BACHELOR OF SCIENCE (B.Sc.)

(THREE YEAR DEGREE COURSE)

SUBJECT

BIO TECHNOLOGY

B.Sc. (BIO TECHNOLOGY)

COURSE STRUCTURE

FIRST YEAR

PAPER – 101: Introductory Biological Chemistry	50 MARKS
PAPER – 102: Biophysical Chemistry	50 MARKS
PAPER – 103: Cell Biology and Genetics	50 MARKS
PAPER – 104: PRACTICAL (Based on Paper 101, 102, 103)	50 MARKS

SECOND YEAR

PAPER – 201: Bioenergetics and Bio-membranes	50 MARKS
PAPER – 202: Animal and Plant Physiology	50 MARKS
PAPER – 203: Biostatistics and Computers	50 MARKS
PAPER – 204: PRACTICAL (Based on Paper 201, 202, 203)	50 MARKS

THIRD YEAR

PAPER – 301: Molecular Biology and Genetic Engineering	50 MARKS
PAPER – 302: Animal and Plant Biotechnology	50 MARKS
PAPER – 303: Industrial and Environmental Biotechnology	50 MARKS
PAPER – 304 : PRACTICAL (Based on Paper 301, 302, 303)	50 MARKS

B.Sc. (BIO TECHNOLOGY)

FIRST YEAR DETAILED SYALLBUS

PAPER – 101

Introductory Biological Chemistry

- General account of the chemical nature of living cells.
- Carbohydrates: Classification, configurations and conformations, sugar derivatives, structural and storage polysaccharides.
- Amino acids: General properties, peptide bond, essential and non-essential amino acids.
- Lipids: Classification, properties of lipid aggregates, biological significance.
- Nucleic acid: Chemical structure and base composition, double helical structures, Tm, super-coiled DNA.
- Protein chemistry: Classification, different levels of protein structure, forces stabilizing protein structure, protein folding, protein modification.
- Enzymes: Nomenclature, apoenzyme and holoenzyme, substrate specificity, coenzymes, factors affecting enzyme activity, regulation of enzyme activity, enzyme inhibition, isozymes, ribozymes, abzymes.
- Vitamins, water and fat soluble vitamins, deficiency and diseases .

B.Sc. (BIO TECHNOLOGY)

FIRST YEAR DETAILED SYALLBUS

PAPER – 102

Biophysical Chemistry

- Water: Structure and interactions, water as solvent, proton mobility, acid-base reactions, pH and buffers, isoelectric pH.

- Photometry: Basic principles of UV-Visible spectrophotometry and colorimetry, instrumentation and application.

- Centrifugation: Principles and application, sedimentation coefficient, differential, density gradient and ultra-centrifugation.

- Chromatography: Ion Exchange, partition, gel filtration and affinity chromatography their principles and applications.

- Electrophoresis: Principle, types (polyacrylamide and agarose gel electrophoresis), applications, Isoelectric focusing.

- Microscopy: Principles and applications of light, phase contrast, fluorescence and electron microscopy.

- Tracer technique: Applications of radioisotopes in biotechnology, autoradiography.

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FIRST YEAR DETAILED SYALLBUS

PAPER – 103

Cell biology and Genetics

- Cell theory, cell as basic unit of life.

- Structure and organization of prokaryotic and eukaryotic cells. Cell organelles- structure, function and integration, micro bodies.

- Cell division- mitosis and meiosis, Cell cycle, its regulation and cancer, Characteristic of cancer cells.

- Major signaling pathways of eukaryotic cells.

- Mendel's law of inheritance, Gene interactions. Sex determination, linkage, crossing over, recombination and gene mapping.

- Chromosome structure and behaviour through the cell cycle, karyotype. Chromatin organization. Polytene and Lampbrush chromosome, Banding patterns in human chromosome, structural and numerical changes in chromosomes, hereditary defects.

- Extra-chromosomal inheritance, sex-linked inheritance in humans, Mutation at phenotypic level, biochemical level and molecular level.

- Gene frequencies in population, Hardy-Weinberg law.

B.Sc. (BIO TECHNOLOGY)

FIRST YEAR DETAILED SYALLBUS

PAPER – 104

PRACTICAL

1. Preparation of buffers.
2. Qualitative tests of sugars.
3. Estimation of sugar by anthrone method
4. Qualitative tests of proteins.
5. Estimation of protein by Lowry's method
6. Estimation of DNA by diphenylamine method
7. Estimation of RNA by orcinol method
8. Chemistry practical's- group analysis, gravimetry
9. Assay of salivary amylase activity
10. Isolation of casein from milk.

B.Sc. (BIO TECHNOLOGY)

SECOND YEAR DETAILED SYALLBUS

PAPER – 201

Bioenergetics and Bio-membranes

- Fundamentals of thermodynamics- endergonic and exergonic processes, enthalpy, entropy, activation energy, free energy change, phosphoryl transfer reaction, oxidation reduction reaction, redox potential, equilibrium and non equilibrium thermodynamics, high energy compounds, causes of energy richness in ATP.

- Glycolytic pathway and its regulation, homolactic fermentation, alcoholic fermentation, energetics of fermentation, glycogen breakdown, Citric acid cycle and its regulation, gluconeogenesis, Electron transport and oxidative phosphorylation, pentose phosphate pathway, glyoxalate pathway.

- Fatty acid oxidation- major and minor pathways of fatty acid oxidation, ketone bodies.

- Metabolic breakdown of amino acids, transamination, deamination, urea cycle.

- Biological membranes- membrane proteins, fluid mosaic model of membrane structure, erythrocyte membrane, plant cell membrane, bacterial cell wall.

- Thermodynamics of transport, kinetics and mechanism of transport, active and passive transport, ATP-driven active transport, Ion gradient driven active transport.

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SECOND YEAR DETAILED SYALLBUS

PAPER – 202

Animal and Plant Physiology

- Photosynthesis: Photosynthetic pigments, electron transport, Photophosphorylation and Carbon fixation pathways. Fixation of atmospheric nitrogen by plants and microorganisms. Nitrate uptake and metabolism.

- Plant hormones: Cytokinins, Gibberellic acid, Auxins, Ethylene. Abscissic acid- their physiological effects and mode of action. Nutrition- Macronutrients and micronutrients and their uptake by plants.

- Seed germination and dormancy. Photoperiodism. Vernalization, Flowering. Senescence. Abscission.

- Blood, its cellular and chemical composition, blood clotting.

- Respiratory system: diffu sion of oxygen and carbon dioxide, transport of oxygen, role of he moglobin, dissociation curve of oxyhemoglobin and its significance, Bohr's effect, transport of CO_2 and chloride shift. Various buffer system of the blood, acidosis, alkalosis. Role of lung and kidney in regulation of acid base balance.

- Kidney- structure, its organization and function. Structural and functional characteris tics of tubules, ultrafiltration, selective reabsorption and secre tion, role of aldos ter one and antidiuretic hormones and mechanism of urine formation.

- Digestive System- different compo nents, digestion and absorp tion of carbohydrates, lipids and proteins,

- Endocrine- brief outline of various endocrine glands and their physiological roles, storage and secretion of hor mones. Nervous System- Nerve cells, nerve fibers, nerve impulse and neurotransmis sion, chemical and electrical synapses, functional properties of nerve fibers, action potential, the reflex action and reflex arc.

- Immunity, antigen, antibody, hapten, antigen-antibody interaction, introduction to antigen presentation, role of MHC, complement system, vaccines.

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SECOND YEAR DETAILED SYALLBUS

PAPER – 203

Biostatistics and Computers

- Graphic and Diagrammatic representations. Classification and tabulation. Measures of central tendency and dispersion. Skewness and Kurtosis.

- Introduction to probability, and distribution, sampling theory and errors. Tests of significance. Z, t, Chi square and F-test.

- Analysis of variance. Correlation and regression.

- Introduction to computers, hardware, storage and memory devises, input and output devises, file and folders concepts. File management, networks, printers, floppies, mouse and keyboard.

- Different types of booting, operating systems-single user, multi-user and multi tasking operating systems with examples.

- Internet and E-Mail. Important services provided by internet. Use of internet in Biotechnology studies and research.

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SECOND YEAR DETAILED SYALLBUS

PAPER – 204

PRACTICAL

1. Determination of urine urea nitrogen.
2. Isolation of serum albumin by salting out method.
3. Determination of serum albumin by Bromocresol green method.
4. Determination of total cholesterol.
5. Determination of SGOT.
6. Determination of SGPT.
7. Determination of serum bilirubin.
8. Blood group analysis
9. Ouchterlony double diffusion test
10. Determination of haemoglobin content by haemoglobinometer

B.Sc. (BIO TECHNOLOGY)

THIRD YEAR DETAILED SYALLBUS

PAPER – 301

Molecular Biology and Genetic Engineering

- Nucleic acids as genetic material, structure of A-, B- and Z-DNA, palindromic sequences, structure of RNA (t-RNA, m-RNA and r-RNA), DNA denaturation and renaturation.

- DNA replication in prokaryotes, DNA polymerase I, II and III, modes and mechanism of DNA replication, DNA repair mechanisms.

- Transcription in prokaryotes, RNA polymerase, types and functions of RNA polymerases in eukaryotes. Genetic code, translation in prokaryotes, Post-translational modifications. Gene organization, Operon concept and introduction to gene regulation mechanisms.

- Transposons: An elementary idea

- Basic concept of recombinant DNA technology, principles of gene cloning. Restriction-modification systems, use of restriction enzymes in biotechnology, cloning vectors.

- Methods of gene transfer, DNA libraries.

- Introduction to PCR, RFLP, DNA sequencing, blotting techniques.

B.Sc. (BIO TECHNOLOGY)

THIRD YEAR DETAILED SYALLBUS

PAPER – 302

Animal and Plant Biotechnology

- Plant tissue culture techniques, *in vitro* pollination and fertilization, embryo culture and its applications, embryogenesis and organogenesis, micropropagation, haploids and their applications, somaclonal variations and applications, Endosperm culture and production of triploids.

- Introduction to protoplast isolation, culture and regeneration, methods of fusing protoplasts, somatic hybridization. Protoplast and tissue culture manipulation for genetic manipulation of plants, methods of gene transfer in plants, crop improvement and development transgenic plants.

- Single cell protein (SCP), economic implications of SCP.

- Basic techniques in animal cell culture and organ culture, cell line and isolation of cell line, culture media, contaminations and their laboratory management, cell fusion, cell differentiation and growth of cultured cells, bioreactors for large scale culture of cells.

- Cloning in mammalian cells, integration of DNA into mammalian genome-different methods.

- Development of recombinant vaccines, monoclonal antibody their applications. Introduction to trangenics, gene therapy.

- Production of secondary metabolites/products: Insulin, growth hormones, interferons etc.

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THIRD YEAR DETAILED SYALLBUS

PAPER – 303

Industrial and Environmental Biotechnology

- General characteristics of microorganisms, structure of bacteria and viruses, bacterial growth - bacterial growth curve, factors affecting bacterial growth.

- Recombination in bacteria- transformation, conjugation and transduction, reproduction in bacteria, Bacterial diseases of humans, Food spoilage, food preservation.

- Environmental microbiology- water pollution, treatment of water and sewage, biogeochemical cycles of elements in the environment.

- Renewable and non renewable sources of energy.

- Disposal of solid wastes, oil spills, cellulose etc.

- Microbes in industry – foods from microorganism (vinegar and cheese). production of citric acid, amylases, proteases, vitamin $B_{12,}$ beer, wine, biogas, methane, hydrogen

- Bacteriology of water and sewage, Bacteriological examination of water.
- Biodegradation of plastic , pesticides and hydrocarbons

- Bioremediation, Bioleaching, Biosorption, Biopesticides, Biofertilizers, Biofuels, Biosensors, Bioindicators, Biodegradable plastics

B.Sc. (BIO TECHNOLOGY)

THIRD YEAR DETAILED SYALLBUS

PAPER – 304

PRACTICAL

1. Methods of sterilization.
2. Preparation of culture media
3. Simple staining
4. Differential staining
5. Culture of bacteria on solid medium
6. Culture of bacteria on liquid medium (broth culture)
7. Determination of bacterial growth by turbidimetric method.
8. Preparation of alcohol from fruit juice(s).
9. Isolation and of DNA
10. Agarose gel electrophoresis of DNA