5 ME/MTech PROGRAMME

5.1 ELIGIBILITY FOR ADMISSION

Admission to all the ME/MTech programmes shall be made on the basis of merit of the Entrance test to be conducted by the Thapar University. GATE Score card shall be used for the purpose of scholarship only. Admission to ME/MTech programme will be open to a candidate who obtains at least 50% marks in the aggregate in the qualifying examination from a recognised University.

Qualifying examination for ME/MTech programme (regular as well as part-time) in various disciplines is as under:

ME Programmes

CAD/CAM & Robotics
BE/BTech degree in Mechanical/Production/Industrial Engineering.

Civil (Structures) Engineering
BE/BTech degree in Civil Engineering.

Electronics & Communications Engineering
BE/BTech degree in Electronics & Communication

Production & Industrial Engineering
BE/BTech degree in Mechanical/Production/Industrial/Automobile Engineering.

Software Engineering
BE/BTech degree in any discipline of Engineering OR MSc in Mathematics/Statistics/Computer Science/ Electronics/Physics/Operations Research/Information Science/Information Technology OR MCA OR Equivalent

Computer Science & Engineering
BE/BTech degree in any discipline of Engineering OR MSc in Mathematics/Statistics/Computer Science/ Electronics/Physics/Operations Research/Information Science/Information Technology OR MCA OR Equivalent

Electronic Instrumentation & Control Engineering
BE/BTech/ degree in Electrical/Electronics/Instrumentation Engineering OR MSc Physics with Electronics

Power Systems and Electric Drives
BE./BTech in Electrical Engineering.

Thermal Engineering
BE/BTech degree in Mechanical/Production/Industrial/Aeronautical/Chemical/RAC/Automobile Engineering

MTech Programmes

Materials & Metallurgical Engineering
BE/BTech degree in any branch of Engineering OR MSc in Materials Science/Physics/ Chemistry (with Physics and Mathematics at BSc Level)

Environmental Science & Technology
BE/BTech degree in Civil/Chemical/Mining/Metallurgy/Biotechnology Engineering OR MSc in Chemistry/Bio-chemistry/Biotechnology/Life Sciences/Atmospheric Sciences.

VLSI Design & CAD
BE/BTech degree in Electronics /Computer Science/Electronics & Communication/Electronics (Instrumentation & Control)/Electrical Engineering OR MSc in Computer Science/Electronics/Physics with Electronics / Instrumentation with Mathematics as one of the subjects in B.Sc

Chemical Engineering
BE/BTech (Chemical Engineering/Technology, Environmental, Biotechnology, Pulp & Paper Tech. or allied discipline) or MSc (Applied Sciences with Mathematics)

Computer Science & Applications
B.E./B.Tech. Degree in any discipline OR M.Sc. in Mathematics /Statistics /Operation Research /Computer Science / Electronics/ Information Technology/ Physics OR MCA OR equivalent.

Note: Candidate who has passed Section B of the Institution of Engineers (India) or Grade IETE and has three years of professional experience in reputed organisation are also eligible for admission to ME/MTech programme in respective disciplines.

Sponsored Candidates with 55% marks in the qualifying examination are eligible for admission. Such candidates must have a minimum of two years of full time work experience in a registered firm/company/industry/educational and research institutions/any Government Department of Government Organization in the relevant field in which admission is being sought. The employer in the sponsorship certificate must indicate that the fee will be borne by the sponsoring organization and the candidate will not be withdrawn before the completion of the programme. **The fee of the sponsored candidates shall be paid by the sponsoring agency from the company's bank account.**

5.2 NUMBER OF SEATS

The University offers PG programme of four semesters (regular) and seven semesters (part time) leading to ME/MTech degree. The distribution of seats discipline-wise is as under:

Programme	Number of Seats		
	Open	Sponsored	SC/ST
ME Programme (Regular)			
CAD/CAM & Robotics	19	5	6
Civil (Structures) Engineering	19	5	6
Electronics & Communication Engineering	19	5	6
Production & Industrial Engineering	19	5	6
Software Engineering	19	5	6
Electronic Instrumentation & Control Engineering	19	5	6
Computer Science & Engineering	19	5	6
Power Systems & Electric Drives	19	5	6
Thermal Engineering	19	5	6
ME Programme (Part-time)			
Civil (Structures) Engineering	10	-	-
Production & Industrial Engineering	10	-	-
MTech Programme (Regular)			
Materials & Metallurgical Engineering	19	5	6
Environmental Science & Technology	19	5	6
VLSI Design & CAD	19	5	6
Chemical Engineering	19	5	6
Computer Science and Applications	19	5	6

In addition to above seats, 5 seats in each regular discipline of ME/MTech programme are available for FN/NRI candidates. Refer section 8 for eligibility and other conditions.

5.3   LEAVE RULES

ME/MTech regular students getting scholarship shall be entitled for leave for a maximum period of thirty days per year in addition to general holidays but not entitled to vacation, e.g., summer, winter, etc. The students must apply for leave in advance and obtain the sanction from the concerned Head of the Department. The student shall be required to give an undertaking to the effect that he/she would not leave the course midway or appear in any competitive examinations, etc., not related to Engineering & Technology, in order to be eligible to receive this scholarship.

5.4   TEACHING ASSIGNMENTS

It will be obligatory for every post-graduate student to undertake eight to ten hours per week of work related to teaching and research activities as assigned to him/her by the University. This could include

tutorials, laboratories classes, development and maintenance of laboratories, assistance in research and development activities undertaken by faculty members, maintenance and operation of computers and other central facilities, assistance in library etc.

5.5 TIMING FOR PART-TIME CLASSES

The classes for ME/MTech part-time programmes may be held on either Saturday or Sunday (whole day) during all the weeks in a Semester.

5.6 DURATION OF PROGRAMME

The normal duration of programme leading to the ME/MTech degree shall be four semesters for regular students and seven semesters for part-time students, which includes course work of twelve subjects, seminar/minor project and thesis. The maximum duration for regular programmes is six semesters and for part time programmes is ten semesters.

5.7 SCHOLARSHIPS/ASSOCIATESHIPS

The candidates admitted in ME/MTech with valid GATE score will be considered to receive scholarships only if approved & amount released by AICTE or any other funding agency.

There are 50 teaching associateships (Rs 60,000- per annum: 20, Rs 36000- per annum: 30) for students who will not be getting GATE Scholarships. The decision regarding eligibility criteria for distribution of these scholarships will be decided by DOAA.

Note: The part-time candidates must produce No Objection Certificate from the present
    employer/Department.
If the number of students registered is less than ten on the date of registration in a PG programme, then decision of the Director shall be final regarding offering of such programme.

5.8 SCHEDULE OF ENTRANCE EXAMINATION:

TABLE-A

	Time of Entrance Test (**15.06.2010**)		Time of Entrance Test (**16.06.2010**)	
	From	**To**	**From**	**To**
ME Programmes				
CAD/CAM & Robotics			9.00 AM	10.30 AM
Civil (Structures) Engineering	9.00 AM	10.30 AM		
Electronics & Communication Engineering	8.30 AM	10.00 AM		
Production & Industrial Engineering			11.00 AM	12.30 PM
Power Systems & Electric Drives			11.00 AM	12.30 PM
Software Engineering	12.00 PM	1.30 PM		
Computer Science & Engineering	2.00 PM	3.30 PM		
Electronic Instrumentation & Control Engineering			1.30 PM	3.00 PM
Thermal Engineering			3.30 PM	5.00 PM
MTech Programmes				
Materials & Metallurgical Engineering	1.30 PM	3.00 PM		
Environmental Science & Technology			1.30 PM	3.00 PM
VLSI Design & CAD	10.15 AM	11.45 AM		

| Chemical Engineering | | | 3.30 PM | 5.00 PM |
| Computer Science and Applications | 3.45 PM | 5.15 PM | | |

Note:
  i. Duplicate Admit Cards may be issued to the candidates on the day of Entrance Test.
  ii. No TA/DA will be paid for appearing in the Entrance test/Interview etc
  iii. A candidate willing to apply for more than one ME/MTech programme, whether in same or different departments, is required to fill separate form for each programme alongwith requisite exam fee.
5.9   CENTRE FOR ENTRANCE TEST : TU Patiala

SYLLABUS FOR ENTRANCE TEST FOR ADMISSION TO ME/MTech PROGRAMMES.

Duration of test: 90 minutes
Negative marking: ¼ marks shall be deducted for each wrong answer.

11.1 ME PROGRAMME (REGULAR/ PART-TIME)

CAD/CAM & ROBOTICS ENGINEERING

Basics of the courses covered in the qualifying degree. (Detailed analytical treatment not required); Definitions of CAD/CAM, advantages/benefits of CAD/CAM; Industrial Robot configurations and applications; Computer Hardware/Software for CAD/CAM application, Automated drafting; Introduction to NC/CNC; Introductory Programming in C and C++.

CIVIL (STRUCTURES) ENGINEERING

Basic Structural Mechanics: Bending moment and shear force diagrams. Analysis of pinjointed and rigid plane frames. Influence lines, Analysis of axially loaded and eccentrically loaded columns. **Concrete Technology:** Concept of quality control. Concrete making materials. Properties of fresh and hardened concrete. Methods of concrete mix design. **Reinforced Concrete:** Limit state design methods for flexure, shear, bond and torsion. Design of basic elements using IS: 456-2000. **Design of Steel Structures:** Design of tension and compression members. Design of beams and columns (including bases and foundations). Welded and riveted joints. **Introduction to pre-stressed concrete.**

ELECTRONICS & COMMUNICATION ENGINEERING

Networks : Network graphs; ,matrices associated with graphs, incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's Maximum Power Transfer, Wye-Delta Transformation Steady state sinusoidal analysis using phasors. 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 equations for networks. **Analog Circuits:** Characteristics and equivalent circuits (large and small signal) of diodes, BJTs, JFETs and MOSFETs Simple diode circuits : clipping, clamping, rectifier Biasing and bias stability of transistor and FET amplifiers. Amplifiers : single and multistage, differential, operational; feedback and power. Analysis of amplifiers; frequency response of amplifiers. Simple op-amp circuits. Filters Sinusoidal oscillators: criterian for oscillation; single-transistor and op-amp configurations. Function generators and wave-shaping 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, timer, multivibrators. Sample and hold circuits, ADCs and DACs. Semiconductor memories Microprocessor :8085/8086; architecture, AL programming, memory and

I/O interfacing. **Communication System:** Fourier analysis of signals amplitude, phase and power spectrum, Autocorrelation and cross-correlation and their Fourier transforms. Signal transmission through linear time-invariant (LTI) system, impulse response and frequency response, group delay and phase delay. Analog modulation systems-amplitude and angle modulation and demodulation systems, spectral, analysis of operations, superheterodyne receivers, elements of hardware realizations of analog communication systems. Basic sampling theorem. Pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation (DM). **Digital Modulation Scheme :** 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). Signal to noise ratio (SNR) calculation for amplitude modulation (AM) and frequency (FM) for low noise conditions. **Electromagnetism :** Elements of vector calculus : gradient, divergence and curl; Gauss' and Strokes' theorems, Maxwell's equations : differential and integral forms. Wave equation. Pointing vector Plane waves : propagation through various media; reflection; phase and group velocity; Skin depth Transmission lines : Characteristics impedance; impedance transformation, Smith Chart, Impedance matching pulse excitation. **Waveguides :** Modes in rectangular waveguides; Boundary conditions; Cut-Off frequencies; Dispersion relations. **Antennas:** Dipole antennas; antenna arrays; radiation pattern; reciprocity theorem; antenna gain.

PRODUCTION & INDUSTRIAL ENGINEERING

Basics of courses covered in the qualifying degree (Detailed analytical treatment not required); Introduction to Production Systems and their Planning and Control, Work Study, Inspection & Quality Control; Engineering Economics & Value Engineering, Basics of Manufacturing Processes and awareness of modern developments in Industrial Management.

SOFTWARE ENGINEERING/COMPUTER SCIENCE & ENGG

Section-I: Logical Reasoning & Analytical Ability

Section-II: Mathematical Foundations of Computer Science

Mathematical Logic: Prepositional logic, first-order logic, **Probability:** Random variables and expectation, conditional probability, independent random variables, frequency distributions; **Discrete Mathematics:** Sets, relations, functions, groups, lattices, boolean algebra, induction, recurrence relations; **Combinatorics:** Permutations, combinations, counting, summation; **Elementary Graph Theory:** Basic properties, graph traversals, topological sort, spanning tree, shortest paths; **Computational Techniques:** Solution of non-linear equations, elementary concepts of linear and matrix algebra, solution of system of linear equations, curve fitting and interpolation, numerical differentiation and integration, regression and correlation analysis; **Theory of Computation:** Regular languages and finite automata, context free languages and pushdown automata, Turing machines.

Section III: Computer Hardware

Digital Logic: Logic functions, minimization, design and synthesis of combinational and sequential circuits; **Number Representation and Computer Arithmetic**; **Computer Organization:** Machine instructions and addressing modes, ALU and data-paths, hardwired and micro-programmed control, memory interface, I/O interfaces, serial communication interface, instruction pipelining, cache, main and secondary storage.

Section IV: Software Systems

Programming Methodology: C programming, program control, functions, recursion, scope, binding, parameter passing, pointers, array handling, structures and unions, file handling, elementary concepts of Object Oriented, Functional and Logic Programming; **Data Structures:** Notion of abstract data types, stacks, queues, linked lists, trees, heap, graphs; **Algorithms for Problem Solving:** Tree and graph traversals, connected components spanning trees, shortest paths, hashing, sorting, searching; design techniques; **Complier Design:** Lexical analysis, parsing, syntax directed translation, runtime environment, code generation, linking; **Operating Systems:** Classical concepts (concurrency, synchronization, deadlock), processes, threads and inter-process communication, CPU scheduling, memory management, file systems, I/O systems, protection and security; **Database Systems:** Relational model, ER diagram, relational algebra, database design, normalization, SQL, file structures, transactions management and concurrency control; **Computer Networks:** ISO/OSI stack, sliding window protocol, LAN technologies (Ethernet, Token ring), TCP/UDP, IP, Basic concepts of switches, gateways and routers.

ELECTRONIC INSTRUMENTATION & CONTROL ENGINEERING

Mathematical Principles: Laplace and Fourier transform, Theory of maxima & minima. **Electrical Principles:** Kirchoff's laws, Norton/Thevenin theorem, Current- voltage transformation, Ideal current source, Ideal voltage source. **Electronic Principles:** Zener/Avalanche breakdown, Basic Transistor Operation, Biasing Circuits, SCR, MOSFET, Oscillator & Amplifier Principles, Op-Amps, their applications, Logic gates, Flip flops, Timers, Counters & Registers. **Microprocessor :** 8085 & 8086 architecture, Addressing modes of 8085 & 8086, Mnemonics, Basic programming, RS-232 protocol. **Electrical Measurements:** PMMC, moving iron Galvanometer, Electro dynamometer, Wattmeter, Wheat-stone Bridge, Maxwelll Bridge, De-saute's, Bridge, Current & Voltage transformer, Q-meter, Distortion meter, digital Voltmeter, CRO-analog & digital. **Generalized Measurement Systems:** Generalized impedance & stiffness concepts, Static-response of step & ramp signals to 1st & 2nd order systems, Loading effects, Analogies. **Signal Conditioning & Display :** Filters-active & passive, Dead time elements, LED/LCD. **Process Modelling & Control :** Lumped & Distributed parameters, interacting & non interacting systems, Concept of feedback & fed forward control, Actuators like Relay, Stepper motor, Servo motor, Pneumatic valves. **Industrial Measurements:** Principles of Level, Flow, Pressure, Temperature and Vibration measurements. **Analytical & Biomedical Instrumentation:** Principles of UV, Visual Spectroscopy, chromatographic techniques, Thermography & ultrasonography Cardiovasular Measurements.

POWER SYSTEMS & ELECTRIC DRIVES

Power Systems : Transmission line - performance, models, Cables, Electrical & mechanical design of transmission line, Load flow and solution techniques, Symmetrical and unsymmetrical faults, Insulators, Circuit breakers, Electromechanical relays, Static relays, Protection schemes for feeders, generators, motors and transformers. High Voltage AC, DC and Impulse voltages generation and measurement; breakdown in solid, liquid and gases, Transient phenomenon in power systems.

Electrical Machines & Drives : Electromechanical energy conversion principals; construction, operation and performance of Transformer and rotating electrical machines, Drives – Basics, starting, speed control, braking through conventional and static drives.

Networks : Network Topology, Network Theorems, Circuit transients, Laplace transforms, Single and Three phase system, Fourier analysis, Magnetic circuits, Two port Network, Network Synthesis.
Electronics : Diode and Transistor, Operational Amplifiers, Oscillators: Boolean algebra; logic and sequential circuits : registers, counters, flip flops, Semiconductor memories, Microprocessor (8085), architecture, programming, memory and 1/0 Interfacing; Thyristors and power converter.

THERMAL ENGINEERING

Thermodynamics: Laws of thermodynamics, non flow and Flow processes. Properties of a pure substance, Kelvin-Plank's statement and Clausius's statements of the 2nd law of thermodynamics. Carnot cycle, Concept of entropy, Causius'Inquality, Third law of Thermodynamics. Concept of Availability and Irreversibility. Thermodynamic relations.

IC Engines and Gas Turbines: Introduction to IC engines, 2-stroke and 4-stroke engines. Air standard cycles, Otto cycle, diesel cycle and dual cycle. Combustion phenomenon in SI and CI engines. Carburetion, fuel pumps, Ignition systems. Friction and Lubrication., supercharging and turbocharging.Emission and its control. Gas turbines

Steam Engineering: Fuel and combustion analysis, adiabatic flame temperature. Properties of steam. Types of boilers. superheater, air preheater and economizer. Draught. Rankine cycle, reheating and regeneration, reheat factor Impulse and reaction steam turbines, Steam nozzles, steam condensers air pumps.

Heat and Mass Transfer: Modes of heat transfer, conduction, Fourier's law of heat conduction and applied to plane wall, cylinder, and sphere with and without heat generation. Heat transfer through extended surfaces. Convection, Free and Forced convection, Dimensional analysis, Dimensionless Numbers. Radiation heat transfer, shape factor, governing law for the radiation heat transfer. Radiation shields, reradiating surfaces. Heat exchanger and its type, fouling factor, LMTD and NTU-effective techniques for the parallel and counter flow heat exchangers.Bsics of mass transfer. Boiling and condensation

Refrigeration and Air Conditioning: Vapour compression cycle, multistages compression systems, multiple cascade refrigeration system. Types of Evaporators, compressors, condensers. Rrefrigerants.Vapours absorption cycles.Psychometry, psychometric chart. Winter and summer air conditioning. Air craft refrigeration.
Fluid Mechanics and Fluid machines:. Newton's law of viscosity, buoyancy and floatation. Hydrostatics and Kinematics of the fluid. Fluid dynamics, Laminar and Turbulent flows. Flow through the pipes. Dimensional analysis. Losses through pipes, open channel flows. Impact of jet on the different type of surfaces, hydraulic turbines, impulse and reaction turbines. Specific speed and units parameters, similitudes. Reciprocating and centrifugal pumps.

Gas dynamics and compressible flow machines: Subsonic and supersonic flows, Normal and oblique shock waves. Positive and Non positive displacement type compressors (reciprocating air compressors, rotary air compressors, screw air compressors, lyshome air compressors, centrifugal compressors, axial flow compressors).

Power Plant Engineering: Energy conversion devices, hydro and steam power plants, nuclear power plants.

Non Conventional and Renewable Energy Resources: Energy sources and availability, renewable energy sources. Solar energy, green house effect. Wind energy, bio-energy. Photosynthesis, Geothermal Energy: Energy from ocean, energy from tides.

11.2 MTech PROGRAMMES (REGULAR)

MATERIALS & METALLURGICAL ENGINEERING

Bonding in solids, electronic configurations, ionic, covalent, metallic and secondary bonds. Space lattice and unit cells; crystal systems; indices for planes and directions; effect of radius ratio on coordination; structures of common metallic, semiconducting, polymeric, ceramic, amorphous/glassy materials. X-ray diffraction, Bragg's law, use of x-ray diffraction for the determination of simple crystal structures; Point, line and surface defects; geometry of edge and screw dislocations; Burger's vector; energy of dislocations; First and second Fick's laws of diffusion and their solutions under simple boundary conditions; Solid solutions; intermediate phases and intermetallic compounds; Gibbs' phase rule; unary

and binary phase diagrams; iron-iron carbide phase diagram; Phase transformations; nucleation and growth; solidification; crystal growth and zone refining; precipitation hardening; recrycstallization and grain growth; martensitic transformations; Elastic behaviour of materials including composite, atomic models of elasticity, rubber-like elasticity; Plastic deformation; slip systems in crystals; critical resolved shear stress; strengthening mechanisms; ductile and brittle fracture; Griffith's criterion, mechanisms of creep; fatigue; Polymeric materials; polymerization, cross-linking; glass transition; composites; Absorption, oxidation and corrosion; Thermal properties of materials, specific heat, thermal conductivity, thermoelectricity; Electrical/electronic behaviour of materials; electrical conductivity; free electron and band theory of solids; intrinsic and extrinsic semiconductors; p-n junctions; solar cells; superconductivity; type I and II superconductors and their applications; Dielectric behaviour of materials; polarization phenomena; spontaneous polarization; dielectric constant and loss; piezo - and Ferro electricity; Magnetic behaviour of materials; dia-, para-, ferro and ferrimagnetism; soft and hard magnetic materials and their applications; Optical properties of materials; refractive index, absorption and emission of light; optical fibres, lasers and optoelectronic materials.

ENVIRONMENTAL SCIENCE & TECHNOLOGY

Interactions between humans and environment; The physical environment - land, water, air and climate; Resources and their management - Natural, technological and human; Concept of sustainability - Natural ecosystems and sustainability; Agricultural and industrial systems from the angles of environmental protection; Environmental chemistry - Analytical techniques and instrumentation, Atmospheric chemistry; Basic microbiology - Nature and extent of the microbial world, Growth and energetics, Microbiology of water and waste water, Microbial corrosion and biofouling; Quantity of water - per capita demand, factors affecting the demand; Quality of water - Physical, chemical and biological characteristics; Treatment of water - Sedimentation, coagulation, filtration, chlorination, absorption, adsorption, and Miscellaneous methods; Sewage and sewerage systems; Primary and secondary treatment of sewage - Aerobic and anaerobic processes and their applications in the wastewater treatment.

VLSI DESIGN & CAD

Logical and Analytical Ability; Fundamentals of Computer and C programming: Basics of Computers; Operators, Data types, Expression, Control Flow statement, Functions, Arrays, Strings, pointers, structures, and unions. **Data Structures and Algorithms:** Data types, structures, stacks, queues, and linked lists. Sorting and Searching, B-trees, B+ trees and hashing. **Networks :** Network graphs; ,matrices associated with graphs, incidence, fundamental cut set and fundamental circuit matrices. Solution methods: nodal and mesh analysis. Network theorems: superposition, Thevenin and Norton's Maximum Power Transfer, Wye-Delta Transformation Steady state sinusoidal analysis using phasors. 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 equations for networks. **Semiconductor Devices and Analog Circuits :** Characteristics and0020equivalent circuits (large and small signal) of diodes, BJTs, FETs, JFETs, MOSFETs, UJT, SCR, photodiode, phototransistor, etc. Simple diode circuits; clipping, champing, rectifier, biasing and bias stability of transistor and FET amplifiers. Amplifiers : single and multistage, differential, operational, feedback and power, Analysis of amplifiers. Amplifiers : frequency response of amplifiers, simple op-amp circuits. Sinusoidal Oscillators: criterion for oscillation; op-amp configurations. Function generators and wave shaping circuits. Regulated power supplies. **Digital Circuits :** Number Systems, Fixed-point and floating number representations, Boolean Algebra, Demorgan's therorems, minimization of Boolean functions, logic gates, digital logic families (DTL, TTL, ECL, MOS, CMOS), Combinational circuits, arithmetic circuits, code converter, multiplexers and decoders; sequential circuits : latches and flipflops, Registers, Counters, Comparators, timers, multivibrators; Sample and hold circuits, ADCs and DACs; Semiconductor memories. **Microprocessors :** Evolution, microcomputer architecture; Intel 8085: architecture, addressing mode,

Instruction set, programming technique, Interrupt Structure; Intel 8086: architecture, concept of segmented memory, addressing modes, Instruction set, programming techniques, Interrupt Structure; Interfacing devices i.e. 8255,8279,8257,8253,8259etc.: memory and I/O interfacing, read/write timing diagrams. **Computer Architecture :** Basic computer organization and Design, memory organization, I/O organization, I/O Devices, Data transfer techniques, Register transfer Language Microprogrammed control, CPU, Concept and CISC and RISC architecture.

CHEMICAL ENGINEERING

Process Calculations and Thermodynamics: Laws of conservation of mass and energy; degree of freedom analysis, first and second laws of thermodynamics and their applications; phase equilibria; chemical reaction equilibria. **Fluid Mechanics and Mechanical Operations**. Fluid statistics, Bernoulli equation, macroscopic friction factors, dimensional analysis, flow through pipeline systems, flow meters pumps and compressors, packed and fluidized beds, size reduction and size separation free and hindered settings; centrifuge and cyclones; thickening and classification, filtration, mixing and agitation, conveying. **Heat Transfer**: conduction, convection, radiation, heat exchangers, evaporators. **Mass Transfer**: Ficks' law, molecular diffusion in fluids, distillation, absorption, drying, etc. **Chemical Reaction Engineering**: Kinetics of homogeneous reactions, interpretation of kinetic data, residence time, kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis. **Instrumentation and Process Control**: Dynamics of simple systems, controller modes (P, PI and PID). **Plant Design and Economics**: Design and sizing of chemical engineering equipment, principles of process economics an cost estimation. **Chemical Technology**: Inorganic chemical industries; sulfuric acid, NaOH, fertilizers (Ammonia, Urea, SSP and TSP); organic chemical industries (Pulp and Paper, Sugar, Oil and Fats); petroleum refining and petrochemicals: polymerization industries; polypropylene, PVC and polyester synthetic fibers., **Process modeling and simulation:** Equation of continuity, momentum, energy, CSTR, exchangers, distillation, etc. **Computational methods in chemical engineering:** PDE, ODE, use of excel sheet, MATLAB etc., **Differential Equations**: First order (Linear and nonlinear), Laplace transforms, **Numerical Methods**: Numerical solutions of linear and non linear algebraic equations, integration by trapezoidal and Simpson's rule, single and multi-step methods of differential equations **Probability and Statistics**: Mena median moxe and standard deviation, random variables, Poisson, normal and binominal distributions.

COMPUTER SCIENCE AND APPLICATIONS

Section-I : Analytical Ability (20 Marks)

The questions in this section will cover logical reasoning, quantitative reasoning, visual-spatial reasoning.

Section-II : Mathematical Aspects of Computer Science (40 Marks)

Combinatorics : Permutations, combinations, counting, summation;

Theory of Probability : Axiomatic definition of Probability, conditional probability, Baye's Theorem : random variables, Functions of random variables. Expectation, Probability distributions: Binomial Poisson, Exponential and Nomial distribution and their moment generating functions.

Discrete Mathematics : Sets, relations, functions, lattices, Boolean algebra, induction, recurrence relations. Groups, Subgroups, Homomorphisms, Normal and subnormal subgroups.

Linear Algebra:
Review of matrices, Consistency of system of Linear equations. Vector spaces and subspace, linear independence and dependence of vectors, Basis and dimensions. Rank and nullity of a linear transformation, Eigen values and eigenvectors of a Matrix, diagonalization.

Optimization Techniques

Linear Programming : Graphical method, Simplex method, Duality Theory and Sensitivity Analysis.
Transportation and Assignment Problem: Initial Basic Feasible Solutions of Balanced and Unbalanced Problems, Optimal Solutions.
Network Analysis : Shortest Path problem. Minimum Spanning Tree Problem. Maximum Flow Problem. Minimum Cost Flow Problem.

Numerical Techniques : Number systems, Solution of non-linear equations, solution of system of linear equations, curve fitting, interpolation, numerical differentiation and integration, solutions of IVP.

Section III : Concepts of Computer Science (40 Marks)

Number Representation and Computer Arithmetic

Computer Organization : Machine instructions and addressing modes, ALU and data-paths, hardwired and micro-programmed control pipelining , memory interface, I/O interfaces, serial communication interface, parallel processing**,** memory management

Structured and object oriented programming concepts(with reference to "C/ C++") :
program control, functions, recursion, scope, binding, parameter passing, pointers, array handling, structures and unions, file handling, concepts of Object Oriented Programming.

Data Structures : Notion of abstract data types, stacks, queues, linked lists, trees, heap,graphs, Tree and graph traversals, hashing, sorting, searching.

Theory of Computation : Regular languages and finite automata, context free languages and pushdown automata, Turing machines.
Complier Design : Lexical analysis, parsing, syntax directed translation, runtime environment, code generation, linking.

Operating Systems: Definition and significance of OS, OS as resource manager, Classical concepts processes, concurrency, synchronization, deadlock, threads and inter-process communication, CPU scheduling, memory management, file systems, I/O systems, protection and security, DOS, UNIX and windows.

Database Management Systems: Relational model, ER diagram, relational algebra, database design, normalization, SQL, transactions management and concurrency control.

Computer Networks: OSI reference model, sliding window protocols, LAN technologies (Ethernet, Token ring), TCP/UDP, IP, , Networking addresses, transmission medias, Networking devices-Hub, switches. gateways and routers.

Software Engineering: Basics of s/w engineering, Software Process models, software project planning and management.