

# ANNEXURE - VI

## M.E./M.Tech. Admissions (2024-2025) SYLLABUS FOR M.E. (CIVIL) ENTRANCE TEST

### 1. STRUCTURAL ENGINEERING

1. Strength of Materials: Simple Stress and Strains, elastic constants, shear forces and bending moment diagrams for beams, principal stresses and Mohr's stress circle, bending and shear stresses, deflections, torsion, thin and thick cylinders and fixed beams, shear centre, trusses, Betti-Maxwell theorem, unsymmetrical bending.
2. Theory of Structures: Direct and bending stresses, Columns, Strain energy, Moving loads and influence lines, Arches, Suspension bridges – static and kinematic indeterminacy, Moment distribution, Slope deflection and Kani's methods applied to continuous beams and portal frames, column analogy, matrix methods.
3. Concrete Structures: Materials and stresses, stress blocks limit state and working stress methods of design of Beams, Slabs, Columns and Footings. Retaining walls, water tanks, Slab and T-Beam bridges, design for shear and torsion, yield line theory.
4. Steel Structures: Riveted and welded joints and connections, simple and compound columns, column bases, roof trusses, plate and gantry girders, plate girder and lattice girder railway bridges and bearings. Plastic analysis and design of beams and frames.
5. Pre-stressed concrete: Basic concepts, material losses, system of pre-stressed analysis and design of beams.

### 2. GEOTECHNICAL ENGINEERING

- a) Soil Mechanics: Physical properties of soils, Classification and Identification, Permeability, Capillarity, Seepage, Compaction, Consolidation, Shear strength, Earth pressure, Slope stability and advances topics in soil mechanics.
- b) Foundation Engineering: Stress distribution in soils, Bearing capacity, Settlement analysis, Pile foundations, Cofferdams, Caissons, Dewatering, Bracing for excavations, Site investigations, Newmark charts, machine foundations.
- c) Engineering Geology: Mineralogy, Structural Geology Groundwater Earthquake Engineering, Tunnels, Dams and Reservoirs, rock mechanics, Geological hazards..

### 3. HYDRO MECHANICS AND WATER POWER ENGINEERING

- a) Fluid Mechanics: Basic concepts, Fluid Statics, Kinematics and Dynamics, Measurement of flow, Compressible flow, Flow Through pipes, Open channel flow, Specific Energy Concepts, Hydraulic Jump. Similarity concepts, Hydraulic machines-Turbines and pumps.
- b) Hydrology: Rainfall, Runoff, Floods, Groundwater, hydrographs, Unit hydrographs, flood control and mitigation.
- c) Irrigation: Diversion Head Works, Canals, Corp water requirement, Soil agronomy, Water management, wears, cross drainage works, canal falls and weirs & bariages
- d) Dam Engineering: Storage works, Dams, Surplus works, Energy dissipation, Earth dams.
- e) Water Power: Development, Power House, Components of hydro power system.

### 4. TRANSPORTATION ENGINEERING

- a) Highway alignment, Geometric design, Traffic Engineering, Pavement material characterization, pavement design: flexible pavements, rigid pavements and advanced design approaches like mechanistic methods of pavement design, pavement maintenance, pavement evaluation and highway drainage
- b) Railway Engineering: History, alignment, geometrics, rails, sleepers, ballast sub-grade preparation, curves, crossings etc.
- c) Airport Engineering: Airport planning, runway orientation and design, design of taxi ways and other geometric components.

### 5. OTHER IMPORTANT TOPICS

Elements of Surveying: Plane table, compass, Leveling and theodolite survey; Building materials and technology; Elements of estimation & costing; environmental engineering, CPM and PERT, contracts and tenders, remote sensing and GIS, GPS concepts and applications.

**MODEL question paper for M.E.(Civil) Entrance Test**

**Note:**

1. The Question Paper consists of 120 multiple choice questions to be answered in 120 minutes.
2. OMR Answer Sheets will be supplied for answering the test.

**Model Questions:**

1. Poisson's ratio for mild steel is about  
(a) 0.2                      (b) 0.3                      (c) 0.4                      (d) 0.5
2. Maximum bending moment in a simply supported beam of span 6m and carrying a UDL of 4 kN/m over its left half span is equal to  
(a) 10 kN m                (b) 12 kN m                (c) 8 kN m                (d) None of these

# **M.E./M.Tech. Admissions (2024-2025)**

## **SYLLABUS FOR M.E. (MECH.) ENTRANCE TEST**

### **ENGINEERING MECHANICS AND DESIGN**

Engineering Mechanics: Free body diagrams and equilibrium, trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion, including impulse and momentum (linear and angular) and energy formulations; impact.

Strength of Materials: Stress and strain, stress-strain relationship and elastic constants, Mohr's circle for plane stress and plane strain, thin cylinders, shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns, strain energy methods, thermal stresses.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; gear trains, fly wheels.

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

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, spur gears, rolling and sliding contact bearings, brakes and clutches.

### **FLUID MECHANICS AND THERMAL SCIENCES**

Fluid Mechanics: Fluid properties, fluid statics, manometry, buoyancy; control – volume analysis of mass momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; viscous flow of incompressible fluids; boundary layer; elementary turbulent flow; flow through pipes, head losses in pipes, bends.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer inflow over flat plates and through pipes; thermal boundary layer; effect of turbulence; radiative heat transfer, black and grey surfaces, shape factors, networks analysis, heat exchanger performance, LMTD and NTU methods.

Thermodynamics: Zeroth, First and Second laws of thermodynamics; thermodynamic system and processes; Carnot cycle, Irreversibility and availability, behaviour of ideal and real gases, properties of pure substances, calculation of work and heat in ideal processes; analysis of thermodynamic cycles related to energy conversion.

Applications: Power Engineering; Steam tables, Ranking, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles, Refrigeration and air-conditioning; Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle, moist air psychrometric chart, basic psychrometric processes. Turbo machinery, Pelton-wheel, Francis and Kaplan turbines – impulse and reaction principles, velocity diagrams.

### **MANUFACTURING AND INDUSTRIAL ENGINEERING**

Engineering Materials: Structure and properties of engineering materials, heat treatment, stress strain diagrams for engineering materials.

Metal Casting: Design of patterns, moulds and cores; Solidification and cooling, riser and gating design, design considerations.

Forming: 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 power metallurgy.

Joining: Physics of welding, brazing and soldering; adhesive bonding design considerations in welding.

Machining and Machine Tool Operations: Mechanics of machining, 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, principles of design of jigs and fixtures.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools. Production Planning and Control: Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Inventory Control: Deterministic and probabilistic models; safety stock inventory control systems.

Operations Research: Linear programming, simplex and duplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

### **MODEL Question Paper for M.E.(Mech.) Entrance Test**

- Note:**
1. The Entrance test paper consists of 120 multiple choice questions to be answered in 120 minutes.
  2. OMR Answer sheets will be supplied for answering the test.

**Model Paper:**

- Ex:
1. High carbon steel is used for the manufactures of
    - a) Solid drawtube
    - b) Angle iron
    - c) Boiler plates
    - d) Hammers

# **M.E./M.Tech. Admissions (2024-2025)**

## **SYLLABUS FOR M.E. (ECE) ENTRANCE TEST**

### **Engineering Mathematics**

**Linear Algebra:** Matrix Algebra, Systems of linear equations, Eigen values and Eigen vectors.

**Calculus:** Mean value theorems, Theorems of integral calculus, Evaluation of definite and improper integrals, Partial Derivatives, Maxima and minima, multiple integrals, Fourier series. Vector identities, Directional derivatives, Line, Surface and Volume integrals, Stokes, Gauss and Green's theorems.

**Differential equations:** First order equation (linear and nonlinear), Higher order linear differential equations with constant coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential Equations and variable separable method.

**Complex variables:** Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent's series, Residue theorem, solution integrals.

**Probability and Statistics:** Sampling theorems, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Correlation and regression analysis.

**Numerical Methods:** Solutions of non-linear algebraic equations, single and multi-step methods for differential equations.

### **Electronics and Communication Engineering**

**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 shift-registers. Sample and hold circuits, ADCs, DACs. Semiconductor memories. 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-Integral-Derivative (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.

**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.

### MODEL Question Paper for M.E. (E.C.E.) Entrance Test

**Note:** The entrance test paper consists of 120 multiple choice questions to be answered in 120 minutes. OMR Answer Sheets will be supplied for answering the test.

#### Example:

1. Simplified form of  $AB + ABC + \bar{A}BC$

- a)  $A\bar{B}$                       b)  $ABC$                       c)  $B$                       d)  $\bar{A}\bar{B}C$

2. Linearity in networks implies

- a) Reciprocity                      b) Casualty                      c) Superposition                      d) Time invariance

## **M.E./M.Tech. Admissions (2024-2025)**

### **Syllabus for M.E. (EE) entrance test**

**Electric Circuits and Fields:** Network graph, KCL, KVL, node and mesh analysis, transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, basic filter concepts; ideal current and voltage sources, 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.

**Signals and Systems:** Representation of continuous and discrete-time signals; shifting and scaling operations; linear; time-invariant and causal systems; Fourier series representation of continuous periodic signals; sampling theorem; Fourier, Laplace and Z transforms.

**Electrical Machine:** Single phase transformer-equivalent circuit, phasor diagram, tests, regulation and efficiency; three phase transformers-connections, parallel operation; auto-transformer; energy conversion principles; DC machines – types, windings, generator characteristics, armature reaction and commutation, starting and speed control of motors; three phase induction motors – principles, types, performance characteristics, starting and speed control; single phase induction motors; synchronous machines – performance, regulation and parallel operation of generators, motor starting characteristics and applications; servo and stepper motors.

**Power Systems:** Basic power generation concepts; transmission line models and performance; cable performance, insulation; corona and radio interference, distribution systems; per-unit quantities; bus impedance and admittance matrices; load flow; voltage control power factor correction; economic operation; symmetrical components fault analysis, principles of over-current, differential and distance protection; solid state relays and digital protection; circuit breakers; system stability concepts, swing curves and equal area criterion; HVDC transmission and FACTS concepts.

**Control Systems:** Principles of feedback; transfer function; block diagrams; steady-state errors; Routh and Nyquist techniques; Bode plots; root loci; lag, lead and lead-lag compensation; state space model; state transition matrix, controllability and observability.

**Electrical and Electronic Measurements:** Bridges and potentiometers; PMMC, moving iron, dynamometer and induction type instruments; measurements of voltage, current, power, energy and power factor; instrument transformers; digital voltmeters and multi-meters; phase, time and frequency measurement; Q-meters; oscilloscopes; potentiometric recorders; error analysis.

**Analog and Digital Electronics:** Characteristics of diodes, BJT, FET; amplifiers – biasing, equivalent circuit and frequency response oscillators and feedback amplifiers; operational amplifiers – characteristics and applications; simple active filters; VCOs and timers; combinational and sequential logic circuits, multiplexer; Schmitt trigger, multi-vibrators, sample and hold circuits; A/D and D/A converters; 8-bit microprocessor basics, architecture, programming and interfacing.

**Power Electronics and Drives:** Semiconductor power diodes, transistors, thyristors, triacs, CTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.

### **MODEL Question Paper for M.E. (E.E.) Entrance Test**

Note: The entrance test paper consists of 120 multiple choice questions to be answered in 120 minutes. omr answer sheets will be supplied for answering the test.

#### **Example:**

1. Linearity in networks implies

- a) Reciprocity                      b) Casualty                      c) Superposition                      d) Time invariance

## **M.E./M.Tech. Admissions (2024-2025)**

### **Syllabus for M.Tech. (CSE) entrance test**

**ENGINEERING MATHEMATICS:** Mathematical Logic: Propositional Logic, First order Logic;

Probability: Conditional probability, Mean, Median, Mode and Standard Deviation; Random Variables; Distributions; Uniform, normal, exponential, Poisson, Binomial.

Set Theory & Algebra: Sets; Relations; Functions; Groups; Partial orders: Lattice; Boolean Algebra.

Combinatorics; Permutations; combinations; counting; Summation; generating functions; recurrence relations; asymptotics.

Graph theory: Connectivity; spanning trees; Cut vertices & edges; covering; matching; independent sets; Colouring; Planarity; Isomorphism.

Linear Algebra: Algebra of matrices, determinants, systems of linear equations, Eigen values and Eigen vectors.

Numerical Methods: LU decomposition for systems of linear equations; numerical solutions of non-linear algebraic equations by Secant, Bisection and Newton-Raphson Methods; Numerical integration by trapezoidal and Simpson's rules.

Calculus: Limit, Continuity & differentiability, mean value Theorems, Theorems of integral calculus, evaluation of definite & improper integrals, partial derivatives, Total derivatives, maxima & minima.

### **COMPUTER SCIENCE AND ENGINEERING**

Theory of computation: Regular languages and finite automata, context free languages and push-down automata, Recursively enumerable sets and Turing machines, undecidability NP-completeness.

Digital Logic: Logic functions, Minimization, Design and synthesis of combinational and sequential circuits; Number representation and computer arithmetic (fixed and floating point)

Computer Organization and Architecture: Machine instructions and addressing modes ALU and data-path, CPU control design, Memory interface, I/O interface (Interrupt and DMA mode), Instruction pipelining, Cache and main memory, Secondary storage.

Programming and Data Structures: Programming in C; Functions, Recursion, Parameter passing, Scope, Binding; abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

Algorithms: Analysis, Asymptotic notation, Notions of space and time complexity, worst and average case analysis; Design; Greedy approach, Dynamic programming, Divide-and-conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; hashing, Sorting, Searching.

Compiler Design: Lexical analysis, Parsing, Syntax directed translation, Runtime environments, Intermediate and target Code generation, Basics of code optimization.

Operating System: processes, Threads, Inter-process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and Security.

Databases: ER-model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.

Computer Networks: ISO/OSI Stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, routing algorithms, congestion control, TCP/UDP and sockets, IP (v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); basic concepts of hubs, switches, gateways, and routers.

Note: It is recommended to set the question paper having 30% of the questions from Engineering Mathematics and 70 % of questions from the Computer Science and Engineering part of the syllabus.

**MODEL Question Paper for M.Tech. (C.S.E) Entrance Test**

**Note:** The entrance test paper consists of 120 multiple choice questions to be answered in 120 minutes on OMR answer sheet.

1. If a set A has n elements, then the number of objective functions from A to A are  
a) n                                      b)  $n^2$                                       c)  $2^n$                                       d)  $n!$
  
2. In two Phase locking, how many number of different locks are used  
a) 2                                      b) 3                                      c) 4                                      d) 5



# **M.E./M.Tech. Admissions (2024-2025)**

## **Syllabus for M.E. –Bio-Medical Engg. (BME) entrance test**

### **Electrical Circuits:**

Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, inductor, mutual inductor and capacitor; transient analysis of RLC circuits with dc excitation.

Kirchoff's laws; mesh and nodal analysis; Superposition, Thevenin, Norton, maximum power transfer and reciprocity theorems.

Peak, average and RMS values of ac quantities; apparent, active and reactive powers; phasor analysis, impedance and admittance; series and parallel resonance, realization of basic filters with R, L and C elements

### **Signals and systems for Bioengineers**

**Continuous and Discrete Signal and Systems:** Periodic, aperiodic and impulse signals; Sampling theorem; Laplace, Fourier and Z-transforms; transfer function, frequency response of first and second order linear time invariant systems, impulse response of systems; convolution, correlation. Discrete time system: impulse response, frequency response, DFT; basics of IIR and FIR filters, pre-processing of Bio-signals, QRS detection methods, ECG Data Compression Algorithms, EEG segmentation and Sleep EEG, Detection of resting rhythms.

### **Analog and Digital Electronics**

Characteristics and applications of diode, zener diode, BJT and MOSFET; feedback amplifiers. Characteristics of operational amplifiers; applications of opamps: difference amplifier, adder, subtractor, integrator, differentiator, Analog filters and wave form generators, instrumentation amplifier, buffer.

Number Systems, Logic gates, Boolean algebra, Combinational logic circuits, Arithmetic circuits, comparators, Schmitt trigger, multi-vibrators, sequential circuits, flipflops, shift registers, timers and counters; sample-and-hold circuit, multiplexer. Principles and characteristics of ADC and DAC (resolution, quantization, significant bits, conversion/settling time); microprocessor and microcontroller: applications, memory and input- output interfacing; elements of data acquisition systems.

### **Sensors and Bioinstrumentation**

Resistive, capacitive, inductive, piezoelectric, Hall Effect electro chemical and optical sensors and their associated signal conditioning circuits; Physiological signals and their characteristics. Biopotential Amplifiers, Generation, acquisition, and signal conditioning of biosignals: ECG, EMG, EEG, EOG, ERG, PCG, GSR. Noise and artifacts and their management, Electrical Isolation (optical and electrical) and patient safety systems. Principles of measuring blood pressure, Body temperature, volume and flow in arteries. Operating Principles of medical equipment-cardiac pacemaker, defibrillator, pulse oximeter, hemodialyser, ventilator, anaesthesia machine, spirometer.

### **Human Anatomy and Physiology:**

Basics of cell, types of tissues and organ systems; Homeostasis; Basics of organ systems musculoskeletal, respiratory, circulatory, endocrine, nervous, gastro-intestinal and reproductive.

### **Biomechanics**

**Hard Tissues:** Structure, functions, composition and mechanical properties of cortical and cancellous bones.

**Soft Tissues:** Structure, functions, composition and mechanical properties of Soft Tissues: Cartilage, Tendon, Ligament, Muscle. Viscoelasticity: Features and models.

**Human Joints and Movements:** Skeletal joints, types of joints, forces and stresses in human joints, free body diagrams and equilibrium, biomechanical of analysis joints, Gait parameters and their analysis.

**Biofluid mechanics:** Flow properties of blood, Blood flow in arteries, veins and micro vessels.

**Medical Imaging Systems**

Basic physics, instrumentation and image formation techniques in medical imaging modalities X-Ray, CT, Ultrasound, MRI, PET, SPECT.

**Biomaterials**

Basic properties of biomaterials, types of biomaterials-metals, ceramics, polymers and composites. Characteristics of implants-biocompatibility, bioactivity, biodegradability. Biomaterial characterization techniques- Atomic Force Microscopy, Electron Microscopy, Transmission Electron Microscopy, Infrared Spectroscopy.

**Note:** The entrance test paper consists of 120 multiple choice questions to be answered in 120 minutes on OMR answer sheet.

**M.E./M.Tech. Admissions (2024-2025)**  
**Syllabus for M.E. –Mining Engineering (Mining) entrance test**

**Engineering Mathematics**

**Linear Algebra:** Matrices and Determinants; Systems of linear equations; Eigen values and Eigen vectors.

**Calculus:** Limit, continuity and differentiability; Partial Derivatives; Maxima and minima; Sequences and series; Test for convergence; Fourier series.

**Vector Calculus:** Gradient; Divergence and Curl; Line; surface and volume integrals; Stokes, Gauss and Green's theorems.

**Differential Equations:** Linear and non-linear first order ODEs; Higher order linear ODEs with constant coefficients; Cauchy's and Euler's equations.

**Probability and Statistics:** Measures of central tendency; Random variables; Poisson, Normal and Binomial distributions; Correlation and regression analysis.

**Numerical Methods:** Solutions of linear algebraic equations; Integration of trapezoidal and Simpson's rule; Single and multi-step methods for differential equations.

**Mining Geology:** Minerals, Rocks & their origin

**Mine Development and Surveying**

**Mine Development:** Methods of access to deposits; Underground drivages; Drilling methods and machines; Explosives, blasting devices and blast design practices.

**Mine Surveying:** Levels and leveling, theodolite, tacheometry, triangulation; Contouring; Errors and adjustments; Correlation; Underground surveying; Curves; Photogrammetry; Field astronomy; EDM and Total Station; Introductory GPS.

**Geomechanics and Ground Control**

**Engineering Mechanics:** Equivalent force systems; Equations of equilibrium; Two dimensional frames and trusses; Free body diagrams; Friction forces; Particle kinematics and dynamics; Beam analysis.

**Geomechanics:** Geo-technical properties of rocks; Rock mass classification; Instrumentation and in-situ stress measurement techniques; Theories of rock failure; Ground vibrations; Stress distribution around mine openings; Subsidence; Rock bursts and coal bumps; Slope stability.

**Ground Control:** Design of pillars; Roof supporting systems; Mine filling, Strata control and monitoring plan

**Mining Methods and Machinery**

**Mining Methods:** Surface mining: layout, development, loading, transportation and mechanization, continuous surface mining systems; Underground coal mining: bord and pillar systems, room and pillar mining, longwall mining, thick seam mining methods; highwall mining; Underground metal mining: open, supported and caved stoping methods, stope mechanization, ore handling systems.

**Mining Machinery:** Generation and transmission of mechanical, hydraulic and pneumatic power; Materials handling: wire ropes, haulages, conveyors, face and development machinery, hoisting systems, pumps, crushers.

**Surface Environment, Mine Ventilation, and Underground Hazards**

**Surface Environment:** Air, water and soil pollution : Standards of quality, causes and dispersion of contamination, and control; Noise pollutions, Land reclamation, Environmental Impact Assessment (EIA).

**Mine Ventilation:** Underground atmosphere; Heat load sources and thermal environment, air cooling; Mechanics of air flow, distribution, natural and mechanical ventilation; Mine fans and their usage; Auxiliary ventilation; Ventilation planning; Ventilation networks.

**Subsurface Hazards:** Mine Gases. Underground hazards from fires, explosions, dust and inundation; Rescue apparatus and practices; Safety in mines; Accident data analysis; Mine lighting; Mine legislation; Occupational safety, Safety Management Plan (SMP).

### **Mine Economics, Mine Planning, Systems Engineering**

**Mine Economics:** Mineral resource classification; Discounted cash flow analysis; Mine valuation; Mine investment analysis; Mineral taxation.

**Mine Planning:** Mine Planning & its Components, Sampling methods, practices and interpretation; Reserve estimation techniques: Basics of geostatistics and quality control; Optimization of facility location; Work-study.

**Systems Engineering:** Concepts of reliability; Reliability of simple systems; Maintainability and availability; Linear programming, transportation and assignment problems; Network analysis; Inventory models; Queueing theory; Basics of simulation.

**Note:** The entrance test paper consists of 120 multiple choice questions to be answered in 120 minutes on OMR answer sheet.