

## SYLLABUS FOR ENTRANCE TEST,

### ET (M.TECH.), FOR M.TECH. CIVIL (WATER RESOURCE ENGINEERING) COURSE

#### ENGINEERING MATHEMATICS

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

Calculus : Functions of single variable : Limit, continuity and differentiability, mean-value theorems, theorems of integral calculus; evaluation of definite and improper integrals. Functions of two variables: Limit, continuity, partial derivatives, total derivative and directional derivative, maxima and minima, multiple integrals and their applications, sequences and series, test for convergence, Fourier series.

Ordinary Differential Equations : First order equations (linear and nonlinear), higher order linear differential equations with constant coefficients, method of variation of parameters, Cauchy's or Euler's equations, initial and boundary value problems, Laplace transform.

#### STRUCTURAL ENGINEERING

Structural Analysis : Statically determinate structure : displacements by energy principles; static and kinematic indeterminacies; analysis of indeterminate structures by flexibility and stiffness methods; slope-deflection and moment-distribution methods; influence lines for determinate and indeterminate structures; approximate analysis of multistory frames by cantilever and portal frame methods; trusses; two and three hinged arches; analysis of trusses and frames by Matrix method; concepts of plastic analysis of beams and frames.

Concrete Structure : Working stress and limit state methods of design; design of reinforced concrete beams, slabs, columns, staircase, building frame, water tanks, bridges, equal leading structure and foundations, detailing of reinforcement, analysis and design of pre-stressed concrete beams.

Steel Structures : Analysis and design of tension and compression members, beams and beam-columns, column bases; connections-simple & eccentric, beam and connections, plate and gantry girders and trusses; plastic design of beams and frames.

#### GEOTECHNICAL ENGINEERING

Soil Mechanics : Origin of soils; soil classification; three-phase system, fundamental definitions, relationship and inter-relationships; permeability and seepage; effective stress principle: consolidation, compaction; shear strength.

Foundation Engineering : Sub-surface investigation-scope, drilling bore holes, sampling, penetrometer tests, plate load test; earth pressure theories, effect of water table, layered soils; stability of slopes-infinite slopes, finite slopes; foundation types-foundation design requirements; shallow foundations; bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sands and clays; deep foundations-pile types, dynamic and static formulae, load capacity of piles in sands and clays.

#### WATER RESOURCES ENGINEERING

Fluid Mechanics and Hydraulics : Hydrostatics applications of Bernoulli equation, Laminar and turbulent flow in pipes, pipe networks; concept of boundary layer and its growth; uniform flow, critical flow and gradually varied flow in channels, specific energy concept, hydraulic jump; forces on immersed bodies; flow measurement in channels; tanks and pipes; dimensional analysis and modelling; velocity triangles and specific speed of pumps and turbines. Applications of Momentum equation, Potential flow, Kinematics of flow.

Hydrology : Hydrologic cycle; Rainfall; evaporation infiltration, unit hydrographs, flood estimation, reservoir and channel routing, well hydraulics.

Irrigation : Duty, delta, Estimation of evapo-transpiration; crop water requirements; design of lined and unlined canals; waterways; head works, gravity dams and Ogee spillways. Designs of weirs on permeable foundation, Irrigation methods.

## ENVIRONMENTAL ENGINEERING

Water Requirements; quality and standards, basic unit processes and operations for water treatment, distribution of water. Sewage and sewerage treatment; Quantity and characteristic of waste water sewerage; primary and secondary treatment of waste water sludge disposal; effluent discharge standards.

## TRANSPORTATION ENGINEERING

Highway planning; Geometric design of Highways; Testing and specifications of paving materials; Design of flexible and rigid pavements.

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### SYLLABUS FOR ENTRANCE TEST,

#### ET (M.TECH.), FOR M.TECH. (COMPUTER) / M.TECH. (I.T.) COURSE

**Basic Mathematics :** Elements of probability, matrix algebra, numerical methods: interpolation, root finding, differentiation and integration. Discrete Mathematics; Sets, relations, functions, mathematical induction, counting, groups, graphs, piratical orders, lattices and Boolean algebra propositional logic.

**Theory of Computation :** Regular and context free languages, finite state machines and pushdown automata, Turing machines and undesirability.

**Computer Hardware :** Logic function, minimization techniques, design of combinational and sequential circuits using gates and flip-flops, design with integrated circuits including ROM and multiplexers, microprocessor architecture; programming, interfacing with memory and I/O devices (modes of data transfer and their implementation, serial and parallel communication interfaces). Detailed knowledge of 8095 microprocessor will be assured.

**Computer Organization :** Number representation and arithmetic, functional organization, machine instructions and addressing modes, ALU, hardwired and microprogrammed control, instruction pipelining, memory organization, input/output.

**Programming and Data Structures :** Structured programming with Pascal/C including recursion; arrays, stacks, strings, queues, lists, trees, sets and graphs; algorithm for tree and graphs traversals, connected components, spanning trees, shortest paths; hashing, sorting and searching; algorithm design and analysis techniques, big 'on' notation, solution of simple recurrence relations.

**Language Processors :** Assemblers, loaders, linkers, macroprocessors, text editors, programming languages; scope rules and parameter passing mechanisms; compilers; lexical analysis, parsing, syntax directed translation, run time environment, machine code generation; interpreters.

**Operating Systems :** Batch, multi-programming and time-sharing systems; processor, memory, device and file management, virtual memory, process scheduling, interprocess communication, process synchronization and concurrency, deadlocks protection.

**Database Systems :** File organization techniques: indexing, B-trees, B-plus trees; relational and network data models; normal forms; query languages, SQL.

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### SYLLABUS FOR ENTRANCE TEST,

#### ET (M.TECH.), FOR M.TECH. (CHEMICAL) COURSE

**Engineering Mathematics :** Determinants & Matrices, system of linear equations, eigenvalues and eigenvectors. Calculus-mean value theorems of integral calculus, partial, total and directional derivatives, maxima and minima.

Sequences and Series, convergence, Fourier series.

Vector calculus : gradient, divergence and curl, line and surface integrals, Green, Gauss and Stokes theorems.

Ordinary differential equations : First order equations, linear and nonlinear equations, higher order linear equations with constant coefficients, initial and boundary value problems, Laplace transforms.

Complex analysis: Complex numbers, polar form of complex numbers, Powers and roots, limit, derivative, analytical functions.

Probability and Statistics : Concept of probability, means and variance, linear regression analysis.

Process Calculations and Thermodynamics : Laws of conservation of mass and energy; use of tie components; recycle, bypass and purge calculations; degrees of freedom.

First and Second laws of thermodynamics and their applications; equations of state and thermodynamic properties of real systems; phase equilibria; fugacity, excess properties and correlations of activity coefficients; chemical reaction equilibria.

Fluid Mechanics and Mechanical Operations : Fluid statics, Newtonian and non-Newtonian fluids, Macroscopic energy balance, Bernoulli equation, dimensional analysis, continuity equation, flow through pipeline systems, flow-meters, pumps and compressors, packed and fluidized beds, elementary boundary layer theory, size reduction and size separation; free and hindered settling; centrifuges and cyclones; thickening and classification, filtration; mixing and agitation; conveying of solids.

Heat Transfer : Conduction, convection and radiation, heat transfer coefficients, steady and unsteady heat conduction, Boiling, condensation and evaporation; types of heat exchangers and evaporators and their design.

Mass Transfer : Fick's law, mass transfer coefficients, Film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stagewise and continuous contacting and stage efficiencies; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, crystallization, drying, humidification, dehumidification and adsorption.

Chemical Reaction Engineering : Theories of reaction rates; Kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non-ideal reactors; non-isothermal reactors, kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis.

Instrumentation and Process Control : Measurement of process variables; dynamics of simple systems such as CSTRs, heat exchangers etc.; transfer functions and responses of simple systems, process reaction curve, controller modes (P, PI, and PID); control valves; analysis of closed loop systems including stability, frequency response (including Bode plots) and controller tuning.

Plant Design and Economics : Design of chemical engineering equipment; principles of process economics and cost estimation.

Chemical Technology : Inorganic chemical industries; sulfuric acid, NaOH, fertilizers; natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries; polyethylene, polypropylene and synthetic fibres.

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**SYLLABUS FOR ENTRANCE TEST, ET (M.TECH.),  
FOR M.TECH. (ELECTRICAL - POWER SYSTEMS) COURSE**

Electrical Circuits & fields : Network graph, KCL, KVL node/cut set, mesh/tie set analysis, transient response of d.c. & a.c. network Sinusoidal steady state analysis, resonance in Electrical Circuits, concept of ideal voltage and current source, Network theorems, driving points, impedance and transfer function of two port network, elementary concept of filters. Three phase circuit, Fourier series and its application. Gauss theorem, electric field intensity & potential due to points. Line plane & spherical charge distribution, dielectrics, capacitance calculations for simple configuration, Ampere's & Biot-Savart's law, inductance calculation for simple configuration.

Electrical Machines : Single phase transformers-equivalent circuits, phasor diagram, tests, regulation & efficiency, Three phase transformers - connections, parallel operation, auto-transformers, & three winding transformers, principle of energy conversion, winding of rotating machines, D.C. generators & Motor characteristics, starting & speed controls, Armature reactions & commutations, Three phase induction motors-performance characteristics, Single phase induction motors, synchronous generator performance, regulation, parallel operations, synchronous motor starting characteristics applications, synchronous condensers, fractional horse power motors, permanent magnet & stepper motors.

Power Systems : Electric power generators-thermal, hydro, nuclear, transmission line parameters, steady state performance of overhead Transmission line & cable & surge propagation, distribution system, insulators, bundle conductors, corona & radio interference effect, per unit quantities, bus admittance, impedance matrices, load flow, voltage control & power factor Corrections, economic operations, symmetrical components, analysis of symmetrical & unsymmetrical faults, Principles of over current, differential & distance protection, concept of solid state relays & digital protection. Circuit breakers, concept of system stability-swing curves & equal area criterion, basic concept of HVDC Transmission.

Control systems : Principal of feedback, transfer function, block diagrams, steady state errors, stability-Routh & Nyquist criteria, Bode plots, compensation, root loci, elementary state variable formulation, state transition matrix & response for Linear time invariance system.

Electrical & Electronic Measurement : Bridge & potentiometers, PMMC, moving iron, dynamometer & induction type instruments, measurement of voltage, Current, power, energy & power factor, instrument transformers, digital voltmeter & multimeters, phase, time & Frequency measurement, Q-meter, oscilloscope, potentiometric recorders, error analysis.

Analog & digital electronics : Characteristics of diode, BJT, FET, SCR, amplifier biasing, equivalent circuit, Frequency response, oscillator & feedback amplifier, operational amplifier characteristics, & application, simple active filters, VCO's & timer, combinational & sequential logic circuits, multiplexer, Schmitt's trigger, multivibrators, sample & hold circuits, A/D & D/A converters, micro-processors & their applications.

Power electronics & Electric Drives : Semiconductor power device-diodes, transistors, thyristors, triac's, GTO's MOSFETs, IGBTs static characteristics Principle of operations, triggering circuits, phase control rectifiers, bridge converters-fully controlled & half controlled Principle of choppers & invertors, basic concept of adjustable speed dc & ac drives.

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### SYLLABUS FOR ENTRANCE TEST,

### ET (M.TECH), FOR M.TECH. (ELECTRONICS - VLSI DESIGN) COURSE

Network : Network graphs, matrices associated with graphs; incidence, fundamental cut set, fundamental circuit matrices, Solution method: nodal & mesh analysis, Network theorem: super position, thevenin & 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 circuit, Solution of network equation using Laplace transform; frequency domain analysis of simple RCL circuit; 2-port network parameter; driving point & transfer function, state Equation of network.

Electronics Drives : Energy bands in silicon, intrinsic & extrinsic silicon; carrier transport in silicon; diffusion current; drift current mobility; resistivity, generation & recombination of carriers, p-n junction diode, Zener diode, tunnel diode, BJT, JFET, MOS capacitor, MOSFET, LED, p-i-n & avalanche photo diode, LEDs, device technology, integrated circuit fabrication process, oxidation, diffusion, ion, implantation, photolithography, n-tub, p-tub, & twin tub CMOS process.

Analog circuits : Analog circuits, (large & small-signals) of diodes, BJTs, BJT, JFETs, MOSFETs, simple diode circuit, clipping, clamping, rectifier, biasing & bias stability of transistors & FET amplifier, single & multistage, differential, operational, Feedback & power, analysis of amplifier, frequency response amplifier, simple op-amp circuits, filters, sinusoidal Oscillators, criterion for oscillation, single transistor & op-amp configuration. Function generators & wave shaping circuits, power supplies.

Digital circuits: Boolean algebra, minimisation of Boolean function, logic gates digital families (DTL, TTL, ECL, MOS, CMOS), Combinational circuits, arithmetic circuits, code converters, multiplexer & decoders, sequential circuits, latches and flip flops, counters and shift registers, sample & hold circuits, ADCs & DACs, semiconductor memories. L/C interfacing.

Signals & systems : Definition & properties of Laplace transform, continuous-time & discrete time Fourier transform, Z-transform, Sampling theorem, linear time invariant (LTI) system, definitions & properties, causality & stability, impulse response, Convolution property, Zero frequency response, group delay, phase delay, signal transmission through LTI sys.

Random signal & noise, probability, Random variable, probability density function, auto correlation, power spectral density.

Controls systems : Basic control system component, basic diagrammatic description, open loop & closed loop system, stability analysis of these system, signal flow graphs, their use in determining transfer function of system, transition & steady state analysis of (LTI) control system, & frequency response, tools & techniques of (LTI) control system, root loci, routh-hurwitz criteria, Bode & nyquist plots, control system compensators, elements of lead & lag compensation, elements of proportional integrative derivative (PID) control, state variable representation & solution of state equation of (LTI) control system.

Communications : Analog Communication systems, amplitude & angle modulation & demodulation system, spectral analysis of these operations, superheterodyne receiver, elements of hardware, realisation of analog Communication system, signal to noise ratio (SNR), calculation for amplitude modulation (AM), frequency modulation, (FM) for low noise condition, digital Communication systems, pulse code modulation, differential pulse code modulation (DPCM), delta modulation, Digital modulation scheme amplitude, phase & frequency shift keying, (ASK, PSK, FSK), matched filter receivers, bandwidth consideration & probability of error calculation for these scheme.

Electromagnetics : Elements of vector calculus, divergence & curls, Gauss & Stoke theorem, Maxwell's equations, differential & integral forms, wave equations, Poynting vector, plane waves, propagation through various media, reflection & refraction, phase & group velocity, skin depth, transmission lines, characteristic impedance, impedance transformation, smith chart, impedance matching, pulse excitation, waveguides, modes in rectangular waveguides boundary conditions, cut-off frequencies, dispersion relation, antennas, dipole antennas, radiation pattern, reciprocity theorem, antenna gains.

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**SYLLABUS FOR ENTRANCE TEST, ET (M.TECH) ,  
FOR M.TECH. (MECHANICAL-CAD/CAM) COURSE**

**ENGINEERING MATHEMATICS**

Linear Algebra : Algebra of matrices, system of linear equation, eigen value & eigen vectors.

Calculus : Taylor series, fourier series, partial derivatives, total derivatives, definite & improper integrals, multiple integrals.

Vector Calculus : Gradient, divergence & curls, line & surface integrals, Green, Gauss & Stoke theorems

Differential equations : Linear ODEs, first order non-Linear ODEs, initial & boundary value problems, Laplace transformations, PDE's Laplace Wave & diffusion equations

Numerical Methods : Solution system of linear equations, interpolation, Numerical integrations, Newton-Raphson's method, Runge-Kutta methods.

Probability & statistics : Gaussian, Weibull distribution & their properties, methods of least squares, regression analysis, analysis of Variance.

**APPLIED MECHANICS & DESIGNS :**

Engineering Mechanics : Equivalence force system, free body concept, equation of equilibrium, truss & frames, virtual work & minimum potential energy, kinematics & dynamics of particles & rigid body, impulse & momentum (linear & angular), Energy methods, central force motion.

Strength of Materials : Stress & strain, Stress-strain relationship & Elastic constant, Mohr's circle for plane stress & strain, shear force & bending moment diagrams, bending & shear stress, deflection of beam, torsion of circular shafts, thin & thick cylinders, Euler's theory of columns, strain energy methods, thermal stress.

Theory of Machines : Displacement, velocity & acceleration, analysis of plane mechanisms, dynamic analysis, slider crank mechanism Planer cams & followers, gear tooth profiles, kinematic of gears, governors & flywheels, balancing of reciprocating & rotating masses.



Vibrations : Free & forced vibrations of single degree freedom systems, effect of damping, vibration isolation, resonance, Critical speed of rotors.

Design & machine Elements : Design of static & dynamics loading, failure theories, fatigue strength design of bolted, riveted, welded joints; Design of shafts & keys, Design of spur gears, rolling & sliding contact bearings, breaks & clutches, belt, rope & chain drives.

#### MANUFACTURING & INDUSTRIAL ENGINEERING

Engineering Materials : Structure & properties of Engineering Materials & their applications, heat treatments.

Metal Casting : Casting process, (extendable & non extendable)-pattern, moulds, cores, heating & pouring, solidification and cooling Gating Design, Design considerations, defects.

Forming process : Stress-strain diagrams for ductile & brittle materials, plastic deformation & yield criteria, fundamentals of hot & cold working process, bulk metal forming processes, (forming, rolling, extrusion, drawing), sheet metal working process, (punching, blanking, deep drawing, coining, spinning, load estimation using homogenous deformation process, Defects), processing of powder metals, compaction, sintering, secondary & finishing operations, forming & shaping of Plastic extrusion, injection moulding.

Joining process : Physics of welding, fusion & non fusion welding process, brazing & soldering, adhesive bonding, design consideration in welding, weld quality defects

Machining & machine tool operations : Mechanics of Machining, single & multiple cutting, tool, tool geometry & materials, tool life & wears Cutting fluids. machinability non traditional machining process.

Metrology & inspection : Limit, fits & tolerance, linear & angular measurements, comparators, gauge design, interferometry, form & finish measurements, measurements of screw threads, alignment, testing methods.

Tool Engineering : Principle of work holding, design of jigs & fixtures.

Computer Integrating Manufacturing : Basic concept of CAD/CAM & their integration tools.

Manufacturing Analysis : Part print analysis in Manufacturing & assembly, time & cost analysis.

Work-study : Method study, work measurement, time study, work sampling, job evaluation, merit rating.

Production planning & control : Forecasting Models, aggregate production planning, master scheduling, material requirements planning.

Inventory control : Deterministic & probabilistic models, safety stock Inventory control systems.

Operational research : Linear programming, simplex & duplex method, transportations, assignment, network flow models, Simple queuing models, PERT & CPM.

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### SYLLABUS FOR ENTRANCE TEST, ET (M.TECH. NANOTECHNOLOGY) COURSE

Linear Algebra : Algebra of matrices, system of linear equation, eigen value & eigen vectors.

Calculus : Taylor series, fourier series, partial derivatives, total derivatives, definite & improper integrals, multiple integrals.

Vector Calculus : Gradient, divergence & curls, line & surface integrals, Green, Gauss & Stokes theorems

Differential equations : Linear ODEs, first order non-Linear ODEs, initial & boundary value problems, Laplace transformations, PDE's Laplace Wave & diffusion equations

Numerical Methods : Solution system of linear equations, interpolation, Numerical integrations, Newton-Raphson's method, Runge-Kutta methods.

Probability & Statistics : Gaussian, Weibull distribution & their properties, methods of least squares, regression analysis, analysis of Variance.

Physics : Motion, Newton's Laws, Energy and Conservation Laws, Physics of Matter, Temperature and Heat, Waves, Sound, and Ultrasound, Electricity Electromagnetism and EM Waves, Atomic Physics

Chemistry: Physical quantities and their measurement, States of matter, Atomic structure, Classification of elements and periodicity in properties, Chemical bonding, Equilibrium in physical and chemical processes, Ionic equilibrium,

Biology: Cell, Structure and Function, Genetics and Evolution, Structure and Function – Plants and Animals, Reproduction, Growth and Movement in Plants and Animals, Ecology and Environment

Programming in C : Data types, Control Flow Statements, Logical Statement, Pointers, Arrays, Structures & File Handling.

Engineering Mechanics : Equivalent force system, free body concept, equation of equilibrium, truss & frames, virtual work & minimum potential energy, kinematics & dynamics of particles & rigid body, impulse & momentum (linear & angular), Energy methods, central force motion.

Strength of Materials : Stress & strain, Stress-strain relationship & Elastic constant, Mohr's circle for plane stress & strain, shear force & bending moment diagrams, bending & shear stress, deflection of beam, torsion of circular shafts, thin & thick cylinders, Euler's theory of columns, strain energy methods, thermal stress.

Material Science : Atomic Structure, Interatomic Bonding and Structure of Crystalline, Solids, Imperfections in Solids, Mechanical Properties of Metals, Diffusion, Dislocations and Strengthening Mechanisms, Failure.

Applications and Processing of Materials : Metals and Alloys, Ceramics and Polymers, Composites, Corrosion and Degradation of Materials, Electrical Properties, Thermal Properties, Magnetic Properties, Optical Properties

Metrology & Inspection : Limit, Fits & Tolerances, Linear & Angular Measurements, Comparators, Gauge design, Interferometry, form & Finish Measurements.