VIT®

Vellore Institute of Technology

(Deemed to be University under section 3 of the UGC Act, 1956)

VITMEE SYLLABUS

Admission to M.Tech / MCA Degree Programmes (2023-2024)

VIT - A place to learn; A chance to grow

Entrance Examination Syllabus

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APPENDIX - I

SYLLABUS for ENTRANCE EXAMINATION

BM - BIO-MEDICAL ENGINEERING

Mathematics : Linear algebra, calculus, differential equations, numerical methods, probability theory.
Basics of Circuits: Kirchoff 's laws, mesh and nodal Analysis. Circuit theorems. One port and two-port Network Functions. Static and dynamic characteristics of Measurement Systems. Error and uncertainty analysis. Statistical analysis of data and curve fitting.
Transducers and Measurement : Resistive, Capacitive, Inductive and piezoelectric transducers. Measurement of displacement, velocity and acceleration (translational and rotational), force, torque, vibration and shock.
Analog Electronics : Characteristics of diode, BJT, JFET and MOSFET. Diode circuits. Transistors at low and high frequencies, Amplifiers, single and multi- stage. Feedback amplifiers. Operational amplifiers, characteristics and circuit configurations. Instrumentation amplifier. Precision rectifier. V-to-I and I-to-V converter. Op-Amp based active filters . Oscillators and signal generators.
Digital Electronics : Combinational logic circuits, minimization of Boolean functions. IC families, TTL, MOS and CMOS. Arithmetic circuits. Comparators, Schmitt trigger, timers and mono-stable multi-vibrator. Sequential circuits, flip-flops, counters, shift registers. Multiplexer, S/H circuit. Analog-to-Digital and Digital-to- Analog converters. Basics of number system. Microprocessor applications, memory and input-output interfacing. Microcontrollers.
Signals, Systems and Communications : Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Convolution, correlation and characteristics of linear time invariant systems. Discrete time system, impulse and frequency response. Pulse transfer function. IIR and FIR filters. Amplitude and frequency modulation and demodulation. Sampling theorem, pulse code modulation. Frequency and time division multiplexing. Amplitude shift keying, frequency shift keying and pulse shift keying for digital modulation.
Electrical and Electronic Measurements : Bridges and potentiometers, measurement of R, L and C. Measurements of voltage, current, power, power factor and energy. A.C & D.C current probes. Extension of instrument ranges. Q-meter and waveform analyzer. Digital voltmeter and multimeter. Time, phase and frequency measurements. Cathode ray oscilloscope. Serial and parallel communication. Shielding and grounding.
Analytical, Optical and Biomedical Instrumentation : Mass spectrometry. UV, visible and IR spectrometry. X-ray and nuclear radiation measurements. Optical sources and detectors, LED, laser, photo-diode, photo-resistor and their characteristics. Interferometers, applications in metrology. Basics of fiber optics. EEG, ECG and EMG, Clinical measurements, Ultrasonic transducers and Ultrasonography. Principles of Computer Assisted Tomography.

CI – CIVIL ENGINEERING

STRUCTURAL ENGINEERING

Strength of Materials: Bending moment and shear force in statically determinate beams. Simple stress and strain relationship Stress and strain in two dimensions, principal stresses, stress transformation, Mohr's circle. Simple bending theory, flexural and shear stresses, unsymmetrical bending, shear centre. Thin walled pressure vessels, uniform torsion, buckling of column, combined and direct bending stresses.
Structural Analysis: Analysis of statically determinate trusses, arches, beams, cables and frames, displacements in statically determinate structures and analysis of statically indeterminate structures by force / energy methods, analysis by displacement methods (slope deflection method), influence lines for determinate andindeterminate structures. Basic concepts of matrix methods of structural analysis.

Reinforced Concrete Structures: Concrete Technology- properties of concrete, basics of mix design. Concrete design-basic working stress and limit state design concepts, analysis of ultimate load capacity and design of members subjected to flexure, shear, compression and torsion by limit state methods. Basic elements of pre-stressed concrete, analysis of beam sections at transfer and service loads.

Steel Structures

Analysis and design of tension and compression members, beams and beam columns, column bases. Connections simple and eccentric, beam-column connections, plate girders and trusses. Plastic analysis of beams and frames.

Construction Management

Types of construction projects, project planning and network analysis—PERT and CPM; cost estimation.

GEOTECHNICAL ENGINEERING

Soil Mechanics

Origin of soils, soil classification, three - phase system, fundamental definitions, relationship and interrelationships, permeability and seepage, effective stress principle, consolidation, compaction, shear strength.

Foundation Engineering

Sub-surface investigations- scope, drilling bore holes, sampling, penetration 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, negative skin friction.

WATER RESOURCES ENGINEERING

Fluid Mechanics and Hydraulics

Properties of fluids, principle of conservation of mass, momentum, energy and corresponding equations, potential flow, applications of momentum and Bernoulli's equation, laminar and turbulent flow, flow in pipes, pipe networks. Concept of boundary layer and its growth. Uniform flow, critical flow and gradually varied flow in channels, specific energy concept, hydraulic jump. Forces on immersed bodies, flow measurements in channels, tanks and pipes. Dimensional analysis and hydraulic modeling. Kinematics of flow, velocity triangles and specific speed of pumps and turbines.

Hydrology

Hydrologic cycle, rainfall, evaporation, infiltration, stage discharge relationships, unit hydrographs, flood estimation, reservoir capacity, reservoir and channel routing. Well hydraulics.

Irrigation

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

ENVIRONMENTAL ENGINEERING

Water requirements: Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of waste water. Primary, secondary and tertiary treatment of waste water, sludge disposal, effluent discharge standards. Domestic wastewater treatment, quantity of characteristics of domestic wastewater, primary and secondary treatment Unit operations and unit processes of domestic wastewater, sludge disposal.

Air Pollution: Types of pollutants, their sources and impacts, air pollution meteorology, air pollution control, air quality standards and limits.

Municipal Solid Wastes: Characteristics, generation, collection and transportation of solid wastes, engineered systems for solid waste management (reuse/ recycle, energy recovery, treatment and disposal).

Noise Pollution: Impacts of noise, permissible limits of noise pollution, measurement of noise and control of noise pollution.

TRANSPORTATION ENGINEERING

Highway Planning: Geometric design of highways, testing and specifications of pavin`g materials, design of flexible and rigid pavements.

Traffic Engineering: Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.

CE – CHEMICAL ENGINEERING

Process Calculation and Thermodynamics : Laws of thermodynamics - reversible and irreversible process - concept of ideal gas and real gas - equations of states - Maxwell relations - adiabatic and isothermal compression - phase equilibrium - Gibbs phase rule - system of variable composition - vant Hoffs equation - applications of Gibbs - Duhem equation.

Law of conservation of mass and energy - material balance energy balance and their applications - unit operation and unit process - psychrometry - combustion calculations.

Momentum Transfer : Classification of fluids - fluid statics - basic equations of fluid flow - Bernoulli's equation - laminar flow – friction in flow through beds of solids - packed beds - fluid moving machinery - classification of pumps and its characteristics.

Particle Technology : Introduction to particulate solids - particle separation - size reduction - motion of a particle through fluid - classification of particulate solids - centrifugal classifier - sedimentation techniques - flotation - filtration equipments - agitation and mixing of liquids.

Heat Transfer and Chemical Reaction Engineering : Fourier's law of heat conduction - concept of thermal conductivity - heat transfer through fins - convective heat transfer - transfer of heat in flowing fluids - laminar and turbulent flow - heat transfer with and without phase change - types of evaporators - multiple effect evaporators.

Differential and integral method of analysis of rate data - ideal reactor design - Residence time distribution - C, E and F curves.

Chemical Technology : Basic principles of unit operation and unit process - schematic representations of unit operations - manufacture of sulfur, hydrochloric acid, cement, glass, products used in photography, ceramics and refractory, industrial gases, paints, pigments, fertilizers - fermentation process for the production of ethanol - manufacture of citric acid, antibiotics, penicillin, soaps, detergents – petroleum refining process - process for the production of petrochemical precursors - production of resins, nature and synthetic rubber.

Mass Transfer : Diffusion in liquids - development of rate equation for mass transfer - contracting devices for improving mass transfer characteristics - humidification, drying and crystallization - distillation, continuous rectification operation, absorption, liquid -liquid extraction and leaching - fundamental principles and design of the pressure, reaction vessels and related equipments in the above process.

Biochemical Engineering : Overview of industrial biochemical processes – industrially important microbial strains - enzymes used in industry, medicine and food - industrial production, purification and immobilization of enzymes - reactors types, characteristics and design-growth characteristics of microbial cells - free cell and immobilized cell reactors - downstream processing and effluent treatment.

EE – ELECTRICAL AND ELECTRONICS ENGINEERING

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.
coefficients, Method of variation of parameters, Cauchy's and Euler's equations, Initial and boundary value problems, Partial Differential

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, Method of separation of variables.

Analysis of complex variables: Analytic functions, Cauchy's integral theorem and integral formula, Taylor's and Laurent' series, Residue theorem, solution of integrals.

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

Numerical Methods: Matrix inversion, solutions of non-linear algebraic equations, iterative methods for solving differential equations, numerical integration, regression and correlation analysis.

Transform Theory: Fourier transform, Laplacetransform, Z-transform.

ELECTRICAL ENGINEERING

Electric 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, locus diagrams, realization of basic filters with R, L and C elements. One-port and two-port networks, driving point impedance and admittance, open-, and short circuit parameters, Three phase circuits, Power and power factor in ac circuits.

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, Applications of Fourier Transform, Laplace Transform and z-Transform.

Electromagnetic Fields: Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss's Law, Divergence, Electric field and potential due to point, line, plane and spherical charge distributions, Effect of dielectric medium, Capacitance of simple configurations, Biot-Savart's law, Ampere's law, Curl, Faraday's law, Lorentz force, Inductance, Magnetomotive force, Reluctance, Magnetic circuits, Self and Mutual inductance of simple configurations.

Electrical Machines: Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase transformers: connections, parallel operation; Autotransformer, Electromechanical energy conversion principles, DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, starting and speed control of dc motors; Three phase induction motors: 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, regulation and parallel operation of generators, starting of synchronous motor, characteristics; Types of losses and efficiency calculations of electric machines.

Power Systems: Power generation concepts, ac and dc transmission concepts, Models and performance of transmission lines and cables, Series and shunt compensation, Electric field distribution and insulators, Distribution systems, Per-unit quantities, Bus admittance matrix, Gauss-Seidel and Newton-Raphson load flow methods, Voltage and Frequency control, Power factor correction, Symmetrical components, Symmetrical and unsymmetrical fault analysis, Principles of over-current, differential and distance protection; Circuit breakers, System stability concepts, Equal area criterion.

Control Systems: Mathematical modeling and representation of systems, Feedback principles, transfer function, Block diagrams and signal flow graphs, transient response, steady-state-errors, Bode plot, phase and gain margins, Routh and Nyquist criteria, root loci, design of lead, lag and lead-lag compensators, state-space representation of systems; time-delay systems; mechanical, hydraulic and pneumatic system components, synchro pair, servo and stepper motors, servo valves; on-off, P, P-I, P-I-D, cascade, feed forward, and ratio controllers.

Electrical and Electronic Measurements: Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multimeters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

Analog and Digital Electronics: Characteristics of diodes, BJT, MOSFET; Simple diode circuits: clipping, clamping, rectifiers; 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, Demultiplexer, Schmitt trigger, Sample and hold circuits, A/D and D/A converters, 8085 Microprocessor: Architecture, Programming and Interfacing.

Power Electronics and Drives: Characteristics of semiconductor power devices: Diode, Thyristor, Triac, GTO, MOSFET, IGBT; DC to DC conversion: Buck, Boost and Buck-Boost converters; Single and three phase configuration of uncontrolled rectifiers, Line commutated thyristor based converters, Bidirectional ac to dc voltage source converters, Issues of line current harmonics, Power factor, Distortion factor of ac to dc converters, Single phase and three phase inverters, Sinusoidal pulse width modulation.

EI – INSTRUMENTATION ENGINEERING

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' 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.

Transform Theory: Fourier transform, Laplacetransform, Z-transform.

INSTRUMENTATION ENGINEERING

Basics of Circuits and Measurement Systems: Kirchoff's laws, mesh and nodal Analysis. Circuit theorems. One-port and two-port Network Functions. Static and dynamic characteristics of Measurement Systems. Error and uncertainty analysis. Statistical analysis of data and curve fitting.

Transducers, Mechanical Measurement and Industrial Instrumentation: Resistive, Capacitive, Inductive and piezoelectric transducers and their signal conditioning. Measurement of displacement, velocity and acceleration (translational and rotational), force, torque, vibration and shock. Measurement of pressure, flow, temperature and liquid level. Measurement of pH, conductivity, viscosity and humidity.

Analog Electronics: Characteristics of diode, BJT, JFET and MOSFET. Diode circuits. Transistors at low and high frequencies, Amplifiers, single and multi-stage. Feedback amplifiers. Operational amplifiers, characteristic and circuit configurations. Instrumentation amplifier. Precision rectifier. V-to-I and I-to-V co nverter. Op-Amp based active filters. Oscillators and signal generators.

Digital Electronics: Combinational logic circuits, minimization of Boolean functions. IC families, TTL, MOS and CMOS. Arithmetic circuits. Comparators, Schmitt trigger, timers and mono-stable multi-vibrator. Sequential circuits, flip-flops, counters, shift registers. Multiplexer, S/H circuit. Analog-to-Digital and Digitalto- Analog converters. Basics of number system. Microprocessor applications, memory and input-output interfacing. Microcontrollers.

Signals, Systems and Communications: Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first- and second order systems. Convolution, correlation and characteristics of linear time invariant systems. Discrete time system, impulse and frequency response. Pulse transfer function. IIR and FIR filters. Amplitude and frequency modulation and demodulation. Sampling theorem, pulse code modulation. Frequency and time division multiplexing. Amplitude shift keying, frequency shift keying and pulse shift keying for digital modulation.

Electrical and Electronic Measurements: Bridges and potentiometers, measurement of R, L and C. Measurements of voltage, current, power, power factor and energy. A.C & D.C current probes. Extension of instrument ranges. Q-meter and waveform analyzer. Digital voltmeter and multimeter. Time, phase and frequency measurements. Cathode ray oscilloscope. Serial and parallel communication. Shielding and grounding.

Control Systems and Process Control: Feedback principles. Signal flow graphs. Transient Response, steadystate- errors. Routh and Nyquist critera. Bode plot, root loci. Time delay systems. Phase and gain margin. State space representation of systems. Mechanical, hydraulic and pneumatic system components. Synchro pair, servo and step motors. On- off, cascade, P, P-I, P-I-D, feed forward and derivative controller, Fuzzy controllers.

Analytical, Optical and Biomedical Instrumentation: Mass spectrometry. UV, visible and IR spectrometry. X-ray and nuclear radiation measurements. Optical sources and detectors, LED, laser, photo-diode, photo-resistor and their characteristics. Interferometers, applications in metrology. Basics of fiber optics. Biomedical instruments, EEG, ECG and EMG. Clinical measurements. Ultrasonic transducers and Ultrasonography. Principles of Computer Assisted Tomography.

EC – ELECTRONICS AND COMMUNICATION ENGINEERING

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.

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

Transform Theory: Fourier transform, Laplacetransform, Z-transform.

NETWORK

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 Nortan's, maximum power transfer, wye-delta transformation, steady state sinusoidal analysis using phasors, fourier series, linear constant coefficient differential and difference equations; time domain analysis of simple RLC circuits. Laplace and Z transforms: frequency domain analysis of RLC circuits, convolution, 2-port network parameters, driving point and transfer functions, state equation for networks.

ANALOG CIRCUITS: Characteristics and equivalent circuits (large and small signal) of diodes, BJT, JFETs and MOSFETs simple diode circuits: clipping, clamping, rectifier, biasing and bias stability of transistor and FET amplifiers. Amplifiers: single and multi-stage,differential, operational, feedback and power. Analysis of amplifiers; frequency response of amplifiers. Simple op-amp circuits. Filters. Sinusoidal oscillators: criterion for oscillation; single-transistor and op-amp configurations. Function generators and waveshaping circuits, Power supplies.

DIGITAL CIRCUITS: Boolean algebra; minimization of Boolean functions; logic gates; digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinational circuits: arithmetic circuits, code converters, multiplexers and decoders. Sequential circuits: latches and flip-flops, counters and shift- registers. Comparators, timers, multivibrators. Sample and hold circuits, ADCs and DACs. Semiconductor memories. Microprocessor (8085): architecture, programming, memory and I/O interfacing

CONTROL SYSTEMS: Basic control system components; block diagrammatic description, reduction of block diagrams, properties of systems: linearity, time-invariance, stability, causality. Open loop and closed loop (feedback) systems. Special properties of linear time-invariance (LTI) systems- transfer function, impulse response, poles, zeros, their significance 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 system 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 compensations, elements of proportional-integral- Derivative (PID) control. State variable representation and solution of state equation for LTI systems.

COMMUNICATION SYSTEMS: Fourier analysis of signals - amplitude, phase and power spectrum, auto-correlation and cross-correlation and their Fourier transforms. Signal transmission through linear time-invariant (LTI) systems, impulse response and frequency response, group delay, phase delay. Analog modulation systems-amplitude and angle modulation and demodulation systems, spectral analysis of these operations, superhete rodyne receivers, elements of hardware realizations of analog communication systems. Basic sampling theorems. Pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation (DM). Digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK). Multiplexing - time division and frequency division. Additive Gaussian noise; characterization using correlation, probability density function (PDF), power spectral density (PSD). Signalto-noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions.

ELECTROMAGNETICS: Elements of vector calculus: gradient, divergence and curl; Gauss and strokes theorems, maxwells equation: 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 impedence; impedence transformation; smith chart; impedence matching pulse excitation. Wave guides: modes in rectangular waveguides; boundary conditions; cut-off frequencies; dispersion relations. Antennas; Dipole antennas; antenna arrays; radiation pattern; reciprocity theorem, antenna gain.

BT – Biotechnology

Biophysics: Levels of structures in biological macromolecules. Basic strategies in biophysics. Forces that determine protein and nucleic acid structure, prediction of protein structures in nucleic acids, properties of lipid bilayers, biochemical kinetics studies, unimolecular reactions, methods of determining macromolecular structures inclusive of the spectroscopic techniques like UV-vis absorption, IR absorption, circular dichroism, fluorescence, NMR, X-ray and neutron diffraction techniques.

Biochemistry: Structure and properties of Amino acids, peptides, proteins and conjugated proteins, protein hydration, coagulation, denaturation - gelation, protein-protein interactions, cytosolic and membrane properties, purines, pyrimidines, nucleosides, nucleotides,polynucleotides, ribonucleic acids and deoxyribonucleic acids, TCA cycle, glycolysis, pentose phosphate pathway, urea cycle, metabolic regulation, respiratory chain, TP cycle, energy rich compounds, integrated metabolism, Carbohydrates - linear and branched carbohydrates, N containing carbohydrates, cell wall carbohydrates, metabolism of carbohydrates, fats and oil-structure and properties of saturated and unsaturated fatty acids, glycerolipids, phospholipids, sphingolipids, glycolipids, steroids, vitamins and mineral-types, structure and functional properties of vitamins, utility of essential minerals sources and trace elements.

Biotechnology and Bioinformatics: Industrial biotechnology – Isolation; preservation and strain improvement for the overproduction of primary and secondary metabolites. Medium formulation, optimization and sterilization; biological waste treatment processes. Bioprocess - Types of reactors; volumetric oxygen mass transfer coefficient and its estimation; models for ideal and non-ideal flow. Downstream processing-Unit operations in downstream processing, cell disruptions method, solid liquid separation methods, precipitation methods, extraction methods, membrane based separation methods, different types of purification and chromatographic techniques.

Bioinformatics - Biological databases, File formats, sequence alignment, Database searches, phylogenetic tree construction and validation, Homology modeling, Drug discovery, DNA mapping and sequencing, sequence assembly and gene prediction, molecular predictions with DNA strings, Visualization tolls.

Cell Structure and Function of the Organelles: Eukaryotic and Prokaryotic cells, cell division, mitosis & meiosis cell cycle and molecules that control cell cycle, endocytosis and Exocytosis. Ultrastructure of cellular organelles, viz. Mitochondria, ER, Golgi, Chloroplast, plasma membrane, centriole, nuclear and membrane bound receptors, Signal Transduction, Signal Amplification Techniques of propagation of prokaryotic and Eukayotic cells, Autocrine, Paracrine and Endocrine models of action, Cell line, generation of cell lines.

Molecular Biology: Structure of DNA and histone molecules, Replication of eukaryotic chromosomes, nucleoid the complex replication apparatus, process of transcription and, Structure of tRNA, mRNA, rRNA, Deciphering of the genetic code, Translation, Mutation. General principles of cloning, inhibitors of replication, transcription and translation.

Recombinant DNA: Genetic elements that control gene expression, method of creating recombinant DNA molecules creating transgenic animals, plants microbes, Safety guidelines for creating recombinant DNA research, restriction enzymes and mapping of DNA, plasmid and phage and other vectors. Construction of genomic and cDNA libraries, methods of nucleic acid. Patents and methods of application of patents.

Genetics: Classical genetics, Mendel's genetics, crossing over, linkage, Chromosome maps, chromosomal theory of heredity, cytoplasmic inheritance, Sex determination, sex linked inheritance, microbial genetics, population genetics, polyploidy, pedigree analysis, eugenics, mutation.

Microbiology: Basic concepts of microbiology, classification,morphology, physiology of bacteria, viruses, fungi, parasite. Microbes of various plant and animal diseases. Industrial microbiology, Microbial biotechnology, Microbial diversity and ecology.

Immunology: Basic concepts of immunology, types of immunity, organs of immune response, Innate and adaptive immunity, clonal selection theory, hypersensitivity, hybridoma-technology, vaccine development, epitope mapping and immunomics, immunological tolerance and transplantation biotechnology.

Plant and Environmental Sciences: Taxonomy and systematic botany, Plant structure and development, morphology and anatomy, embryogenesis of monocots and dicots. Phytohormones, respiration, nutrition, transpiration. Photosynthesis, C3 and C4, & CAM plants, photoperiodism, concepts of ecosystems and energy flow in biosphere. Ecosystems, energy flow, ecological succession, pollution. Conventional and Non conventional sources of energy. Bio-geo chemical cycles. Biodiversity and wild life conservation. Social issues and the environment. Legal implications in bioremediation.

ME – MECHANICAL ENGINEERING

MATHEMATICAL FUNDAMENTALS

Algebra and Complex Analysis: Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Canonical forms, diagonal forms, triangular forms, Quadratic forms, reduction and classification of quadratic forms Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations—Fourier series—harmonics.

Calculus and its Applications : Linear ordinary differential equations (ODEs), variation of parameters, Sturm-Liouville problem. Partial differential equations (PDEs) - Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations. Transformation techniques—Laplace transformation—Fourier transforms—z—transformation to solve differential and difference equations.

Numerical Methods: Numerical solutions of algebraic and transcendental equations iteration methods and Newton—Raphson method, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods-Numerical differentiation and integration, Numerical solutions of ODEs and PDEs.

Descriptive statistics, Exploratory Data Analysis: Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate) - expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Standard discrete and continuous univariate distributions. Correlation and simple and multiple linear regression. Test of hypotheses—Large and small sample tests confidence intervals. Chi-square test goodness of fit. Simple non parametric tests for one and two sample problems, rank correlation and test for independence. ANOVA.

APPLIED 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; thermal stresses; Stress concentration factor; Fatigue Strength and S-N curve; failure theories.

Theory of Machines : Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider-crank mechanism; flywheels.

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

Technical drafting: Engineering drawing practice; Indian standards for technical drawing. Machine Elements Basic concepts of machine elements and their design;

FLUID MECHANICS AND THERMAL SCIENCES

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

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, fins; dimensionless parameters in free and forced convective heat transfer, radiative heat transfer, black and grey surfaces, shape factors; 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.

Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines, air-standard Otto, Diesel cycles. Stirling cycle.

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: Load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powdermetallurgy

Joining: Physics of welding, brazing and soldering; adhesive bonding;

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.

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.

SOMECURRENT TRENDS IN DESIGN ANDMANUFACTURING

Mechatronics System Design: Pneumatic and hydraulic systems; Eletro-pneumatic and electro-hydraulic systems; Pneumatic, hydraulic and electric motors and actutators; Concepts of microcontrollers, Feedback devices; Point-to-point, continuous-path and servo control; Types of CNC machines and robots. Programmable logic controllers; CNC and robot programming. Some current developments in modern machine tools, robotics, mechatronics; Basic topics related to micro-electro mechanical systems (MEMS).

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools. Exchange of product design and manufacturing data; CNC and robot programming methods. CAD/CAM Software and Virtual Product Development; Rapid Manufacturing Technologies; Concepts of Machine vision and Jigless manufacturing;

Computer Aided Engineering: Finite Element Methods; Computational FluidDynamics; Mechanical Systems Simulation; Tools for conventional mechanisms and MEMS design.
Automotive Engineering: Development in Bio-fuels, other alternative fuels and hydrogen as future fuel; Emission standards; Electronic injection systems; Passenger comfort and safety devices; Indian auto industry and Automotive vehicles in Indian market.

CS & IT – COMPUTER SCIENCE & ENGINEERING AND INFORMATION TECHNOLOGY

Engineering Mathematics

Mathematical Logic : Syntax of First Order Logic, Semantics of First Order Logic, a Sequent Calculus, the Completeness Theorem, the Limitations of First Order Logic.
Differential and Integral Calculus : Limit, Continuity, Differentiability, Leibniz theorem, Mean Value Theorems, Taylor's theorem, Integrals, Improper integrals, Total Differentiation, Partial derivatives ,Maxima and Minima, vector calculus, Linear differential equations.
Probability and Statistics : Probability, conditional probability, Baye's theorem, means, median, mode, moments, standard deviation. Random variables, Uniform, Binomial, Poisson, normal distributions, Correlation and regression, Sampling and Tests of significance.
Numerical Methods : Solutions to algebraic and transcendental equations (Bisection and Newton Raphson's methods), simultaneous linear algebraic equations (Gauss elimination, Crout's, Gauss seidel and relaxation), Interpolation methods (forward, backward and central), numerical integration (Trapezoidal, Simpson's and Weddle's) eigenvalues and eigenvectors, Numerical solutions to ordinary (Euler, modified Euler, Runga Kutta 4th order) and partial differential (parabolic, elliptic and Hyperbolic) equations.
Linear Algebra and Transforms : linear vector space, determinants, matrices, eigen values, eigen vectors, elements of complex analysis, Laplace transforms, Fourier analysis.
Algebra and Complex Analysis: Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Canonical forms, diagonal forms, triangular forms, Quadratic forms, reduction and classification of quadratic forms Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations—Fourier series—harmonics.
Calculus and its Applications : Linear ordinary differential equations (ODEs), variation of parameters, Sturm-Liouville problem. Partial differential equations (PDEs) - Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations. Transformation techniques—Laplace transformation—Fourier transforms—z—transformation to solve differential and difference equations.
Numerical Methods: Numerical solutions of algebraic and transcendental equations iteration methods and Newton—Raphson method, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods-Numerical differentiation and integration, Numerical solutions of ODEs and PDEs.
Descriptive statistics, Exploratory Data Analysis: Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate) - expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Standard discrete and continuous univariate distributions. Correlation and simple and multiple linear regression. Test of hypotheses—Large and small sample tests confidence intervals. Chi-square test goodness of fit. Simple non parametric tests for one and two sample problems, rank correlation and test for independence. ANOVA.

Discrete Mathematics : Sets, relations and functions, algebra of matrices and determinants, algebraic structures, Boolean algebra and applications, order relations and structures, graph theory, logic and combinatorics.

Theory of Computation: Regular languages and finite automata, context free languages and Push down automata, recursively enumerable sets and Turing machines, undecidability.

Programming Language Processors : Compiler, Interpreter, assembler, Linker, Loader, Macro processors, phases of compilers, Lexical analysis, parsing, Top-down parsing and bottom up parsing, syntax directed translation, runtime environment, Symbol table, type checking, intermediate Code generation, Code optimization, code generation.

Algorithmic Analysis and Data Structures

Analysis of Algorithms and Computational Complexity : Asymptotic analysis (best , worst, average case) of time and space, Upper and lower bounds on the complexity of specific problems, NP-completeness, code and query tuning techniques, numerical analysis, power analysis & resiliency, intractable problems.

Algorithms for Problem Solving : Tree and graph traversal, connected components, spanning trees, shortest paths, hashing, sorting, searching, design paradigms (Greedy, dynamic programming, divide and conquer).

Data Structures : Notion of abstract data types, stack, Queue, List, set, string, Tree, binary search trees, heap, graph.

Computer Architecture & Organization and Operating Systems

Electronics : Network analysis, semiconductor devices, bipolar transistors, FET's, Power supplies, amplifier, Oscillators, Operational amplifiers, elements of digital electronics, logic circuits.

Digital Logic : Number systems and codes, Gates, TTL circuits, Boolean algebra and Karnaugh maps, Arithmetic logic units, Flip flops, registers and counters, Memories, Combinational and sequential logic circuits .

Computer Architecture and Organization : Machine instructions and addressing modes, ALU and data path, Register Transfer Language , hardware and micro programmed control, memory interface, RAM, ROM I/O interface (Interrupt and DMA modes), serial communication interface, instruction pipe-lining, Cache , main and secondary memory storage, organization and structure of disk drives, RAID architectures Microprocessors: 8085, 8086, Interfacing and memory addressing.

Operating Systems : Memory management, page faults, overlay, processor management, device management, deadlocks, Process, thread and inter process communication, CPU scheduling, file systems, I/O systems, protection and security.

Software Engineering and Programming

System & Program Development Methodology : Software paradigms, principles of programming in any language, documentation, system analysis and design methodologies, User Interface Design (UID), software construction, software testing, software quality, Object Oriented Analysis and Design (OOAD) concepts.

Programming Methodology : Introduction to programming, pointers, arrays, control structures, Iterational control structures, functions, recursion, testing, debugging, code review, structures, files (C, C++, JAVA).

Computer Networks & Data Communications: Analog versus Digital communication, modems, multiplexers, and concentrators, serial versus parallel communication, simplex, duplex, and half duplex communication, synchronous and asynchronous communication, Error detection/correction methods, data link control protocols, balanced and unbalanced interfaces, communication media, ISO/OSI stack, Sliding window protocol, LAN Technologies (Ethernet, Token ring) , TCP/UDP, IP, switches, gateways, and routers, security.

Computing Technologies : Client server computing, Logical layers in client server architecture, Two-tier versus Three-tier, Distributed computing, Middle-ware, Mobile Computing, Cloud Computing.

Databases Management Systems: Data, database and DBMS, Data dictionary/directory, schema, description of database structure, forms of DBMS systems, Hierarchical, network and RDBMS, DDL, DML , stored data structure

language and query language, Recent trends in database management systems, Memory management techniques used in computers, query languages (SQL), file structures (sequential files, indexing, B* trees) Transactions and concurrency control, Basic concepts of transaction processing , ACID properties of transactions, serializability of transactions, concurrency control, recovery, OLAP.

PM – PHARMACY

Medicinal Chemistry: Structure, nomenclature, classification, synthesis, SAR and mechanism of action of the following categories of drugs, which are official in Indian pharmacopoeia and British pharmacopoeia. Introduction to drug design. Stereochemistry of drug molecules. Analgesics - NSAIDS, Antidepressants, Anxiolytics, Neuroleptics, Hypnotics and seda tive. Anticonvulsan ts , Antihistaminics, Local anaesthetics, Antianginal agents, Cardiotonic agent, Diuretic, Cardiovascular drugs, Anticoagulants, Coagulants, Antihypertensive drugs - Adrenergic and Cholinergic drugs Cardiotonic agents,
Hypolipidemic agents, Hypoglycemic agents, Antiplatelet agent, Chemotherapeutic agents, Antibiotics, Antibacterials, Antiprotozoal drugs, Sulphonamides, Antimalarial, Antiviral, Antitubercular, Antiamoebic drugs, Anticancer drugs, Diagnostic agents. Preparation and storage, and uses of official radio pharmaceuticals, Vitamins and Hormones,Eicosonoids and applications.
Natural Products: Pharmacognosy and Phytochemistry, Chemical tests for identification, chemistry, isolation, characterizations and estimation of phytopharmaceuticals belonging to the groups of terpenoids, steroids, Bioflavanoids, Purines, Alkaloids, Guggul lipids, Glycosides. Pharmacognosy of crude drugs that contain the above constituents. Standardization of raw materials and Herbal products, WHO guideline quantitative microscopy including modern techniques used for evaluation, Biotechnological principles and techniques for plant development, tissue culture.
Pharmaceutics: Formulation and preparation of cosmetics - lipstick, shampoo, nail preparation, creams, and dentifries, quality control of tablets, capsules, liquid dosage forms, parental preparations of ointment and creams, suppositories, and controlled release product, Quality control of containers, closures, caps, and secondary packing material like paper and board for pharmaceuticals, safety and legislation for cosmetic products, pharmaceutical calculations, Development, Manufacturing standards, Quality control limits, labeling, as per the pharmacopoeical requirement. Storage of different dosage forms and new drug deliver y systems, Biopharmaceutics and pharmacokinetics and their importance informulations.
Microbiology: Principles and methods microbiological assays as per Indian pharmacopoeia, methods of preparations of official sera and vaccines, Serological and diagnostics tests, Enzymes immuno assay, concept and methodology, Sterility testing - methodology and interpretation, Applications of microorganisms in Bioconversions and in pharmaceutical industry.
Clinical Pharmacy: Adverse drug reaction, Drug - Drug interaction, and Drug - Food interactions, Medication History, interview and patient counseling. Therapeutic drug monitoring, Dosage regimen in pregenancy and lactation, pediatrics and Geriatrics, Renal and Hepatic impairment.
Pharmaceutical Analysis: Principles, Instrumentation and applications of the following, Absorption spectroscopy UV visible, IR, Flame photometry, Potentiometry, Fluorimetry, Conductometry and Polarography, Pharmacopoeial assays. Principles of NMR, ESR, Mass spectroscopy, X- ray diffraction, optical Rotatory dispersion, statistical analysis and different chromatographic methods, Quality control of Radio pharmaceuticlas and Radio Chemical methods in analysis.
Pharmaceutical Jurisprudence: Pharmaceutical Ethics, Pharmacy Acts, Drugs and Cosmetics Acts and rules with respect to manufacture, sales and storages.
Bio-chemistry: Metabolism of Carbohydrates, lipids, proteins, methods to determine, kidney and liver function, Lipid profiles, General principles of immunology, immunological, Biochemical role of Harmones, Vitamins, Enzymes, Nucleic acids, Bio energetics.

Pharmacology: Pharmacology of Autocoids, Harmones, Hormone antagonists, Chemotherapeutic agents including Anticancer drugs, Bioassays, Immuno Pharmacology, General Pharmacological Principles includingtoxicology, Drug interaction. Pharmacology of drug acting on central nervous systems, cardiovascular systems, Autonomic nervous systems, Gastro intestinal systems and Respiratory systems, Drug acting on the renal systems, Drug acting on the blood and blood forming organs.

PH – PHYSICS

Mathematical Physics: Fourier series - Fourier transform - properties - convolution theorem - Application to solve differential equations - Laplace's transform - properties - application to ordinary and partial differential equations - Cayley Hamilton Theorem - Eigen value problems

Classical Mechanics: Conservation laws, Variational principle - Lagrange's and Hamilton's formalisms, equation of motion, poisson bracket , special theory of relativity - Larentz transformations, relativistic kinematics, mass - energy equivalence.

Spectroscopy: Atomic and Molecular Physics, Spectra of one - and many - electron atoms; LS and jj coupling; hyperfine structure; Zeeman and Stark effects; electric; electric dipole transitions and selection rules; X-ray spectra; rotational and vibrational spectra of diatomic molecules; electronic transition in diatomic molecules, Franck-Condon principle; Raman effect; NMR and ESR. Laser, Basic principle and concepts of laser - Types of Laser - Ruby laser - Nd - YAG laser - Helium - Neon laser - Carbon dioxide laser - semiconductor lasers.

Electro Magnetic Theory: Faraday's laws of induction - Maxwell's displacement current - Maxwell's equations - vector and scalar potentials - Gauge invariance - wave equation and plane wave solutions - Coulomb and Lorentz Gauges - energy and momentum of the field - Poynting's theorem.

Quantum Mechanics: Time Independent and Time Dependant Schrodinger equations, Justification of Schrodinger equation - the Schrodinger receipe - probabilities and normalization - Applications - particle in a box - simple harmonic oscillator - Dirac relativistic equations.

Statistical Mechanics: Equation of state - gas degeneracy - Bose-Einstein condensation - thermal properties of Bose -Einstein gas -liquid Helium - Tisza's two fluid model - Landau's theory of liquid Helium II-Black body radiation - phonons - Einstein and Debye models for lattice specific heat.

Experimental Design: Measurement of fundamental constants e, h, c - Measurement of High & Low Resistances - L and C - Detection of X-rays - Gamma rays, charged particles - neutrons etc - Ionization chamber - proportional counter - GM counter - Scintillation detectors - Solid State detectors - Measurement of Magnetic field - Hall effect, magneto resistance - X-ray and neutrondI fraction - Vacuum Techniques - basic idea of conductance - pumping speed etc - Pumps - Mechanical pump - Diffusion pump - Gauges Thermocouple - Penning - Pirani - Hot Cathode - Low Temperature - Cooling a sample over a range upto 4 K and measurement of temperature.

Solid State Physics: Types of lattices - Miller indices - Simple crystal structures - Crystal diffraction - Bragg's law - Reciprocal Lattice (BCC, FCC) - Brillouin zone - Structure factor - Atomic form factor - Cohesive energy of ionic crystals - Madelung constant - Types of crystal binding. Concept of Phase diagram - phase rule - single component system - binary phase diagram - Applications of phase diagram.

Electronics: Semiconductor devices; Bipolar junction Transistors, Field effect Transistors, amplifier and oscillator circuits - operational amplifier, negative feedback circuits, active fillers and oscillators; basic digital logic circuits, sequential circuits, flip-flops, counters, registers, A/D and D/A Conversion.

MC - MCA SYLLABUS FOR ENTRANCE EXAMINATION

MATHEMATICS :

Algebra: Fundamental operations in Algebra, Expansion, factorization, quadratic equations, indices, logarithms, arithmetic, geometric and harmonic progressions, binomial theorem, permutations and combinations.

Calculus: Functions of single variable, limit, continuity and differentiability, Mean value theorems, indeterminate forms and L'Hospital rule, Maxima and minima, Taylor's series, Fundamental and mean value-theorems of integral calculus, total derivatives, Lagrange method of multipliers.

Differential Equations: Differential equations of first order and their solutions, linear differential equations with constant coefficients, homogenous linear differential equations.

Algorithms: Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide-and conquer; Connected components, Spanning trees, Shortest paths. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds.

Probability: Probability theory, Dependent and independent events, frequency distributions, and measures of dispersions, Skewness and Kurtosis, random variable and distribution functions, mathematical expectations, Binomial, Poisson, normal distributions.

Algebra and Complex Analysis: Algebra of matrices, rank and determinant of matrices, linear equations. Eigenvalues and eigenvectors, Cayley-Hamilton theorem. Matrix representation of linear transformations. Canonical forms, diagonal forms, triangular forms, Quadratic forms, reduction and classification of quadratic forms Analytic functions, Cauchy-Riemann equations. Contour integral, Cauchy's theorem, Cauchy's integral formula, Taylor series, Laurent series, calculus of residues. Conformal mappings, Mobius transformations—Fourier series—harmonics.

Calculus and its Applications : Linear ordinary differential equations (ODEs), variation of parameters, Sturm-Liouville problem. Partial differential equations (PDEs) - Classification of second order PDEs, General solution of higher order PDEs with constant coefficients, Method of separation of variables for Laplace, Heat and Wave equations. Transformation techniques—Laplace transformation—Fourier transforms—z—transformation to solve differential and difference equations.

Numerical Methods: Numerical solutions of algebraic and transcendental equations iteration methods and Newton—Raphson method, Solution of systems of linear algebraic equations using Gauss elimination and Gauss-Seidel methods-Numerical differentiation and integration, Numerical solutions of ODEs and PDEs.

Descriptive statistics, Exploratory Data Analysis: Sample space, discrete probability, independent events, Bayes theorem. Random variables and distribution functions (univariate and multivariate) - expectation and moments. Independent random variables, marginal and conditional distributions. Characteristic functions. Standard discrete and continuous univariate distributions. Correlation and simple and multiple linear regression. Test of hypotheses—Large and small sample tests confidence intervals. Chi-square test goodness of fit. Simple non parametric tests for one and two sample problems, rank correlation and test for independence. ANOVA.

Date Structures: Arrays, Stacks, Queues, linked Lists. Sorting techniques, Searching Techniques, Trees and Graph terminology and representation in memory, binary search tree, traversal techniques of graphs and Trees.

Computer Networks: Network models, Internet model, OSI model, Physical Layer - Analog and Digital Signals, Analog and Digital Transmission, Coding, Sampling. Data Link Layer - Error detection and correction, Data link control and Protocols, Stop and wait, Go-back-n, Selective repeat. Network Layer - Inter-networks, Addressing, unicast and multicast routing, Presentation Layer.

Programming in C: Data types, Declarations, Expressions, statements and symbolic constants, input-Output functions. Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators. Control statements: While, do-while, for statements, nested loops, if else, switch, break, Continue, comma operators. Storage types: Automatic, external, register and static variables. Functions: Defining and accessing, passing arguments, Recursion.

Database Management Systems: DBMS architecture, Data models, data independence, E-R model, normalization, Relational Model: concepts, constraints, languages. Data storage, indexing, query processing, design and programming SQL.

Operating Systems: Process management, Process States, Process Control Block, Process and Threads, CPU Scheduling, Scheduling algorithm, Process Synchronization and Deadlock, Memory management, Virtual memory concepts paging and segmentation File organization, Blocking and buffering, file descriptor, File and Directory structures, I/O Devices.

Computer Architecture: Boolean algebra and computer arithmetic, flip-flops, design of combinational and sequential circuits, instruction formats, addressing modes, interfacing peripheral devices, types of memory and their organization, interrupts and exceptions. Von Neumann Computer, System Bus. Instruction Cycle, Data Representation, Machine instruction and Assembly Language.

ENGLISH COMMUNICATION
(COMMON TO ALL SUBJECTS)
20 Questions

1. Grammar

    Subject – Verb Agreement

    Tense forms

    Voices

    Articles and Preposition

    Use of Conjunctions

2. Writing Technical Instructions

3. Writing Memos & Writing Minutes

4. Transcoding

5. Preparing Questionnaire

6. Proof Reading