Syllabus and Examination pattern for written Test to be held in the respective departments at Tezpur University, for admission into various Ph. D. programmes (Spring Semester - 2024)

S. No	Department/ Centre	Syllabus for TUEE24	Examination pattern	
			MCQ%	Descriptive %
1	Assamese	History of Assamese Literature History of Assamese Language and Script Culture of Assam Literary Theory and Criticism (Eastern and Western) Research Methodology	60%	40%
2	Business Administration	General Awareness: National and international economic environment, conceptual background and applications in economic theory. (20) General English: Basic English grammar (20) General Reasoning: Basic arithmetic and mathematics, Quantitative and alphabetic reasoning, pictorial reasoning. (20) Research Methodology: Basic statistical tools: Measures of Central Tendency, Measures of Dispersion; Correlation; Index Numbers; Time series analysis; Sources of Data: Primary and Secondary sources, Observation and Self-reported data; Basics of Sampling: Sample Vs. Census; Probabilistic Sampling Techniques, Non- Probabilistic Sampling Techniques; Scales of Measurement' Validity and reliability; Basics of Hypothesis Testing: Null and alternative hypothesis; Basic hypothesis testing tools: Chi square test, z test, t test, Analysis of Variance; Style of Referencing: American Psychological Association (APA) 7th Edition style.(40)	100%	0%
3	Chemical Sciences	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.	50%	50%
4	Computer Science & Engineering	Discrete Mathematics, probability, statistics, algebra Data structures-Array, stack, queue, linked list, binary tree, heap, AVL tree, graph. Programming languages- C, C++. Design and analysis of algorithms-Asymptotic notation, sorting, selection, searching. Computer organization and architecture – Number representation, computer arithmetic, Logic Design, Boolean algebra, memory organization, I/O Organization. Operating systems - Memory management, processor management, critical section problem, deadlocks. Formal languages and automata theory - Finite automata and regular expressions, push down automata, context-free grammars, Turing machines, elements of undecidability.	70%	30%

		Database management systems - Relational model, relational algebra, relational calculus, functional dependency, normalization (up to BCNF). Computer networks – Physical layer, LAN technology, MAC protocols, circuit switching, packet switching, data encoding, routing, flow control, error detection/correction, Internetworking, TCP/IP networking protocols. Principles of Compiler Construction-Lexical analyzer, parser, syntax-directed translation, intermediate code generation.		
5	Cultural Studies	Cultures in contemporary and historical perspectives; Cultural Studies as a discipline; Cultural Memory, Cultural History, Oral History; Contemporary Ethnography, Material Cultures, Media and Culture, Digital Archiving, Visual Culture, Gender Studies, Folk and Literary Cultures, Culture and Environment, Research Methods	30%	70%
6	Design	Section I : Visualization and spatial ability: Pictorial and diagrammatic questions to test the understanding of transformation and/or manipulation of 2D shapes and 3D objects and their spatial relationships. Environmental and social awareness: General awareness of environmental factors (such as climate, population, water, vegetation, pollution, weather, natural resources) and their implications on the design of products, images, infrastructure and environment. Awareness of design terminologies, social and cultural connection with design, history of the designed artefact, and socially responsible and environmentally sustainable design responses. History of art, sculpture and literature. Analytical and logical reasoning: Ability to analyse given information logically and select the most appropriate solutions; ability to weigh opinions, arguments or solutions against appropriate criteria; ability to use logic and structured thinking to deduce from a short passage, which of a number of statements is the most accurate response to a posed question. Language and creativity: Ability to understand passages in commonly used English language; ability to think creatively in terms of alternatives; ability to distinguish innovative options and think out-of-the-box. Design thinking and problem solving: Ability to understand the context, the users and the constraints and select the most appropriate solution for a given design problem. Observation and design sensitivity: Ability to detect concealed properties in day-to-day life and think critically about them. Ability to discern subtle differences in visual properties and aesthetic outcomes. Section II :	100%	0%

		Product Design: Product life cycle and stages. Design Toolkits, Design selection and concept development : intuitive and directed methods. Product architecture and its types, importance of aesthetic and usability. Prototyping -Tools, materials, and techniques. Ergonomics : - Overview, objective, and application. MME interaction; Human Factors and its fundamentals, mutual task comfort. Anthropometry - Human body, various postures, and movements, measuring techniques; Biomechanics and its applications. Design Research Methodologies: Design Research Strategies, Methodologies, Techniques and Procedures. Systematic literature review; Interviews: types & techniques; Questionnaires; Observation techniques; Participatory methods; Cognitive Task Analysis; Mental model elicitation; Contextual inquiry; Needs assessment; Thematic analysis; Think-aloud technique.		
7	Electronics & Communication Engineering	Mathematics: Linear Algebra: Vector space, basis, linear dependence and independence, matrix algebra, eigenvalues and eigenvectors, rank, solution of linear equations- existence and uniqueness 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. Differential Equations: 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. Vector Analysis: 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 Probability and Statistics: Mean, median, mode, standard deviation, combinatorial probability, probability distributions, binomial distribution, Poisson distribution, exponential distribution, normal distribution, joint and conditional probability. Section 2: Networks, Signals and Systems 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. Section 3: Electronic Devices: 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	100%	0%

and recombination of carriers, Poisson and continuity equations. P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, photo diode and solar cell.

Section 4: Analog Circuits:

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 o i lators.

Section 5: Digital Circuits and Microprocessor:

Number representations: binary, integer and floating-point- numbers. Combinatorial circuits: Bo@ean 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

Section 6: Control Systems:

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 compensation; State variable model and solution of state equation of LTI systems.

Section 7: Communications and microwave:

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, super heterodyne 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

Section 8: Electromagnetics:

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. Secion 9: Electrical Machines: 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 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 machine		
8	Electrical Engineering	Verbal Aptitude: Basic English grammar: tenses, articles, adjectives, prepositions, conjunctions, verb-noun agreement, and other parts of speech. Basic vocabulary: words, idioms, and phrases in context Reading and comprehension Narrative sequencing. Quantitative Aptitude: Data interpretation: data graphs (bar graphs, pie charts, and other graphs representing the data), 2-and 3-dimensional plots, maps, and tables Numerical computation and estimation: ratios, percentages, powers, exponents and logarithms, permutations and combinations, and series Mensuration and geometry Elementary statistics and probability. Analytical Aptitude: Logic: deduction and induction, Analogy, Numerical relations and reasoning. Spatial Aptitude: Transformation of shapes: translation, rotation, scaling, mirroring, assembling, and grouping Paper folding, cutting, and patterns in 2 and 3 dimensions General & Engineering Mathematics: Linear Algebra, Calculus, Differential Equations, Linear Equation, Quadratic Equations, Complex Variables, Geometry, Probability and Statistics

Basic Electrical & Electronics Engineering: D.C. & AC Circuit Analysis: Independent and Dependent sources, Nodal and Mesh circuit analysis, Source equivalence and conversion, Superposition, Thevenin, Norton, Maximum Power Transfer and Reciprocity theorems. AC fundamentals and Circuits: A.C. generation, waveforms, R-L, R-C and R-L-C circuits, Single Phase and Three-phase circuit analysis: Star and Delta connected Systems, voltages, current and power in 3-phase circuits. Ammeter, voltmeter, Wattmeter. Semiconductor, diodes, rectifier clipper, clamper. Transistor: BJT, MOSFET. OPAMP: Differentiator, Integrator, SCR | 100% | 0% |
| 9 | Energy | Energy conversion and Energy systems, Energy-Environment interaction, Instrumentation and control, Electrical energy systems | 100% | 0% |
| 10 | English | Div -I: English Language Teaching English in the global context, ELT in India in historical perspective. Principles and practice of ELT - Language acquisition, language learning- theories, principles; Languageskills; Language teaching-different approaches (methods, techniques, procedures); Teaching of literature; | 40% | 60% |

		Evaluation, testing. Syllabus designing and material production.English for Specific/Academic Purpose. Div -II: American Literature Research Methodology, Literary Theory and Criticism, American Literature Div -III: Indian Literature Research Methodology, Literary Theory and Criticism, Indian Writing in English Div -IV: Gender and Literature Research Methodology, Literary Theory and Criticism, Gender and Literature Div V: Life Writing, Travel Writing Research Methodology, Literary Theory and Criticism, Life Writing, Travel Writing Div VI; Film Adaption, Popular Culture Research Methodology, Literary Theory and Criticism, Life Writing, Travel Writing Div VII: Anglophone South Asian Literature, Ecocriticism Research Methodology, Literary Theory and Criticism, Life Writing, Travel Writing		
11	Environmental Science	B Earth and Environmental Science, Mathematics, Statistics, Physics, Chemistry, Botany, Zoology, and Agriculture, from master's level curriculum of Indian Universities.	100%	0%
12	Food Engineering & Technology	Food Engineering; Food Chemistry & Nutrition; Food Microbiology;Food Product technology (As per the outline of GATE syllabus for Food Technology)	100%	0%
13	Hindi	हिंदी भाषा की उत्पत्ति और विकास, हिंदी भाषा की संरचना, भाषा विज्ञान, हिंदी साहित्य का इतिहास, हिंदी आलोचना, अनुवाद विज्ञान, हिंदी पत्रकारिता, लोक साहित्य, तुलनात्मक साहित्य, भारतीय काव्यशास्त्र, पाश्चात्य काव्यशास्त्र, राजभाषा हिंदी, समकालीन हिंदी साहित्य, हिंदी सिनेमा, शोध प्रविधि और शोध दृष्टि	40%	60%
14	Linguistics and Language Technology	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.	40%	60%
15	Mechanical Engineering	Mathematics: Linear Algebra: Matrix algebra, systems of linear equations, eigenvalues and eigenvectors. Calculus: Functions of single variable, limit, continuity and differentiability, mean value theorems, indeterminate forms; Fourier series; gradient, divergence and curl, directional derivatives, applications of Gauss, Stokes and Green's theorems. Differential equations: First order equations (linear and nonlinear); higher order linear differential equations with constant coefficients; initial and boundary value problems.	100%	0%

		Applied Mechanics and Design:		
		Engineering Mechanics: Free-body diagrams and equilibrium; friction and its applications including rolling friction, kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations.		

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance.

Machine Design: 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.

Fluid Mechanics and Thermal Sciences:

Fluid Mechanics: 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, flow through pipes.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance heat transfer through fins; lumped parameter system, 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.

Thermodynamics: 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.

Applications:

Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Refrigeration and air-conditioning.

Turbomachinery: Impulse and reaction principles, Pelton-wheel, Francis and Kaplan turbines; steam and gas turbines.

Materials and Manufacturing Engineering

		Engineering Materials: Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials. Casting, Forming and Joining Processes: Different types of castings, solidification and cooling; plastic deformation and yield criteria; fundamentals of hot and cold working processes; Principles of welding, brazing, soldering and adhesive bonding. Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; tool life and wear; Metrology and Inspection: Limits, fits and tolerances.		
16	Molecular Biology & Biotechnology	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.	100%	0%
17	Multi-Disciplinary Research	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. Comprehensive understanding of programmes and policies of Government of India related to welfare and development, food security, access to education including provisions of NEP2020. 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. Fundamental knowledge in mathematics, science, statistics, history, creative arts subjects and geography. 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.	100%	0%
18	Physics	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)	100%	0%
19	Sociology	**Research Methodology**: 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. **Sociological Theory**: 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. **Indian Society**: Theories of Social Change in India, Caste, Varna and Class, Kinship systems, Secularism and Communalism, Nationalism, Nation Building, Regionalism..	40%	60%

| 20 | Mathematical Sciences | 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. | 100% | 0% |
| 21 | Mass Communication and Journalism | No written test Candidates with valid NET/JRF will be called for Personal Interview | Nil | Nil |

Controller of Examinations