

**Eligibility Criteria for the Ph.D. programs**  
**Tezpur University Entrance Examination 2023**

**School of Humanities and Social Sciences**

Sl. No	Programmes	Eligibility	Syllabus
1	<b>Ph.D. in Cultural Studies</b>	M.A. in any of the disciplines in Humanities or Social Sciences with a uniformly good academic career. Candidates with UGC JRF, UGC NET or SET will be given preference.	General knowledge; matters of contemporary and historical social and cultural importance with particular reference to North East India, Cultural Studies as a discipline: its origin and evolution; theoretical legacies of the discipline of Cultural Studies; Cultural Memory; Cultural History of North East India; Oral History, Research Methods in general etc
2	<b>Ph.D. in Education</b>	Post Graduate in Education or in any allied discipline/subjects with 55% marks.	<p>Research Methodology in Education- Concept of Educational Research, Methods of Research, Approaches of Research, Hypothesis, Synopsis, Sample-population, Designs of Research, Descriptive and Interferential Statistics, Research Report, Bibliography Etc.</p> <p>Contemporary issues in Education- Educational scenario of India, Inclusive Education, RTE Act 2009, and Education for peace, yoga and gender, Constitutional Provisions, Environmental Education etc.</p> <p>Perspectives in Education- Philosophical, Sociological and Psychological foundation of Education.</p>
3	<b>Ph.D. in English</b>	M.A. in English with at least 55% marks (specialization may be in American Literature as well as in English Language Teaching, English Literature, Indian Writing in English, New Literature in English and Women's Writing in English).	<p><b>Div -I: English Language Teaching</b>            English in the global context, ELT in India in historical perspective. Principles and practice of ELT - Language acquisition, language learning-theories, principles; Language skills; Language teaching-different approaches (methods, techniques, procedures); Teaching of literature; Evaluation, testing. Syllabus designing and material production. English for Specific/Academic Purpose.</p> <p><b>Div -II: American Literature</b></p>

			<p>Research Methodology, Literary Theory and Criticism, American Literature</p> <p><b>Div -III: Indian Literature</b> Research Methodology, Literary Theory and Criticism, Indian Writing in English</p> <p><b>Div -IV: Gender and Literature</b> Research Methodology, Literary Theory and Criticism, Gender and Literature</p> <p><b>Div V: Life Writing, Travel Writing</b> Research Methodology, Literary Theory and Criticism, Life Writing, Travel Writing</p> <p><b>Div VI; Film Adaption, Popular Culture</b> Research Methodology, Literary Theory and Criticism, Life Writing, Travel Writing</p> <p><b>Div VII: Anglophone South Asian Literature, Ecocriticism</b> Research Methodology, Literary Theory and Criticism, Life Writing, Travel Writing</p>
4	<b>Ph.D. in Hindi</b>	M.A. in Hindi from Recognised University	Hindi Bhasha evam Sahitya, Hindi Alochana, Hindi Patrakarita, Lok Sahitya, Tulnatmak Sahitya
5	<b>Ph.D. in Linguistics and Language Technology</b>	MA in Linguistics and Language Technology/MA in Linguistics/MA in Allied Subjects with 55% marks.	Modern Linguistic theories (formal and functional, especially, Chomsky's generative theory, Cognitive Linguistics, Construction Grammar); Morphology; Phonetics and Phonology; Semantics and Pragmatics; Philosophy of Language (e.g. ordinary language philosophy; logical positivism); Sociolinguistics (e.g. bilingualism, multilingualism, politeness; Critical Discourse Analysis), Languages and linguistic situation of Northeast, Scheduled languages and non-scheduled languages, Language endangerment, Language policies and planning.
6	<b>Ph.D. in Mass Communication and Journalism</b>	M. A. in Mass Communication, Mass Communication & Journalism/ Communication. Master of Mass Communication (MMC). Master of Journalism & Mass Communication (MJMC). Master of Science in	Research methodology for social sciences, theoretical concepts of communication and media, a higher level of critical awareness about various important issues of mass media at national and international level.

		Communication (M. S. Communication). M. Sc. Communication. Master of Journalism.	
7	<b>Ph.D. in Social Work</b>	Consistently good academic record with at least 55% marks in M.A. in Social Work or allied Social Sciences such as Sociology, Psychology, Rural Development, Development Studies, Law, Public Health, Education and Management	<ul style="list-style-type: none"> <li>• Social Work</li> <li>• Social work and allied social science theories</li> <li>• Social science research and statistics</li> <li>• General knowledge and aptitudes</li> <li>• Developmental issues</li> <li>• Civil society issues</li> </ul>
8	<b>Ph.D. in Sociology</b>	Post –Graduation in Sociology / Cultural Studies/Anthropology (with specialization in Social Anthropology)/Economics/History/Political Science / Philosophy / Mass Communication /English/ Law / Management/ Social Work	<p><b>Research Methodology:</b> Philosophy, science and research, Theory and field, Social research strategies, Research designs and sample designs, Planning a research project and formulating research questions, reviewing the literature, Ethics in social science research, Nature of quantitative research, Nature of qualitative research, participant observation and ethnography, Triangulation: mixed methods research, Problem of objectivity and subjectivity.</p> <p><b>Sociological Theory:</b> Classical sociological traditions: Marx, Durkheim, Weber, Approaches to social reality: positivism, hermeneutics, post-structuralism, post-modernism, Functionalism and its critiques, neo-functionalism, Structuralism, social structure as model, structuration, Critical theory and Frankfurt School, Symbolic Interactionism, phenomenology, ethnomethodology, dramaturgy.</p> <p><b>Indian Society:</b> Theories of Social Change in India, Caste, Varna and Class, Kinship systems, Secularism and Communalism, Nationalism, Nation Building, Regionalism.</p>
9	<b>Ph.D. in Women studies</b>	Masters degree with at least 55% marks in Women Studies/ Humanities/ Social Sciences with consistently good academic	Women's history, feminist research methodology, women and development, women and health.

		record. Candidates with Masters degree in Humanities and Social Sciences having one course in the area of women studies will be preferred.	
<b>School of Engineering</b>			
<b>1</b>	<b>Ph.D. in Applied Sciences - Chemistry</b>	1. M.Sc. in Chemistry/ Chemical Sciences/ Polymer Chemistry/ Polymer Science/ Physics/ Nano Science/ Material Science/ Environmental Science or allied subjects OR 2. M.E./M.Tech in allied subjects (Chemical Engineering/ Polymer Technology/ Material Sciences/ Environmental Engineering/ Energy etc.)	Organic Chemistry, Inorganic Chemistry, Physical and Quantum Chemistry, Polymer Chemistry, Analytical Chemistry, Spectroscopy, Interdisciplinary topics from post graduate level curriculum of all leading Indian Universities.
<b>2</b>	<b>Ph.D. in Applied Sciences - Mathematics</b>	1. M.Sc./M.A./M.E./M.Tech./MS/BS - MS/Integrated M.Sc. Degree in Mathematics/Statistics/Engineering Mathematics/ Mathematics and Computing/ Applied Mathematics/ Operations Research/ Mechanical Engg./ Industrial Engineering/ Computer Science and Engineering/ Information Technology/any allied subject with 55% marks in aggregate or equivalent CGPA.	Linear Algebra, Abstract Algebra, Real Analysis, Complex Analysis, Functional Analysis, Topology, Ordinary and Partial Differential Equations, Numerical Analysis, Measure Theory, Classical Mechanics, Probability and Statistics, Mathematical Programming, Number Theory, Special Functions, Integral Equations and Transforms, Calculus of Variation.

		<p>OR</p> <p>2. B.Tech. in Mathematics and Computing/any allied subjects with 75% marks in aggregate or equivalent CGPA with a valid GATE Score. Minimum two recommendation Letters from the Institute/ University from where B.E./B.Tech degree was obtained.</p>	
3	<b>Ph.D. in Applied Sciences - Physics</b>	<p>1. M.Sc./Integrated M.Sc. in Physics/ Astrophysics/ Electronics/ Geophysics/ Material Science/ Applied Mathematics/ Nanoscience and Technology/ Biotechnology/ Environmental Science and Chemical Science.</p> <p>OR</p> <p>2. M.Phil., M.Tech. in Solid State Material/ Material Science/ Electronics/ Energy/ Nanoscience and Technology/ Biotechnology/ Environmental Science and Chemical Sciences.</p> <p>OR</p> <p>3. M.S Astronomy and Astrophysics.</p> <p>OR</p> <p>4. B.Tech. in Engineering Physics with 80% marks in aggregate or equivalent CGP</p>	<p>M.Sc. Physics syllabus of any Indian University (Quantum Mechanics, Classical Mechanics, Mathematical Physics, Condensed matter Physics, Statistical Physics, Atomic and Molecular Physics, Nuclear and Particle Physics, Astrophysics, Electrodynamics, Electronics)</p>

4	<b>Ph.D. in Civil Engineering</b>	<p>(a) M.E./M.Tech. /M.Sc.(Engg.) in Civil Engg. or allied areas or (b) M.Sc. in relevant discipline with minimum 70% marks in aggregate or equivalent CGPA or (c) B.E. / B.Tech with 75% marks in aggregate or equivalent CGPA with a valid GATE Score.</p> <p>Minimum two recommendation Letters from the Institute/University from where B.E./B.Tech degree was obtained.</p>	<p>Soil formation, Soil structure, Soil properties, Permeability and seepage, Stress distribution in soils, Compaction, Consolidation, Shear strength, Soil exploration &amp; site investigation, Shallow foundations, Deep Foundations, Ground improvement techniques, Lateral earth pressure, Stability of slope, Introduction to soil dynamics &amp; machine foundation, Liquefaction of soils, Pavement material.</p> <p>Water and Wastewater Quantity Estimation, Water Quality, Microbiology, Environmental Chemistry, Dissolved oxygen Model, Sewer Design, Type I and II suspensions, Sedimentation Tanks, Coagulation and Flocculation, Hydraulics of Filtration, Disinfection Methods, Ion exchange and Adsorption, Water Softening, Manganese and Iron Removal, Wastewater treatment, Septic tank, wastewater stabilization ponds, aerated ponds and oxidation ditches.</p> <p>Fluid properties, Application of the continuity, momentum and energy equations, Flow in pipes, Boundary Layer theory, forces on submerged bodies, hydrostatic forces on bodies, buoyancy, kinematics of flow, dynamics of fluid flow, Dimensional analysis; flow in open channel, hydraulic machines, Hydrologic cycle, precipitation and abstraction losses, hydrograph analysis, flood estimation, groundwater hydrology –well hydraulics, aquifers, Darcy’s Law, irrigation systems and methods, Gravity Dams and Spillways</p>
5	<b>Ph.D. in Computer Science and Engineering</b>	<p>M.Tech. in Computer Science/ I.T./ Electronics, MCA, M.Sc. in Computer Science, I.T. B.E. / B.Tech with 75% marks in aggregate or equivalent CGPA with a valid GATE Score.</p> <p>Minimum two recommendation Letters from the Institute/ University from where B.E./B.Tech degree was obtained.</p>	<ul style="list-style-type: none"> <li>• Basic 10+2 mathematics</li> <li>• Data structures - Array, stack, queue, linked list, binary tree, heap, AVL tree.</li> <li>• Programming languages - Languages like C and C++.</li> <li>• Design and analysis of algorithms - Asymptotic notation, sorting, selection, searching.</li> <li>• Computer organization and architecture - Number representation, computer arithmetic, memory organization, I/O Organization.</li> <li>• Operating systems - Memory management, processor management, critical section problem, deadlocks.</li> </ul>

			<ul style="list-style-type: none"> <li>• Formal languages and automata theory - Finite automata and regular expressions, pushdown automata, context-free grammars, Turing machines, elements of undecidability.</li> <li>• Principles of Compiler Construction - Lexical analyzer, parser, syntax-directed translation, intermediate code generation.</li> <li>• Database management systems - Relational model, relational algebra, relational calculus, functional dependency, normalization (up to BCNF).</li> <li>• Computer networks - OSI, LAN technology - Bus/tree, Ring, Star; MAC protocols; WAN technology - circuit switching, packet switching; Data communications - data encoding, routing, flow control, error detection/correction, Internetworking, TCP/IP networking including IPv4.</li> <li>• Switching Theory and Logic Design - Boolean algebra, minimization of Boolean functions, combinational and sequential circuit synthesis and design. MCA Syllabus for T</li> </ul>
6	<b>Ph.D. in Electrical Engineering</b>	(a)ME/MTech/MS/ in Electrical/ Electronics/Communication/ Power System/ Power Electronics/ Instrumentation/ Control/ Computer Science & Engineering/ MBBS with MD/MS and any other relevant discipline. (b) BE/BTech with 75% marks in aggregate or equivalent CGPA with a valid GATE Score. Minimum two recommendation Letters from the Institute/ University from where B.E./B.Tech degree was obtained.	<p>Sensor fabrication for application in food industry, IoT and health monitoring, Green energy sensor.</p> <p>Control systems, smart energy system, Chaos, IoT, Waste water purification.</p> <p>Renewable energy, power system, Electric drives, Electrical vehicles.</p> <p>Power electronics and drives, Microgrids/Smart grids</p>
7	<b>Ph.D. in Electronics and Communication Engineering</b>	M.E. / M.Tech. / M.Sc. Engg. / M.S. in Electronics/ Communication/ Electronics Design/ Electrical/ Instrumentation/ Control/	<p><b>Section 1: Engineering Mathematics:</b>  <i>Linear Algebra:</i> Vector space, basis, linear dependence and independence, matrix algebra, eigenvalues and eigenvectors, rank, solution of linear equations- existence and uniqueness</p>

		<p>Microwave/ Biomedical/ Bioelectronics/ Bio - Technology/ Computer Science/ Information Technology. M.Sc. in Electronics/ Physics/ Applied Mathematics. MCA with Physics, Chemistry and Mathematics in Bachelor degree, MBBS with MD/ MS degree. B.E. / B.Tech with 75% marks in aggregate or equivalent CGPA with a valid GATE Score. Minimum two recommendation Letters from the Institute/ University from where B.E./ B.Tech degree was obtained.</p>	<p>Calculus: Mean value theorems, theorems of integral calculus, evaluation of definite and improper integrals, partial derivatives, maxima and minima, multiple integrals, line, surface and volume integrals, Taylor series.  <i>Differential Equations</i>: First order equations (linear and nonlinear), higher order linear differential equations, Cauchy's and Euler's equations, methods of solution using variation of parameters, complementary function and particular integral, partial differential equations, variable separable method, initial and boundary value problems.  <i>Vector Analysis</i>: Vectors in plane and space, vector operations, gradient, divergence and curl, Gauss's, Green's and Stokes' theorems.  Complex Analysis: Analytic functions, Cauchy's integral theorem, Cauchy's integral formula, sequences, series, convergence tests, Taylor and Laurent series, residue theorem  <i>Probability and Statistics</i>: Mean, median, mode, standard deviation, combinatorial probability, probability distributions, binomial distribution, Poisson distribution, exponential distribution, normal distribution, joint and conditional probability.</p> <p><b>Section 2: Networks, Signals and Systems</b>  Circuit analysis: Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform. Linear 2-port network parameters, wye-delta transformation. Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications. Discrete-time signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay.</p> <p><b>Section 3: Electronic Devices:</b></p>
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			<p>Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors. Carrier transport: diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations. P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.</p> <p><b>Section 4: Analog Circuits:</b>  Diode circuits: clipping, clamping and rectifiers, BJT and MOSFET amplifiers: biasing, ac coupling, small signal analysis, frequency response. Current mirrors and differential amplifiers. Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.</p> <p><b>Section 5: Digital Circuits and Microprocessor:</b>  Number representations: binary, integer and floating-point- numbers. Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaugh map, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders sequential circuits: latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay. Data converters: sample and hold circuits, ADCs and DACs. Semiconductor memories: ROM, SRAM, DRAM.  8085 Microprocessor: Programmers model, register structure, addressing modes and assembly languages, interrupts. Peripherals: Programmable interrupt controller (8259), programmable peripheral interface (8255), serial communication (8251), programmable timer and event counter (8254) and DMA controller (8257)</p> <p><b>Section 6: Control Systems:</b>  Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag lead</p>
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			<p>compensation; State variable model and solution of state equation of LTI systems.</p> <p><b>Section 7: Communications and microwave:</b>  Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems. Analog communications: amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, superheterodyne receivers. Information theory: entropy, mutual information and channel capacity theorem. Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter- symbol interference, MAP, ML detection, matched filter receiver, SNR and BER. Fundamentals of error correction, Hamming codes, CRC.  Passive Microwave Devices and Components - Reciprocal and non-reciprocal devices and their applications. Guided and Free Space Propagation. Active Microwave Devices - Tubes and Solid State Devices, their principles and applications. Measurement Systems and Measurement Techniques. Microwave Materials and their Properties</p> <p><b>Section 8: Electromagnetics:</b>  Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector. Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth. Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S- parameters, Smith chart. Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.</p> <p><b>Section 9: Electrical Machines:</b>  Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC</p>
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			machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors; Types of losses and efficiency calculations of electric machines
8	<b>Ph.D. in Energy</b>	M.Sc. / M.E. / M.Tech. degree in Energy Technology/ Energy Management/Energy related Engineering and Technology/ Physics/ Chemistry/Agriculture Allied subjects.	Energy conversion and Energy systems, Energy-Environment interaction.
9	<b>Ph.D. in Food Engineering and Technology</b>	M.Tech/ M.E./ Integrated M.Tech in Food Engineering and Technology/ Food and Dairy related other programme/ Mechanical Engineering/ Chemical Engineering/ Bio-process/ Bio-chemical/ Biotechnology or M.Sc/ Integrated M.Sc in Food Engineering and Technology/ Food and Dairy related other programme/ Applied Microbiology/ Microbiology/ Bio-Chemistry/ Chemistry/ Biotechnology/ Biosciences and Informatics, or, B.E./ B.Tech (in Food Engineering and Technology/ Food and Dairy related other programme) with	Food Engineering; Food Chemistry & Nutrition; Food Microbiology; Food Product technology (As per the outline of GATE syllabus for Food Technology)

		75% marks in aggregate or equivalent CGPA with valid GATE Score). Minimum two recommendation Letters from the Institute/ University from where B.E./ B.Tech degree was obtained	
10	<b>Ph.D. in Mechanical Engineering</b>	M.E. / M.Tech. / M.Sc. (Engg.) in Mechanical Engg. or allied areas. B.E. / B.Tech with 75% marks in aggregate or equivalent CGPA with a valid GATE Score. Minimum two recommendation Letters from the Institute/University from where B.E./B.Tech degree was obtained.	<p><b>Engineering Mathematics</b></p> <p><b>Linear Algebra:</b> Matrix algebra, systems of linear equations, eigenvalues and eigenvectors.</p> <p><b>Calculus:</b> Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; evaluation of definite and improper integrals; double and triple integrals; partial derivatives, total derivative, Taylor series (in one and two variables), maxima and minima, Fourier series; gradient, divergence and curl, vector identities, directional derivatives, line, surface and volume integrals, applications of Gauss, Stokes and Green's theorems.</p> <p><b>Differential equations:</b> First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; Euler- Cauchy equation; initial and boundary value problems; Laplace transforms; solutions of heat, wave and Laplace's equations.</p> <p><b>Complex variables:</b> Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series.</p> <p><b>Probability and Statistics:</b> Definitions of probability, sampling theorems, conditional probability; mean, median, mode and standard deviation; random variables, binomial, Poisson and normal distributions.</p>

			<p><b>Numerical Methods:</b> Numerical solutions of linear and non-linear algebraic equations; integration by trapezoidal and Simpson's rules; single and multi-step methods for differential equations.</p> <p><b>Applied Mechanics and Design</b></p> <p><b>Engineering Mechanics:</b> Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.</p> <p><b>Mechanics of Materials:</b> Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.</p> <p><b>Theory of Machines:</b> Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.</p> <p><b>Vibrations:</b> Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.</p> <p><b>Machine Design:</b> Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.</p>
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			<p><b>Fluid Mechanics and Thermal Sciences</b></p> <p><b>Fluid Mechanics:</b> Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.</p> <p><b>Heat-Transfer:</b> Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis</p> <p><b>Thermodynamics:</b> Thermodynamic systems and processes; properties of pure substances, behavior of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.</p> <p><b>Applications:</b>  <i>Power Engineering:</i> Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. <i>I.C. Engines:</i> Air-standard Otto, Diesel and dual cycles. <i>Refrigeration and air-conditioning:</i> Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes. <i>Turbomachinery:</i> Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.</p>
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			<p><b>Materials, Manufacturing and Industrial Engineering</b></p> <p><b>Engineering Materials:</b> Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.</p> <p><b>Casting, Forming and Joining Processes:</b> Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.</p> <p><b>Machining and Machine Tool Operations:</b>  Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.</p> <p><b>Metrology and Inspection:</b> Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).</p> <p><b>Computer Integrated Manufacturing:</b> Basic concepts of CAD/CAM and their integration tools; additive manufacturing.</p> <p><b>Production Planning and Control:</b> Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.</p> <p><b>Inventory Control:</b> Deterministic models; safety stock inventory control systems.</p>
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			Operations Research: Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.
<b>School of Sciences</b>			
<b>1</b>	<b>Ph.D. in Chemical Sciences</b>	M.Sc. in all branches of Chemical Science/ Physics/Nanoscience/ Material Science/ Biotechnology/ Biochemistry/ Bioinformatics/ Environmental Science. M.E./M.Tech. in allied subjects (Chemical Engineering/ Polymer Technology/ Material Sciences/ Environmental Engineering etc.).	Organic Chemistry, Inorganic Chemistry, Physical and Quantum Chemistry, Polymer Chemistry, Analytical Chemistry, Spectroscopy, Interdisciplinary topics from post graduate level curriculum of all leading Indian Universities.
<b>2</b>	<b>Ph.D. in Environmental Science</b>	Masters in any Science/ Applied Science / Engineering discipline with at least 55% marks or equivalent CGPA. At Bachelor's level the candidate must have attended Science / Technology programme.	Botany, Zoology, Agriculture, Physics, Chemistry, Mathematics, Statistics, Earth and Environmental Science from master's level curriculum of Indian Universities.
<b>3</b>	<b>Ph.D. in Mathematical Sciences</b>	M.A. / M.Sc. in Mathematics or M.A./M.Sc. in Statistics with requisite background in Mathematics.	Linear Algebra, Abstract Algebra, Real Analysis, Complex Analysis, Functional Analysis, Topology, Ordinary and Partial Differential Equations, Numerical Analysis, Measure Theory, Classical Mechanics, Probability and Statistics, Mathematical Programming, Number Theory, Special Functions, Integral Equations and Transforms, Calculus of Variation.
<b>4</b>	<b>Ph.D. in Molecular Biology and Biotechnology</b>	Masters in any branches of Life Sciences/ Physical Sciences/ Chemical Sciences/ Mathematical Sciences/ Agricultural Sciences / Veterinary or Sciences /	Master (MSc/MTech)/B.Sc (Graduation) level Life Science (includes Botany, Zoology, Microbiology, Biochemistry, Cell Biology, Physiology, Genetics etc.), basic bioinformatics, and Higher Secondary level Physics, Chemistry and Mathematics.



		Engineering Sciences /Medical Sciences or in any allied field. B. Tech./ B. E. degree with 80% marks in CGPA (with GATE score > 90.00 percentile) in Chemical Engineering/ Chemical Sciences/ Bioinformatics or any allied field. MBBS or BVSc. degree with at least 60% marks or equivalent CGPA. Apart from the above, candidates having consistently good academic record will be preferred.	
5	<b>Ph.D. in Physics</b>	M.Sc. in Physics/ Electronics/ Geophysics/ Material Science/ Applied Mathematics/ Nanoscience and Technology/ Biotechnology/ Environmental Science and Chemical Science. M.Phil., M.Tech. in Solid State Material/ Material Science/ Electronics/Energy/ Nanoscience and Technology/ Biotechnology/ Environmental Science and Chemical Sciences. B.Tech. in Engineering Physics with 80% marks in aggregate or equivalent CGPA.	M.Sc. Physics syllabus of any Indian University (Quantum Mechanics, Classical Mechanics, Mathematical Physics, Condensed matter Physics, Statistical Physics, Atomic and Molecular Physics, Nuclear and Particle Physics, Astrophysics, Electrodynamics, Electronics)
<b>School of Management Sciences</b>			
1	<b>Ph.D. in Business Administration</b>	M.B.A. , M.Com. , M.A. / M.Sc. in Economics, M.A. in Psychology/ Sociology/Social Work/ Cultural	<b>General Awareness:</b> National and international economic environment, conceptual background and applications in economic theory.

		Studies, MCA , M.T.M. / M.T.A. FCA/ FCS/ FICWA.	<p><b>General English:</b> Basic English grammar</p> <p><b>General Reasoning:</b> Basic arithmetic and mathematics, Quantitative and alphabetic reasoning, pictorial reasoning.</p> <p><b>Research Methodology:</b> Basic statistical tools: Measures of Central Tendency, Measures of Dispersion, Correlation, Index Numbers, Time series analysis. Basics of Sampling: Sample Vs. Census; Probabilistic Sampling Techniques: Simple Random Sampling, Stratified Random Sampling, Cluster Sampling; Non- Probabilistic Sampling Techniques: Convenience Sampling, Judgement Sampling, Quota Sampling and Snowball Sampling. Basics of Hypothesis Testing: Null and alternative hypothesis, Type I error, Type II error. Style of Referencing: American Psychological Association (APA) 6th Edition style.</p>
2	<b>Ph.D. in Commerce</b>	1. M.Com., 2. M.A./M.Sc. in Economics, 3. FCA/ FCMA/ FCS.	<ol style="list-style-type: none"> <li>1. Research Methodology</li> <li>2. Accounting (PG and NET Standard)</li> <li>3. Finance (PG and NET Standard)</li> <li>4. Economics (including Indian Economy)</li> </ol>
<b>Centre for Multidisciplinary Research</b>			
1	<b>Ph.D. in Multidisciplinary Areas of Research</b>	<p>Thematic area: Robotics (<i>Prospect, issues, and impact of new technologies in the contexts of society, environment, and economy</i>):</p> <p>M.E. / M.Tech. / M.Sc. Engg. / M.S. in Electronics/ Communication/ Electronics Design/ Electrical/ Mechanical Engg/Instrumentation/ Control/ Biomedical/ Bioelectronics/ MBBS with MD/ MS degree.</p>	<p>General aptitude in research as evidenced by comprehensive knowledge on issues related to scientific thinking, research ethics (Good Academic Research Practices), sustainability, development, economy, technology, environment, peace, conflict, and harmony.</p> <p>Comprehensive understanding of programmes and policies of Government of India related to welfare and development, food security, access to education including provisions of NEP2020.</p> <p>Basic understanding of major challenges faced by mankind including global, national, and regional initiatives to combat such challenge (for example, not limited to, modern lifestyle vis-à-vis mental health, exploitation of natural resources vis-à-vis climate change) including SDG and Net Zero targeting.</p>

		<p><i>Thematic area: Big data including its applications in Biology and medicine, Systems Biology, Climate adaptation</i>  M.Sc/M.Tech in Biotechnology/ Bioinformatics/ Molecular Biology/ Life Sciences/ Agricultural Sc./ Environmental Sc./ Computer Science and Engineering/ IT / Statistics, MCA/MBBS/ MV.Sc/ M.Pharm</p> <p><i>Thematic area: Data science for solving engineering problems</i>  Post-graduation in Engineering/ Science/ Management. Basic knowledge of data science preferred.</p> <p><i>Thematic area: Mental Health and well-being</i>  M. Tech in Computer Science and Engineering /ECE/ M. Sc in MBBT, Bioinformatics</p> <p><i>Thematic area: Intellectual Property Rights</i>  Post-Graduation in Science or Engineering or Management or Law (<b>Two Fellowships are available through DPIIT IPR Chair, if selected in this area</b>)</p>	<p>Fundamental knowledge in mathematics, science, statistics, history, creative arts subjects and geography.</p> <p>Working knowledge on ethical use of ICT, and of Language and communication, basic understanding on education as a mean of attaining higher order thinking skills and a driver of self-directed learning.</p>
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