplace transform: frequency domain analysis of RLC circuits. 2-port network parameters: driving point and transfer functions. State equations for networks

ELECTRONIC DEVICES:

Energy bands in silicon, intrinsic and extrinsic silicon. Carrier transport in silicon: diffusion current, drift current, mobility, and resistivity. Generation and recombination of carriers. p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-I-n and avalanche photo diode, Basics of LASERs. Device technology: integrated circuits fabrication process, oxidation, diffusion, ion implantation, photolithography, n-tub, p-tub and twin-tub CMOS process

ANALOG CIRCUITS:

Small Signal Equivalent circuits of diodes, BJTs, MOSFETs and analog CMOS. Simple diode circuits, clipping, clamping, rectifier. Biasing and bias stability of transistor and FET amplifiers. Amplifiers: single-and multi-stage, differential and operational, feedback, and power. Frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators; criterion for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping circuits, 555 Timers. Power supplies

DIGITAL CIRCUITS:

Boolean algebra, minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinatorial circuits: arithmetic circuits, code converters, multiplexers, decoders, PROMs and PLAs. Sequential circuits: latches and flip-flops, counters and shiftregisters. Sample and hold circuits, ADCs, DACs. Semiconductor, Microprocessor(8085): architecture, programming, memory and I/O interfacing.

SIGNALS AND SYSTEMS:

Definitions and properties of Laplace transform, continuous-time and discrete-time Fourier series, continuous-time and discrete-time Fourier Transform, DFT and FFT, ztransform. Sampling theorem. Linear Time-Invariant (LTI) Systems: definitions and properties; causality, stability, impulse response, convolution, poles and zeros, parallel and cascade structure, frequency response, group delay, phase delay. Signal transmission through LTI systems

CONTROL SYSTEMS:

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh-Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional-IntegralDerivative (PID) control. State variable representation and solution of state equation of LTI control systems

COMMUNICATIONS:

Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superheterodyne receivers; elements of hardware, realizations of analog communication systems; signal-to-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM.

COMPUTER NETWORKS:

ISO/OSI stack, LAN technologies (Ethernet, Token ring, etc),Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP(v4), Application layer protocols (dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers.

OPTICAL FIBRE COMMUNICATION:

Introduction, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal Analysis of a step index fiber. Optical channel Modeling – Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers measurement techniques like OTDR, Optical sources – LEDs and Lasers, Photo-detectors – Pin-detectors, detector responsively noise, Optical link design – BER calculation, quantum limit, power panelities.

ELECTROMAGNETICS:

Elements of vector calculus: divergence and curl; Gauss' and Stokes' theorems, Maxwell's equations: differential and integral forms. Wave equation, Poynting vector. Plane waves: propagation through various media; reflection and refraction; phase and group velocity; skin depth. Transmission lines: characteristic impedance; impedance transformation; Smith chart; impedance matching; S parameters, pulse excitation. Waveguides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Basics of propagation in dielectric waveguide and optical fibers. Basics of Antennas: Dipole antennas; radiation pattern; antenna gain.

**SECTION B: PHYSICS
(SCIENCES)**

Mathematical Physics: Dimensional analysis, Vector algebra and vector calculus, Linear algebra, Matrices, Linear differential equations, Elementary probability theory, Binomial, Poisson and normal distributions, Fourier series, Fourier and Laplace transforms, Elements of complex analysis.

Classical Mechanics: Newton's law, central forces, Kepler's law and planetary motion, Lagrange and Hamilton's formalisms, Special theory of relativity – Lorentz transformations, time dilation, Length contraction, Relativistic kinematics, Variation of mass with velocity, Mass – Energy equivalence, Relation between energy and momentum.

Electromagnetic Theory & Acoustic wave: Gauss's Law and its applications, Laplace and Poisson equations, Magnetostatics : Bio-Savart's law, Ampere's theorem, Electromagnetic induction, Faraday's law, Maxwell's equations, Scalar and vector potentials, Electromagnetic waves and their reflection , Refraction, Interference, diffraction, polarization, Poynting vector, Energy and momentum ;electromagnetic waves, acoustics, acoustical holography, acoustic radiation, acoustic transmission.

Quantum Mechanics: Physical basis of quantum mechanics, Wave – Particle duality, De-Broglie hypothesis, Wave packet and group velocity, , Heisenberg's uncertainty principle, Schrodinger equation (time dependent and time independent), Eigen value problems such as particle- in- a- box, Harmonic oscillator etc.

Thermodynamics and Statistical Physics: Law of thermodynamics and their consequences, Macro state and microstates, Phase space, Probability ensembles, Partition function, Free energy, Calculation of thermodynamic quantities, Classical and quantum statistics, Degenerate Fermi gas, Black body radiation and Planck's distribution law, Bose- Einstein condensation, First and second order phase transitions.

Atomic and Molecular Physics: Quantum states of an electron in an atom, Electron spin, Spectra of one- and manyelectron atoms, Relativistic corrections for energy levels of hydrogen, Hyperfine structure and isotopic shift, Width of spectral lines, LS & JJ coupling, Zeeman, Paschen Back and Stark effect, X-ray spectroscopy, Electron spin resonance, Nuclear magnetic resonance, lasers.

Solid State Physics: Atomic structure and bonding in materials. Crystal structure of materials, unit cell and space lattices, Miller indices of planes and directions, Concept of amorphous, Single and polycrystalline structures and their effect on properties of materials, Crystal growth techniques, Free electron theory, Band theory of solids; metals, semiconductors and insulators, Hall effect, superconductivity, Fermi level, energy gap.

Nuclear and Particle Physics: Basic nuclear properties, Size, Shape, Charge distribution, Spin and Parity, Mass defect, Binding energy, semi-empirical mass formula, Liquid drop model, Nature of nuclear force, Nuclear shell model, Alpha decay, Beta decay, Gama decay, Laws of radioactivity, Nuclear reactions, Compound nuclei and direct reactions, Controlled and uncontrolled chain reaction, critical mass, fission and fusion, Nuclear reactor, Elementary particles.

Electronics: Semiconductor devices & physics P-N-Jn.depletion region, barrier potential, Transistors, Bipolar junction Transistors, Field effect transistors, UJT,SCR, Rectifier circuits, , Logic gates and symbols, Boolean algebra & Karnaugh map, DeMorgan's theorem, Basic digital logic circuits, Optoelectronic devices including solar cells; photonic devices; Photo detectors and LEDs, Digital techniques and applications (Registers Counters, Comparators and similar circuits); ICs; modulation & demodulation, AM,PM,FM;A/D and D/A convertors; Sensors.

SECTION B: CHEMISTRY**(SCIENCES)****INORGANIC CHEMISTRY**

Main Group Elements : S-N compounds Sulphur-phosphorus compounds: Molecular sulphides such as P₄S₃, P₄S₇, P₄S₉ and P₄S₁₀. Phosphorus-nitrogen compounds: Phosphazines. Other P-N compounds. Boron-nitrogen compounds:

Metal Complexes: Valence bond theory and its limitations. Ligand field theory: Splitting of d orbitals in different ligand fields Jahn-Teller effect MO diagrams of complexes with and without n bonds. Spectral & Magnetic properties of complexes.

Nuclear Chemistry: . Nuclear reactions: . Types of nuclear reactions. Spontaneous and induced fission. Principles of working of the reactors of nuclear power plants. Breeder reactor. Nuclear fusion reaction.

Analytical Principles: Volumetric methods: Theories of indicators: Acid-base, redox, metallochromic, indicators. Complexation Precipitation Redox titrations. Gravimetric methods: Mechanism of precipitate formation. Aging of precipitates. Precipitation from homogeneous solutions. Coprecipitation and postprecipitation. Contamination of precipitates. Washing, drying and ignition of precipitates.

Water treatment: Hardness, Alkalinity, Domestic water treatment Chemical analysis of water, D.O., B.O.D, C.O.D., T.D.S.

PHYSICAL CHEMISTRY

Quantum Mechanics: Introduction to Classical Mechanics: The blackbody radiation, photoelectric effect, Compton Effect and atomic spectra. Failure of classical mechanics to explain these phenomena. Quantum mechanical explanations.

Chemical Kinetics: Theories of reaction rate: Influence of temperature on reaction rate. Arrhenius equation and its limitations, activation energy. Collision theory and absolute reaction rate theory. Free energy of activation and volume of activation. Thermodynamic formulation of reaction rate. Effects of pressure and volume on the velocity of gas reaction.

Surface Chemistry: The colloidal state: Multimolecular, macromolecular and associated colloids. Stability of colloids. The zeta potential. Kinetic, optical and electrical properties of colloids: Electrophoresis, electroosmosis, sedimentation potential and streaming potential Catalysis: Mechanism and theories of homogeneous and heterogeneous catalysis. Acid-base and enzyme catalysis.

Thermodynamics: Intensive and extensive properties. Exact differentials. Intrinsic energy, enthalpy, entropy, free energy and their relations and significances. . Maxwell relations. Thermodynamic equations of state. Joule- Thomson effect. Joule-Thomson coefficient for van der Waals' gas. The third law of thermodynamics. .

Spectroscopy: Energy levels in molecules, rotational, vibrational, electronic NMR and ESR spectroscopy.

ORGANIC CHEMISTRY

Principles of organic chemistry: Inductive, mesomeric, electromeric effect. Carbocations, carbanions, carbens. Addition, Elimination, Substitution reactions

Chemistry of Polymers: Types and mechanism of polymerization reactions. Step-growth, free radical, addition, ionic polymerizations. Copolymers. Characterization of polymers. Manufacture and applications of polyolefins, thermoplastics, polyamides, polyesters, polyurethanes, epoxies and industrial polymers. Chemistry of natural products- Biosynthesis of terpenes and alkaloids. Carbohydrate protein and nucleic acid.

Organic Photochemistry: Photochemical processes. Energy transfer, sensitization and quenching. Singlet and triplet states and their reactivity. Photoreactions of carbonyl compounds, enes, dienes, and arenes. Norrish reactions of acyclic ketones. Applications of photoreactions in laboratory and industrial synthesis.

Separation Techniques: Chromatographic methods: Classification of chromatographic separations. Theory of chromatography. Applications of chromatographic methods: Adsorption and partition chromatography. Paper, thinlayer and column chromatographic methods.

**SECTION B: MATHEMATICS
(SCIENCES)**

Linear Algebra : Finite dimensional vector spaces; Linear transformations and their matrix representations, rank; systems of linear equations, eigen values and eigen vectors, minimal polynomial, Cayley-Hamilton Theorem, diagonalisation, Hermitian, Skew-Hermitian and unitary matrices; Finite dimensional inner product spaces, Gram-Schmidt orthonormalization process, self-adjoint operators.

Complex Analysis : Analytic functions, conformal mappings, bilinear transformations; complex integration; Cauchy's integral theorem and formula; Liouville's theorem, maximum modulus principle; Taylor and Laurent's series; residue theorem and applications for evaluating real integrals.

Real Analysis : Sequences and series of functions, uniform convergence, power series, Fourier series, functions of several variables, maxima, minima; Riemann integration, multiple integrals, line, surface and volume integrals, theorems of Green, Stokes and Gauss; metric spaces, completeness, Weierstrass approximation theorem, compactness; Lebesgue integral, Fatou's lemma, dominated convergence theorem.

Ordinary Differential Equations : First order ordinary differential equations, existence and uniqueness theorems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients; method of Laplace transforms for solving ordinary differential equations, series solutions; Legendre and Bessel functions and their orthogonality.

Algebra : Normal subgroups and homomorphism theorems, automorphisms; Group actions, Sylow's theorems and their applications; Euclidean domains, Principal ideal domains and unique factorization domains. Prime ideals and maximal ideals in commutative rings; Fields, finite fields.

Functional Analysis : Banach spaces, Hahn-Banach extension theorem, open mapping and closed graph theorems, principle of uniform boundedness; Hilbert spaces, orthonormal bases, Riesz representation theorem, bounded linear operators.

Probability and Statistics : Probability space, conditional probability, Bayes theorem, independence, Random variables, joint and conditional distributions, standard probability distributions and their properties, expectation, conditional expectation, moments; weak and strong law of large numbers, central limit theorem; Sampling distributions; Testing of hypothesis, standard parametric tests based on normal, Chi-Square, t, F - distributions; Linear regression; Interval estimation.

**SECTION B: BOTANY
(SCIENCE)**

- 1. Microbiology** - Viruses and Bacteria Structure, classification and reproduction. General Account of infection, immunity and serology: Microbes in industry and agriculture.
- 2. Pathology** - Knowledge of important plant disease in India caused by fungi. Modes of infection and methods of control.
- 3. Plant Groups** - Structure, reproduction, life- history, classification, evolution, ecology and economic importance of algae, fungi, bryophytes, pteridophytes and gymnosperms.
- 4. Morphology, anatomy and embryology of Angiosperms** - Tissues and tissue systems. Morphology and anatomy of stem, root and leaf (including development aspects and anomalous growth), Morphology of flower Structure of anther and ovule, fertilization and Development of seed.
- 5. Taxonomy** - Principles of nomenclature and classification of angiosperms. Modern trends in Taxonomy. A general knowledge of the more important families of angiosperms.
- 6. Cell Biology** - Cell as unit of structure and functions. Ultra structure function and interrelationships of plasma membranes endoplasmic reticulum, mitochondria, ribosomes chloroplasts and nucleus, Chromosomes- chemical and physical nature behaviour during mitosis and meiosis.
- 7. Genetics and Evolution** - Mendelian concept of genetics. Development of the gene concept Nucleic acids their structure and role in reproduction and protein synthesis. Genetic code and regulation. Mechanism of microbial recombination. Organic evolution evidences, mechanism and theories.
- 8. Physiology** - Photosynthesis history, factors, mechanism and importance. Absorption and conduction of water and salts. Transpiration, Major and minor essential elements and their role in nutrition, Nitrogen fixation and nitrate reduction Enzymes, Respiration and fermentation. General account of growth. Plant hormones and their functions. Photoperiodism. Seed dormancy and germination.
- 9. Ecology** - Scope of ecology, structure, function and dynamics of ecosystems, Plant communities and succession. Ecological factors. Applied aspects of ecology including conservation and control of pollution.
- 10. Economic Botany** - General account of important sources of food fiber, wood and drugs.

**SECTION B: ZOOLOGY
(SCIENCE)**

1. **Non-Chordata and Chordata** : A general survey, classification and relationship of the various phyla. Protozoa : Study of the structure, bionomics and life history of 'Jerboalla, Paramecium, Monocystic, malarial parasite, Typanosoma. Protozoa & disease. Perifera : Sycon. Coelenterate : Structure and life history of Obelia and Aurelia. Sea anemones, Corals, Aleyonium. Helminths, Structure and life history of planaria. Fasciola. Tacenia. Ascaris, Medical importance of Nematodes. Annelida, Neries , earthworm and leech Arthropoda, Palaemon , Scorpion, Cockroach, Mollusea. Unio and Pita, Pearl Formation Modifications of nervous system. Echinodermata , Asterias and its larva. General organisation and characters, outline classification and inter- relationship of proto - chordata. Pisces, Amphibia , Reptilia, Ayes and Mammalia. Neoteny and retrogressive metamorphosis. A general study of comparative account of the various systems of vertebrates. Locomotion and respiration in fishes, structure and affinities of Dipnoi. Structural peculiarities of Amphibia. Poisonous and non- poisonous snakes of India, Aerial adaptations of birds. Structural peculiarities and affinities distribution relation of prototheria and Metatheria
2. **Ecology and Economic Zoology:** Environment: Abiotic factors and their role; Biotic factors -Inter and Intra-specific relations. Ecosystem, Niogeo-Chemical cycles. Adaptation in fresh water, marine and terrestrial habitats. Pollution in air, water and land. Wild life in India and its conservation.
3. **Economic Zoology:** Parasitism, Commensalism and Host parasite relationship. Parasitic protozoan's and helminthes of man. Beneficial and harmful insects.
4. **Cell Biology** -Structure and function of cell and cytoplasmic constituents : structure of nucleus , plasma membrane, mitochondria, Golgi-bodies, endoplasmic reticulum and ribosome's , cell division, mitosis and meiosis. Gene structure and function: Watson-Crick models of DNA, sex-chromosomes and sex -determination.
5. **Genetics** - Mendelian laws of inheritance, linkage and crossing over, mutation and evolution, cytoplasmic inheritance genes and diseases.
6. **Evolution and Systematics** - Origin of life, History of evolutionary thought. Lamarck and his works, Darwin and his works, Sources and nature of organic variation. Natural selection, Isolation. Concept of species and sub-species, principles of classification, zoological nomenclature and international code. Fossils, geological eras, distribution of animal's zoogeographical realms of the world.
7. **Biochemistry** -Structure of carbohydrates, lipids, amino-acids, proteins and nucleic acids, glycolysis and Krebs cycle, oxidation and reduction. Oxidative phosphorylation, energy conservation and release, ATP, cholesterol. Enzymes and coenzymes, Hormones and their functions.
8. **Physiology with special reference to mammals:** Composition of blood, blood groups in man , coagulation, oxygen and carbon dioxide transport, nephron and urine formation, mechanism of conduction along axon and across synapse ,neurotransmitters, Vision, Hearing and other receptors, mechanism of contraction of skeletal muscle, role, of salivary gland, liver, pancreases and intestinal glands indigestion. Absorption of digested food, roles of pituitary, thyroid, parathyroid, pancreas, adrenal testis, ovary and pineal body.
9. **Embryology:** Gametogenesis, fertilization, types of eggs, cleavage, development up to gastrulation in Branchiostoma, frog and chick, Metamorphosis in frog; Formation and fate of extra embryonic membranes in chick; formation of amnion, allantois and classification of placenta in mammals, function, of placenta in mammals.

**SECTION B: BIOTECHNOLOGY
(SCIENCE)**

Molecular Biology, Genomics, Proteomics, & Metabolic Engineering

Structure and regulation of prokaryotes and eukaryotes genes, post-transcriptional and translational modifications, phylogenetics, molecular markers, genetic and physical mapping, cloning and expression vectors, rDNA technology, gene cloning approaches, whole genome sequencing & annotation, high throughput gene expression and function elucidation technologies, protein-protein interactions, MALDI-TOF MS, LC-MS, high throughput identification of biomarkers, Signal transduction pathways and their elucidation, primary and secondary metabolic pathways, systems biology frameworks for metabolic engineering, bioinformatics and statistics, Biodiversity, IPR, Biosafety & Bioethics

Microbiology, Immunology and Diagnostics

Biology of microbes, infectious diseases, immunology, molecular virology, cancer biology, cell & developmental biology, immunotechnology, antibody engineering, vaccines and the associated manufacturing processes, molecular diagnostics and their applications, cell culture technologies, regenerative medicine & transplantation technology, animal biotechnology.

Bioprocess Engineering, Fermentation Technology & Downstream Processing

Bioprocessing vs. chemical processing, Substrates for bioconversion processes, Inoculum development, Process technology for production of primary metabolites, such as baker's yeast, ethanol, citric acid, amino acids, polysaccharides and plastics, Microbial production of industrial enzymes, Production of secondary metabolites, Operation Batch, Fed-batch, CSTR, packed bed reactor, Immobilization, Aeration and agitation, Recovery and purification of fermentation products: removal of insoluble, concentration and purification, effluent treatment, principle and large scale instrumentation requirement for downstream processing.

**SECTION B: MICROBIOLOGY
(SCIENCE)**

UNIT 1: Microbial Taxonomy and Diversity

Microbial World, Concepts and Scope, Classifying and Naming Microorganisms, ICNB Rules, Major Characteristics used to Classify Microorganisms, Importance and Conservation of Microbial Diversity, Metagenomics, In situ Conservation and Ex situ Conservation, Role of Culture collection centers in conservation.

UNIT 2: Microbial Physiology

Microbial Energetics, Microbial enzymes, Metabolism of Carbohydrate, Alternate pathways of Carbohydrate Metabolism, Gluconeogenesis, Utilization of sugars other than glucose, Lipid metabolism, Nitrogen metabolism, Nucleic acid metabolism, Photosynthetic bacteria, Autotrophic Mechanisms in bacteria, Microbial Stress Responses to different conditions.

UNIT 3: Microbial Genetics

Generalized reproductive cycles of microbes: Viruses, Bacteria, Neurospora, Saccharomyces, Chlamydomonas and Acetabularia. Viral Genetics: Phage Phenotypes, Phenotypic Mixing, Bacterial Genetics: Bacterial Transformation, Bacterial Conjugation, Hfr conjugation. Transduction: Generalized and specialized transduction, Mutation and mutagenesis, Fungal and algal genetics.

UNIT 4: Immunology

Immunity, Innate immunity: physical, biochemical and genetic factors involved in governing innate immunity, Acquired immunity, humoral or antibody mediated immunity, cell mediated immunity. Immunological disorders: Hypersensitivity Type I to Type IV, Immunodeficiency diseases; AIDS and other acquired or secondary immunodeficiencies, HIV – 1 and associated opportunistic infections, autoimmune diseases, Antigens and Antibodies, Immunogenicity versus Antigenicity, Factors that influence immunogenicity Antigen processing and presentation, properties of antigen, Super antigen, Hapten; Haptens and the study of antigenicity Microbes as antigen Antigen recognition and MHC molecules. Antibodies – structure and function, clonal selection, antibody diversity, monoclonal antibodies and its clinical applications, Antibody engineering (Construction of monoclonal antibodies Lymphoma and other diseases by genetically engineered antibodies.

UNIT 5: Environmental Microbiology

Microbiology of air, water and soil, Sources of water pollution, Biological indicators of water pollution, Water and air borne diseases. Determination of potable quality of water, Microbes in extreme environment and their survival mechanisms, Microbes in the degradation of wastes, Microbial degradation of pesticides, Xenobiotics, bioremediation - advantages and disadvantages, Geomicrobiology: Microbes in metal extraction, mineral leaching and mining.

UNIT 6: Food Microbiology

Concepts and scope, Detection of food-borne microorganisms, Microbial spoilage of foods, Food poisoning and intoxication, Food borne diseases, Food preservation, Microbial indicators of food safety and quality, Food laws and standards.

UNIT 7: Agricultural Microbiology

Introduction to Agricultural Microbiology, Plant pathology, Diagnosis of plant diseases, Parasitism and disease development, Entry of pathogens to the host, Effect on physiology of host, Plant disease epidemiology, Environment and Plant diseases, Defense Mechanism of Plant Disease, Plant Diseases and their management, Host pathogen interaction, Biofertilizer, PGPR,

Biopesticides.

UNIT 8: Medical Microbiology

Milestones in the development of Medical Microbiology, Microbial Infections, Urinary tract infections, Sexually transmissible infection, Oral cavity and respiratory infection, Gastrointestinal infection, Nosocomial infections, General concepts for specimen collection and handling of specimen, Epidemiology, Pathogenesis, Spectrum of disease, Laboratory diagnosis and Prevention. Diseases caused by Viruses, Bacteria, Fungi, Chlamydiae, Protozoa and emerging diseases,

UNIT 9: Industrial Microbiology

Concepts and Scope of industrial Microbiology, Fermentation, Development of inocula, Fermenters, Batch and Continuous fermentation, Industrially important microorganisms, strain improvement and preservation, Media for industrial fermentation, sterilization, upstream processing, downstream processing, Industrial production of energy fuels (solvents), organic acids, enzymes (amino acids), food additives, Health care products (antibiotics, vitamins), probiotics, biomass production (SCP), hydrocarbons, recombinant proteins, quality control of fermented products, IPR, Patents, Biosafety and Entrepreneurship.

UNIT 10: Molecular Biology and Genetic Engineering

Concept and scope of Molecular Biology and Genetic engineering, Microbes in Molecular Biology, DNA as Genetic material, DNA replication, Differences in prokaryotic and eukaryotic DNA replication, Protein synthesis, Gene expression, Regulation of gene expression in prokaryotes, eukaryotes and bacteriophages, Gene silencing, Importance of gene cloning and future perspectives, Enzymes in genetic engineering, Cloning vectors, Applications of Genetic Engineering, Antisense technology, Safety of rDNA technology, Restriction and regulation for the release of GMOs into Environment, Ethical, Legal, Social and Environmental Issues related to rDNA technology.

**SECTION B: FINANCE / MARKETING MANAGEMENT
(MANAGEMENT)**

Management Process & Organizational Behavior-Overview : Functions and Principles of management; Management Thought and Concepts; Management Decision Making Processes and Types. Overview of Organizational Behaviour; Understanding and managing Individual Behavior-personality, Perception, Values, Attitudes, Learning and Motivation; Group Dynamics and Team Work. Leadership; Overview of Organizational Development: Organizational structure; Organizational design; OD Interventions & Change Management.

Managerial Economics-Overview of Micro-Economics : Basic Concepts of Demand and Supply; Demand Analysis; Production Function; Cost-Output Relations; market Structures; Pricing theories; Overview of macro-Economics; National Income Concepts; Budgeting.

Quantitative Techniques Overview of Probability: Types of Probability distributions (e.g. Binomial, Poisson, Normal and Exponential). Co-relation & Regression Analysis; Overview of Sampling: Sampling distributions; Tests of Hypothesis; Large and small samples. Univariate and Bivariate Data Analysis: t-test, z-test, Chi-square tests; ANOVA.

Strategic Management- Overview of Strategic Management: Concept of Corporate Strategy; BCG Model; GE-9 Cell Model ; Value Chain Analysis; SWOT & TOWS Analysis; Porter's Generic Strategies; Competitor Analysis. Overview of Strategy Formulation and Implementation at Corporate and Business level. Strategic Control.

Ethics in Business Overview of Ethical issues in Business: Value Based Organizations; Ethical Issues on Individual in Organizations; Gender Issues; Ecological Consciousness; Environmental Ethics; Social Responsibilities of Business; Corporate Governance and Ethics; Benefits of Corporate Social Responsibility.

Human Resource management Overview of HRM: Concepts and Perspectives in HRM; HRM in Changing Environment, Overview of HR Planning: Objectives Process and Techniques; Job Analysis ; Recruitment and Selection, Induction; Training and Development; Performance & Potential Appraisal, Overview of Industrial Relations: Wage Policy and Determination; Trade Unions; Dispute Resolution and Grievance Management; Labour Welfare .Overview of e- HRM.

Finance- Overview of Financial Accounting; Analysis of Balance Sheet Statement, Overview of Cost Accounting: Costing Methods and Techniques, Overview of Financial Management: Fund Flow Analysis; Management of Working Capital, Overview of Capital Budgeting: Capital Budgeting Decisions; Capital Structure and Cost of Capital. Overview of Dividend Policy: Determinants; Long-term and Short-term Financing Instruments; Mergers and Acquisitions.

Marketing Management: Overview of Marketing: Marketing Mix, Market Segmentation, Targeting and Positioning; Overview of Product Management; Product Mix Decisions; Product Life Cycle, New Product Development, Branding; Pricing Methods and Strategies. Overview of Promotional Management: Promotion Mix; Advertising; Personal selling; Supply Chain Management; Viral & Niche Marketing; Customer Relation management. Overview of e-Marketing: Uses of Internet as Marketing Medium; Issues in Branding, Market Development, advertising and Retailing on Internet.

Production Management: Overview of Production management: Demand Forecasting for Operations; Production Scheduling; Work Measurement; time and Motion Study; Statistical Quality Control; Facility

Location; Layout Planning. Overview of Operations Research: Linear programming; Transportation model; Inventory control; Queuing theory; Decision theory; PERT/CPM.

Information System-Overview of MIS: Application of Information Systems in management; MIS and Decision Making; System Analysis and Design. Overview of Database Management System; Overview of E-Commerce:

SECTION B: COMMERCE

Business Environment: Meaning and Elements of Business Environment, Economic Environment, Economic Policies, Economic Planning. Competition policy , Consumer protection, Environment protection Liberalization , Privatization and globalization, Second generation reforms , Industrial policy and implementation, Industrial growth and structural changes.

Financial & Management Accounting: Basic Accounting concepts, Capital & Revenue, Financial statements. Partnership Accounts: Admission, Retirement, Death, Dissolution and cash Distribution. Advanced Company Accounts: Issue, Forfeiture, Purchase of Business, Liquidation, Valuation of shares, Amalgamation, Absorption and Reconstruction , Holding company accounts. Cost Management Accounting: Ratio Analysis, Funds Flow Analysis , Cash Flow Analysis, Marginal costing & Break-even analysis, Standard costing, Budgetary control, Costing for decision making, Responsibility accounting.

Business Economics: Nature & uses of Business Economics, Concept of Profit & Wealth maximization. Demand Analysis & Elasticity of Demand, Curve Analysis Law Utility Analysis & Indifference Curve analysis, Laws of Returns and Law of Variable proportions.

Business Statistics & Data Processing: Data types , Data collection and analysis, Sampling, need , errors, & method of sampling, Normal Distribution , Hypothesis testing, Analysis and Interpretation of data. Correlation and Regression , small sample tests-t-test, F-test and chi-square test

Business Management: Concept of management Planning : Objectives, Strategies, Planning process, Decision-making. Staffing : Leading , Motivation, Leadership, Committees, Communication. Controlling: Corporate Governance and Business Ethics.

Marketing Management : The evolution of marketing concepts, Concepts of Marketing, Marketing mix, Marketing environment, Product decision, Pricing decision, Distribution decision.

Financial Management: Capital Structure, Financial & Operating leverage Cost of capital, Capital budgeting, Working capital management. Dividend Policy.

Human Resources Management: Concepts, Role and Functions of Human Resource management, Human Resource planning, Recruitment & Selection. Training & Development, Succession planning. Compensation: Wage & Salary Administration

Banking & Financial Institutions: Importance of Banking to Business, Types of Banks & Their functions Development Banking: IDBI, IFCI, SFCs, UTI, SIDBI.

International Business: World Trade Organisation: Its function & policies.

**SECTION B: ENGLISH
(ARTS, HUMANITIES AND SOCIAL SCIENCES)**

The paper will cover the study of English literature from Shakespeare to 1950. A first hand reading of the prescribed texts and critical ability is required to be tested.

I Literary Forms

Poetry : Lyric, Ode, Sonnet, Elegy, Satire, Epic
Drama : Tragedy, Comedy, Farce, Melodrama, One Act Play, Masque

II William Shakespeare : General Questions on the writer and a critical study of the following works Hamlet, The Tempest

III A critical study of the following poets with reference of the poems shown against each of them Poetry

Milton : Sonnets
Pope : Essay of Man
Johnson : The Vanity of Human Wishes
Wordsworth : Tintern Abbey. Immortality Ode
Keats : Odes
Tennyson : Ulysses

IV The works of the following novelists with special reference to the novels mentioned against each.

Dickens : Oliver Twist
Thomas Hardy : Tess of the D'urbervilles Poetics
Aristotle : Poesie
Longinus : On the Sublime
Dryden : Essay on Dramatic Poesie
Arnold : The Study of Poetry

V (a) A critical study of the 20th century writers and their works.

E.M. Forster : A Passage to India
D.H. Lawrence : Sons and Lovers
G.B. Shaw : Saint Joan
W.B. Yeats : Byzantium, The Second Coming, A Prayer to My Daughter
T.S. Eliot : The Waste Land

V (b) American Literature

Emerson : The American Scholar
Thoreau : Civil Disobedience
Hawthorne : The Scarlet Letter
Eugene O'Neill : The Hairy Ape.

RECOMMENDED BOOKS:-

1. A History of English Literature - Arthur Compton-Rickett.
2. American Literature - Meenakshi Raman
3. English Language Literature - P.D. Wadgaunkar

**SECTION B: ECONOMICS
(ARTS, HUMANITIES AND SOCIAL SCIENCES)**

will contain of 35 questions (multiple choices) to assess the candidates capability of explaining concepts & knowledge from the relevant discipline in which he/she seeks registration as indicated in application form (70 marks)

1. **Economic Systems** - Capitalism, Socialism and mixed economy.
2. **National Income** -Concept and measurement
3. **Consumer behaviour** - Law of demand , Elasticity of demand, utility analysis and indifference - curve techniques
4. **Producer's behaviour** - Production Function, Laws of Returns, Returns, of Scale cost curves
5. **Price Theory** - Price determination under different maker condition, pricing of factors of production Keynesian and Modern theory of employment Banking objective and instruments of Central Banking , credit policies in a planned developing economy
6. **Types and principles of taxation.** Principles of Public expenditure, objective and instruments of budgetary and fiscal policy in a planned developing economy
7. **International trade**-Theory and policy of international trade , determination of exchange rates ,balance of payment
8. **International Monetary institutions** - I. B.R.D. and I.M.F. Characteristics of under developed economy, human and natural resources, primary,secondary and tertiary sectors in India, mixed economy in India
9. **Agricultural development**- Agricultural Policy. land reforms Green Revolution and its aftermath
10. **Industrial development** - Industrial Policy, Public. and private sectors, Regional distribution of Industries in India Pricing policies for agricultural and industrial outputs. Fiscal and momentary policy in India - Objectives, recent budgetary trends, bank nationalization in India. Reserve Bank and monetary policy in India Recent trends in Inida's foreign trade and balance of payments
11. **Indian Planning** - Objectives and strategies, planned growth and distributive justice eradication of poverty, problems of Indian planning.

SECTION B: PERFORMING ARTS

(COMMON TO DANCE & DRAMA THEATRE)

Unit 1. Cultural History of India

Cultures of India from pre-historic to CE 1200

Evolution of Art in pre-historic and historic periods, as evidenced in cave paintings, sculptures and other visual representations

Evolution of dance and drama (*Natya*), (a) the divine origin theory according to *Natyasastra*, and, (b) art as a product of society, its rituals and belief systems

The *Vedas*, major epics and *puranas* (*Ramayana*, *Mahabharata*, *Cilappadikaram* and *Bhagavatapurana*) in terms of their content, character and relevance to dance and theatre

Bhakti and various religious movements and their influence on different representative aspects of culture with focus on dance and theatre

Unit 2. Folk and Traditional Theatre Forms of India

Understanding and defining the terms Tribal, Folk, Traditional and Classical in the context of Indian dance and drama and their interrelation

Introduction to the different tribal, folk and traditional dance and theatre forms spread over various regions of India

Introduction to regional theatrical practices of *Kudiattam*, *Yakshagana*, *Bhagavatamela*, *Tamasha*, *Ramalila*, *Rasalila*, *Bhavai*, *Nautanki*, *Jatra*, *Chhau*, *Laiharaoba*, *Therukoothu*, *Theyyam*, *Ankia-nat*, *Pandvani*, *Chindu Bhagavata*, *Bhand Jashan* and others

Awareness of various musical instruments, costumes and make-up used in these forms

Unit 3. The Natyasastra

Knowledge of *Natyasastra* and the concept of *Natya* and *Nritta*

Study of chapters relating to the eleven aspects (*ekadash sangraha*) such as, *Abhinayas*, *Dharmis*, *Vrittis*, *Pravrittis* and *Aatodyas*. *Samanya* and *Chitrabhinayas* and their classification

Dasarupakas

Natyagruha (Playhouse) and *Ranga* – Construction, types and different elements

Poorvarangavidhi and Stage conventions viz. *Kakshya vibhag* etc.

Unit 4. Art and Aesthetics

'*Rasasutra*' of Bharata

Elaboration of the theory of *Rasa* by commentators like Bhattalollata, Sri Sankuka, Bhattanayaka and Abhinavagupta.

Rasa and its constituent elements, viz., *Sthayi*, *Sanchari* and *Sattvika bhavas* and their corresponding *Vibhavas* and *Anubhavas*

Definition, purpose and elements of Art

A brief introduction to Performance studies and significant western theories on Art : 'Art as Imitation/Catharsis', 'as Imagination', 'as Beauty', 'as Communication' and 'as Utility' put forth by various Philosophers

Unit 5. Dance and Theatre forms of East and South Asian Countries

An overview of dance and theatre forms of East Asian (China, Japan and Korea), South Asian (Bangladesh, Pakistan and Sri Lanka) and South- East Asian (Indonesia, Thailand, Vietnam, Cambodia, Myanmar, Philippines and Laos) countries

History and presentation techniques of various popular theatre and dance forms of the above countries

DANCE

Unit 6. Dance in Sanskrit Literature and Treatises

A brief study of references to dance in the works of Kalidasa, Bhasa, Sudraka and others

General understanding of the concepts relating to dance from texts of ancient and medieval period- *Natyasastra*, *Abhinaya Darpana*, *Sangeeta Ratnakara*, *Nritta Ratnavali* and *Nartana Nirnaya*. Concepts include *Natya*, *Nritta*, *Nritya*, *Lasya*, *Tandava*, *Marga*, *Desi*, *Baddha*, *Anibaddha*, *Nartaki lakshana*, *Sabha lakshana* and the like. Also specific study of the *padas*, *hastas*, *caris*, *mandalas* and *karanas*, and *anga*, *upanga* and *pratyanga* movements

Detailed study of *Abhinaya Darpana* along with introduction to other region/form specific texts like *Hasta Lakshana Deepika*, *Balarama Bharatam*, *Abhinaya Chandrika*, *Srihasta Muktavali* and others

The various categories and typologies of *Nayakas* and *Nayikas* and their *avasthas* according to Bharata's *Natyasastra*, Saradatanaya's *Bhavaprakasana*, Bhanudatta's *Rasamanjari* and Akbar Shah's *Sringaramanjari*

Unit 7. India Classical Dance

Origin and history of Indian classical dance

Evolution, technique, costumes, music, Gurus and pioneers of Bharatanatyam, Kathak, Kathakali, Kuchipudi, Manipuri, Mohiniattam, Odissi and Sattriya

General understanding of major Talas of Hindustani and Carnatic music traditions

A brief study of Composers/*Vaggeyakaras* and their works including Jayadeva, Narayanateertha, Surdas, Meera Bai, Tulasidas, Vanamalidas, Kshetranya, Srimanta Shankar Deva, Govindadas, Vidyapati, and others.

Study of the role of Rabindranath Tagore, Rukmini Devi Arundale, Vallathole Narayana Menon, Madame Menaka and others in the revival and reconstruction of classical dance

Unit. 8 Indian Classical Dance in Independent India

An overview of major Gurus, performers, their works and important institutions in Independent India

Institutionalization of dance and its effect on form, pedagogy, repertoire etc.

The new wave in Indian dance - Its development through the works of Uday Shanker and Ram Gopal and the later major contemporary artists and their works. eg. Shantibardhan, Narendra Sharma, Sachin Shanker, Mrinalini Sarabhai, Maya Rao, Kumudini Lakhia, Manjusri Chaki Sarkar, Chandralekha, Astad Deboo and others)

Indian classical dances in diaspora

Patronage to Dance- the role of government and private bodies

Awareness of important dance festivals, awardees and current happenings in dance

Unit 9. Dance Education, Pedagogy and Research

Dance as part of curriculum in school education and Universities

Movement Analysis based on kinesthetics and Laban system

Eminent scholars and their works, who contributed significantly to the knowledge of Indian dance

Key inroads in dance training and research in India from the 1930's to the present like applied areas of dance, therapy, cross- cultural training etc.

Unit 10. International dance and interactions

Study of the history and development of classical ballet in Europe, Russia and America

Emergence of Modern Dance in the west and major personalities involved

Influence of the West on Indian dance in terms of production design

DRAMA / THEATRE

Unit 6 Drama and its theories: Indian and Western

Concept of drama- Indian and Western Elements and structure of drama according to Indian and Western Dramaturgy A brief study of different classifications of Western dramas – Tragedy, comedy, tragic comedy, melodrama and farce A brief introduction to various ‘isms’ in relation to drama including realism, naturalism, symbolism, expressionism, absurd and epic Playwrights and their contribution: Sanskrit – Kalidasa, Bhasa, Sudraka, Bhavabhuti, Visakhadutta, Bhattanarayana; Ancient Greek and Roman – Aeschylus, Sophocles, Euripides, Aristophanes, Seneca Western – Shakespeare, Moliere, Ibsen, Brecht, Pirandello, Miller, Chekov, Beckett, Ionesco

Unit 7 Modern Indian Theatre

Origin and development of modern Indian theatre with reference to region, state and personalities

A brief study of new trends in theatre since Independence movement both at national and regional level, such as, IPTA movement, Navanatya movement, Root Theatre movement, Third Theatre, Alternate theatre, Street theatre, Theatre of the Oppressed, Applied theatre, Forum Theatre, Site Specific theatre

An overview of major playwrights, directors and other contributing personalities of various regions, whose plays are widely performed at the national level.

Popular Play Houses, Theatre Companies, Institutions and Groups in India and their contribution

Unit 8 Acting and Direction

(A)

Different schools of acting – Western and Eastern

1. Early period- Greek, Roman, Elizabethan, Commedia Dell’ arte
2. Modern Period – Representational, Stanislavsky, Meyerhold, Brecht, Grotowski
3. Eastern – Sanskrit, Peking Opera, Noh, Kabuki

Role of Mime, Voice, Speech, Improvisation and Physical Theatre in actor’s training

(B)

Different directorial innovations and methods

Role of director in Theatre

Fundamentals of play direction: Balance, emphasis, composition, picturisation, movement, tempo and rhythm

Process of production: Script to performance

(C)

Ideas on Production

1. Realistic : Duke of Sexe Meiningen, Stanislavsky, Elia Kazan, Antione

2. Non-realistic : Brecht, Meyerhold, Peter Brook, Augusto Boal
Impact of above ideas on post independent Indian Theatre movements

Unit 9: Theatre Design and techniques

(A)

Theatre architecture: Greek, Roman, Elizabethan, Thrust Stage, Proscenium, Arena, Open Stage.

Sanskrit : Vikrishta – Madhyam Natyagruha

Chinese, Japanese play houses of classical era

(B)

Stage craft: Fundamentals and functions of sets, lights, costumes, make-up, sound, props, other arts and theatre music in terms of various kinds of play production

Aharya and Nepathya vidhi in classical Indian, Chinese, Japanese and Indian Traditional theatre

(C)

Theatre management and organization

(D)

Children's theatre, applied theatre, community theatre, theatre in education, theatre of oppressed and feminist theatre

Unit 10: Theatre Education, Pedagogy and Research

Theatre as part of curriculum from primary education and in University system

Relevance of traditional theatre training

Movement analysis based on kinesthetics, Yoga, Theatre Game, Martial Arts, Folk, Puppetry and other forms

Eminent scholars and their works who contributed to the knowledge of Indian Theatre

Trends in Indian Theatre research and scholarship in India

Patronization to theatre- major institutions, organizations, Government, corporate, private bodies and personalities after independence

Awareness of important theatre festivals, Awardees and current affairs in theatre

SECTION B: JOURNALISM & MASS COMMUNICATIONS

Unit - 1

Introduction to Journalism and Mass Communication

Concept of Journalism and mass communication, mass communication in India.

b. History, growth and development of print and electronic media. Major landmarks in print and electronic media in Indian languages. Media's role in formulation of states of India.

Media criticism and media literacy, Press Council and Press Commissions of India, status of journalism and media education in India. Media policies of the Government of India since Independence.

Models and theories of mass communication, normative theories, administrative and critical traditions in communication, media and journalism studies, communication and theories of socio-cultural, educational and agricultural change. Technological determinism, critique of Marshall McLuhan's views on media and communication and Marxist approaches. Information and knowledge societies.

Indian traditions and approaches to communication from the Vedic era to the 21st century. Western and Eastern philosophical, ethical and aesthetic perceptions of communication - Aristotle and Plato, Hindu, Buddhist, and Islamic traditions.

Media and culture - framework for understanding culture in a globalised world. Globalisation with respect to politico-economic & socio-cultural developments in India.

Unit - 2

Communication for Development and Social Change

Concept and definition of development communication, role of media and journalism in society, characteristics of Indian society – demographic and sociological impact of communication, media and journalism. Media and specific audiences.

Development and social change. Issues and post-colonial conceptions.

Deconstruction of dominant paradigm of communication and development. Responses and critique of dominant models.

Corporatisation of development - Corporate Social Responsibility, non-state actors in development, mass campaigns by NGOs, Government of India, international agencies and corporates. Paradigms and discourse of development communication.

Emergence of global civil societies, public sphere, global communication system - nation state-universal, national communication policies.

Leading influencers of social reform in India - Raja Rammohan Roy, Pandit Madanmohan Malviya, Bal Gangadhar Tilak, Mahatma Jyotiba Phule, Mahatma Gandhi, Acharya Vinoba Bhave, Dr B. R. Ambedkar, Deendayal Upadhyay, Dr Ram Manohar Lohia etc.

Unit - 3

Reporting and Editing

News-concepts, determinants (values), structure and perspectives. Reporting for print, radio, television and digital media. Types of reporting. National and international news agencies and feature syndicates, functions and role.

Writing for print, electronic and digital news media. Translation and transcreation. Editing and presentation techniques for print, television and digital media. Journalism as profession, reportage of contemporary issues, ethics of reporting. Critique of western news values, effect of new technology on global communication flows. Niche Reporting.

Unit - 4

Advertising and Marketing Communication

Definition, concept, functions, types, evolution of advertising, standards and ethics in advertising. theories and models of communication in advertising. Brand management. Advertising management - agency-role, structure and function, client-agency relationship, media planning and budgeting. Advertising and creativity, language and translation. Advertising campaign and marketing. Advertising and marketing research.

Unit - 5

Public Relations and Corporate Communication

Public Relations and Corporate Communication - definition, concept and scope. Structure of PR in State, Public, Private and non-government sectors. Tools and techniques of PR and Corporate Communication. Crisis communication and crisis communication management. Ethics of Public Relations. International Public Relations, communication audit.

Unit - 6

Media Laws and Ethics

Concept of law and ethics in India and rest of the world. The Constitution of India, historical evolution, relevance. Concept of freedom of speech and expression in Indian Constitution.

Defamation, Libel, Slander-IPC 499-502, Sedition IPC 124(A), Contempt of Courts Act 1971, Official Secrets Act 1923, Press and Registration of Books Act 1867, Working Journalists and other Newspaper Employees (Conditions of Service) and Miscellaneous Provisions Act 1955, Wage Boards, Law of Obscenity (Section 292-294 of IPC); the Miller test, the Hicklin test, Indecent Representation of Women (Prohibition) Act 1986, Scheduled Castes and Tribes (Prevention of Atrocities) Act, 1989, Parliamentary Privileges. Famous cases involving journalists and news media organisations.

Right to Information Act 2005, Copyright Act 1957, Intellectual Property Rights, Cable Television Network (Regulation) Act 1995, Information Technology Act (relevant) 2000 and cyber laws, Cinematograph Act 1952, Film Censorship, Press Council Act as amended from time to time, IPR, ASCI, Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954, Various regulatory bodies for print, TV, Advertising, PR, and Internet.

Rules, regulations and guidelines for the media as recommended by Press Council of India, Information and Broadcasting ministry and other professional organisations, adversarial role of the media, human rights and media.

Unit – 7

Media Management and Production

Definition, concept of media management. Grammar of electronic media. Communication design theories and practice. Media production techniques – print and electronic. Digital media production

techniques. Economics and commerce of mass media in India. Principles and management in media industry post liberalisation.

Unit – 8

ICT and Media

ICT and media - definition, characteristics and role. Effect of computer mediated communication. Impact of ICT on mass media. Digitisation. Social networking. Economics and commerce of web enabled media. Mobile adaption and new generation telephony by media, ethics and new media. ICT in education and development in India, online media and e-governance. Animation - concepts and techniques.

Unit - 9

Film and Visual Communication

Film and television theory. Film and identity in Indian film studies, leading film directors of India before and after Independence. Indian cinema in the 21st century. Approaches to analysis of Indian television. Visual Communication. Visual analysis. Basics of film language and aesthetics, the dominant film paradigm, evolution of Indian cinema-commercial and 'non-commercial' genres, the Hindi film song, Indian aesthetics and poetics (the theory of Rasa and Dhvani).

National cinema movements: Soviet Montage cinema, German Expressionistic cinema, Italian Neo-Realistic cinema, French New Wave cinema, British New Wave cinema, Indian New Wave cinema, Period cinema. Cinema in the new millennium.

Unit - 10

Communication Research

Definition, concept, constructs and approaches to communication research process.

Research Designs - types, structure, components, classical, experimental and quasi experimental, variables and hypotheses; types and methods of research; basic, applied, descriptive, analytical, historical, case study, longitudinal studies.

Research in journalism, Public Relations, advertising, cinema, animation and graphics, television, Internet, social media practices, magazines, children's media. Communication, journalism and media research in India.

Levels of measurement: sampling-probability and non-probability, tests of validity and reliability, scaling techniques. Methods and tools of data collection-interviews, surveys, case studies, obtrusive and non-obtrusive techniques, ethnography, schedule, questionnaire, dairy, and internet based tools, media specific methods such as exit polls, opinion polls, telephone, SMS surveys and voting with regard to GEC (general entertainment content).

Data analysis, testing, interpretation, application of statistical tests-parametric and non-parametric, tests of variance-univariate, bivariate and multivariate, tests of significance, computer mediated research.

Ethical considerations in communication, media and journalism research, writing research reports, plagiarism.

SECTION B: AGRICULTURE

- Unit 1** **Horticulture** - Its definition and branches, importance and scope; horticultural botanical classification; climate and soil for horticultural crops, Plant propagation-methods and propagating structures; principles of orchard establishment Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness. Pollination, importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops
- Unit 2** **Biochemistry**.-Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Enzymes: General properties; Classification; Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.
- Unit 3** **Biotechnology**- Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, another culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance. Introduction to recombinant DNA methods. Biotechnology regulations.
- Unit 4** **Soil Science**- Soil as a natural body, Soil physical properties, soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability. Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution
- Unit 5** **Agronomy**- Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources. Soil-plant-water relationship, crop water requirement. Growth and development of crops, factors affecting growth and development, plant. Crop management technologies in problematic areas, harvesting and threshing of crops.
- Unit 6** **Genetics and Plant breeding** - Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. , Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis.
- Unit 7** **Plant pathology** - Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth, Bacterial genetics: Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation. Microbes in human welfare: silage production, Biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.
- Unit 8** **Crop Physiology**- Introduction to crop physiology and its importance in

Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology. Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms. Plant growth regulators. Role of Physiological growth parameters in crop productivity.