DETIAILED SYLLABUS FOR THE TECHNICAL TEST

1. CHEMICAL ENGINEERING

There are seven subjects and students can choose any three

1.1 Process Control & Thermodynamics
Laws of conservation of mass and energy; use of tie components; recycle, bypass and purge calculations; degree of freedom analysis. First and Second laws of thermodynamics. First law application to close and open systems. Second law and Entropy. Thermodynamic properties of pure substances: equation of state and departure function, properties of mixtures: partial molar properties, fugacity, excess properties and activity coefficients; phase equilibria: predicting VLE of systems; chemical reaction equilibria.

1.2 Fluid Mechanics & Mechanical Operations
Fluid statics, Newtonian and non–Newtonian fluids, Bernoulli equation, Macroscopic friction factors, energy balance, dimensional analysis, shell balances, flow through pipeline systems, packed and fluidized beds, elementary boundary layer theory. Size reduction and size separation; free and hindered settling; centrifuge and cyclones; thickening and classification, filtration, mixing and agitation; conveying of solids.

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

1.4 Mass Transfer
Fick’s laws, molecular diffusion in fluids, mass transfer coefficients, film theory; momentum, heat and mass transfer analogies; stagewise and continuous contacting and stage efficiencies; HTU & NTU concepts design and operation of equipment for distillation, absorption, liquid–liquid extraction, dehumidification and adsorption.

1.5 Chemical Reaction Engineering
Theories of reaction rates; kinetics of homogeneous reactions, interpretation of kinetic data, single and multiple reactions in ideal reactors, non–ideal reactors; residence time distribution, single parameter model; non–isothermal reactors; kinetics of heterogeneous catalytic reactions; diffusion effects in catalysis.

1.6 Bioprocess Engineering
Kinetics of microbial growth, substrate utilization and product formation; Simple structured models; Sterilization of air and media; Batch, fed–batch and continuous processes; Aeration and agitation; Mass transfer in bioreactors; Rheology of fermentation fluids; Scale–up concepts; Design of fermentation media; Various types of microbial and enzyme reactors; Instrumentation in bioreactors.

1.7 Downstream Processing
Fundamentals of various down stream purification steps (unit operations) involved in a biochemical process. Cell breakage; recovery of intracellular material; isolation of solids; product recovery; product enrichment / purification; product polishing and finishing.
2. LIFE SCIENCES

There are seven subjects and students can choose any three

2.1 **Cell Biology**: Cell Structure and Function; Organelles; Cell Cycle and Cellular Reproduction; Transport Across Cell Membranes; Receptors & Cell Signalling; Gene Organization and Regulation of Gene Expression in Prokaryotes and Eukaryotes; Replication; Transcription and Translation.

2.2 **Immunology**: The origin of immunology; Inherent immunity; Humoral and cell mediated immunity; Primary and secondary lymphoid organ; Antigen; B and T cells and Macrophages; Major histocompatibility complex (MHC); Antigen processing and presentation; Synthesis of antibody and secretion; Molecular basis of antibody diversity; Polyclonal and monoclonal antibody; Complement; Antigen–antibody reaction; Regulation of immune response; Immune tolerance; Hyper sensitivity; Autoimmunity; Graft versus host reaction.

2.3 **Bioinformatics**: Major bioinformatics resources (NCBI, EBI, ExPASy); Sequence and structure databases; Sequence analysis (biomolecular sequence file formats, scoring matrices, sequence alignment, phylogeny); Genomics and Proteomics (Large scale genome sequencing strategies; Comparative genomics; Understanding DNA microarrays and protein arrays); Molecular modeling and simulations (basic concepts including concept of force fields).

2.4 **Molecular Biology and Genetics**: Molecular structure of genes and chromosomes; DNA replication and control; Transcription and its control; Translational processes; Regulatory controls in prokaryotes and eukaryotes; Mendelian inheritance; Gene interaction; Complementation; Linkage, recombination and chromosome mapping; Extrachromosomal inheritance; Chromosomal variation; Population genetics; Transposable elements, Molecular basis of genetic diseases and applications.

2.5 **Biochemistry**: Biomolecules and their conformation; Weak inter–molecular interactions in biomacromolecules; Chemical and functional nature of enzymes; Kinetics of single substrate and bi–substrate enzyme catalyzed reactions; Bioenergetics; Metabolism (Glycolysis, TCA and Oxidative phosphorylation); Membrane transport and pumps; cell growth control; signal transduction.

2.6 **Microbiology**: Prokaryotic and eukaryotic cell structure; Microbial nutrition, growth and control; Microbial metabolism (aerobic and anaerobic respiration, photosynthesis); Nitrogen fixation; Chemical basis of mutations and mutagens; Microbial genetics (plasmids, transformation, transduction, conjugation); Microbial diversity and characteristic features; Viruses.

2.7 **Recombinant DNA Technology**: Restriction and modification enzymes; Vectors: plasmid, bacteriophage and other viral vectors, cosmids, Ti plasmid, yeast artificial chromosome; eDNA and genomic DNA library; Gene isolation; Gene cloning; Expression of cloned gene; Transposons and gene targeting; DNA labeling; DNA sequencing; Polymerase chain reactions; DNA fingerprinting; Southern and northern blotting; In–situ hybridization; RAPD; RFLP; Site–directed mutagenesis; Gene transfer technologies; Gene therapy.

Soil microorganisms associated with vascular plants.
There are twelve subjects and students can choose any three

3.1 Programming
C: Functions, Recursion, Parameter passing, Scope, pointers, files
C++: Classes in C++, operator overloading, storage management, inheritance, polymorphism, input and output in c++ programs
Java: Java classes and objects, inheritance, exception handling, object classes, wrapper classes, packages, applets, awt and swings, threads.

3.2 Data Structures and Algorithms
Data Structures: Abstract data types, Arrays, Stacks, Queues, Linked Lists, Trees, Binary search trees, Binary heaps.

Algorithms: Analysis, Asymptotic notation, Notions of space and time complexity, Worst and average case analysis; Design: Greedy approach, Dynamic programming, Divide–and–conquer; Tree and graph traversals, Connected components, Spanning trees, Shortest paths; Hashing, Sorting, Searching. Asymptotic analysis (best, worst, average cases) of time and space, upper and lower bounds, Basic concepts of complexity classes P, NP, NP–hard, NP–complete.

3.3 Theory of Computation: Regular languages and finite automata, Context free languages and Push-down automata, Recursively enumerable sets and Turing machines, Un–decidability.

3.4 Computer Networks: ISO/OSI stack, LAN technologies (Ethernet, Token ring), Flow and error control techniques, Routing algorithms, Congestion control, TCP/UDP and sockets, IP (v4), Application layer protocols (icmp, dns, smtp, pop, ftp, http); Basic concepts of hubs, switches, gateways, and routers. Network security basic concepts of public key and private key cryptography, digital signature, firewalls.

3.5 Operating System: Processes, Threads, Inter–process communication, Concurrency, Synchronization, Deadlock, CPU scheduling, Memory management and virtual memory, File systems, I/O systems, Protection and security.

3.6 Data Base Management System: ER–model, Relational model (relational algebra, tuple calculus), Database design (integrity constraints, normal forms), Query languages (SQL), File structures (sequential files, indexing, B and B+ trees), Transactions and concurrency control.


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

3.10 **Embedded Systems**: Introduction: Embedded system, Processor, hardware units, software embedding, SOC, NOC, VLSI circuit; Device and Device drivers, I/O devices, timer and counting devices, serial communication using IC, LAN and advanced I/O buses between the networked multiple devices, Host system, parallel communication using ISA, PCI, PCI–X, and advanced buses, device drivers, parallel port device drivers in a system, serial port device drivers. Interrupt service handling mechanism; Software and programming concepts: processor and memory selection for embedded system, embedded programming in C++, Java and UML, multiple processes and applications, problem of sharing data by multiple tasks and routines, interprocess communication.

3.11 **Micro Processors and Micro Controllers**: Architecture of the 8086/8088 microprocessor, Internal operations, Maximum mode, Minimum mode of operation, Addressing modes, Instruction Format, Instruction execution timing, 8088 vs 8086; Assembly Language Programming: Data Transfer instruction, Arithmetic and Logical instructions, String Manipulation instructions etc., needed for ALP, Modular programming: Simple assembler directives and operators, Linking and relocation, Stack, Procedures, Interrupt, Macro, Programming examples. Byte and string manipulation, I/O programming. 8087 Numeric data processor and its use in the 8086/8088 system, 8089 I/O processor (IOP), Architecture, Communication between CPU & IOP. Arithmetic Coprocessor, MMX and SIMD Technology; Bus interface, The 80386/80486/Pentium/Pentium II/Pentium III/Pentium IV Microprocessors; 8051 Microcontroller: Architecture, Instruction, Programming and Interfacing.

3.12 **Image Processing and Machine Vision**


*Machine Vision*: Object recognition, Image understanding, 3D vision, geometry and radiometry, use of 3D vision.
4. CIVIL ENGINEERING

There are fifteen subjects and students can choose any three

4.1 Mechanics
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.

4.2 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 and moment distribution methods), influence lines for determinate and indeterminate structures. Basic concepts of matrix methods of structural analysis.

4.3 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 prestressed concrete, analysis of beam sections at transfer and service loads.

4.4 Steel Structures

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

4.6 Foundation Engineering

4.7 Highway Planning
Geometric design of highways, testing and specifications of paving materials, design of flexible and rigid pavements.

4.8 Traffic Engineering
Traffic characteristics, theory of traffic flow, intersection design, traffic signs and signal design, highway capacity.
4.9 **Fluid Mechanics and Hydraulics**

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

4.11 **Irrigation**

4.12 **Sanitary Engineering**
Basic unit operations and unit processes for surface water treatment, distribution of water. Sewage and sewerage treatment, quantity and characteristics of wastewater. Primary, secondary and tertiary treatment of wastewater, 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.

4.13 **Surveying**
Importance of surveying, principles and classifications, mapping concepts, coordinate system, map projections, measurements of distance and directions, leveling, theodolite traversing, plane table surveying, errors and adjustments, curves.

4.14 **Remote Sensing, GIS, GPS**
Introduction to remote sensing. Basic principles of remote sensing – energy sources and radiation principles, atmospheric absorption, interaction of energy with earth’s surface, multispectral remote sensing in visible, infrared, thermal IR and microwave regions, digital processing of satellite images. GIS – basic concepts, raster and vector mode operation. GPS – different segments – space, control and user segment – satellite configuration

4.15 **Geology**
Weathering; soil formation; action of river, wind, glacier and ocean; earthquakes, volcanism and orogeny. Basic structural geology, mineralogy and petrology. Geological time scale and geochronology; stratigraphic principles; major stratigraphic divisions of India. Engineering properties of rocks and soils; rocks as construction materials; role of geology in the construction of engineering structures including dams, tunnels and excavation sites; natural hazards. Ground water geology – exploration, well hydraulics and water quality. Physical basis and applications of gravity, magnetic, electrical, electromagnetic, seismic and radiometric prospecting for oil, mineral and ground water; introductory well logging.
5. **ELECTRICAL / COMMUNICATION / INSTRUMENTATION ENGINEERING**

There are fourteen subjects and students can choose any three

### 5.1 Control Systems

Basic control system components; block diagrammatic description, reduction of block diagrams. Open loop and closed loop (feedback) systems and stability analysis of these systems. Signal flow graphs and their use in determining transfer functions of systems; transient and steady state analysis of LTI control systems and frequency response. Tools and techniques for LTI control system analysis: root loci, Routh–Hurwitz criterion, Bode and Nyquist plots. Control system compensators: elements of lead and lag compensation, elements of Proportional–Integral–Derivative (PID) control. State variable representation and solution of state equation of LTI control systems.

### 5.2 Analog & Digital Electronics


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

### 5.3 Signals & Systems


### 5.4 Electrical and Electronic Measurements


### 5.5 Electric Circuits & Networks


### 5.6 Electromagnetics

Vectors, Coulomb's Law, Electric Field, Electro Static Potential, The Gradient, Gauss's Law, Poisson's Equation, Energy in the Field, Example Problems in Electro Statics, Displacement Vector,

5.7 Signal & Image Processing


5.8 Communication
Random signals and noise: probability, random variables, probability density function, autocorrelation, power spectral density. Analog communication systems: amplitude and angle modulation and demodulation systems, spectral analysis of these operations, super heterodyne receivers; elements of hardware, realizations of analog communication systems; signal–to–noise ratio (SNR) calculations for amplitude modulation (AM) and frequency modulation (FM) for low noise conditions. Fundamentals of information theory and channel capacity theorem. Digital communication systems: pulse code modulation (PCM), differential pulse code modulation (DPCM), digital modulation schemes: amplitude, phase and frequency shift keying schemes (ASK, PSK, FSK), matched filter receivers, bandwidth consideration and probability of error calculations for these schemes. Basics of TDMA, FDMA and CDMA and GSM

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

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

5.11 Power Electronics & Drives
Semiconductor power diodes, transistors, thyristors, triacs, GTOs, MOSFETs and IGBTs – static characteristics and principles of operation; triggering circuits; phase control rectifiers; bridge converters – fully controlled and half controlled; principles of choppers and inverters; basis concepts of adjustable speed dc and ac drives.
5.12 Transducers, Mechanical Measurement & Industrial Instrumentation

5.13 Process Control

5.14 Analytical, Optical & Biomedical Instrumentation
6. **MECHANICAL ENGINEERING**

There are twelve subjects and students can choose any three

6.1 **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.

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

6.3 **Theory of Machines**
Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of slider–crank mechanism; gear trains; flywheels. Vibrations; Free and forced vibration of single degree of freedom systems; effect of damping; vibration isolation; resonance, critical speeds of shafts.

6.4 **Design**
Design for static and dynamic loading; failure theories; fatigue strength and the S–N diagram; principles of the design of machine elements such as bolted, riveted and welded joints, shafts, spur gears, rolling and sliding contact bearings, brakes and clutches.

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

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

6.7 **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.

6.8 **Thermal Engineering Applications**
6.9 **Engineering Materials**
Structure and properties of engineering materials, heat treatment, stress–strain diagrams for engineering materials

6.10 **Manufacturing Processes**
Metal Casting: Design of patterns, moulds and cores; solidification and cooling; riser and gating design, design considerations. Forming: Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Joining: Physics of welding, brazing and soldering; adhesive bonding; design considerations in welding.

6.11 **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

6.12 **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.


6.14 **Aerospace Propulsion:** Thermodynamics of aircraft engines, Thrust, efficiency and engine performance of turbojet, turboprop, turbo shaft and ramjet engines, thrust augmentation of turbojets and turbofan engines. Aerothermodynamics of non rotating propulsion components such as intakes, combustor and nozzle. Axial compressors and turbines, Centrifugal compressor.

6.15 **Aerospace Structures:** States of stress and strain, transformation, Mohr’s circle, Principal stresses, Equilibrium and compatibility equations, Plane stress and strain, Failure theories, Maximum stress, Strain energy. Determinate and Indeterminate trusses and beams, buckling of columns. Characteristics of aircraft structures and materials, Torsion, bending and flexural shear of thin walled sections. Free and forced vibration.
7. MATHEMATICS

There are thirteen subjects and students can choose any three

7.1 **Linear Algebra**
Finite dimensional vector spaces; Linear transformations and their matrix representations, rank; systems of linear equations, eigen values and eigen vectors, minimal polynomial, Cayley–Hamilton Theorem, diagonalisation, Hermitian, Skew–Hermitian and unitary matrices; Finite dimensional inner product spaces, Gram–Schmidt orthonormalization process, self–adjoint operators.

7.2 **Complex Analysis**
Analytic functions, conformal mappings, bilinear transformations; complex integration: Cauchy’s integral theorem and formula; Liouville’s theorem, maximum modulus principle; Taylor and Laurent’s series; residue theorem and applications for evaluating real integrals.

7.3 **Real Analysis**
Sequences and series of functions, uniform convergence, power series, Fourier series, functions of several variables, maxima, minima; Riemann integration, multiple integrals, line, surface and volume integrals, theorems of Green, Stokes and Gauss; metric spaces, completeness, Weierstrass approximation theorem, compactness; Lebesgue measure, measurable functions; Lebesgue integral, Fatou’s lemma, dominated convergence theorem.

7.4 **Ordinary Differential Equations**
First order ordinary differential equations, existence and uniqueness theorems, systems of linear first order ordinary differential equations, linear ordinary differential equations of higher order with constant coefficients; linear second order ordinary differential equations with variable coefficients; method of Laplace transforms for solving ordinary differential equations, series solutions; Legendre and Bessel functions and their orthogonality.

7.5 **Algebra**
Normal subgroups and homomorphism theorems, automorphisms; Group actions, Sylow’s theorems and their applications; Euclidean domains, Principle ideal domains and unique factorization domains. Prime ideals and maximal ideals in commutative rings; Fields, finite fields.

7.6 **Functional Analysis**
Banach spaces, Hahn–Banach extension theorem, open mapping and closed graph theorems, principle of uniform boundedness; Hilbert spaces, orthonormal bases, Riesz representation theorem, bounded linear operators.

7.7 **Numerical Analysis**
7.8 Partial Differential Equations
Linear and quasilinear first order partial differential equations, method of characteristics; second order linear equations in two variables and their classification; Cauchy, Dirichlet and Neumann problems; solutions of Laplace, wave and diffusion equations in two variables; Fourier series and Fourier transform and Laplace transform methods of solutions for the above equations.

7.9 Mechanics
Virtual work, Lagrange’s equations for holonomic systems, Hamiltonian equations.

7.10 Topology
Basic concepts of topology, product topology, connectedness, compactness, countability and separation axioms, Urysohn’s Lemma.

7.11 Probability and Statistics
Probability space, conditional probability, Bayes theorem, independence, Random variables, joint and conditional distributions, standard probability distributions and their properties, expectation, conditional expectation, moments; Weak and strong law of large numbers, central limit theorem; Sampling distributions, UMVU estimators, maximum likelihood estimators, Testing of hypotheses, standard parametric tests based on normal, X2, t, F – distributions; Linear regression; Interval estimation.

7.12 Linear programming
Linear programming problem and its formulation, convex sets and their properties, graphical method, basic feasible solution, simplex method, big-M and two phase methods; infeasible and unbounded LPP’s, alternate optima; Dual problem and duality theorems, dual simplex method and its application in post optimality analysis; Balanced and unbalanced transportation problems, u –u method for solving transportation problems; Hungarian method for solving assignment problems.

7.13 Calculus of Variation and Integral Equations
Variation problems with fixed boundaries; sufficient conditions for extremum, linear integral equations of Fredholm and Volterra type, their iterative solutions.
8. PHYSICS

There are six subjects and students can choose any three

8.1 Mathematical Physics
Linear vector space; matrices; vector calculus; linear differential equations; elements of complex analysis; Laplace transforms, Fourier analysis, elementary ideas about tensors.

8.2 Electromagnetic Theory
Solution of electrostatic and magnetostatic problems including boundary value problems; dielectrics and conductors; Biot–Savart’s and Ampere’s laws; Faraday’s law; Maxwell’s equations; scalar and vector potentials; Coulomb and Lorentz gauges; Electromagnetic waves and their reflection, refraction, interference, diffraction and polarization. Poynting vector, Poynting theorem, energy and momentum of electromagnetic waves; radiation from a moving charge.

8.3 Quantum Mechanics
Physical basis of quantum mechanics; uncertainty principle; Schrodinger equation; one, two and three dimensional potential problems; particle in a box, harmonic oscillator, hydrogen atom; linear vectors and operators in Hilbert space; angular momentum and spin; addition of angular momenta; time independent perturbation theory; elementary scattering theory.

8.4 Atomic and Molecular Physics
Spectra of one– and many–electron atoms; LS and jj coupling; hyperfine structure; Zeeman and Stark effects; 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; lasers.

8.5 Solid State Physics
Elements of crystallography; diffraction methods for structure determination; bonding in solids; elastic properties of solids; defects in crystals; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids; metals, semiconductors and insulators; transport properties; optical, dielectric and magnetic properties of solids; elements of superconductivity.

8.6 Electronics
Network analysis; semiconductor devices; Bipolar Junction Transistors, Field Effect Transistors, amplifier and oscillator circuits; operational amplifier, negative feedback circuits, active filters and oscillators; rectifier circuits, regulated power supplies; basic digital logic circuits, sequential circuits, flip–flops, counters, registers, A/D and D/A conversion.
9. CHEMISTRY

There are four subjects and students can choose any three

9.1 Physical Chemistry
Kinetics: Rates of chemical reactions, temperature dependence of chemical reactions; elementary, consecutive, and parallel reactions; steady state approximation; theories of reaction rates – collision and transition state theory, relaxation kinetics, kinetics of photochemical reactions and free radical polymerization, homogeneous catalysis, adsorption isotherms and heterogeneous catalysis.

9.2 Inorganic Chemistry
Transition Elements: General characteristics of d and f block elements; coordination chemistry: structure and isomerism, stability, theories of metal ligand bonding (CFT and LFT), mechanisms of substitution and electron transfer reactions of coordination complexes. Electronic spectra and magnetic properties of transition metal complexes.

9.3 Organic Chemistry
Stereochemistry: Chirality of organic molecules with or without chiral centres. Specification of configuration in compounds having one or more stereogenic centres. Enantiotopic and diastereotopic atoms, groups and faces. Stereoselective and stereospecific synthesis. Conformational analysis of acyclic and cyclic compounds. Geometrical isomerism. Configurational and conformational effects on reactivity and selectivity specificity.


9.4 Analytical Chemistry
Spectroscopy: Principles and applications of UV-visible, IR, NMR and Mass spectrometry in the determination of structures of organic molecules.
Chromatography: TLC, LC, GC
TG, DTA, DSC – Principles & applications
Titrimetric & Gravimetric Analysis – Principles & applications
10. Management

There are seven subjects and students can choose any three

10.1 Marketing Management
Fundamental Marketing Concepts, Company orientation towards market place; Building Customer value, Satisfaction and Loyalty; Marketing Environment; Consumer Buying behaviour. Segmentation – Targeting – Positioning (STP); Introduction to marketing research; Product Strategy, Packaging & Labeling; Managing Services; Developing Pricing strategies. Designing and managing value Networks and Channels, Managing Wholesaling, Retailing and logistics, Direct Marketing, E–Commerce Marketing practices, Kiosk marketing. Advertising, Sales promotions, Events and Public relations, Managing personal communication: Direct marketing and personal selling, Corporate Social Responsibilities – Social marketing; Trends in marketing practices & Future of Marketing

10.2 Managerial economics

10.3 Financial Accounting and Management Accounting

10.4 Financial Management

10.5 Principles of Management
10.6 **Organizational Behaviour**


10.7 **Human Resource Management**