SCHEME OF STUDIES AND EXAMINATION
I STYEAR
DIPLOME IN BIOTECHNOLOGY

S.NO	SUBJECT	THEORY		PRACTICALS		TOTAL	
	PART-A	Marks	Hours	Marks	Hours	Hours	Marks
	1.Communication skill in English	245	75	65	25	320	100
	2. General Foundation Course(Computer applications)	150	50	130	50	280	100
	Vocation subjects PART-B						
	1. Fundamentals of Biology	100	150	-	--	150	100
	2. Cell biology and Microbiology	100	150	50	75	225	150
	3. Biomolecules and Biophysical techniques	100	150	50	75	225	150
	4. Biostatistics for Biologists	100	150	50	75	225	150
	PART-C						
	On job training			50	100	100	50
	TOTAL	795	725	395	400	1525	800

SCHEME OF STUDIES AND EXAMINATION
II ND YEAR
DIPLOME IN BIOTECHNOLOGY

S.NO	SUBJECT	THEORY		PRACTICALS		TOTAL	
	PART-A	Marks	Hours	Marks	Hours	Hours	Marks
	1.Communication skill in English	245	75	65	25	320	100
	2. General Foundation Course(Computer applications)	150	50	130	50	280	100
	Vocation subjects PART-B						
	1. Molecular Biology	100	150	50	75	225	150
	2. Genetic Engineering	100	150	50	75	225	150
	3. Immunology	100	150	50	75	225	150
	4. Food Science Biotechnology	100	150	50	75	225	150
	PART-C						
	On job training			50	100	100	50
	TOTAL	795	725	445	475	1600	850

I ST PAPER
FUNDAMENTALS OF BIOLOGY

Nature of living things: Definition of life, Miller's experiment, theories and evidences of origin of life, levels of biological organization, classification of living world, difference between prokaryotes and eukaryotes.

Molecular organization of cell: Difference between animal and plant cell, salient features of intracellular organelles, cell division and cell cycle.

Evolutionary processes: Lamarckism, Darwinism, role of mutations and isolating mechanisms, adaptive radiation.

Fundamentals of genetics: Mendelian principles, Pleiotropy, epitasis, linkage and crossing over.

Animal physiology: Hormones and their mode of action, types of asexual and sexual reproduction, stages of embryogenesis.

Biology of plants: Morphology and anatomy of root stem and leaves reproduction in flowering plants.

Plant physiology: Water relations (absorption, adsorption, imbibitions, guttation transpiration, diffusion and osmosis). Plant growth regulators (auxins, cytokinins, gibberellins, abscisic acid and ethylene)

Books Recommended

1. Purves et al, Life: The Science of Biology
2. R. Dulbecco, The Design of Life.

Ist Year – Paper - II **CELL BIOLOGY**

Introduction to The Cell: Evolution of cell, Prokaryotic and eukaryotic cell, unicellular and multicultural organisms.

Cell Organelles: Cell wall, cell membranes, cytosol, mitochondria, chloroplast, nucleus, ribosome, lipososmes, golgibody, endoplasmic reticulum, motility organelles, flagella, pills, cilia

Molecular Genetics: Cell division, mechanism of cell division, mechanism of cell development, formation of tissues.

Cell Signaling: General principles of cell Signaling, Signaling via G-Protein linked cell-surface Receptors, Signaling via Enzyme-linked cell-surface Receptors, target cell adaptation.

Cell Kinetics: Concept of free energy, laws of thermodynamics, entropy, Gibbs free energy.

Chromosomes: Chromosomal DNA and its packaging, the global structure of chromosomes, chromosome replication.

Reaching Cell: Fractionation of sub-cellular organelles, Microscopy (SE, TE M,Confocal microscopy, Phase contrast microscopy, Fluorescent microscopy). Micrometery, Nephelometry, heamocytometer, flow cytometry.

Books Recommended

1. Albert's et al, Molecular Biology of the Cell
2. Lodish et al, Molecular Cell Biology
3. Derobertis, Cell Biology

Harper, The Cell **Ist Year – Paper - II BT 4003 MICROBIOLOGY (1.0 Unit)**

Introduction: microbes and man, History of Microbiology, Methods in Microbiology-Microscopy, Methods of sterilization, culture media, Pure culture methods, Staining of Bacteria, Micrometry, culturing cells and spores, Classification of microorganisms into different groups: Bacteria, Viruses, Fungi, Actinomycetes, Outline of classification of classification of bacteria and fungi.

Structure of Microorganisms and Microbial Metabolism: Fine structure of bacteria, Archaebacteria, Mycoplasmas, Mycobacteria, yxobacteria, Rickettesae and chlamydiae, structure and classification of Viruses (Bacteriophage, Oncogenic viruses). Growth of Microorganisms Cell cycles, Population growth, Batch culture, Continuous culture, Synchronous growth, Fed-batch culture.

Microbial Genetice: Control of transcription, Mutation in microorganisms, Recombinatin in prokaryotes, Genetic Engineering, Modern application of Genetic Engineering, Transposable genetic elements.

Environmental Microbiology: Distribution of Microbes in Air and water, Allergic disorders by air microflora, air sampling Microbial components of water, Water treatment, Bacteriological analyses of water. Microbiology of extreme environments (Methanogens, halobascteria, Thermoacidophies), Transposable eubacteria, Microbiology of sewage

Agricultural Microbiology and Microbial Biotechnology: Microbial Biodeterioration of agricultural products, Mycotoxins, control of microbes and safe storage of agricultural products, RH value, Aw values. Microbes in metal recovery, Microbes in paper industries, Microbes as a source in vitamin production. Industrially important micro-organisms, secondary metabolites form micro-organisms.

Food Microbiology: Microbiology of gllds, Types of microbes associated with food spoilage, food Preservation methods, Microbiology of milk and dairy products, Microbiological examination of milk, Food Poisoning, Important Fermented foods, Single cell Protein.

Medical Microbiology: Diseases caused bacteria, virus, fungi, and protozoans, fungal diseases (Mycoses), Immunity and types of Immunity, Vaccines, Anti microbial agents, Antibiotics and disinfectants, Classification of antibiotics (Broad spectrum and narrow spectrum), National Immunization Programme,

Books Recommended

1. Pelczer, Chan and Krieg, microbiology
2. Stanier et al, General Microbiology

Ist Year – Paper - III
BIOMOLECULES

Introduction: Composition of Liveng matter, major classes of biomolecules in cell, chemical evolution of bimolecules. Physical properties and hydrogen bonding of H_2O, hydrophobic interaction, Vander Waals interactions, ionic interactions, ionization of water, Hendersom-Hassel Balch equation, Ph scale, idea about buffer.

Nucleic acids: Generalesed structural plan of nucleic acids)DNA,RNA), Nucleotides, Nucleoside, Features of DNA double helix, Phosphodiester bonds, Hypochromic effect, different types of DNA, Denaturation.

Proteins: Structure and properties of 20 amino acids, Zwitterions nature amino acids in aqueous solution, Abbreviation and classification of 20 amino acids, titration curve of glycine, peptide bond formation, definition of N-terminal and C-terminal amino acids, basic understanding of primary, secondary, tertiary, quaternary structure of proteins, Ramachandran plot, Elementary idea of protein denaturation and loss of biological activity.

Enzymes: IUB enzyme classification (Overview), Lock and key model and induced fit model apoenzyme, holoenzyme, Mechanism of enzyme action by lowering activation energy, concept of active site, Michaels Mention equation, Effect of temperature, Ph and substrate concentration on enzyme action, enzyme turnover number Specific inhibitors, competitive, non-competitive uncompetitive inhibition (Brief idea).

Carbohydrates: Definition, empirical formula, classification into mono, oligo, and polysaccharides, optical isomerism, mutarotation, structure of biologically important carbohydrates)D-glucose, D-galactose, D-mannose, D-ribose, D-2 deoxyribose), formation of D-maltose D-sucrose, D-lactose, Polysaccharides such as starch, glycogen, cellulose, mucopolysaccharides.

Lipids: Definition, general formula of fatty acids, properties of fatty acids, general structure and function of major lipid sub-classes: triacylglycerol, phosphoglycerides, sphingolipids, waces, sterols, Suitability of triglycerides as storage lipids.

Vitamins & Minerals: Different types of vitamins- water soluble and fat soluble, role of vitamins as coenzyme precursors and enzyme prosthetic group (General treatment), details of

coenzyme function of NAD, & pyridoxal phosphate. Role of inorganic elements like Iron, Copper, Zinc, Manganese, Cobalt, & Selenium

Books Recommended:

1. Albert Lehninger, Principles of Biochemistry
2. lehninger, Nelson, Cox, Principles of Biochemistry
3. Cohn and Stumpf, Outlines of Biochemistry
4. Lubert Stryer, Jeremy M.Berg, John L. Tymoczko, Biochemistry
5. R.K. Murray, D.K. Granner et al, Harper's Biochemistry
6. Voet & Voet, Biochemistry

Ist Year- Paper - IV
STATISTICS FOR BIOLOGISTS

Population and samples, Types of variables, Plotting the data, Probability, Random samples, Binomials, Poisson and normal distributions, Chi-squared tests: goodness-of fit tests and contingency tables, Sampling distributions.
Standard error, Confidence intervals for means, Significancetests on means, Students distribution, Analysis of variance, Fishers Distribution, Simple linear regression, Correlation coefficient, Non parametric tests.

Books Recommended:

Godfrey, Roebuck and Sherlock, Concise Statistics
Mahajan, Methods of Biostatistics

Ist Year PaperIV
MODERN METHODS OF ANALYSIS

Centrifugation Techniques: Introduction, basic principle of sedimentation, basic idea of types of centrifuges, density gradient centrifugation, preparative centrifugation, analyses of subcellular fractions, & applications of analytical centrifugation.

Chromatographic Techniques – I: (a) Introduction to chromatography, General principles, column chromatography-columns, stationary phases. Packing of columns, application of sample, column development, fraction collection and analyses) Partition and adsorption chromatography (Brief idea). (b) Affinity Chromatography, principle, materials-matrix, selection of attachment of ligands, practical procedures, specific and non-specific elution, applications. (c) Ion Exchange Chromatography: Principle, types of exchangers, materials, choice of exchangers and buffers and applications. (d) Gel Filtration: Principle, idea of distribution coefficient, exclusion limit, fractionation range, bed volume, void elution volume, chemical properties of gel and applications.

Chromatographic Techniques-II: (a) Gas Chromatography; Principle of GC system solid support, capillary column, stationary phase, preparation and application of sample, separation conditions, detection systems and applications. (b) HPLC: principle, components of HPLC system, column, column packing, chromatographic solvents, pumping systems, detectors systems and its applications.

Electrophoresis: (a) General principle, factors affecting electrophoreses – voltage, current, resistance, buffer – composition, concentration, Ph. (b) Gel electrophoreses,
Types of gels (starch, agarose, polyacrylamide), Idea of electrophoreses unit, preparation of gel, sample application, running the samples, SDS-PAGE – Principle, apparatus and methods, gradient gels, Two dimensional gels, isoelectric focusing.

Spectroscopy – I: (a) Spectroscopic Techniques, Introduction, Energy levels and transition of electrons, Types of spectra, Beers Lamberts law, molar and extinction coefficient, limitations of Beers Lamberts law. (b) Visible and UV Spectrophotometery, principles, Instrumentation and applications. (c) Spectroflourimetry, Principle, stokes shift, quantum efficiency, instrumentation & applications

Spectroscopy – II: (a) Atomic and Flame spectrophotometry; Principles, Instrumentation & applications for flame emission / atomic absorption spectrophotometry and their comparative study. (b) Mass spectrometry; principles, Instrumentation and applications.

Thermal Analyses: Differential scanning calorimetry and differential analyses – Instrumentation, Thermogravimetry, Methodology of Thermogravimetry, differential scanning calorimetry and differential thermal analyses.

Books Recommended:

1. K. Wilson & K.H. Goulding, A biologists guide to Principles and Techniques of Practical Biochemistry.
2. Willard and Merrit, Instrumental Methods and Analyses
3. Ewing GW Instumental Methods of Chemical analyses.

Ist Year **MICROBIOLOGY LAB**

1. Cleanliness, media preparation, sterilization, culturing mthods, dilution techniques, and isolation of pure cultures – techniques.
2. Staining techniques in microbiology (i) simple staining. (ii) Negative staining. (iii) Positive staining. (iv)Spore staining. (v) Capsule staining and identification.
3. Culture characteristics of microbes, identification of unknown bacteria by biochemical tests.
4. Bacterial growth curve-serial dilution plating and turbidity measurement.
5. Competent cell preparation, replica plating.
6. Extra cellular enzymatic activities of microbes, immobilization of Sacchromyces cerevisiae and alcohol.
7. Standard qualitative analyses of water.

8. Antibiotic sensitivity test, LD50 potency of drugs/antibiotics and biotransformation.

II nd Year Paper-I MOLECULAR BIOLOGY

DNA structure: DNA as genetic material, structure of DNA, DNA, replication, repetitive DNA, Kinetics of DNA renaturation, genetic recompination, genomic evolution.

Genetic organization: Discovery and salient features of genetic code, overlapping genes, organeller genetic code.

Regulation of gene activity: Central dogma, difference in genetic organization of prokaryote and eukaryote, lac operon, trp operon, regulation of bacteriophage life cycle, nucleic acid binding motifs in regulatory proteins.

Mutation: General properties and types of mutation, reverse and suppressor mutations, duplications, deletions, inversions and translocation, transposable elements, DNA damage and repair, inborn errors of metabolism.

Chromosome biology: Molecular organization of chromosomes, polytene chromosome, lampbrush chromosomes, polyploidy, structure of Centromere and telomere.

RNA: RNA synthesis, RNA processing and RNA editing, transcriptional controls, antisense RNA, ribozyme,
Protein: Protein syntheses, post translational modifications, abzyme, hemophilia, sickle cell anemia, thalassemia.

Book Recommended:

1. Alberts et al, Molecular Biology of the Cell
2. Lodish et al, Molecular Cell Biology,

Year – II MOLECULAR BILOLOGY LAB

1. Chromosome preparations from onion root tip and grasshopper testes.
2. Isolation and purification of genomic DNA from bacteria, plant and animal tissues.
3. Isolation and purification of plasmid DNA.
4. Analysis of DNA by agarose and polyacrylamide gel electrophoreses
5. Recovery of DNA from gels.
6. Restriction analyses of DNA and restriction mapping.
7. Isolation, fractionation and purification of protein samples.
8. Analyses and detection of proteins by native and denaturing (SDS) polyacrylamide gel electrophoresis.
9. Spectrophotometric estimation of DNA, RNA and proteins.
10. In sity gel assays for peroxidase, SOD, acid phosphates and LDH.
11. Bacterial transformation (Chemical & Electroporation) and analyses of transformants.

12. PCR based DNA fingerprinting.
13. Isoelectricfocussing (IEF) and 2-D polyacrylamide gel electrophoresis of proteins.
14. DNA sequencing.

Year – II Paper – II
GENETIC ENGINEERING

Basics of Recombinant DNA Technology: Role of genes within cells, genetic elements that control gene expression, restriction and modifying enzymes, safety guidelines of recombinant DNA research.

Methods in Genetic Engineering: Agarose gel electrophoreses, SDS PAGE, Southern blot, Northern blot, Western blot, Protein purification by IMAC method.

Creation of Recombinant Molecules: Restriction mapping, design of linkers and adaptors. Characteristics of plasmid and phage vectors, prokaryotic and eukaryotic expression vectors YAC, BAC

Construction of Libraries: Construction of DNA and genomic libraries. Screening of libraries with DNA probes and with antisera

Polymerase Chain Reaction: Inverse PCR, Nested PCR, RACE PCR, RAPD, Site directed mutagenesis, Real time PCR

Application of Recombinant DNA Technology: Transgenic plants and animals, DNA microarray, DNA vaccine, Gene therapy, PCR based diagnoses

Books Recommended:

1. Old and Primorose- Gene Manipulation
2. Albert's et al, Molecular Biology of the Cell
3. Watson, Recombinant DNA

Year – II Paper – III
IMMUNOLOGY

Introduction to the immune system, antibodies – structure/function, structure and properties of antigens, identification and measurement of antibodies and antigens, biological aspects of antibody-antigen interaction, the genetic bases of antibody diversity, role of lymphocytes in humoral and cell-mediated immunity, major histocompatibility complex, monoclonal antibodies.

Immunology – Introduction & History, Innate and acquired immune system, Components of immune system, Complement, Hypersensitivity, Immunological disorders, Catalytic antibodies, Development of DNA Vaccines.

Book Recommended:

1. Roitt, Essential immunology
2. Jareway et al, Immunology, the immune system in health and disease**.**

Year – II Paper – IV

BT 6007 FOOD SCIENCE & TECHNOLOGY (10Unit)

Properties and function of food, characteristics of natural and processed food, food spoilage and preservation processes, rheology of food products, flavor, aroma and other additives in processed food, fermented foods.

Books Recommended:

1. G.F. Stewart, Introduction to Food Science and Technology
2. R.P. Snigh and D.R. Heldman, Introduction to Food Engineering, Academic Press.

Practical – I

GENETIC ENGINEERING LAB

1. Isolation of RNA
2. Electrophoresis of RNA on denaturing gels.
3. Southern, Northern and dot blotting technique.
4. CDNA synthesis and cloning
5. Sequencing and computer analysis

6.PCR technique and ELISA

Practical – III

IMMUNOLOGY LAB

1. Immunodiffusion
2. Immunoelectrophoresis
3. Western blotting
4. Production of monoclonal antibodies and testing
5. Antogen-Antibody reactions (Widal test, Blood grouping, Rh factor)
6. RBC & WBC count by haemocytometer