

BIOTECH PRACTICALS – (I, II, III)

Distribution of Marks

Min. pass marks: 18	Duration: 3 hours	Max. Marks: 50
	<u>REGULAR</u>	<u>EX-STUDENT</u>
1. Major Exercise	12	12
2. Minor Exercise	10	10
3. Preparation	8	8
4. Spots (5)	10	10
5. Record	5	-
6. Viva-voce	5	10
TOTAL	50	50

BBT 00 : Compulsory paper: Environmental studies

B.Sc. Biotechnology Part II - 2013

TEACHING AND EXAMINATION SCHEME FOR

Paper Name (Theory)	Lec Hrs	Exam hrs	Max Marks
BBT-10 Cell Biology	3	3	50
BBT-11 Molecular Biology	3	3	50
BBT-12 Metabolic pathways	3	3	50
BBT-13 Molecular genetics	3	3	50
BBT-14 Immunology	3	3	50
BBT-15 Environmental Biotechnology	3	3	50
Total of theory papers			300
Paper Name (Practicals)			
BET-16 Cell Biology + Molecular Biology	3	50	
BBT-17 Metabolic pathways + Molecular genetics	3	50	
BBT-18 Immunology + Environmental Biotechnology	3	50	
Total of Practicals		150	
Grand Total (Theory + Practicals)		450	

BBT - 10 Cell Biology (Theory)

Min. pass marks: 18 **Duration: 3 hours** **Max. Marks: 50**

Note: Attempt any five questions, taking at least one question from each unit. Each question carries equal marks.

Unit-1

Cell as a basic unit of living systems. The cell theory. Precellular evolution: artificial creation of cells. Broad classification of cell types, PPOs, bacteria, eukaryotic microbes, plant and animal cells. A detailed classification of cell types and tissue within an organism.

Unit-2

Techniques for cell studies: Light microscopy, electron microscopy, Transport across membranes – active and passive transport, ionic gradient, carrier proteins, Na⁺ K⁺ pump, ATPase, ABC transporters, Ion channels.

Unit-3

Biochemical structure and composition of cells membrane: protein, lipid, carbohydrates. Structure and function of cell organelles: Cytosol, Mitochondria, Golgibodies, endoplasmic reticulum (rough and smooth), and ribosomes.

Unit-4

Structure and function of cell organelles: chloroplast, lysosomes, peroxysomes, nucleus (Nuclear membrane, Nucleoplasm, nucleolus, chromatin). Cytoskeletal structures and components actin, microtubules etc.

Unit-5

Cell division, cell cycle (including cell synchrony and its applications). Cell-cell interaction, cell locomotion (amoeboid, flagellar and ciliary), muscle and nerve cell, cell senescence and death, cell differentiation in plants and animals.

BBT - 11 Molecular Biology (Theory)

Min. pass marks: 18

Duration: 3 hours

Max. Marks: 50

Note: Attempt any five questions, taking at least one question from each unit. Each question carries equal marks.

Unit-1

Molecular basis of life, Euchromatin and Heterochromatin, Molecular details of chromatin – Nucleosome concept, different levels of folding of DNA Nucleic acids (DNA & RNA): structure and function.

Unit-2

DNA damage and repair with mechanism, Prokaryotic & Eukaryotic DNA Replication, molecular mechanism of DNA recombination (Holiday model, Britten Davidson Model).

Unit-3

Gene Expression: transcription (mechanism in prokaryotes & eukaryotes, Post transcriptional processing: capping, tail formation and RNA splicing.

Unit-4

Gene expression – Translation (mechanism in prokaryotes and eukaryotes), Post translational modifications, chaperones and their role in protein folding, Protein degradation, Intra cellular protein sorting and localization.

Unit-5

Gene regulation – Mechanism of gene regulation in prokaryotes (Lac , His, Trp, Catabolic repression) and Eukaryotes (transcriptional factors, alternative splicing, RNA editing and RNA – interference). Cell signalling.

BBT - 12 Metabolic pathways (Theory)

Min. pass marks: 18

Duration: 3 hours

Max. Marks: 50

Note: Attempt any five questions, taking at least one question from each unit. Each question carries equal marks.

Unit-1

Definition of metabolism (catabolism and anabolism); prokaryotic metabolism; metabolic growth curves, Energy rich compound.

Unit-2

Microbial growth kinetics Analysis of microbial growth, measurement of microbial growth. Growth curve.

Unit-3

Carbohydrate Metabolism – Glycolysis, Kreb's cycle, oxidative phosphorylation, fermentation, microbes involved in various types of fermentations, General idea about Fermentores. Commercial and Industrial uses of fermentation. Entner– Duodorff pathway, Gluconeogenesis and Aerobic, Anaerobic respiration.

Unit-4

Protein Metabolism – Synthesis of amino acids Deamination and transamination, decarboxylation and entry of amino acids into TCA (Krebs) cycle, Urea cycle. De- novo pathways for the synthesis of purine and pyrimidine nucleotides.

Unit-5

Lipid metabolism – Biosynthesis of fatty acids, Glycerol. Break down of fatty acids (alpha and beta oxidation). Glyoxylate cycle.

BBT - 13 Molecular Genetics (Theory)

Min. pass marks: 18

Duration: 3 hours

Max. Marks: 50

Note: Attempt any five questions by taking at least one question from each unit. Each question carries equal marks.

Unit-1

The structure of DNA, DNA replication and repair, protein synthesis, regulation of gene expression mutation, bacterial genetic map, Mendel's law of inheritance; genetic notation, transfer of genetic material in prokaryotes.

Unit-2

Sex determination, sex linked inheritance, cytoplasmic inheritance, linkage, crossing over, pleiotropy (multiple alleles), Hardy Weinberg law (population genetics).

Unit-3

Transformation: competence, mechanism of transformation, transfection; conjugation: Role of surface properties in conjugation, the F. factor: the conjugal transfer process; barriers to conjugation; high frequency combination (HFR) strains.

Unit-4

The order of chromosomes transfer; formation of F primes; transduction: generalized transduction; abortive transduction, specialized transduction (LFT lysates and HFT lysates). Genetic recombination- mechanism of recombination; general recombination (Holiday model).

Unit-5

Gene conversion; site specific recombination; transposable elements- classes of transposable elements, nomenclature of transposable elements, element insertion sequences (IS element), mechanism of transposition and genetic transposition.

BBT - 14 Immunology (Theory)

Min. pass marks: 18

Duration: 3 hours

Max. Marks: 50

Note: Attempt any five questions, taking at least one question from each unit. Each question carries equal marks.

Unit-1

Introduction to immunology. Innate and acquired immunity. Immune response- beneficial, harmful and suppressive.

The organ and cells of the immune system. Lymphoid organs – thymus, Bone marrow bursa of fabricus, Lymph nodes, spleen; cell of immune system- Lymphoblast and lymphocytes (T cells and B cells), plasma blast and plasma cells; Accessory cells – Macrophages, Cancer cells.

Unit-2

Immunoglobulin: basic structure, domain and variants. Classes and subclasses; Biosynthesis of antibodies – Directive theory and selective theory. Monoclonal antibody.

Immunogen: Chemical nature of immunogens, Immune response genes, Major

Histocompatibility system; Difference between any two individuals, major histocompatibility complex; HLA complex.

Unit-3

Complement: Component of proteins; Complements of activation; Classical and alternative pathway. Biology of complement. Complement of deficiency-inherited and acquired; Genetics of Complement; Homology of complement proteins.

Antigen and antibody interaction in *vivo* and *in vitro*. Structure and function of antibodies. Classes and subclasses, gross and fine structure, Antibody mediated effector function.

Unit-4

Immune response: Phylogeny and ontogeny of immune response, cell of immune system and preliminary idea about their differentiation.

Antagonism by indigenous flora- bacterial substances, antiviral substances, Phagocytosis; Mechanism of action of antibodies; live vaccine, HIV.

Unit-5

Hypersensitivity: Classification- immediate, delayed reaction. Cause and control of energy. Mechanism of type I, II, III, IV, V reaction.

Immunological tolerance: Mechanism of development of immunological tolerance; Termination of tolerance; Immunological enhancement.

BBT - 15 Environmental Biotechnology (Theory)

Min. pass marks: 18

Duration: 3 hours

Max. Marks: 50

Note: Attempt any five questions, taking at least one question from each unit. Each question carries equal marks.

Unit-1

Renewable and non-renewable resources. Major consumer items; Food fuel and fibers. Conventional fuel and their environmental impacts; fire wood plant and animal wastes; coal; gas; animal oils, Energy efficient fuels.

Unit-2

Modern fuel and their environmental impacts. Methanogenic bacteria and biogas. Microbial hydrogen production, conversion of sugar to ethanol the gasohol experiment. Mixture of petrol and alcohol

Unit-3

Solar energy converters- hopes from the photosynthetic pigments plan based petroleum industry, cellulose degradation for combustible fuel. Biotechnological inputs in producing good quality natural fibers. Transgenic animals (e.g.sheep) and transgenic plants.

Unit-4

Treatment of municipal waste and industrial effluents. Degradation of pesticides and other toxic chemicals by microorganisms, Natural pesticides – Neem and Thuringiensis.

Unit-5

Biological control of other insects swarming the agriculture fields. Enrichment of ores by microorganisms (biomining). Biofertilizers, nitrogen-fixing microorganisms enriching the soil with assimilable nitrogen compounds.

Practical

BBT - 16 Cell Biology + Molecular Biology

Measurement with the help of light microscope.
Calibration of ocular micrometer.
Measurement of cell size.
Measurement of chromosome length.
Cell counting with haemocytometer and other aids.
Draw cell shape using Camera Lucida.
Separation of cell types from blood and explants by maceration.
Study of chromosomal aberrations.
Isolation of chromosomal and plasmid DNA from bacteria.
Cytoplasmic preparation.
Paper chromatography.
Thin-layered chromatography.
Separation of cell organelles by sucrose gradient.
Preparation and study of various stages of mitosis and meiosis.
Preparation and study of bone marrow mitosis.
Colorimetric estimation of DNA.
Determination base composition of DNA.
Obtaining absorption spectra of the oxidized and reduced form of a molecular species (NAD and NADH).
Estimation of RNA by orcinol method.
Extraction and estimation of phenol based secondary metabolites.

Practical

BBT - 17 Metabolic pathways + Molecular genetics

Sucrose density gradient centrifugation.
Testing of blood groups (A, A, B, B and O) and Rh factor (Rh^T & Rh^-).
Separation of Amino acid using TLC.
Determination of enzyme activity.
Quantitative test for lipids.
Determination of iodine number and acid value of lipids.
Chlorophyll estimation of the given samples.
Isolation and estimation of genomic DNA from E.coli.
Study of common mutants.
Leukocyte cultures.
Genetics of Red Blood Cells antigen in man.
Serum protein polymorphism.
Conjugation in bacteria.
Effect of radiation and chemical mutagen on chromosome in mice.
Separation of Amino acids by SDS –Page Electrophoresis.

Practical

BBT - 18 Immunology + Environmental Biotechnology

Study of different types of cells participating in specific and non-specific immunity.

Immunological diagnosis of pregnancy / infection / cancer.

Immobilization of an enzyme.

Isolation of plasmids.

Alpha amylase production.

Determination of LD 50 values of pesticides / weedicides.

Leaf area damage by air pollutants.

Measurement of stomatal index.

Measurement of trichomes frequency.

Loss of viability of pollen grains by differential staining.

Degradation of an aromatic hydrocarbon by bacteria.

Study of solar equipments : solar chulha, Lanterns, solar heaters etc.