COMPUTER SCIENCE

Module I Digital Systems, Microprocessors & Computer Organization

- Number System (binary, hexa, octal, complements) codes (ASCII, UNICODE, BCD, GRAY), Error detecting and correcting code-parity and Hamming codes. Boolean algebra & Laws.
- Combinational circuits – SOP & POS form, K-Map – encoders, Decoders, multiplexers, demultiplexers-sequential circuits-flipflops, registers & counters.
- Integer representation (signed & unsigned). Half and full address, sequential multiplier, Booth algorithm– floating point representation (IEEF).
- Basic operational concepts – functional units.
- Processor-8085-Architecture-instruction set, fetch & execute, addressing mode, interrupts.
- 8086 -Architecture-registers, RAM organization segment-offset addressing, real & protected modes, addressing modes, instructions – arithmetic, data movement, control, I/O string, logical. Subroutine call & return.
- Features of pentium processor.
- Control unit organisation - Single bus and multibus organisation, Micro instruction, Microprogrammed and hardwired control, Microinstruction-program-sequencing, RISC &CISC (Features)
- Memory – Hierarchi, organisation of RAM, types of RAM (SRAM, DRAM, SDRAM, DDRAM). Cache-operation, cashe mapping, multilevel organization of cache (LI/LII, Primary/secondary). Virtual memory page fault, TLB, segmentation – Multiple memory modules & interleaning.
- Secondary storage – Disk-CDROM/DVD.
- I/O devices (keyboard, mouse, CRT/LCD/LED, Printers, scanners). I/O Interfacing – memory mapped & I/O Mapped I/O, Polling, interrupt driven I/O, DMA – controller. Serial communication – UART, RS 232, USB.
- High performance computing – pipelining, basic conceps in parallel processing, Grid and cluster computing.

Module II

Data Structures of Algorithms

Data Structures – abstract data types – time and space complexity (O, Ω, θ) – practical complexities. Recursive algorithms. Randomized algorithms.
Arrays – representation-address calculation, sparse matrix representation, polynominal and sparse polynominal representation.
Linkied list – single, doubly, circular lists. Header and trailer nodes, basic operations on linked lists (insertion, deletion, merging, concentration, search), linked polynominal, sparse matrix representation using linked list.
Stock-array and linked implementation. Application- evaluation and conversion of expressions.
Queue – array and linked implementation – circular array queue, priority queue.
Non-linear data structures – tree-basic definition, binary tree- array and linked representation, tree traversal (recursive and nonrecursive) threaded binary tree, binary search tree, AVL trees, B-trees, Red-black trees, decision and game trees.
Searching – binacy & sequential, sort, bubble, heap, insertion & selection.
Representation of graphs – BFS & DFS algorithm Minimum cost - ____ free.
Divide & conquer – general method, quick sort, merge sort.
Greedy method – general method, knapscale problem, tree vertex splitting.
Dynamic programming: General method, multistage graph, all pairs shortest path.
Back tracking: General method, sub of subsets, 8-queries problem.
Basic concepts of NP hard and NP - problem.

Module III
Operating Systems

System software – definition, components, operating system, language translator, loaders, linkers, interpreters, compilers, overview of compilation process, scanning, pausing, code optimization, software tools, library routines, text editors, program generators, debugging tools.

OS as a resource manager, structrue of OS shell, Kernel, utilities, resourse management routines, evlution of OS, multiprogramming, time sharing, real time systems, parallel systems, distributed systems, OS functions process disription and control, process control, process state, operation on process, concurrent process, threads, processes and threads, micro kernels, schedulers, scheduling algorithms, independent and concurrent processes, critical section, mutual exclution, Petersons solution, semaphore, classical synchronization concept of interprocess communications. Deadlock, starvation, conditions for deadlock, resource allocation problem, deadlock handling, prevention and avoidance, Bankers algorithm deadlock detection and recovery.

Concept of memory, address binding, logical address, physical address, swapping, contiguous allocation fixed partition variable partition fragmentation. Noncontiguous allocation, paging segmentation, virtual memory-demander paging. replacement algorithms, thrashing protection and security mechanisms, accidental data loss, protection mechanisms, user authentication, attack from inside, viruses, antiviruses.

I/O managments, I/O hardware, application I/O interface kenrnel I/O subsystem DISK I/O, disk scheduling, swap space management RAID, disk cache.

File management-concept, access methods, directory structure, file sharing, file system structure implementation, directory implementation allocation methods, free space managment.

Module IV
Database Management Systems

Database concepts, relational database-relational algebra, relational calcules (TRC & DRC) SQL – basic structure set operation, DDL, DML, embedded SQL, QBE.
Database Design: ER Model, constraints & Keys, ER diagram. UML Relational database design – normal forms 1^{st} to 5^{th} , BCNF). Integrity and security domain constraints, referential integrity, assertions, triggers.
File structures- indexing & hashing. Query optimization. Transaction management concurrency control, recovery systems and dead lock.
Parallel & distributed databases, objected-oriented and object relational DBMS (basic ideas only).
Network fundamentals-LAN, MAN, WAN, Wireless networks. Data communication-channel capacity, features of transmission media (twisted pair, coaxial cables, fiber optic cables, wireless). Multiplexing, switching nanoband and broadband ISDN, ATM.
Computer networks-Topology, Transmission models, categories of networks, transmission media (Twisted pair, coaxial cable, optical, satellite, cellular telephony, terrestrial microwave). OSI and TCP/IP modes.
Physical layer – Digital data transmission, parallel and serial transmission, DTE-DCE, Modems-multiplexing FDM, TDM, WDM. Switching-packet, circuit, message/
Data Link layer-Single bit & burst error, error detectiion, URC, LRC, CRC. Data compression – Hoffman code. Flow control and Error control, ethernet, CSMA/CD, TOKEN BUS.
Network layer – Reapeating, bridges, routers gateways. Logical addressing internet protocols, address mapping (IP Address), error IPU 4 & IPU 6 reporting and multicasting, delivery, forwarding and routing algorithm – distance vector Link state, dijlestra algorithm.
Transport layer: UDP, TCP & SCTP, congestion cotnrol and quality of service. Application layer- DNS, remote logging, file transfer, WWW & HTTP.

Module V – Software Engineering

Introduction to software Engineering, software engineering paradigms, process models, product and process, software, characteristics of software, software development life cycles, generic view of process, waterfall model, prototyping, spiral model, timeboxing, RAD, interative model. Comparison of different life cycle models, software project management project estimation techniques, software requirements analysis and specification, characteristics of SRS, components of SRS,metrics, quality metrics planning of project, effort estimation, risk management teqniques, project scheduling, PERT, GANTT charts.

Problem partitioning, abstraction, modularity, coupling, coheison, top down, bottom up strategies structured design/structured analysis (SA/SD), DID components, ER diagrams, decersion trees, decision tables, structured English, transform analysis.

Object oriented analysis and design, objects attributes and methods, encapsulation, information hiding, messages, inheritance, polymorphism, UML, UML diagram, use case, class diagrams, sequence diagram, collaboration diagrams, state chart diagrams, activity diagrams, component diagrams, deployment diagrams, common coding errors, code inspection, code standards, source code control, code verification static analysis, testing, test plan, test cases, testing techniques and strategies – white box testing, basic path testing, condition testing, control and dataflow testing course effect graphing, cyclimatic complexity, black box testing, equivalance class partitioning, boudnary value analysis, unit testing, integrating testing, verification and validation, system testing – load testing, performance, runtime, stress testing, recovery testing, acceptance testing.

Software configuration management, software quality assurance, quality management, TQM, agile programming, extreme programming, formal methods, CASE tools, sin sigma tools, CMMI, CMM levels.

Module VI – Programming Languages

C programming – Basic concepts, arrays, functions, pointers, structures, files.

Object oriented programming – concepts, comparison with structural programming, classes and objects, data abstraction, encapsulation inheritence, polymorphism, dynamic binding, message passing, advantages – reusability, maintenance, security.

Access modifiers, static members, friend function constructors and destructors, polymorphism, operator overloading, inheritance, virtual base classes.

Java programming, brief history, java basics, data types, variables and arrays, operators, control statements, classes and methods, inheritance, exception handling – multi threading, stream I/O string handling packages. Inheritance and interface, deriving classes, method overriding, method overloading, access modifiers, abstract class and method, interfaces, packages imports and class path, exception handling try-catch-finally clause, threads, creating threads in applications, method in thread class, threads in applets. Java applets, windows, graphics and multimedia in Java, Java APIS, IO packages, Java input stream classes, Java output stream classes, file class, graphic and sound, AWT and swing, graphic methods, fonts, loading and viewing images, loading and playing sound, AWT & Event handling network programming, IP address & port numbers, URLs, client and server concept, port and socket, server socket, simple server and client program, java beans – properties and methods, event model, introspection, customisers and property editors, persistent storage. JDBC, RMI – Defining the remote interface, implemeting the remote interface, servelet overview – basic servelet architecture, servelet form processing, session management, database management, Javascript: Objects names literals and operators and expression statements, function,s events, windows documents forms.

Module -VII

Recent developments in Computer Science

CHEMISTRY

Module -I

Formulation of Quantum Mechanics - Approximation Methods - Hydrogen like Atoms -Multi Electron Systems - Angular Momentum - Applications

Chemical Bonding in Diatomic and Polyatomic Molecules-Electronic Spectroscopy of Atoms - Basic

principles of Molecular Spectroscopy: Microwave, Infrared, Electronic, NMR, ESR, Raman and Mossbaur

Basic principles of Group Theory - Character Tables - Chemical .and Spectral Applications

Introduction to Computational Chemistry - Computational methods : *ab initio,* Semi Empirical methods - Molecular Mechanics

Module -II

Laws of Thermodynamics - Thermodynamics of Solutions - Thermodynamics of irreversible process - Phase Equilibria - Two and Three Component Systems

Statistical Mechanics - Fundamentals - Partition Function - Quantum Statistics - Heat capacities of Solids and Gases .

Electrodes and Electrochemical Cells - Nernst, Debye-Huckel, Omsager Equations - Electro kinetic Phenomena, Electrolytic Polarization.

Electro Analytical Methods : Potentiometry, Polarography , Coulometry, Conductometry, Voltametry and Amperometry.

Electronic Structure of Solids - Crystal Symmetry - Theories of Solids - Properties of Solids : Electrical, Magnetical and Optical - Crystal defects.

Structure and Theories of Liquids - Liquid Crystals and their applications.

Basic principles of Kinetics - Kinetics of Complex reactions - steady state approximation -Theories of Reaction Rates - Arrhenius equation - fast reactions.

Homogenous and Heterogeneous Catalysis - Enzyme Catalysis

Monolayer and multilayer adsorption - Adsorption Isotherms - Principles of SEM, TEM, ECSA and Augur Spectroscopy

Colloids - Zeta Potential - Electrokinetic Phenomena

Module-III

Basic concepts of Organic reactions - Electron displacement effects - Aromaticity

Organic Reactions : Substitution, Addition, Elimination, Rearrangements - Mechanism

Concept of Molecular Chirality - Carbon and Nitrogen Compounds - Chiral reagents and Chiral Catalysts - Stereo chemistry of biphenyl and allenes . Topicity and prostereo isomerism -asymmetric synthesis.

Geometrical isomerism . ,

Conformational analysis in acyclic and cyclic systems ,

Reactivity in substitution and elimination reactions.

Reaction intermediates - reactions related to substitution, addition, elimination and rearrangements - mechanism and application.

Esterification and ester hydrolysis reactions - structure and reactivity: Linear Free Energy relationship.

Module-IV

Photoreactions of Carbonyl compounds - enes, dienes, arenes - applications

Pericyclic reactions : Electrolytic, cycloaddition, Sigmatropic - Selection rules and stereochemistry - applications

Chromatographic techniques. Column, TLC, Paper, GC, HPLC and ion exchange

Applications of UV, IR, HNMR, CNMR and Mass Spectroscopy - D NMR techniques -Structural Analysis using Spectral Data

ORD and CD - theory and applications

Organic, Inorganic and organo metallic reagents in organic synthesis.

Protecting groups in peptide synthesis

Natural Products : Terpenes, steroids, alakaloids, carbohydrates, proteins, nucleic acids, vitamins, prostoglandins, hormones and enzymes.

Fundamentals of polymerization - structure - property relationship of polymers - biopolymers.

Module -V

Accuracy & Precision - statistical treatment of data - Theories of titrations

Thermal methods of analysis

Structure and bonding in molecules - chemical periodicity

Theories of acids and bases - Non-acqueous solvents - Isopoly and heteropoly acids

Theories in co-ordination chemistry - stereochemistry of co-ordination compounds - stability of metal complexes - reactions of metal complexes

Electronic, Infrared, NMR, ESR and Mossbaur spectra of complexes - Co-ordination complexes of Lanthanides and actinides.

Module -VI

Synthesis, structure, properties and bonding of organometallic compounds - metal carbonyls and cyanides - Catalysts by organo metallic compounds - hydrogenation, hydroformylation and polymerization.

Metal ions in biological systems - Role and effects - Coenzymes, Cytochromes, chlorophylls and hormones.

Nuclear reactions - structure and stability - radio active equilibria - neutron activation analysis - counting techniques. . . .

Synthesis, reactions, structure and bonding in boranes - organoboranes and hydriborations -synthesis, structure and uses of phosphorous, nitrogen compounds, phosphorus - sulphur compounds, silicones and silicates.

Module -VII *Recent Developments in Chemistry*

Nanostructures - ID, 2D and 3D structures - Synthesis and applications of nanomaterials.

Principles of Green chemistry - Green synthesis - Application of Phase Transfer Catalysts -Green Reactions.

Molecular recognition : Synthetic Receptors, Cyclodextrin, Calixiranes, Cyclophanes, Crown Ethers.

Drug design and Drug action. .

MATHEMATICS

History of Development of Mathematics.

Module-I

Mensuration, length of arcs, area of sectors of circles, tangents to circles, circumcircle and incircle of polygons, area of polygons, solids-volume and surface area.

Fundamentals of mumber theory. Continued fractions.

Boolean Algebra

Fundamentals of graph theory.

Module -II

Sets and binary operations, groups, Sylon's Theorems, Rings and ideals, Fields, extension fields, rings of polynomials, finite fields, Galois Theory, constructible numbers.

System of Linear Equations -
Vector spaces, linear transformations, characteristic values, characteristic polynomial, Minimal polynomial, Cayley-Hamilton theorem, triangulation and diagonalization of matrics.

Hyperspaces and linear functionals.

Module -III

Normed spaces, Banach spaces and related theorems, Linear Maps, inner product spaces, Hilbert spaces and related theorems, finite dimensional and infinite dimensional normed spaces, bounded operators, spectrum, duals and transposes. Adjoints, normal, unitary and self adjoint operators.
Polynomial Equations, Trigonometry, Analytical geometry of two dimension and three dimension, similarity of triangles, vectors, matrices.
Calculus, applications of differentiation and integration, elemetary functions (logarithms, exponential, hyperbolic, trigonometric etc), Fundamental theorem of calculus, mean value theorems, maxima and minima-functions of more than one independent variables, derivatives, partial derivatives, saddle point, critical point.

Module -IV

Real numbers, rational, irrational numbers, algebraic and order properties of Real numbers, supremum property, countable and uncountable sets, completeness property, sequences and series of red numbers, relations and functions, limits and continuity of functions, uniform continuity, differentiability and integrability of functions, Riemann integral, Riemann-Stieltges integral, sequences and series of functions. Term by term differentiation and integration of series of functions.

Lebesgue measure, lebesgue integral, convergence theorems and applications

Module -V

Complex numbers, De Moirre's Theorem, Algebraic properties of complex numbers, regions in the complex plane.

Complex functions, analytic functions, harmonic functions, conformal mapping, elemetary functions, derivatives and integrals of complex functions and related theorems, sigularities, residue theorem and its applications, Power series, Taylor series, Laurent series.
Metric spaces, topological spaces, basis, subbasis, closed set, closure, interior, boundary, neighbourhood. Connectedness and compactness, locally connected, path connected, locally compact spaces.
Functions, continuous functions, homeomorphism, quotient space.
Seperation axioms and related theorems.

Module -VI

First order ordinary differential equations-formation, properties and various methods of solving. Picards method of approximation.
Numerical methods
Second order ordinary differential equations – formaiton, properties and various methods of solving. Equidimensional equations.
Existence and uniqueness of solutions.
Systems of first order equations.
Series solutions of first order and second order ordinary differential equation at ordinary adn regular singular points.
Hypergeometric functions and equations, legendre equations and polynomials. Chebyshev's Equations and polynomials. Bessels equations and Functions.
Laplace transform, fourier series, beta and Gamma functions.
Formation and solution of first order partial differential equation in two independent variables. Functional dependence, analytic functions. Second order partial differential equation, formation, classification.
Wave equation, heat diffusion equation, laplace equation.
Numerical solutions of algebraic equations, finite differences, interpolation.

Module -VII

Fundamentals of Theory of Wavelets, Fuzzy set theory, Fractal geometry, Modular functions Jordan forms, elliptic functions, Riemann Zets Function, Automate and formal languages, Block Designs.

Monodromy theorem, Reimann mapping theorem, product topology and Tychnoff theorem.

Solutions at infinity of Differential Equations, Integral Equations, calculus of Variations.

Fundamentals of differential geometry, contractions, inverse function theorem, implicit function theorem.
Fundamentals of Mechanics and Fundamentals of Fluid Dynamics.

BIOCHEMISTRY

Unit I

General Biochemistry- Biomolecules, sugars, aminoacids, fatty acids, steroids, vitamins, hormones, free radicals (chemistry and function)- macromolecules-carbohydrates, proteins, lipids, nucleic acids. (Structure and function)-physical aspects-acids and bases, pH, buffers, colloids, viscosity, surface tension, stabilizing interation and hydrogenbonds.

Unit II

Cell and molecular Biology- Ultrastructure of cell, subcellular organelles, cell cycle and cell signalling – membrane transport, replication, transcription, translation, regulation of gene expression, gene mutation, repair, molecular biology techniques rDNA technology, PCR, reverse transcriptase, DNA finger printing-western blotting, apotosis and cancer.

Unit III

Biochemical techniques - Principle, Instrumentation and application of chromatography-TLC, paper, affinity, Gel chromatography, HPLC, GC, and GLC, electrophoresis, Gel, PAGE, SDS PAGE, Isoelectricfocussing, Immuno electrophoresis, radio immunoassay, spectroscopic techniques, UV, IR, Fluorescence NMR and mass spectrum, circular dichorism, x-ray diffraction, polarimetry, radiation techniques.

Unit IV

Enzymology of enzyme technology

Introduction to enzymes, nomenclature kinetics, regulation, inhibition, mechanism of enxyme action, coenzymes, isoenzymes, robozyme, abzyme, isolation and characterization criteria of purity, microbial enzymes, industrial applications of enzymes in food, leather, detergent and bevarages, diagnostic and therapeutic enzymes, enzyme engineering.

Unit V

Metabolism and clinical aspects

Different approaches to study metabolism, Bioenergetics, metabolism of carbohydrates, lipids, proteins, nucleic acids, regulation, photosynthesis and regulation, nitrogen fixation, secondary plant metabolites-mitochondrial electron transport-and oxidative phosphorylation, regulation-genetic disorders of metabolism.

Unit VI

Immunology, Microbiology, Bioinformatics and Biostatistics

Immune system and function, antigen-antibody structure and genetic basis of antibody structure, immunological techniques, vaccines, classification of microbes-bacteria, virus, fungi, properties, cultivation of microbes, identification of microbes, sterilization techniques, microbial conjugatiuon, basics of bioinformatics, tools of bioinformatics, biological databases, data mining, protein data bank, molecular modelling and docking.

Average, statistical dispersion, coefficient of variation, standard deviation, standard error, t-test, basics of correlation, probability, regression, statistical packages SPSS, Excel and Anova.

Unit VII

Recent Developments in Biochemistry

Microanalytical techniques, LC-MS, GC-MS, MALDI-TOF, MS-MS, ICP-AES, Metabolomics, Modern Molecular biology techniques, Nano biotechnology, drug designing, drug delivery, epigenetics, executional pathway.

BIOTECHNOLOGY

Module I-Biochemistry and Enzymology

Biochemistry – bioorganic and biophysicla chemistry-law of Massaction - type of chemical bonds, functional groups of Biological molecules ; Water – properties of water, water as a solvent, acid and bases, PH and Buffers
Biomolecules – structure and functions of proteins, functional diversity of protein, structure and classification of aminoacids, properties of aminoacids, biosynthesis of aminoacids, polymerization of aminoacids-peptide bond, peptides, poly peptides – structure of proteins – primayr, secondary and tertiary structure – quartornary structure.
Ramachandran Plot, its application, supraseconds structure – Motiffs and Domains .
Protein sequencing – Sangus and Edman degradation methods.
Protein purification methods.
Protein-Protein Interactions.

Carbohydrates-Classification and structure-monosaccharides, disaccharides, oligosaccharides and polisaccharides,
Hetero and Homo polysaccharides - starch, cellulose, glycoconjugates-glycoproteins, proteoglycyn-glycolipids.
Biosynthysis of carbohydrates - glucose, starch, glycogen, photosynthesis, calxin cycle, hatch-slack pathway. Photorespiration, gluconeogenesis – Futile cycles.

Lipids
Classification and structure of lipids – fats and oils. Triglycerides, fatty acids, tryglycerols, acyl glycerols, glycosyloglycerols, phosphoglycerides, sphingolipids, waxes, simple lipids, prostaglandins, micelle and bilayers, lipoproteins, its synthesis-Biosynthesis of saturated fatty acids, Triacyl glycerols, phosphoglycerides, spengolipids, cholesterol, synthesis and metabolism, steroids and prostaglandins
Metabolism of lipids – oxidation, Beta oxidation, Keton bodies.

Nucleic acids
Structural components – nucleotides -structure of purines and pyramidines nucleosides-Ribose sugar- types of DNA-A,B, and Z DNA, Types of RNA Super coiling in DNA and RNA, Hydrolysis of nucleic acids. Nucleic acid as genetic materials – Non genetic function of DNA and its components. ATP, NADP, FAD.

Vitamin and coenzyme.
Metabolic pathways. Major metabolic pathways. Phosphorylation, ATP, NADP, FAD and NAD. Creatin phosphate Electrotransport system and phosphorylation. Oxidative and photophosphorylation, substrate level phosphorylation.
Photosynthetic pigments. Light and Dark reaction, glyucolysis, fermentation, glycogenolysis, glycogenisis, glyconeogenisis
Glycolysis, Tricarboxylic acid cycle, Glyoxalate cycle. Phosphogluconote pathway. Oxidation of fatty acids.
Metabolic network – interrelationship of metabolism.
Nitrogen metabolism.
Hormones – Biochemistry of muscle movement, vision and neuronal impulse generation and transmission.

Enzymology

1. Definition and classification and nomenclature of enzymes, coenzymes, cofactors, activation energy catalytic mechanism, isoenzymes.
2. Enzyme isolation, purification, enzyme activity, specific activity,molar activity, criteria for purity.
3. Enzyme kinetics, Michalis-Menton constant its derivation, substrate constant, Kcat, Lineweaver-Burk Plot, Eandie-Hofsae plot, factors affecting enzyme activity.
4. Active sites – aminoacids of active sites. Serine, protease, chymotrypsin Enzyme inhibition – competative, noncompetative inhibitions, two substrate reaction, sequential and ping-pong mechanism.

   Regulatory enzymes, allosteric enzymes, sigmoidal kinetics, zymogins,

   Enzyme technology. Immobilised enzymes – methods of enzyme immobilization, applications in industry and medicine.

   Enzyme engineering – steps in enzyme engineering application of enzymes – industrial enzymes, therapeutic enzymes, diagnosis and treatment, enzymes in organic sensor, enzymes based biosensors

Module II Biophysics and instrumentation:

Thermodynamics-entrophy, extrophy, free energy, thermodynamic equilbrium. Redox potentials, oxidative and photo phosphorylation. High energy molecules ATP, GTP, creatin phosphate, bioenergetics.

Microscopy: light and electron (SEM and TEM)
Phase contrast microscopy, confocal microscopy, atomic force microscopy.
Specteroscopy: Absorption, emission and scattering type of spectroscopy.

Spectrophotometer – U.V. Visible, Beer Lanborts Law, principle, instrument design, methods and applications of UV vible spectrum.

Flurescent spectroscopy IR, NMR, X-ray difraction technique circular dichroism.
Principles and applications of traser techniques in biology. Radioactive isotops and its half life. Autoradiography, GM counter liquid infilation counting

Electrophoresis: Principle and applications, PAGE, SDS-PAGE Isoelctric focussing, 2D, immunoelectrophoresis, AGE.

Chromatography: Principle and application of TLC, LC, Ion-exchange, gel filtration, affinity, HPLC and GC.

Centrifugation: Principle and application, sedimentation, coeffficient and sedbery unit.
Molecular hybridisation: Southern, Northern, and Western blotting analysis, colony hybridisation
Mass spectrometry – principle and application MALD-TOF, ES-MS.

Module III immunology and immunotechnology, animal biotechnology

Immunology and immunotechnology: Types of immunity, organs and cells of immune-system. Hematopoeisis and differenciation. Immunoglobulin-structure, classes and functions, genetic basis of antibody diversity. Antigens, antigenicity, epitops. Antigen-antibody interactions. Humoral and cell meditated immune response. Receptors on T-cell, B-cell and MHC. Complimen system. Cytokines and interlubins. Hypersensitivity types. Transplantation immunology, cancer immunology, autoimmune diseases.

Experimental immunology: Transgenic animal, in immunology, vaccine development, immunodignosis, hibridomatechnology and monoclonal antibody production. Vaccine types. ELISA and immunoelectrophoresis. RIA, RIO.

Animal Biotechnology: Animal cell culture, equipment and facilities for animal cell culture. Medial and its preparation. Role of CO2, serum and serum free media. Types of cell culture primary and secondary. Development of cell lines. Characterisation of cell culture- contact inhibition all transformation, cancer cells, indefinit cell lines, embryonic and adult cell culture. Maintenance of cell lines.

Application of animal cell culture stemcell research – Gene therapy-methods and ethical issues.

Module IV Microbial Biotechnology and Bio process Technology

1. Microbiology:- Classifiation – Bacterial, fungal and Yeast classifiation nomen clature and identification of microbes.
Morphological, Chemical, Cultural, Metabolic, Antegenie, Genetie, pthogenic and Ecological, Chractersitics.
Molecular Taxonoy – rRNA analysis

2. Microbial morphology and cell structure of Bacteria – classification based on staining.
3. Bacterial reproduction and Growth – Growth curve – Growth Kinetics, Generation time, Sychronous growth – Nutritional requirements - photgraphs chemotrophs, Autotrophs, Hetertrophs, Obligate, parasites – Measurement of bacterial growth , Microbial media – Media requirements, Nutritional factors, physical factors, - temperature, pH, air, Mixed culture, selection of microbes – chemical, Physical and Biological methods of selection, pure cuture, maintanance and prevention of pure cultures.
3. Control of Mirobes – Physical agent, chemical agent, antibiotics and their modification.Distribution of microbes in the environent – Soil, water an Air Industrially important microbes, - Bacteria and fungi,
   Microbiology of foods – presevation of food, microbial spoilage of food, asceptic, canning, pasteurization, food borne infection, microbial examination of contaminated foods and drinks, microbial toxins of food, sterlization, various methods in food technology physical, chemical and radiation technics, microbail metabolism and microbial genetics. Viruses – bacterial virus, life cycle. Animal and plant viruses.

Industrial Bio Technology – Industrial application of Microbes – Development of Bio process technology.

Up stream processing – components of up stream processing – Media requirements of selected micro organism – Inoculum preperation, Sterilization – Media sterilization, sterilization of the bioreactor – physical and chemical methods.

Down stream processing- methods of purifiction and product recovery – centrifugation, Chromatography – Instrumental methods of analysis and quality assurane and evaluation.
Bioreactors – fermentors – laboratory fermentors – Fermentors and Bioreactors – Sterilization of fermentors and Bioreactors – dry,wet, chemical and radioation methods for sterilization and filtration
Agitation, gas transfer, heat and transfer in fermentors and bioreactors
Control of physical factors, pH control, temperature, Biomass, disolved oxygen, antifoam, Bio sensors and enzyme probes – micro process based control systems.
Types of Bio reactors – Air lift, Stirred tank, Fluidized bed, packed bed, Swing bucket and roller bottles for animal cell culture
Types of fermentation – chemostat cultures, batch fermentation, continious, solid state, sub mearged
Down stream processing – cell seperation cell disruption, product purification and recovery centrifugation chromatographic technics capillary electro phoresis, dialysis, reverse osmosis, ultrafiltration, electro phoresis, Electro dialysis crystallization drying, affleunt treatment – BOD, COD treatment and effluent disposal.
Bio reactor consideration for animal and plant cell cultivation for industrial scale.
Industrial strain isolation and strain improvement – mutation and , selection, protoplast fusion, rDNA technics for strain improvement, Metabolic engineering for strain improvement.
Microbial production of antibiotics – Pencillin, Streptomycine.
Microbial production of Enzymes – Protease, Amylase, Lipases.

Production of Organic Acids, Citric Acid, Acetic Acid, Lactic Acid, Amino Acids – Glutamate – Lysine.
Alkaloids, Alcohols, Ethyl alcohols, Bio fuels, Beer, Urine, single cell protein, Mushroom cultivation.
Food Bio technology – Food processing and processed foods, diary bio technology, diary products, bio pepticides, bio plastics, bio surfactants and bio fertilizers, bio fuel, ethanol and bio diesel from various biological methods.

Module V – Plant biotechnology and enviornmental bio technology

Plant Biotechnology – conventional plant breeding, tissue culture – media, composition and preperation. Plant tissue culture media.
Micro propogation of plants – initiation and maintance of callus suspention cultures, organogenesis and sonatic embryogenesis. Root formation, Trasfer of plant lets and hardening. Advantages of micropropagation shoting meristum culture.
Production of secondary metabolites from susepention cuture, embryo cuture and embryrescue.
Protoplast technology, isolotation, fusion culture, selection of somatic hybrids, application of somatic hybridisation, production of haploid plants – anther and pollen culture
Somaelonal and gometoclonal variation, significants in plant breeding, germ plasm conservation
Plant transformation – agrobacterium mediated gene transfer, infection and molicular mechanism of tumor formation. Ti and Ri Plasmid, binary vectors, genitic markers, reporters genes promoters
Appliction of plant genetic engineering in agriculture – herbicide, insecticied, virus resistance, Bt genes, coat protein mediated disease resistance. Abiotic resistance molecular pharming edible vaccines
Environmental bio technology:- enivironmental polution – soil water and air, Types of industrialm effleunts, COD, BOD,Total organic carbon, Nitrogen content and suspended solids, Microbiology of waste water, physical chemical and biological treatment of waste water, Treatment strategy – Primary, Secondary, Teritiory treatment. Aerobic and Anaerobic methods.
Activated sludge process, oxidation ponds, tricking filters RBC, UASB, Submerged aerobic filter fluided bed reactor, packed bed reactor, oxidation layout
Soil waste manager :- Land fill, Composting – stages vermi composting- methanogenisis and biogas generation.
Bio remadiation – Insitu and Exsitu, strategies and applications. Xerobiotics – degradation of xerobiotics, Bio fertilization Bioagmentation, Biomanification and Bioaccumulation, Bioplastic, Biofuels.

Module VI

Molecular Biology and rDNA Technology

Molecular Biology:- Organisation of genome, exone, introne, intergenic DNA, SINE, LINE, transposones, microsatlittes, minisatlittes.

DNA replication – models. Mechanism of replication:- initiation, elongation and termination. Enzymes and proteins involved in DNA replication. Types of DNA replication, 'Theta', roling circle, D-loop.
DNA repair – Mechanism, Proof reading.

Transcription:- Prokaryotic and Eukaryotic transcription.
Post transcriptional modification – Caping, Poly adnylation and solicing. Inhibitores & transcription.

Transilation:- Intiation, elongation, termination. Genetic code post translational modification. Amino-acyl tRNA synthetase, peptidyl transferase. Ribosome recycling factors. Inhibitors of translation.

Gene regulation in prokaryotes and eukaryotes.
Operon concept:- Lac operon and trip operon and Ara Operon.

DNA recombination Holiday Model and double strand break model.

rDNA Technology

Basic tools in rDNA technology:- restriction endonucleases, phosphatases, DNA -Polymarases, Ligases, kinases, terminal deoxynucleotidyl transferases, adaphores, linkases, Vectors: Properties, types – plasmid, cosmid, phagemid. Artificial chromosomes, shuttle vectors, expression vectors.

Gene transfer – methodes in prokaryotes, animals and plants. Calcium chloride, liposome mediated, electropuration biolistics. Screening and election of recombinants.

DNA sequencing – Maxam Gilbert method, Sanger method, automated sequencing, PCR and its application, types of PCR, DNA finger printing, foot printing, microarray, RFLP, RAPD, chromosome walking, site-directed mutagenesis, AFLP.

Application of rDNA technology:- Transganic and gene knockout technology. Si RNA, m mi RNA, Anti sense RNA. Animal pharming amo'.

Bioinformatics:- Biological data base:- DNA, protein, EST, RNA.
Structural data basis – PDB, Uniprot, RasMol
DNA data bases – Gene Bank, DDBJ, EMBL
Multiple sequence alignment – BLAST, FASTA, CLUSTAL
Phylogenetic tree construction and analysis – Distance matrics, maximum parsimony etc.
Peptide Man finger printing for protein identification
MODULE-VII
Recent developments in Biotechnology

BOTANY

MODULE -1

PHYCOLOGY

1. Classification of algae - Fritsch and Smith
2. Recent trends in classifications
3. General features of algae - thallus organization, vegetation, sexual and asexual reproduction and life cycle
4. Pattern of life cycle and salient features of the following classes: Cyanophyta, Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta
5. Economic importances of algae : Biofertilizers, Food industry, Industrial and medicinal importances, algal bloom

MYCOLOGY

1. Classification of fungi - Alexopoulos and Mims (1979), Ainsworth and Bisby (1983)
2. General features of fungi - thallus structure, cell wall structure, heterothallism, parasexuality and reproduction
3. Salient features of following classes- Myxomycota, Mastigomycota, Zygomycota, Ascomycota, Basidiomycota and Deuteromycota
4. Fungal associations - symbiosis, saprophytism, mycorrhiza, endophytes, lichens
5. Economic importances of fungi - degradation of pesticides and wastes, decomposition of organic matter, degradation of lignin, significances in medicine and industry, fungal toxins and human health

PLANT PATHOLOGY

1. Principles of plant pathology - biotic and abiotic agents and various symptoms of plant diseases
2. Process of infection and defense mechanisms - enzymes, toxins, structural and biochemical defense systems
3. Disease management - chemical, biological and quarantine measures
4. Common diseases of crops in Kerala - paddy, coconut, rubber, arecanut, pepper, ginger, cardamom, coffee and tea

BRYOLOGY

1. General account on morphology, anatomy and life cycle of the following groups: Hepaticopsida, Anthoceratopsida and Bryopsida
2. Origin, evolution and economic importances of bryophytes - indicators of pollution, horticulture, medicine etc..

PTERIDOLOGY

1. General account on morphology, anatomy and life cycle of the following groups -Psilopsida, Psilotopsida, Lycopsida, Sphaenopsida and Pteropsida
2. Heterospory, seed habit, stelar evolution
3. Economic importances of pteridophytes - as biofertilizers, in horticulture, medicine, ecological indicators, as weed, in food industry

GYMNOSPERMS

1. General account on morphology, anatomy and life cycle of the following groups -cycadopsida, coniferopsida and gnetopsida
2. Economic importances of gymnosperms

MICROBIOLOGY

1. Bacteria: ultra structure, major groups, nutritional types and reproduction
2. Viruses: ultrastructure, major groups, nutritional types, replication
3. Brief account on phones, viroids, virions, mycoplasmas, interferons, actinomycetes, bacteriophages
4. Economic importances of microbes- in ecology, food, industry, medicine, agriculture and other industries

PALAEOBOTANY

1. Geological time scale and evolution of plant groups
2. Types of fossilization
3. Fossil pteridophytes and gymnosperms

MODULE-II

ANGIOSPERM ANATOMY

1.Tissues - meristem, secretory and excretory tissues, primary and secondary tissues
2. Anatomy of stem, root and leaf - both primary and secondary structure in stem and root
3. Anomalous secondary growth in dicot and monocot stems
4. Brief account of nodal anatory, wood anatomy and floral anatomy

MICROTECHNIQUE

1. Tools in microtechnique -microscopy, micrometry, camera lucida, cryostat, microtomes (rotary and sledge)
2. Fixing, killing, dehydration, clearing, embedding, staining and mounting - reagents used in each step
3. Brief account on vital staining, double staining, whole mount, maceration and histochemical tests for carbohydrates, proteins and lipids

EMBRYOLOGY

1. Microsporogenesis and male gametophyte development
2. Megasporogenesis and embryosac development
3. Pollination, fertilization and embryogeny in both monocots and dicots
4. Endosperm types, polyembryony, parthenocarpy and apmixis

PALYNOLOGY

1. Ultrastructure of pollen wall, pollen morphology, - NPC system of classification of pollen apertures
2. Contributions of Dr. PKK. Nair to palynology
3. Palynology in relation to taxonomy
4. Aeropalynology and melittopalynology and pollen allergy

PLANT BREEDING

1. Methods in crop improvement and achievements - plant introduction, selection, mutation breeding, polyploidy breeding and hybridization
2. Consequences of inbreeding, heterosis and incompatibility
3. Back cross breeding, resistance breeding (disease resistance and stress resistance), vertical and horizontal resistances
4. Seed production and certification, major centres of crop production in India
5. Plant breeder's rights, national biodiversitypolicy
6. Methods of vegetative propagation of plants

EVOLUTION

1. Origin of life - theories of evolution, classical and modern
2. Speciation

MODULE-III

TAXONOMY

1. Principles of taxonomy - plant nomenclature, taxonomic hierarchy, phylogeny of angiosperms, taxonomic keys
2. Classification systems - artificial, natural and phylogenetic
3. Interdisciplinary approaches to angiosperm systematic (anatomy, embryology, morphology, cytology, palynology, chemotaxonomy, numerical taxonomy, molecular taxonomy)
4. Study of the following families and their characteristic features: Ranunculaceae, Magnoliaceae, Capparidaceae, Polygalaceae, Cryophyllaceae, Malvaceae, Leguminosae, Myrtaceae, Melastomaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Asclepiadaceae, Boraginaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Scitamineae, Liliaceae, Commelinaceae, Arecaceae, Araceae, Cyperaceae, Poaceae.

MORPHOLOGY

1. Flower as a modifiedshoot
2. Floral whorls and their parts - fruits and seed morphology
3. Vegetative morphology = leaf, root and stem

ECONOMIC BOTANY
1. Common cereals, millets and pulses
2. Vegetables, spices, beverages crops
3. Timbers, fibres, sugar and oil yielding crops
4. Medicinal plants

ETHONOBOTANY

1.Methods of ethnobotanical studies
2. Contributions of SK. Jain to ethnobotany
3. Common plants of ethnobotanical importance in Kerala
4. Sacred groves and their importance

PHYTOGEOGRAPHY

1. Factors affecting plant distribution
2. Phytogeographic zones of India
3. Soil, climate and vegetation of India

FOREST BOTANY

1. Major and minor forest products with special reference to Kerala
2. Significances of forest on environment
3. Consequences of deforestation and industrialization

ENVIRONMENTAL BIOLOGY

1. Habitat ecology - terrestrial, fresh water, wet land and marine
2. Population ecology - community ecology and ecological succession
3. Ecosystems - structure, function and types and biomes ,
4. Species interactions - competitions, herbivory, carnivory, symbiosis etc..
5. Biogeochemical cycles and environmental pollution - air, water and noise
6. Global environmental problems - ozone depletion, global warming, acid rain, nuclear hazards, El-nino, climate change,

7. Environmental impact assessment and major programmes - UNEP, IUCN, MAB, Earth Summit, CBD

MODULE - IV

CELL AND MOLECULAR BIOLOGY

1. A brief account on structure, function of cells and cell organelles, - prokaryotic and eukaryotic cells, cytoskeleton - organization and mobility
2. Origin, Ultrastructure and function of cell membrane, cell organelles
3. Chemistry of chromosome - DNA, RNA, kinetochore, NOR and constriction of chromosomes
4. Numerical and structural variations of chromosomes
5. Cell divisions - stages, synaptonemal complexe, theories and mechanism of crossing over and molecular mechanism of crossing over
6. Cell differentiation - characteristics and mechanisms
7. Prokaryotic and eukaryotic DNA replication
8. Molecular nature of genes
9. Molecular tools for studying genes and gene activities
10. Techniques of DNA analysis - preparation of DNA and RNA probes, hybridization, autoradiography, DNA finger printing
11. DNA sequencing, chemical synthesis of nucleotides
12. PCR and FISH and their applications

GENETICS

1. Mendelian genetics and gene interation
2. Linkage and crossing over, gene mapping
3. Polygenic inheritance
4. Extra chromosomal inheritanace
5. Microbial genetics - transduction, transformation and conjugation in bacteria, Lysogeny and lytic cycle in viruses
6. Nucleic acids - DNA and RNA types, structure, function and replication
7. Mutations, DNA damage and repair
8. Genetic code and gene expressions - protein synthesis, gene regulations - prokaryotes and eukaryotes
9. Translation, post translation and post transcription
10. Gene synthesis - Khorana -Kornberg
11. Population genetics - Hardey-Weinberg equilibrium - genetic drift, genetic load, consanguinity and its genetic effects
12. Human genetics - blood group systems - ABO, Rh and MN blood groups, human karyotype and syndromes caused by its aberrations, genetic counseling, pedigree analysis
13. Brief account of human genome project

MODULE-V

PLANT PHYSIOLOGY

1. Water relation to plants - absorption and transpiration of water - opening and closing of stomata - factors affecting water transport
2. Mineral nutrition - hydroponics, aeroponics

3. Nitrogen metabolism in plants
4. Photosynthesis - C3, C4 and CAM cycle in detail, photorespiration
5. Respiration - oxidative photophosphorylation
6. Ascent of sap - source and sink relationship
7. Growth and development - role of phytohormones, photoperiodism, vernalization, florigines
8. Stress physiology - water, salt, hot and cold stress - heat shock proteins, adaptations
9. Seed germination - physiological and biochemical changes

BIOCHEMISTRY

1. Carbohydrates - structure, function and metabolism, inter conversion
2. Lipids - structure, function and metabolism, biosynthesis of fatty acids, alpha and beta oxidation
3. Amino acids and proteins - structure and properties and classification of amino acids and proteins, amino acid metabolism, Ramachandran plot, verification of proteins
4. Enzymes - major groups, relation of enzyme activity, enzyme kinetics, assay, regulation, allosteric enzymes, isoenzymes, ribioenzymes, coenzymes
5. Vitamins - classification, function and sources of vitamins and their role as co-enzymes

BIOPHYSICS

1. pH and buffers
2. Microscopy - bright field, phase contrast, fluorescent and electron microscope (SEM and TEM), photometry, colorimetry
3. Chromatogram - gel filteration, ion exchange, affinity, TLC, GC, HPLC, HPTLC, GCMS
4. Electrophoresis - AGE, PAGE, SDS-PAGE, isoelectrofocusing, ELISA
5. Centrifugation - density gradient and ultra centrifugation
6. Biophysical methods for analysis of biopolymers - x-ray diffraction, fluorescent, NMR spectroscopy, UV, visible and ESR spectroscopy, ORD/CD, atomic absorption and plasma emission spectroscopy
7. Radiation dosimetry, radioactive isotopes, autoradiography, Cerenkov radiation, liquid scintillation techniques

BIOSTATISTICS

1. Sampling methods and errors
2. Process and presentation of data - tables and graphs
3. Measures of central tendency - mean, median, mode
4. Measures of dispersion - range, quartile deviation, mean deviation, standard deviation and coefficient of variations
5. Probability - basic concept, theorems
6. Experimental design - randomnized block, latin square
7. Tests of significance - T-tests, Chi-square, F-tests, ANOVA
8. Correlation and regression analysis

MODULE - VI

BIOTECHNOLOGY

1. Plant tissue culture techniques - direct and indirect regeneration
2. Somatic cell genetics and somatic clonal variations
3. Somatic embryogenesis - artificial seeds, protoplast culture, somatic hybridization, impacts in plant breeding
4. Haploid production- anther and ovule culture - applications

5. Production of secondary metabolites - cell immobilization - bioreactor technology, in vitro strategies of germplasm conservation
6. Isolation of genomic and organellar DNA. Methods of gene identification - vector mediated and vectorless PCR, genomioc and cDNA libraries
7. Gene transfer techniques - direct and indirect traspossors as vectors - gene silencing
8. DNA markers - RFLP, RAPD, AFLP and Antisense RNA
9. Blotting techniques - Northern, Southern and West
10. Transgenic biology - gene cloning and transformation technique in plants-gene targeting and sequence tag
11. Genetically modified organisms and foods, social and ethical considerations, IPR issues, patents and biopiracy

5. BIOINFORMATICS

6. Introduction to data structures, data base concepts, tools for searching, homology searching
7. Application of databases in biology
8. Sequence databases .sequence comparison, structural databases, proteomics and genomics (elementary)
9. Major bioinformatic resources - NCBI, EBI, EMBL, GENBANK, DDBJ, SWISSPROT, PDB
10. Tools in bioinformatics - BLAST, CLUSTAL -X, CLUSTAL-W, Phylip, GENSCAN
11. Applications of bioinformatics - transcriptomix, metabolomics, pharmacogenomics (brief account only)

COMPUTER APPLICATIONS

1. Computer application in biology
2. Computer packages for biostatistics and numerical taxonomy
3. Hardware and software parts of a computer
4. Internet online biology resources, public library of sciences, online publications, electronic journals and books

MODULE – VII

Recent developments in Botany

ELECTRONICS

MODULE -I

ELECTRONIC DEVICES AND CIRCUITS ***(10 MARKS)***

Basic Semiconducor devices. Diodes, varactors, TRIAC, DIAC, Transistor biasing, Thyristor, SCRs, MOSFET ands applications. Feedback principles, Transistor Amplifier, Power Amplifier, frequency response, rectifiers, operational amplifiers and their applications. Linear Wave shaping circuits, different types of oscillators, multi vibrators, other switching circuits.

MODULE -II

DIGITAL ELECTRONICS AND LOGIC DESIGN

Number systems and conversion, applications of Boolean Algebra, Karnaugh maps, Logic families, programmable logic devices, multiplexers, various types of flip-flops, counters, registers and their applications, Design of code converters, A/D converts, D/A converts, semiconductor memories, design of parity checker, comparator and pattern detector.

MODULE -III

COMMUNICATION SYSTEMS, ELECTROMAGENTICS

Basics of Information Theory, Modulation and Demodulation, AM, FM, PM, PCM, Delta modulation, ASK, PSK, FSK, quantization and coding. TDMA, FDMA, CDMA. Maxwell's equations, propagation of uniform plane waves, potential functions, skin depth, polarization, group velocity, transmission lines, ionospheric propagation, satellite communication basics.

MODULE -IV

SIGNALS AND SYSTEMS

Characteristics of Signals, unit step function, impulse and ramp function, Fourier series expansion, frequency spectra of periodic wave forms, Fourier transforms, network functions, filters, alternators and equalizers, constant K - and M - derived filters, types of control systems, characteristics, components, effect of feed back and stability .

MODULE -V

MICROPROCESSORS AND APPLICA TIONS

Basics of Microprocessor Hardware, Organisation of typical 8-bit processor, CPU, registers, 8085 and 8086: addressing modes, timing diagrams, interfacing memory, I/o devices, programmable and peripheral devices. Digital interface of keyboard display. Preliminaries of microcontroller architecture.

MODULE -VI

SIGNAL PROCESSING ***(10 MARKS)***

Basic properties of discrete time systems, convolution, difference equation representation of discrete time systems, Z transform properties, discrete Fourier transforms, Block convolution, Time and frequency, FFT algorithms, digital filters, IIR and FFR filters, design of IIR filters, Butterworth and Chebyshev approximation, quantization error, Applications of digital signal processing.

MODULE -VII

Recent development in Electronics

GEOLOGY

Module I

Historical development, fundamental concepts and scope of Geomorphology - Different models of evolution of landscape. Geomorphic agents and processes- Fluvial Geomorphology- Morphometric analysis: elements and parameters. Coastal Geomorphology and hill slope processes. Geomorphology of Kerala

Role of Gelogists in environmental studies. Man & Environment - Natural and anthropogenic Environmental hazards/disasters and their management. Changing concepts of waste and their disposal. Atmospheric, terrestrial and marine pollution. Weathering – Type, Processes and products, Factors of soil formation – Soil profile.

Module II

Concept of symmetry in crystals. Important crystal systems in crystallography. Principles of X-Ray crystallography.
Definition of mineral, megascopic identification of minerals. Isomorphism and polymorphism, Important optical properties under open and crossed nicols - refractive index, birefringence, interference colours, dichroism and pleochroism. Uniaxial and biaxial minerals, and indicatrices.
Conoscopic study of minerals, interference figures and optic sign and optic axial angle. Determination of pleochroic scheme.
Geochemical distribution of elements- Geochemical cycle and classification. Principles and methods of isotope dating. Application of thermodynamics in Geochemistry.

Module III

Formation and evolution of magma- Bowen's Reaction Principle and Series, Phase Diagrams: Binary and Ternary Systems. Classification of igneous rocks - textures and structures. Petrography and petrogenesis of Kimberlites, Carbonatites, Anorthosites, Basalts, Alkaline Rocks, and Granites.
Structures and textures of sedimentary rocks- classification of sedimentary rocks. Sandstones and limestones- Provenance studies. Statistical analysis of grain size parameters and their geological significance.
Factors, concepts and kinetics of metamorphism- metamorphic grades, zones and racies.
Genetic significance of textures and structures of metamorphic rocks—Mineral parageneses—ACF & AKF diagrams. Petrogrphy and petrogenesis of charnockites, gneisses, migmatities, ecologites, schists and amphibolites.

Module IV

Rock deformation: concept of stress and strain. Principles of geological mapping and map reading. Classification of folds and their recognition in the field.
Faults: terminology and classification.
Foliation and Lineation. Petrofabric analysis.
Plate Tectonics , Continental drift, Polar wandering and Sea Floor Spreading.
Historical development and principles of stratigraphy. Code of Stratigraphic Nomenclature and Modern stratigraphic classification. Major geological events

during different periods of earth's history. Important Pre-Cambrian formations of India with special reference to Karnataka and Kerala- Cuddapah and Vindhyan Supergroup. Cretaceous rocks of Trichinopoly - Deccan Traps. Fossls and fossilization. Origin and evolution of life. Trends in the evolution of Brachiopoda, Cephalopoda, Trilobita and Graptozoa. Pre-Cambrian stromatolites, classification and morphology. Morphology and evolution of Fishes, Amphibians, Reptiles and Mammals. Micropalaeontology: Techniques in collection, separation and preparation . Palaeoecology and stratigraphic significance of Foraminifera and Ostracoda. Plalynology: classification and applications. Stratigraphy of Kerala

Module V

Classification of Mineral deposits. Controls of ore localization. Metallogenic Epochs and Provinces. Ore deposits associated with mafic and ultramafic complexes. Stratabound and stratiform ore deposts.
Petroleum Geology: origin, migration and accumulation of petroleum and natural gas. Petroliferous basins of India.
Coal Geology: classification, petrography and distribution in India.
Methods/Guides to Mineral prospecting; exploratory workings; pitting, trenching and drilling. Sampling methods. Ore reserve estimation. Various methods of geophysical exploration. Geochemical, geobotanical and radiometric methods.
Mining terminology, Alluvial, Opencast, underground, coal, and deep sea mining methods. Fundamentals of ore dressing.

Module VI

Hydrogeological properties and classification of rocks. Types of aquifers. Movement of groundwater. Darcy's law and aquifer parameters. Ground water prospecting. Geophysical methods. Use of Remote sensing for ground water exploration.
Well hydraulics: aquifer test and pumping test. Sea water intrusion and Ghyben-Herzberg principle. Quality of groundwater Physical, chemical properties. Graphical representation of groundwater quality data. Rainwater harvesting and other method ground water recharge and conservation.
Types of remote sensing. Principles of aerial and satellite remote sensing. Elements of aerial photo interpretation. Application of remote sensing data in geomorphology, environmental studies, land use, land cover studies; mineral and ground water exploration. Microwave remote sensing.
Geographic Information system—Fundamental concepts and components.-applications in Geology.

MODULE -VII

Recent development in Geology

PHYSICAL EDUCATION

MODULE - I

TEST. MEASUREMENT AND EVALUATION IN PHYSICAL EDUCATION AND SPORTS

UNIT -1 INTRODUCTION AND HISTORICAL BACKGROUND

(a) Concept and Definition of test, measurement and evaluation

(b)Need and importance of test, measurement and evaluation

UNIT-II TEST

a) Criteria of Test selection
b) Classification of Tests
c) Administration of Tests

UNIT-III MEASUREMENT

a) Measurement of General Motor ability
b) Measurement of Physical fitness
c) Measurement of Health related Physical fitness

UNIT-IV EVALUATION

a) Principles of evaluation
b) Tools and Techniques of evaluation
c) Recent trends in evaluation

UNIT - V SPORTS SKILL TESTS OF:

a) Football
b) Volleyball
c) Basketball
e) Shuttle Badminton
f) Lawn Tennis

UNIT-VI ANTHROPOMETRY

a) Standard equipments
b) Body types
c) Measurement of girth, height, weight and length.

UNIT-VII SOCIOMETRY

(a) Tools and techniques

UNIT - VIII PSYCHOLOGICAL TESTING

(a) Tools and techniques

UNIT - IX GRADING AND RATING

a) Purpose
b) Criteria
c) Types

UNIT-X POSTURE

(a) Measurement and rating.

MODULE - II

SPORTS TRAINING

UNIT - I GROWTH AND DEVELOPMENT

(a) Physical, physiological and sociological factors affecting growth and development during various stages of life.

UNIT-II SPORTS TRAINING

a) Objectives and definitions
b) Principles

UNIT-HI TRAINING LOAD

a) Principles and characteristics
b) Load and adaptation
c) Signs and symptoms
d) Steps to overcome load

UNIT -IV PLANNING AND ORGANISATION

a) Principles
b) Organisation
c) Periodization
d) Competitions : Types and Planning

UNIT - V TRAINING OF MOTOR COMPONENTS: STRENGTH

a) Characteristics and types of strength
b) Factors affecting strength
c) Principles, Means and methods of strength training
d) Strength training according to sex and age.

UNIT - VI TRAINING OF MOTOR COMPONENTS : SPEED

a) Characteristics and types of speed
b) Factors affecting speed
c) Principles, Means and methods of speed development
d) Speed barrier

UNIT - VII TRAINING OF MOTOR COMPONENTS : FLEXIBILITY

a) Characteristics and types of flexibility
b) Factors affecting flexibility
c) Methods of developing flexibility.

UNIT- VIII TRAINING OF MOTOR COMPONENTS : ENDURANCE

a) Characteristics and types of endurance
b) Factors affecting endurance
c) Methods to develop endurance
d) Training for agility
e) Training for co-ordinate abilities

6. UNIT- IX TECHNICAL AND TACTICAL PREPARATION

a) Skill
b) Technique
c) Tactics and strategy

7. UNIT - X EVALUATION OF TRAINING PROGRAMME

a) By athletes
b) By coaches
c) By sports scientists.

MODULE - III

HEALTH AND FITNESS

UNIT-I HEALTH

a) Definition
b) Dimensions of Health

UNIT-II FITNESS

a) Concept
b) Types and components
c) Development of fitness

UNIT-III FITNESS TRAINING

a) Training according to age and sex
b) Training for differently abled groups

UNIT - IV PHYSICAL ACTIVITY

a) Exercise and lifecycle
b) Lifelong fitness
c) Exercise and Chronic diseases

UNIT- V BIOCHEMICAL ASPECTS OF PHYSICAL FITNESS

a) Energy Metabolism
b) Fatigue
c) Nutrition
d) Diet
e) Calorie requirement

UNIT - VI HEALTH AND FITNESS MANAGEMENT

a) Organizational structure of fitness centers
b) Human resource management
c) Facility management
d) Care and safely at fitness centres

UNIT- VII HEALTH, FITNESS AND LIFESTYLE

a) Healthy Life style

b) Life style diseases

UNIT - VIII EXERCISE PRESCRIPTION

a) for life style diseases
b) according to sex and ages

c) according to different sports and games

UNIT - IXASSESSMENT AND EVALUATION OF HEALTH AND FITNESS

a) Health related physical fitness

b) Physical fitness

UNIT - X PHYSIOLOGICAL TESTING

a) Aerobic tests
b) Anaerobic tests

MODULE - IV

SPORTS MANAGEMENT

UNIT-I MANAGEMENT

a) Functions of management
b) Skills of Management
c) Role of a Manager
d) Management theories and styles

UNIT-II SPORTS ORGANISATIONS

(a) Types of Organisations
(b) Organisational set up at various levels
(c) Apex bodies

UNIT-III PLANNING

a) Steps in the process of planning

b) Budgeting

UNIT - IV SPORTS AND PHYSICAL EDUCATION FACILITIES

a) Indoor and Outdoor
b) Programme planning for normal and special population

c) Social and economic parameters in planning

UNIT-V OFFICE MANAGEMENT

a) Personal Management
b) Financial Management

c) Requirement, recruitment and placement of staff

UNIT - VI PROFESSIONAL RECRUITMENT

(a) Faculty requirement and qualifications

(b) Duties and responsibilities of faculty

UNIT - VII MATERIAL MANAGEMENT

(a) Identification and classification of Sports and fitness materials/equipments.
(b) Storing inventory control
(c) Procedure in procuring sports and fitness equipments

(d) Procedure in procuring sports and fitness equipments

UNIT-VIII ORGANISATION OF SPORTS EVENTS

a) Intramural
b) Extramural
c) Writing of Circulars, Notification and Notices
d) Formation of Committees and selection of officials

UNIT - IX PUBLICITY AND FUND RAISING

a) Publicity through media
b) Sponsorship
c) Reporting and maintaining records

UNIT-X SUPERVISION

a) Supervisory styles and techniques

b) Qualities of Supervisor
c) Evaluating the effectiveness of organization.

MODULE - V

SPORTS SCIENCES - PART - I

UNIT -1 SPORTS AND EXERCISE PHYSIOLOGY

a) Skeletal muscle : structure, functions and types
b) Bioenergetics
c) Recovery process
d) Effect of exercise on various body systems

UNIT-II SPORTS MEDICINE

a) Common sports injuries : prevention, treatment and rehabilitation
b) Therapeutic modalities
c) Doping : Definitions, classification and hazards

UNIT-III SPORTS BIOMECHANICS

a) Mechanics and its applications in Sports
b) Analysis of fundamental movements
c) Mechanical analysis of sports skills

MODULE – VI

SPORTS SCIENCES-PART II

UNIT -1 SPORTS AND EXERCISE PSYCHOLOGY

a) Cognitive process in Physical activities
b) Emotions: Types and its relationship to performance in sports
c) Psychological aspects of competitions.

UNIT-II SPORTS AND SOCIOLOGY -

a) Sports as a social phenomenon
b) Socialization: institutions and process
c) Social stratification

UNIT - III SPORTS STATISTICS AND COMPUTER APPLICATION

a) Descriptive Statistics
b) Inferential Statistics
c) Application of computers in physical education and sports
d) Internet

MODULE - VII

RECENT DEVELOPMENS IN PHYSICAL EDUCATION AND SPORTS

1. Structural and Curricular up gradation of professional courses in Physical education and sports.

2. Role of Science and Technology in manufacturing of sports equipments and attire.

3. Technological advancement and innovations in playing surfaces and infrastructure.

4. Event Management of Sports at various levels.

5. Sports marketing - Recent trends.

6. Sports Tourism

7. Recent Programmes and policies related to physical education and fitness at State and National level.

8. Applied aspects of sports sciences.

9. Influence of sports and politics and vice-versa at Nationaland international levels.

10. Controversial issues in sports and physical education.

PHYSICS

Module I

Mathematical Methods of Physics

Curinlinear coordinates, circular cylindrical and spherical polar coordinates
Victor algebra and Victor calculus,
Matrices – Cayley Hamilton Theorem, Eegin values and Eegin vectors.
Special Functions (Gama, Beta, Hermite, Bessel, Laguerre, Legendre)

Complex Analysis – Analytic function, Taylor and Laurent expansions, poles, residue and evaluation of integrals.
Fourier Series, Fourier and Laplace transforms.

Tensors, Introductory group theory, representation of groups. Irreducible representation SU (2), SU(3).

Module II

Classical Mechanics

Newtons laws, Lagrangian and Hamiltonian formalism. Canonical Transformation and Poison Bracket
Hamilton Jacobi Theory
Rigid body Dynamics -
Small oscillations
Special theory of relativity
Non leniar Dynamics – logistic map – bifurcation – attractors – fractal, fractal dimension.

Module III

Quantum Mechanics

Wave particle duality, Fundamental postulates of Q.M., Schrodinger picture & Heisenberg picture
Eigen value problem (particle in a box, harmonic ocillator). Tunneling through a barrier. Heisenberg uncertainly principle. Algebra of linear vector space, Dirac notation, Angular Momentum algebra (spin, addition of angular momentum).
Time independent perturbation theory and applications :
Variational method.
Time dependent perturbation theory and Fermi Golden Rule.
Elementary theory of Scattering phase shifts, partial waves, Born approximation.
Relaturistic Quantum Mechanics : Klein Gordon – Dirac equations.

Module IV

A) Electro Dynamics & Statistical Physics

Review of Electrostatics and Magnetostatics
(Gausi's law, Biot Savart Law, Amperes theorum)
Maxivells equation in free space and linear isotropic media – boundary conditions on the fields at

interfaces. Sealar and vector potentials.
(Retarded potential Lienard Wiehirt potential, field of a moving point charge)
Electromagnetic waves in free space. Dielectrics and conductors. Reflection, refraction, polarisation
Transmission lines and Wave guides.

Statistical Physics

B) Laws of thermodynamics. Thermodynamic potentials
Phase space, micro and macrostates, Micro canonical, canonical and grand canonical ensembles and partition funtions. Classical and quantum statistics, Ideal Bose and Fermi gases.
First and second order phase transitions. Diamagnetism, paramagnetism an ferromagnetism.

Module V

Spectroscopy and Condensed Matter Physics

A) Spectroscopy

Introduction to Atomic Spectroscopy :- LS coupling, - J J coupling, - Zeeman effect, - Stark effect, Lande - g factor
Electronic, rotational, vibrational and Raman Spectra of diatomic molecules, selection rules.
Spin Resonance Spectroscopy : NMR, ESR, Mossbauer Spectroscopy.
Laser : Spontaneous and stimulated emission, Einstein coefficients. Optical pumping, population inversions, rate equation. Modes of resonators and coherence length.

B) Condensed Matter Physics

Bravais lattice, Reciprocal lattice. Diffraction and the structure factor. Brillouin zone.
Vibractions of crystals with monoatomic and diatomic basis – Phonon heat capacity – Density of states in one an three dimensions – Einstein and Debye models
Free electron theory and electronic specific heat.
Hall Effect
Super conductivity Type I and Type II superconductors.
Josephson functions, BCS theory

Module VI

Nuclear and Particle Physics & Electronics

A) Nuclear Properties : size shape and charge distribution, spin and parity – Binding energy, semi empirical mans formula, liquid drop model, Nature of nuclear force. Elmentary ideas of alpha, beta and gamma decay and their selection rules. Fission and fusion. Nuclear for reactions. Reaction crossection, Q valve.
Elementary particles and their Quantum numbers.
Quark Model

A) Electronics :

Semi conductor devices (diodes, functions, transistors, FET) Amplifuro, Oscillators.
Opto electronic devices (solar cells, photo detection, LED), Operational amplifiers and their applications. Digital techniques and applications (registers, counters, comparators) A/D and D/A converters.

Module VII

Recent Developments in Physics

Nanotechnology

Properties of metal, semi conductor, rare gas and molecular nanoclusters – superconducting fullerene – quantum confined meterials – quantum wells, wires, dots and rings – meta materials – graphene

Non Linear Dynamics

Soliton – Effect of nonlinearity and dispersion.

Non Conventional Energy Resources

Wind Energy, Solar Energy, Tidal energy, Bio.

Evolution of Universe

Big Bang Theory : Spontaneous symmetry breaking, Higgs Boson.

Basis of Quantum Computing

HOME SCIENCE

Module -I

Kinds of Micro Organisms in different foods, Denaturation of micro-organisms. Quality changes in foods during processing and storage. Food born infections and intoxication. Quality Control in food industry. Food additives, Food adulteration. Food Laws and standards.

Module -II

House Plans for different economic groups. Space designing - importance of colour -different treatment and accessories. Markets and prices, Role of Consumer in the economy. Importance of advertisement - Human resources on economic development-entrepreneur ship -conmcepts

Module -III

Rural development - Role of Panchayat Raj and Voluntary Organisations -Administration and Co-ordination. Agencies in promoting science and technology in rural development - waste and fuel management - indicators of development. Family life cycle -different stages - quality of life indicators.

Module -IV

Physical, social and mental development of pre-school children. Methods of studying children. Developmental assessment and delays. Early childhood education. Intervention programmes for children with challenges. Principles of counseling - qualities and skills of counselor.

Module -V

Assessment of health status - different methods - common deficiency disorders. Prevalence in the state and in the country. Morbidity and mortality rates of vulnerable sessions of the population - causative factors - different intervention programmes implemented by national and international agencies.

Module -VI

Food constituents - major and minor - general functions, sources, utilisationand storage in the body. Variation in requirements at different stages of life and RDA specified. Diets for diseases affecting different systems in the body and for degenerating diseases. Importance of parental feeding.

Module -VII *Recent Developments in Home Science*

Emerging trends of Bio Technology on food cultivation industries - Nutaceuticals, Pro-biotics and herbals, Nano technology.

Recent policies on health, nutrition and population -National programmes for women empowerment

Advanced methods of communication.

PSYCHOLOGY

Module I Psychological Processes

Attention, Perception, Cognition, Memory, Intelligence, Thinking, Learning, Motivation and emotion.

Modue II Personality

Deterinants of personality perspectives/ Approaches- Biological, psychodynamic, Behaviourstic, cognitive, Humanistic, Traspersonal Eastern Approach
Trait and Type Approach
Narrow – band Approch – Type A/B
Type C, Auhoritarian, self – monitoring
Teachniques of assessment – observation, Intervew, projective, Inventories and Tests

Module III Counselling Psychology

Relationship strategies (Micro skills)
Goals of counselling, Process of counselling
Effective counsellor – skills, Qualities characterstics
Tyes of counselling – Individual, group, on-line
Areas of counselling- Premaritial, Marital, Family, Adolescent etc.
Counselling in special settings – HIV/AIDS, Counselling, Disable, geriatric, genetic, crisis Intervention
Grief counselling.

Module IV Psychopathology

Classifiation,
Causal Factors,
Anxiety and related disorders,
affective disorders,
somatoform and Dissociative discorders,
Eating disorders,

Personality disorders,

Sexual disorders & Dysfunctions, Schizophrenia & Delusional disorders

Cognitive Impairment Disorders.

Disorders of childhood & Adolescence

Module V Psychology applied to everyday life

Characteristics of learner

Characteristics of an efective teacher

Class room Manageent

Mental Health in School setting

Behavior Modification Techniques

Psycho-social aspects of Anger, Hostility, Violence, Larrassent and Discrimination.

Stressors – Biological, Emotional, Environmental, Social, Occupational – coping strategies

Role of Psychologists, counsellors, clinical psychologists and psychiatrists Concept and Application of Emotional Intelligence.

Module VI

Recent developments in Psychology

STATISTICS

Part - III (Core subjects)

Module 1: Mathematical methods for statistics.

Classes ^of sets, sigma-algebra, measure, measurable functions and properties, Lebesgue measurable sets. Lebesgue integrals and properties. Riemann-Stieltjes' integral. Proper and improper integral, uniform convergence of series and sequences of real numbers/functions.

Linear vector space, subspace, independence of vectors, basis and dimensions. Orthogonal and orthonormal basis, Gram-Schmidt orthogonalisation , orthogonal transformations. Matrices & determinants-rank, null space, nullity, linear transformations, characteristic roots & vectors, spectral decomposition, classification & reduction of quadratic forms. Generalized inverse and properties.

Module II: Probability Theory.

Probability measure, conditional probability and Baye's theorem. Random variable-distribution, density functions and properties. Mathematical expectation and inequalities (Markov, Chebychev's, Liaponov, Jenson). Different modes of convergence of sequence of random variables, weak and strong law of large numbers. Characteristic functions-elementary properties and inverse theorem. Central limit theorems and its applications.

Module III: Distribution theory

Basic concepts in distribution theory, generating functions (pgf, mgf, cf). Bivariate distributions-joint,

marginal conditional distributions and expectations. Least square principle, correlation and regression.

Standard discrete distributions (Binomial, Poisson, negative binomial, geometric, hyper geometric, power series distributions and properties). Continuous distributions (Uniform, normal, exponential, double exponential, beta, gamma, Cauchy, Weibull, Pareto, lognormal, logistic distributions, and Pearson's system of distributions.

Order statistics-joint, marginal distributions of order statistics from uniform and exponential distributions

Sampling distributions- Sample characteristics and their distributions (normal, chi square, t, F)-properties and applications.

Module IV: Sampling theory and design of experiments.

Census and sampling, probability sampling methods (SRSWR, SRSWOR, systematic, stratified, cluster, multistage samplings). PPS sampling (Des Raj's, Murthy, Horvitz-Thompson). Ratio and regression methods of estimations and properties.

Gauss-Markov set up, basic designs (CRD.RBD.LSD). Incomplete block designs- BIBID, PBIBD. Factorial experiments (2^n and 3^n) and confounding. Split plot design.

Module V: Statistical Inference

Problem of estimation, Point estimate and interval estimate-basic concepts, general properties of estimates, sufficiency and completeness-exponential family. Fisher's information, C-R inequality, Racf^Blackwell and Lehman-Scheffe theorems. Methods of estimation (MLE, Moments, Minimum Chi square). Fundamental concepts of testing of hypotheses. Neyman-Pearson'lemma, most powerful test, UMP test, likelihood-ratio test, large sample and small sample tests. SPRT

Non-parametric tests (Chi square test of goodness fit, K-S test, sign test, Wilcoxon, Signed rank, run, Mann-Whitney, Wilcoxon).

Module VI: Stochastic Processes , Multivariate Analysis

Definition of stochastic process- basic concepts, Markov Chain, classification of states, discrete time branching process, Poisson process and related processes. Renewal theorem and limit theorems.

Multivariate distributions (Normal, multinomial)- marginal , conditional and characteristic functions. Distribution of quadratic forms, Partial and multiple correlations. Multivariate sampling distributions^Hotelling's T^2 and Mahalanobis - D^2.

Classification problems- Classifying to one of k multivariate normal populations, discriminant analysis, Principal component analysis, canonical variables and canonical correlations.

Module VII Recent developments in Statistics

Generalized linear modeling. Statistical decision problem, Bayesian inference, Prior and posterior distributions, Bayes' estimates, life time distributions, basic concepts of survival analysis - survival function, hazard rate. Construction and properties;yarious typesjcontrol charts. Acceptance sampling for attributes. Linear programming problem. Markovian Queuing models. Components of time series, ARMA and ARIMA. Basic concepts in Econometrics (demand, revenue, elasticity and equilibrium analysis). Simulation Techniques.

SYLLABUS ZOOLOGY]

MODULE I: SYSTEMATICS AND EVOLUTIONARY BIOLOGY

1. SYSTEMATICS

- Basic concepts , Importance and applications
- Trends -Chemotaxonomy, Cytotaxonomy, Molecular taxonomy, Cladistics, Numerical taxonomy
- Dimensions of speciation, Species concept, Theories of biological classification, Hierarchy of categories.
- Procedural keys- Taxonomic procedures- Collection, Preservation, Curating, Identification.
- Taxonomic keys- Merits and demerits; ICZN, Formation of scientific names of various taxa.

2. EVOLUTIONARY BIOLOGY

An outline of evolutionary theories: Darwinism, Lamarckism, Modern synthesis (not in detail).

Origin of higher categories- Punctuated equilibrium- Macroevolution- Microevolution- Coevolution-Founder principle- C-value paradox-Concept of molecular clock- Cytochrome C- Haemoglobin-Histone.

MODULE II: PHYSIOLOGY AND BIOCHEMISTRY.

I. PHYSIOLOGY

1. Nutrition and Digestion

- Types of nutrition
- Mechanism of Digestion , Absorption
- Gastro intestinal hormones
- Deficiency diseases of nutrients.

2. Circulatory Physiology

- Physiology of cardiac muscles
- cardiac cycle
- Electrical properties
- conducting system of heart
- Blood pressure
- Blood volume
- pressure control - integrated system.

3. Nerve Physiology

- Nerve action potential
- conduction of nerve impulse
- Synapse
- Synaptic transmission
- Neurotransmitters.

4. Excretory physiology

5. Respiratory physiology

6. Muscle physiology

7. Endocrinology

- Major Endocrine glands and their hormones and functions
- Mechanism of hormone action.

II. BIOCHEMISTRY

Biomolecules

- Carbohydrates: Classification, Structure, Properties, Functions.
- Proteins: Classification, Structure, Properties, Functions.
- Lipids: Classification, Structure, Properties, functions.

Enzymes: Mechanism of enzyme action. Factors affecting enzyme action, Enzyme kinetics, Menton-Michaelis kinetics, Substrate concentration, Enzyme inhibition and regulation, Isozyme, Coenzyme, Ribozymes.

Metabolism of carbohydrate: Glycolysis, TCA cycle, Pentose phosphate pathway, Glycogenesis, Glucogenesis, Gluconeogenesis, Regulation of carbohydrate metabolism.

Metabolism of protein: Deamination, Transamination,

Metabolism of Lipids: B oxidation, Synthesis of Fatty acid, Biosynthesis of cholesterol.

Energy metabolism: Oxidative metabolism, Oxidative phosphorylation, Chemiosmotic theory .

MODULE III: MICROBIOLOGY AND IMMUNOLOGY

I. MICROBIOLOGY

- Classification of Microorganisms- Berg's manual.
    - Salient features of Bacteria, Viruses, Fungi, Protozoa, Algae.
    - Bacterial Cell- Structure and function
    - Bacterial Cell wall- Peptidoglycan, Gram's positive and Gram's negative, Mechanism of Gram's staining.
    - Bacterial culture media
    - Growth curves

2. **Industrial Microbiology:** Fermentation.

II: IMMUNOLOGY

- Types of immunity - Innate, Acquired, Passive, Active, Cell mediated.
- Cells of primary and secondary lymphoid organs.
- Cells and organs of immune system.

III. Immunogens [Antigen]

- General properties- Structure and function, Variability and Diversity.
- Factors affecting antigenicity
- Epitopes and haptens
- Adjuvants.

IV. Immunoglobulins [Antibodies]

- General properties- Structure and function
- Different classes- Ig A, IgD, IgE, IgM
- Variability and Diversity
- Monoclonal and polyclonal antibodies

V. Antigen Antibody interaction

Complement system- Classical pathway, Alternate, cell mediated and humoral reactions.

VI. Transplantation

MHC genes, Auto-immune diseases.

MODULE IV

CELL, MOLECULAR BIOLOGY AND BIOTECHNOLOGY

CELL

Cell membrane- Structure and function.
Cell organelles with special reference to Mitochondria and Ribosomes

MOLECULAR BIOLOGY

- Organization of eukaryotic genome, gene content and genomic size complexity of eukaryotic genome, conserved exons and recombination
- DNA replication , Repair and Recombination
- Prokaryotic and eukaryotic DNA replication. Enzyme involved in replication. DNA damage and repair.
- Transcription and RNA processing
- Prokaryotic and Eukaryotic transcription, Binding of transcription complexes, Post -transcriptional processing .
- Translation- prokaryotic and eukaryotic gene expression, Translational machinery, mechanism of initiation, elongation and termination, Post-translational modification of protein.
- Gene regulation mechanism in Prokaryotes, Eukaryotes
- Transcriptional signals-TATA, CAAT box, Enhancers.

A. BIOTECHNOLOGY

Gene cloning.

- Major steps in cloning, Isolation and purification of genes.
- Vectors- properties of an ideal vector, different types [plasmids, Ti plasmid, bacteriophages, cosmids, phagemids, artificial chromosomes].
- Enzymes in gene cloning.
- Probes and molecular markers [RFLP, RAPD, AFLP].
- Homoploymer tailing, linkers and adapters.

BGenetic engineering techniques.

B1 Polymerase Chain reaction, DNA finger printing, Blotting techniques [Northern, Southern , Western blottings, Dot blot, Slot blot].

B2 DNA sequencing - Maxam-Gilbert method, Sanger-Coulson method. Chromosome jumping, Genomic library and cDNA library, Site specific mutagenesis and gene targeting,

Human genome project, Human gene therapy, and other genome projects.

B3 Transgenic animals.

MODULE V: GENETICS AND DEVELOPMENTAL BIOLOGY

I. GENETICS.

- Mendelian principles of genetics- Laws , Linkage, Crossing over, Mutation, DNA, Types of DNA, RNA, Types of RNA.
- Lyon hypothesis.
- Syndromes- Klinefelter, Down, Turner.
- Genetic code.

II. DEVELOPMENTAL BIOLOGY

- Gametogenesis, Fertilization and early development - Cleavage, Blastulation, gastrulation, Organogeny.
- Experimental Embryology.
- Embryonic induction.

MODULE VI: ECOLOGY, ETHOLOGY , BIODIVERSITY CONSERVATION AND BIOSTATISTICS

1. ECOLOGY:

Definitions- Habit and habitat, Ecological niche, Ecosystem, Population ecology, Community ecology, Ecological succession, Pollution, Global warming.

2.ETHOLOGY

Learning behaviour, Communication behaviour, Motivation.

3.BIODIVERSITY CONSERVATION

Biodiversity concept, status in India, Value, Loss and causes of loss.
Indices, Hot spots of Biodiversity.

In situ and Ex-situ conservation.

4.BIOSTATISTICS

Mean, Median, Mode, Standard deviation; Graphical representation of data.

BIOPHYSICS, BIOINFORMATICS AND COMPUTER APPLICATION

1.INSTRUMENTATION

- Scanning electron microscope, Transmission electron microscope
- Electrophoresis- Gel, PAGE, Agarose, 2D- Immunoelectrophoresis, Fluorescent
- HPLC, Flow cytometry
- NMR spectroscopy- Mass, Plasma , Atomic
- X-ray diffraction
- ELISA

2. BIOINFORMATICS

Proteomics, Genomics, Data bases - Primary and Secondary, Search engines.

Transgenic animals, Stem cell research, IPR, Carbon trading, Ecological foot printing, Treaties and protocols related to climate change.

MODULE – VII

Recent developments in Zoology