MANAV BHARTI UNIVERSITY
Village- Laddo,
P.O- Sultanpur(Kumarhatti),
Teh. & Distt.-Solan (H.P)

SYLLABUS FOR B.Tech.

in

Biotechnology
YEAR 2009 ONWARDS

1ST SEMESTER

THEORY PAPERS

BT-101 Foundation course in Physico-Inorganic Chemistry – I

BT-102 Foundation course in Physics- I

BT-103 Life Sciences –I

BT-104 Mathematics – I

BT-105 Concepts in Biotechnology

BT-106 Introduction to Computers

Practicals :

BT-107 Chemistry - I Lab

BT-108 Physics – I Lab

BT-109 Life Sciences –I Lab

BT-110 Biotechnology Lab

BT -111 Computer Lab

2nd SEMESTER

THEORY PAPERS

BT-112 Foundation course in Physico-Inorganic Chemistry –II

BT-113 Foundation course in Physics-II

BT-114 Life Sciences –II

BT-115 Mathematics- II

BT-116 Laboratory Techniques in Biotechnology

BT -117 Electrical Science

Practicals :

BT-118 Physics - II Lab

BT-119 Chemistry – II Lab

BT-120 Life Sciences - II Lab

BT-121 Laboratory Techniques of Biotechnology in Lab

BT -122 Electrical Science-Lab

IST SEMESTER

BT-1O1 FOUNDATION COURSE IN PHYSICO INORGANIC CHEMISTRY - I

1. Chemical Bonding: Ionic bond ; energy changes, lattice energy Born Haber Cycle, Covalent bond-energy changes, Potential energy curve for H2 Molecule, characteristics of covalent compound, co-ordinate bond - Werner's Theory, effective atomic numbers, isomerism in coordinate compounds. Hydrogen bonding, Vander Waal's forces, hybridisation and resonance, Valance Shell Electron Repulsion theory (VSEPR). Discussion of structures of H2O, NH3, SiF4. Molecular orbital theory, Linear combination of atomic orbitals (LCAO) method. Structure of simple homo nuclear diatomic molecule like H2, N2, O2, F2.

2. Thermochemistry: Hess's Law, heat of a reaction, effect of temperature on heat of reaction, at constant pressure (Kirchoff's Equation) heat of dilution, heat of hydration, heat of neutralization and heat of combustion, Flame temperature.

3. Reaction Kinetics: Significance of rate law and rate equations, order and molecularity, Determinations of order of simple reactions-experimental method, Equilibrium constant and reaction rates-Lindemann, collision and activated complex theories, complex reactions of Ist order characterstics of consecutive, reversible and parallel reactions-Steady state and non-steady state approach.

4. Catalysis: Criteria for Catalysis - Homogeneous Catalysis, acid-base, Enzymatic catalysis, Catalysis by metal salts, Heterogeneous catalysis - concepts of promoters, inhibitors and poisoning, Physiosorption, Chemisorption, Surface area, Industrially important process. Theories of Catalysis.

5. Polymers: Basic concepts & Terminology, such as monomers, Polymers, Functionality, Thermoplastics, Thermosets Linear, Branched, cross linked polymers etc. different definitions of molecular weight viz., Mw, Mn, Mv and then determinations, Industrial

applications of polymers, Addition, condensation and Ionic polymerization's, solutions of polymers, good solvents, & bad solvent, solubility parameter, solutions viscosity and determination of intrinsic viscosity.

6. Colloids: Collidal state, classification of colloidal solution, true solution, colloidal solution and suspensions, preparation of sol, Purification of colloidal solutions, General properites and optical properites, stability of colloids, coagulation of lyphobic sols, electrical properties of sols, kinetic properties of colloids:- Brownion movement, size of colloidal particle, emulsions, gels, colloidal electrolytes and applications of colloids.

Text / Reference Books

1. Inorganic Chemistry by J.D. Lee.
2. Physical Chemistry by Lewis.

BT-102 FOUNDATION COURSE IN PHYSICS - I

1. **Optics. Interference:** Coherence and coherent sources, Interference by division of wavefront (Young's double slit experiment, Fresnels' biprism), Interference by division of amplitude (Thin films, Newton's rings,Michelson's Interferrometer,Fabry Perot Interferrometer

2. **Diffraction:** Fresnel and Fraunhoffer types of diffraction, Fraunhofer diffraction: Single slit, double slit, circular aperture and N-slit. Diffraction grating - wavelength determination, resolving power and dispersive power. Resolving power of optical instruments – Rayleigh criterion. Fresnel Diffraction: zone plate, circular aperture, opaque circular disc, narrow slit.

3. **Polarization:** Types of polarization, elliptically and circularly polarized light Brewster's law, Malu's law, Nicol prism, double refraction, quarter-wave and half-wave plates, optical activity, specific rotation, Laurent half-shade polarimeter.

4. **Lasers:** Introduction, Coherence, Einstein A and B coefficients, population inversion, Basic principle and operation of a laser, Types of lasers, He-Ne laser, Ruby laser, semi-conductor

laser, holography - theory and applications

5. **Introduction to Optical fibre:** Types of optical fibres and their characteristics, (Attenuation and Dispersion) step index and graded index fibres, principle of fibre optic communicationtotal internal reflection, Numerical aperture, Fibre optical communication network- its advantages. Fibre optic sensors (qualitative)

6. **Nature of light and matter:** Particle nature of radiation- The Photoelectric effect, Compton effect. X-rays (continuous and characteristic), x-ray diffraction- Bragg's law. The origin of quantum theory- Planck's hypothesis, the wave nature of matter- wave-particle duality, matter waves (de Broglie hypothesis). Basic postulates of quantum mechanics - the wave function - its physical interpretation, the Schrodinger equation.

7. The electromagnetic spectrum: Sources of light, emission and absorption spectra, Brief introduction to spectroscopy (optical, magnetic resonance).

Text / Reference Books

1. Modern Physics by A. Beiser.
2. Optics by A.K. Ghetak.
3. Modern Physics by Hallday & Resvik.
4. Introduction to Physical Optics by Jenkin & White.

BT-1O3 LIFE SCIENCES - I

1. **Origin of Life :** History of earth, theories of origin of life nature of the earliest organism.

2. **Varieties of life :** Classification, Five kingdoms, viruses (TMV, HIV, Bacteriophage), Prokaryote (Bacteria-cell structure, nutrition, reproduction), Protista, Fungi, Plantae and Animalia.

3. **Chemicals of life :** (Biomolecules)- Carbohydrates lipids, amino acids, proteins, nucleic acids, identification of biomolecules in tissues.

4. **Cell :** The cell concept, structure of prokaryotic and eukaryotic cells, plant cells and animal cells, cell membrances, cell organelles and their function. Structure and use of compound microscope.

5**. Plant and Tissue Culture :** Isolation of protoplast, purification, culture**,** regeneration of plants; protoplast fussion and somatic hybridization; cytoplasmic hybrids (cybrids).

6. **Nutrition:** Autotrophic (Photosynthesis) Pigment systems, Chloroplast, light absorption by chlorophyll and transfer of energy, two pigment systems, photosynthetic unit, phosphorylation and electron transport system, Calvin-Benson Cycle (C3), Hatch Slack Pathway (C4), Crassulacan Acid Metabolism (CAM), factors affecting photosynthesis; Mineral Nutrition in plants. Heterotrophic - Forms of heterotrophic nutrition, elementary canal in humans, nervous and hormonal control of digestive systems, fate of absorbed food materials; Nutrition in humans, Reference values.

7**. Energy Utilization:** (Respiration) - Structure of mitochondria, cellular respiration, relationship of carbohydrate metabolism to other compounds, Glycolysis, fermentation, formation of acetyl co-A, Kreb cycle, Electron Transport System and Oxidative Phosphorylation, ATP, factors affecting respiration.

8. **Transport:** Plant water relationships, properties of water, diffusion, osmosis, imbibition, movement of water in flowering plants, uptake of water by roots, the ascent of water in xylem, apoplast symplast theory, Transpiration-structure of leaf and stomata in plants opening and closing mechanisim of stomata factors affecting transpiration, significance of transpiration General characteristics of blood vascular system, development of blood systems in animals, Composition of blood, circulation in blood vessels, formation of tissue fluids, the heart, functions of mammalian blood, the immune system.

BT-104 **MATHEMATICS - I**

1. **Differentiation:** Successive Differentiation, Leibnitz's theorem (without proof). Lagrange's Theorem, Cauchy mean value theorem, Taylor's theorem (without proof), Remainder Term, Asymptotes, Curvature, Curve Tracing

2. **Infinite Series :** Convergence, divergence, Comparison test, Ratio test, Cauchy's nth root test test, Leibnitz's test (without proof), Absolute and Conditional Convergence. Taylor and Meclaurin series, Power series, Radius of convergence

3. Integral Calculus : Reduction Formulae of trignometric functions, Properties of definite Integral, Applications to length, area, volume, surface of revolution, Definition of improper integrals, Beta-Gamma functions.

4. Calculus of Functions of Several Variables : Partial derivatives, Chain rule, Differentiation of Implicit functions, Exact differentials. Maxima, Minima and Saddle points. Method of Lagrange multipliers. Differentiation under integral sign. Jacobians and transformations of coordinates. Double and Triple integrals, Simple applications to areas, volumes etc

5. Vector Calculus : Scalar and vector fields. Curves, Arc length, Tangent, normal, Directional Derivative, Gradient of scalar field, divergence and curl of a vector field. Line integrals (independent of path), Green's theorem, Divergence theorem and Stoke's theorem (without proofs), Surface Integrals.

Text / Reference Books

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 6th edition, Addision Wesley/Narosa, 1985.
2. Shanti Narayan, "Differential Calculus", S. Chand & Co.
3. Shanti Narayan, "Integral Calculus", S.Chand & Co.

4. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publication.
5. E. Kreyszig, “Advanced Engineering Mathematics”, 5th Edition, Wiley Eastern, 1985.

BT-105 CONCEPTS IN BIOTECHNOLOGY

1. Introduction to Biotechnology: Definitions, Historical perspectives, Scope and importance, Commercial potential, An interdisciplinary challenge, Classical vs. Modern concepts, Manufacturing quality control, Product safety, Good laboratory practices, Marketing, Biotechnology in India and Global trends

2. Fundamentals of Biochemical Engineering - Concept of pH, Buffer, Physical variables, dimensions and units, Errors in data calculations, types of error, Statistical analysis, Presentation of experimental data, Data analysis, Trends, Testing mathematical models, goodness of Fit, General procedure for plotting data, Homogeneous reactions, Heterogeneous reactions,

3. Protein Structure and Engineering: Introduction to the world of Proteins, 3-D Shape of Proteins, Structure Function relationship in Proteins, Purification of Proteins, Characterization of Proteins, Protein based products, Proteomics.

4. Recombinant DNA Technology: Introduction, Tools of rDNA Technology, Making Recombinant DNA, DNA Library, Introduction of Recombinant DNA into host cells, Identification of Recombinants, Polymerase Chain Reaction (PCR), DNA Probes, Hybridization Techniques, DNA Sequencing, Site-directed mutagenesis.

5. Genomics and Bioinformatics: Introduction, Genome Sequencing Projects, Gene prediction and Counting, SNPs and comparative genomics, Functional Genomics, History of Bioinformatics, Sequences and Nomenclature, Data bases and search tools, Analysis using Bioinformatics tools.

6. Microbial Culture and Applications: Introduction, Microbial Culture Techniques, Measurement and Kinetics of Microbial Growth, Scale up of Microbial Process, Isolation of Microbial Products, Strain Isolation and Improvement, Applications of Microbial Culture Technology, Bioethics in Microbial Technology.

7. Plant Tissue Culture and Application: Introduction, Cell and Tissue Culture Techniques and Applications, Gene Transfer Methods in Plants, Transgenic Plants with Beneficial Traits, Cloning and Cryopreservation, Bioethics in Plant Genetic Engineering.

8. Animal Tissue Culture and Hybrodoma Technology: Introduction, Animal Cell and Tissue Culture; Techniques, advantages and applications. Characterisation of Cell Lines, Stem Cell Technology, Hybrodoma technology and its application, Bioethics in Animal Genetic Engineering, In-vitro fertilization and embryo transfer.

9. Biotechnology and Society - Role of sciences, Engineering, Arts, Commerce, Patenting - Criterion for patents, Discovery vs Invention, Product and process patent, Reading a patent, National and International Patent Laws, Intellectual property rights,, Patenting of biological systems, Ethical issues in agriculture and health care

Text / Reference Books

1. A textbook of Biotechnology for Class XI and XII, CBSE.
2. Biotechnology by Smith, Cambridge Press.
3. . Biotechnology, expanding horozon by BD Singh, Kalyani Publishers.

BT – 106 INTRODUCTION TO COMPUTERS

1. Introduction: Overview of computer organization and historical perspective computer applications in various fields of science and management, Data representation: Number systems, character representation codes, Binary, hex, octal codes and their inter conversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers. Data storage: Primary and Secondary storage. Introduction to various computer devices such as keyboard, mouse, printers, disk files, floppies etc. Concept of computing, contemporary, Operating Systems such as DOS, Windows 95, UNIX etc. (only brief user level description). Introduction to organization and architecture of mainframe, mini and micro systems. Introduction to E-mail, ftp, login and other network services, worldwide web, MS-Office.

2. Introduction to Programming: Concept of algorithms, Flow charts, Example of Algorithms such as how to add ten numbers roots of a quadratic equation. Concept of sequentially following up the steps of the algorithm, Notion of program, programmability and programming languages. Structure of programs, object codes, compilers, Introduction to the Editing tools such as vi or MS-VC editors, Concepts of the finite storage, bits, bytes, kilo, mega and gigabytes. Concepts of character representation.

3. Programming using C: The emphasis should be more on programming techniques rather that the language itself. The C programming language is being chosen mainly because of the availability of the compilers, books and other reference materials, Example of some simple C program. Dissection of the program line by line. Concepts of variables, program statements and function calls from the library (print for example), C data types, int, char, float etc, C expressions, arithmetic operations, relational and logic operations, C assignment statements, extension of assignment to the operations. C primitive input output using getchar and putchar, exposure to the scanf and printf functions, C statements, conditional executing using if, else. Optionally switch and break statements may be mentioned, Concepts of loops, example of loops in C using for, while and do-while. Optionally continue may be mentioned, One dimensional arrays and

example of iterative programs using arrays, 2-d arrays. Use in matrix computations, Concept of Sub-programming, functions. Example of functions. Argument passing mainly for the simple variables, Pointers, relationship between arrays and pointers. Argument passing using pointers. Array of pointers. Passing arrays as arguments, Strings and C string library, Structures and Unions. Defining C structures, passing strings as arguments. Programming examples, File I/O. use of fopen, fscanf and fprintf routines.

Text / Reference Books

1. Fundamentals of Computers by V. Raja Raman.
2. 'C' Language by Brian Gottfried by Schaum Series.
3. Introduction to Computers by Leon & Leon.