

Details of syllabus for Question Papers for CBT, 2024 (HURL)

Detailed Syllabus for Various Trades of GET- GRADUATE ENGINEER TRAINEE (EXECUTIVE CADRE)- (100 Questions/100 Marks)

1) Syllabus for Chemical Engineering (Graduate Engineer Trainee)

Sr. No.	Subject
1	Process Calculations and Thermodynamics: Steady and unsteady state mass and energy balances including multiphase, multi-component, reacting and non-reacting systems. Use of tie components; recycle, bypass and purge calculations; Gibb's phase rule and degree of freedom analysis. First and Second laws of thermodynamics. Applications of first law to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: Equation of State and residual properties, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibrium.
2	Fluid Mechanics and Mechanical Operations: Fluid statics, surface tension, Newtonian and non-Newtonian fluids, transport properties, shell balances including differential form of Bernoulli equation and energy balance, equation of continuity, equation of motion, equation of mechanical energy, Macroscopic friction factors, dimensional analysis and similitude, flow through pipeline systems, velocity profiles, flow meters, pumps and compressors, elementary boundary layer theory, flow past immersed bodies including packed and fluidized beds, Turbulent flow: fluctuating velocity, universal velocity profile and pressure drop. Particle size and shape, particle size distribution, size reduction and classification of solid particles; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, agitation and mixing; conveying of solids.
3	Heat Transfer: Equation of energy, steady and unsteady heat conduction, convection and radiation, thermal boundary layer and heat transfer coefficients, boiling, condensation and evaporation; types of heat exchangers and evaporators and their process calculations; design of double pipe, shell and tube heat exchangers, and single and multiple effect evaporators.
4	Mass Transfer: Fick's laws, molecular diffusion in fluids, mass transfer coefficients, film, penetration and surface renewal theories; momentum, heat and mass transfer analogies; stage-wise and continuous contacting and stage efficiencies; HTU & NTU concepts; design and operation of equipment for distillation, absorption, leaching, liquid-liquid extraction, drying, humidification, dehumidification and adsorption, membrane separations (micro-filtration, ultra-filtration, nanofiltration and reverse osmosis).

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5	Chemical Reaction Engineering: Theories of reaction rates, kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, kinetics of enzyme reactions (Michaelis-Menten and Monod models), non-ideal reactors, residence time distribution, single parameter model, non-isothermal reactors, kinetics of heterogeneous catalytic reactions, diffusion effects in catalysis, rate and performance equations for catalyst deactivation.
6	Instrumentation and Process Control: Measurement of process variables; sensors and transducers; P&ID equipment symbols; process modelling and linearization, transfer functions and dynamic responses of various systems, systems with inverse response, process reaction curve, controller modes (P, PI, and PID); control valves; transducer dynamics; analysis of closed loop systems including stability, frequency response, controller tuning, cascade and feed forward control.
7	Plant Design and Economics: Principles of process economics and cost estimation including depreciation and total annualized cost, cost indices, rate of return, payback period, discounted cash flow, optimization in process design and sizing of chemical engineering equipment such as heat exchangers and multistage contactors.
8	Chemical Technology: Inorganic chemical industries (sulfuric acid, phosphoric acid, chlor-alkali industry), fertilizers (Ammonia, Urea, SSP and TSP); natural products industries (Pulp and Paper, Sugar, Oil, and Fats); petroleum refining and petrochemicals; polymerization industries (polyethylene, polypropylene, PVC and polyester synthetic fibers).

2) Syllabus for Instrumentation Engineering (Graduate Engineer Trainee)

Sr. No.	Subject
1	Electricity and Magnetism: 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.
2	Electrical Circuits and Machines: Voltage and current sources: independent, dependent, ideal and practical; v-i relationships of resistor, inductor, mutual inductance 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. transient analysis of RLC circuits with ac excitation. One-port and two-port networks, driving point impedance and admittance, open-, and short circuit parameters. Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three phase induction motors: principle of operation, types, performance, torque-speed characteristics, no-load and blocked rotor tests, equivalent

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	circuit, starting and speed control; Types of losses and efficiency calculations of electric machines.
3	Signals and Systems: Periodic, aperiodic and impulse signals; 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, pulse transfer function; DFT and FFT; basics of IIR and FIR filters.
4	Control Systems: Feedback principles, 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, PI, PID, cascade, feed forward, and ratio controllers, tuning of PID controllers and sizing of control valves.
5	Analog Electronics: Characteristics and applications of diode, Zener diode, BJT and MOSFET; small signal analysis of transistor circuits, feedback amplifiers. Characteristics of ideal and practical operational amplifiers; applications of opamps: adder, subtractor, integrator, differentiator, difference amplifier, instrumentation amplifier, precision rectifier, active filters, oscillators, signal generators, voltage-controlled oscillators and phase locked loop, sources and effects of noise and interference in electronic circuits.
6	Digital Electronics: Combinational logic circuits, minimization of Boolean functions. IC families: TTL and CMOS. Arithmetic circuits, comparators, Schmitt trigger, multi-vibrators, sequential circuits, flipflops, shift registers, timers and counters; sample-and-hold circuit, multiplexer, analog-to-digital (successive approximation, integrating, flash and sigma-delta) and digital-to-analogue converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADC and DAC (resolution, quantization, significant bits, conversion/settling time); basics of number systems, Embedded Systems: Microprocessor and microcontroller applications, memory and input-output interfacing; basics of data acquisition systems, basics of distributed control systems (DCS) and programmable logic controllers (PLC).
7	Measurements: SI units, standards (R, L, C, voltage, current and frequency), systematic and random errors in measurement, expression of uncertainty - accuracy and precision, propagation of errors, linear and weighted regression. Bridges: Wheatstone, Kelvin, Megohm, Maxwell, Anderson, Schering and Wien for measurement of R, L, C and frequency, Q-meter. Measurement of voltage, current and power in single and three phase circuits; ac and dc current probes; true rms meters, voltage and current scaling, instrument transformers, timer/counter, time, phase and frequency measurements, digital voltmeter, digital multimeter, oscilloscope, shielding and grounding.
8	Sensors and Industrial Instrumentation: Resistive-, capacitive-, inductive-, piezoelectric-, Hall effect sensors and associated signal conditioning circuits; transducers for industrial instrumentation: displacement (linear and angular), velocity, acceleration, force, torque, vibration, shock, pressure (including low pressure), flow (variable head, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters) temperature (thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor); liquid level, pH, conductivity and viscosity measurement. 4-20 mA two-wire transmitter.

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9	<p>Communication and Optical Instrumentation: Amplitude- and frequency modulation and demodulation; Shannon's sampling theorem, pulse code modulation; frequency and time division multiplexing, amplitude-, phase-, frequency-, quadrature amplitude, pulse shift keying for digital modulation; optical sources and detectors: LED, laser, photo-diode, light dependent resistor, square law detectors and their characteristics; interferometer: applications in metrology; basics of fiber optic sensing. UV-VIS Spectrophotometers, Mass spectrometer.</p>
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3) Syllabus for Electrical Engineering (Graduate Engineer Trainee)

Sr. No.	Subject
1	<p>Basic concepts: Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.</p>
2	<p>Electric circuits: Network elements: ideal voltage and current sources, dependent sources, R, L, C, M elements; Network solution methods: KCL, KVL, Node and Mesh analysis; Network Theorems: Thevenin's, Norton's, Superposition and Maximum Power Transfer theorem; Transient response of dc and ac networks, sinusoidal steady-state analysis, resonance, two port networks, balanced three phase circuits, star-delta transformation, complex power and power factor in ac circuits.</p>
3	<p>Magnetic Circuit: Concepts of flux, MMF reluctance, Different kinds of magnetic materials, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction.</p>
4	<p>AC Fundamentals: Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. and C, Resonance, Tank Circuit. Poly Phase system star and delta connection, 3 phase power, DC and sinusoidal response of R-L and R-C circuit.</p>
5	<p>Single phase transformer: equivalent circuit, phasor diagram, open circuit and short circuit tests, regulation and efficiency; Three-phase transformers: connections, vector groups, parallel operation; Auto-transformer, Electromechanical energy conversion principles; DC machines: separately excited, series and shunt, motoring and generating mode of operation and their characteristics, speed control of dc motors; Three-phase induction machines: principle of operation, types, performance, torque-speed characteristics, no-load and blocked-rotor tests, equivalent circuit, starting and speed control; Operating principle of single-phase induction motors; Synchronous machines: cylindrical and salient pole machines, performance and characteristics, regulation and parallel operation of generators, starting of synchronous motors; Types of losses and efficiency calculations of electric machines</p>
6	<p>Measurement and measuring instruments: Measurement of power (1 phase and 3 phase, both active and re-active) and energy, 2 wattmeter method of 3 phase power measurement. Measurement of frequency and phase angle. Ammeter and volt meter (both moving coil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Brid of CRO Signal Generator, CT, PT and their uses. Earth fault detection.</p>

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7	Synchronous: Generation of 3-phase E.M.F armature reaction, voltage regulation, parallel, operation of two alternators, synchronizing, control of active and reactive power.
8	Generation, Transmission and Distribution: Different types of power stations. Load factor, diversity factor, demand factor, cost of generation inter-connection of power stations. Power factor improvement various types of tariffs, types of faults, short circuit for symmetrical faults. Switchgears and Productions: Rating of circuit breakers, Principles of are extinction by oil and air. H.R.C. Fuses, Protection again earth leakage / over current, etc. Buchholz relay, Merz Price system of protection of generators & transformers, protection of leaders and bus bars. Lightning arresters, various transmission and distribution system, comparison of conductor materials efficiency of different system. Cable -Different type of cables rating and derating factor.
9	Estimation and costing: Estimation of lighting scheme, electric installation of machines and relevant IE rules. Earthing practices end IE Rules.
10	Utilization of Electrical Energy: Illumination, Electric heating, Electric welding, Electroplating, Electric drives and motors.
11	Basic Electronics: Working of various electronic devices e.g. P N Junction diodes, Transistors (NPN end PNP type) BJT and JFET, Simple circuits use these devices.

4) Syllabus for Mechanical Engineering (Graduate Engineer Trainee)

Sr. No.	Subject
1	Engineering Mechanics: Resolution of forces, Equilibrium and Equilibrant, parallelogram law of forces, triangle law of forces, polygon law of forces, Lami's theorem, couple and moment of a couple, condition for equilibrium of rigid body subjected to number of coplanar non-concurrent forces, definition of static friction, dynamic friction, derivation of limiting angle of friction and angle of repose, resolution of forces considering friction when a body moves on horizontal plane and inclined plane, calculation of moment of inertia and radius of gyration Newton's laws of motion, motion of projectile. D'Alembert's principle.
2	Material Science & Metrology: Crystal Structure: Unit cells, Metallic crystal structures, Imperfection in solids, Mechanical Properties and its measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength. Heat treatment of Steel, alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast iron, Carbon Fibre and alloys, Structure and properties of Graphene Material, Composite Materials, Reinforcement, Limits, fits and tolerances.

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3	<p>Strength of Material: Stress, strain, stress strain diagram, factor of safety, Torsion, combined bending and torsion of solid and hollow shafts, Differential equation of the elastic curve, cantilever and simply supported beams, area moment method, fixed and continuous beams, Deflection of springs, axial load and twisting moment acting simultaneously both for open and closed coiled springs, concept of laminated springs. Introduction, difference between thin-walled and thick-walled pressure vessels, thin-walled spheres and cylinders, hoop and axial stresses and strain, and volumetric strain. Shear force and bending moment diagram - cantilever beam, simply supported beam, continuous beam, fixed beam.</p>
4	<p>Manufacturing Process: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding, Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.</p>
5	<p>Thermodynamics: Thermodynamic systems and processes, properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations, Rankine cycle with P-V & T-S diagrams,</p>
6	<p>Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.</p>
7	<p>Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.</p>
8	<p>Fluid Mechanics & Hydraulic Machinery Properties of fluid, density, specific weight, specific gravity, viscosity, compressibility capillarity, Pascal's law, measurement of pressures, concept of buoyancy. Concept of Reynold's number, pressure, potential and kinetic energy of liquids, total energy, laws of conservation, mass, energy and momentum, velocity of liquids and discharge, Bernoulli's equation and assumptions, venturi meters, pitot- tube, current meters. Working principle & constructional details of centrifugal pumps, efficiencies – manometric efficiency, volumetric efficiency, mechanical efficiency and overall efficiency, cavitation and its effect, working principle of jet & submersible pumps with line diagrams.</p>

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9	Industrial Management: Job analysis, motivation, different theories, satisfaction, performance reward systems, production, planning and control, relation with other departments, routing, scheduling, dispatching, PERT and CPM, simple problems. Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order, level, economic ordering quantity, break even analysis, stores layout, stores equipment, stores records, purchasing procedures, purchase records, Bin card, Cardex System, Material handling, Manual lifting, hoist, cranes, conveyors, trucks, fork trucks.
10	Heat Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis
11	RAC: Applications of Refrigeration and Air Conditioning, Air Refrigeration Cycle, Vapour Compression Refrigeration Systems and its components, Vapour Absorption Refrigeration Systems and its components,
12	Power Engineering: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat. I.C. Engines: Air-standard Otto, Diesel and dual cycles.

The syllabus shall be as per the AICTE for Diploma Engineer Trainee (DET).

Detailed Syllabus for Various Trades for DET-DIPLOMA ENGINEER TRAINEE (NON-UNIONIZED SUPERVISOR)-100 Questions/100 Marks

1) Syllabus for Chemical Engineering (DET)

Sr. No.	Subject
1	Fluid Mechanics & Solid Handling: Fluids, Flow of incompressible fluids, Measurement of flowing fluids: Orifice meter, venturimeter, pitot tube, rotameter, weirs and notches, Transportation of fluids: Classification of pumps, construction and operation of Air lift, reciprocating, rotary, centrifugal and gear pumps, Handling of solids: Conveying equipment, their classification general construction and industrial application, Belt conveyors, chain conveyors and screw conveyors, Types of filtration equipment, their application and operation.
2	Material and Energy Balance: Scope of material and energy balance in chemical industries, Gases and Gas Mixture, Ideal gas law, Boyle's law, Charle's law, value of universal gas constant, Amagat's Law, partial pressure, Vander Waal's equation, Average molecular weight, density and composition (by weight and by mole) of gas mixture, Material Balance without Chemical Reaction, Material Balance with Chemical reaction.
3	Chemical Engineering Thermodynamics: Introduction and Basic Concepts, First Law of Thermodynamics for Open and Closed System, Second Law of Thermodynamics, Third Law of Thermodynamics (Statement only), Entropy, Applications of Second law of Thermodynamics, Chemical Reaction Equilibrium and Vapor Liquid Equilibrium.
4	Heat Transfer Operations: Modes of Heat Transfer, Conduction, Convection, Radiation, Heat Exchanger, Boiling and condensation, Evaporators.

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5	Chemical Technology & Chemical Reaction Engineering: Introduction of Chemical process industries with reference to Indian resources, trade and export potential, Sugar Industry, Sugar Industry, Soaps and Detergent Industry, Pulp and Paper Industry, Polymer Industry, Petroleum Refining Industry, Sulphuric Acid Industry, Phosphorus Industry, Cement Industry, Introduction and uses of Insecticides, Pesticides and Herbicides, Introduction to Chemical Kinetics, Interpretation of batch reactor data, Introduction to Reactor Design, Introduction to Heterogeneous Reacting System, Catalysis.
6	Mass Transfer Operations: Diffusion, Gas Absorption and Desorption, Humidification and Dehumidification, Drying, Distillation, Extraction, Leaching, Adsorption.
7	Pollution Control and Industrial Safety: Air Pollution, Water Pollution, Environment Protection, Radio Active Pollution, Solid Waste Management, Pollution Acts, Safety in Chemical Industry,
8	Introduction To Paint & Polymer Technology: General Introduction of Paint Industry, definition of Paints, Varnishes and Lacquers, their constituents and functions. General classification of surface coatings, mechanism of film formation, sources and composition of oils, non-glyceride, components of oils, classification, extraction and refining of oils, Introduction & historical background of polymers, macro-molecular concept, monomers & polymers nomenclature of polymers, features, characteristics and applications of a polymer, definition of polymerization, rate of polymerization, average degree of polymerization, functionality and polymerization. oligomers and high polymers, scope of elastomeric, fibre forming and plastic materials, Types of polymerizations, addition (chain) polymerization, condensation polymerization, Comparison between addition and condensation polymerization. Bulk, suspension, solution & emulsion polymerization, Fundamental of film formers, chemical structure of monomers, functionality and its determination, polymerization and molecular weight, convertible, non- convertible film formers, linear, branched and cross-linked film formers and co polymers.
9	Plastic Materials & Principles of Polymer Science: Engineering Plastics, Sources of Raw Materials – Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications of Polysulfide, Polyphenylene sulfide, Polyarylsulfone, Polyether Ketone, Polyether Ether Ketone, Polyimide, Polyamide-imides, Liquid Crystal Polymers. Polymer Blends & Alloys, Bio-degradable Plastics & Bioplastics, Introduction to Polymer Science, Polymerization, Polymer Structure and Properties, Polymer Characterization.
10	Introduction to Fertilizers Technology: Synthetic fertilizers, Classification of fertilizers, Role of essential Elements in plant Growth, Macro elements and Micro elements. Select the relevant fertilizers for the different types of crops Application of fertilizers considering Nutrient Balance and types of crops.
11	Pigments And Extenders: Concept of colour phenomena, classification of pigments, testing of pigments, oil absorption value, bulking value, specific Gravity, refractive index, mass tone, reducing power, tinting strength, resistance to heat. Definition of pigment Dyes, dyes stuffs, toners and lake pigment etc, inorganic pigments, extenders, organic pigments, miscellaneous pigments.
12	Petrochemical Processing: Introduction to technology of Dehydrogenation, Oxidation, Hydration, Sulphonation, Alkylation, etc, synthesis of generation, manufacture of olefines, manufacture of aromatics, chemicals used in detergent industry, manufacture of chemicals for use in fibre making, manufacture of polymers, manufacture of chemicals for dyes, pharmaceutical, intermediates and textile auxiliaries.

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2) Syllabus for Instrumentation Engineering (DET)

Sr. No.	Subject
1	Network Theory: Network analysis techniques, Nodal Analysis, Loop Analysis, Mesh Analysis; Network Theorems; Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Reciprocity Theorem, Mollman's Theorem, Star-Delta Connections, two port networks.
2	Electronic Measurements and Instrumentation: Basic concepts, standards and error analysis; Measurements of basic electrical quantities and parameters; Electronic measuring instruments and their principles of working; analog and digital, comparison, characteristics, application Transducers; Electronic measurements of non-electrical quantities like temperature, pressure, humidity, etc.
3	Analog Electronic Circuits: Transistors biasing and stabilization, small signal analysis, power amplifiers, frequency response, wide banding techniques, feedback amplifiers, Tuned amplifiers, Oscillators, Rectifiers and power supplies, Op Amp.
4	Digital Electronic Circuits: Binary number system, Octal, Hexadecimal and BCD numbers system, Boolean algebra, simplification of Boolean functions, Karnaugh map and applications, IC logic, Combination logic circuits, Half adder, Full adder, Digital comparator, Multiplexer, Demultiplexer, Flip Flops, R-S, J-K, D and T flip-flops, different types of counters and registers, A/D and D/A converters, semiconductor memories.
5	Control Systems: Types of Control system, Open Loop and Closed Loop Control system, Effect of feedback on stability and sensitivity; Block Diagram Reduction Technique, Signal Flow Graph, Stability Analysis, Routh's Stability Criterion.
6	Microprocessors: Number systems, Data representation; microprocessors; Architecture and Instruction set of Microprocessors 8085, Assembly language programming.

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Syllabus for B. Sc. (PCM) (DET)

B. Sc. (PCM) - For B. Sc. (PCM) Candidates, (100 questions/100 marks) from course curriculum of B.Sc. specifically from Chemistry stream at graduate level, Syllabus should be as per UGC Norms.

Sr. No.	Subject
1	<p>Inorganic Chemistry-1: Atomic Structure, Chemical Bonding and Molecular Structure,</p> <p>Organic Chemistry-1: Fundamentals of Organic Chemistry, Stereochemistry, Aliphatic Hydrocarbons: Alkanes, Alkenes, Alkynes, formation of metal acetylides, addition of bromine and alkaline KMnO_4, ozonolysis and oxidation with hot alk. KMnO_4.</p>
2	<p>Physical Chemistry-1: Chemical Energetics: Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.</p> <p>Chemical Equilibrium, Ionic Equilibria</p> <p>Organic Chemistry-2: Functional group approach for the following reactions (preparations & reactions) in context to their structure.</p> <p>Aromatic hydrocarbons, Alkyl and Aryl Halides, Alcohols, Phenols and Ethers, Alcohols, Phenols, Ethers (aliphatic and aromatic), Aldehydes and ketones (aliphatic and aromatic).</p>
3	<p>Physical Chemistry-2:</p> <p>Solutions: Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.</p> <p>Phase Equilibrium, Conductance, Electrochemistry,</p> <p>Organic Chemistry-3: Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.</p> <p>Carboxylic acids and their derivatives, Carboxylic acid derivatives (aliphatic), Amines and Diazonium Salts, Amino Acids, Peptides and Proteins, Carbohydrates</p>
4	<p>Coordination Chemistry: Transition Elements (3d series), Coordination Chemistry, Crystal Field Theory.</p> <p>Physical Chemistry-3: Kinetic Theory of Gases, Liquids: Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient</p>

	<p>of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).</p> <p>Solids: Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X-Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals. Glasses and liquid crystals.</p> <p>Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).</p>
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GENERAL APTITUDE (GET/DET)

GA Syllabus Details (GET/DET) -- General English, Quantitative Aptitude, Reasoning, And General Knowledge /Awareness (50 Questions/50 Marks)
(GE-10, QA- 10, Reasoning- 10, GK- 20)

Sr. No.	Subject
1	<p>ENGLISH: Grammar, Synonyms and Antonyms, Cloze Test, Sentence structure, Spot the error, Vocabulary, One-word substitutions, Comprehension passage, Idioms and phrases, Spellings, Sentence Improvement, Para Jumbling, Preposition, Active and Passive Voice.</p>
2	<p>QUANTITATIVE APTITUDE: Number System, HCF and LCM, Decimal and Fractions, Simplification, Percentages, Average, Profit, Loss, and Discount, Time and Distance, Time and Work, Ratio and Proportion, Simple Interest and Compound Interest, Partnership, Algebra, Probability and Statistics.</p>
3	<p>REASONING: Odd One Out, Blood Relations, Direction Sense Test, Order and Ranking, Analogy, Coding and Decoding, Number Series, Alphanumeric Series, Seating Arrangement, Word Formation, Syllogism, Statement and Conclusion.</p>
4	<p>GENERAL AWARENESS Indian History, Arts and Culture, Indian Polity and Constitution, Indian Geography, General Science, Basic Computer, Environment, Countries and Capitals, Currencies, Books and Authors, Sports, Science and Technology.</p>

M. Sharma