Syllabus and Course Scheme
Academic year 2016-17

B.Sc.- Biotechnology
Exam.-2017

UNIVERSITY OF KOTA
MBS Marg, Swami Vivekanand Nagar,
Kota - 324 005, Rajasthan, India
Website: uok.ac.in

B.Sc. Biotechnology- 2017

Eligibility: 10+2 Science Biology/ Agriculture

Selection: Common Entrance Test to be conducted by University of Kota

Scheme of Examination And Course of Study

The number of paper and maximum marks of each paper together with the minimum marks required for a pass are shown against each paper separately. It will be necessary for a candidate to pass in the theory paper as well as in practicals separately.

First Division	60%	of the maximum marks prescribed at part I, II & III
Second Division	48%	Examinations, taken together.

Rest of the candidates shall be declared to have passed the examination, if they obtain the minimum pass marks in each paper viz 36% No division shall be awarded at Part I and Part II Examination.

A candidate may be allowed to appear at the Supplementary examination upto a maximum of two theory papers, provided that he has passed in all the practical examinations.

A candidate may be allowed grace marks in two theory papers upto the extent of 1% of the total marks prescribed for that examination.

TEACHING AND EXAMINATION SCHEME FOR

B.Sc. Biotechnology Part I - 2017

Compulsory paper	**Lec** Hrs/week	**Exam** hrs	**Max** Marks
BBT-00 Environmental studies	3	3	50
Core paper (Theory)			
BBT-01 Basic Bioscience	3	3	50
BBT-02 Mathematics and Biostatistics	3	3	50
BBT-03 Fundamentals of Chemistry and Biochemistry	3	3	50
BBT-04 Fundamentals of Physics and Computer	3	3	50
BBT-05 Biophysics and Instrumentation	3	3	50
BBT-06 Microbiology	3	3	50
Total of theory papers			**300**
Core paper (Practicals)			
BBT-07 Basic Bioscience + Mathematics And Biostatistics		3	50
BBT-08 Chemistry and Biochemistry + Physics and Computers		3	50
BBT-09 Biophysics and Instrumentation + Microbiology		3	50
Total of Practical papers			**150**
Grand Total (Theory + Practical)			**450**

The marks secured in the compulsory paper of Environmental studies shall not be counted in awarding the division to a candidate.

Maximum of three chances will be given to a candidate to pass compulsory paper.
Non appearance or absence in the examination of compulsory paper will be counted a chance.
A candidate shall be eligible to appear in supplementary examination in maximum of two Core theory papers as per University Rules.

One percent of the maximum marks may be awarded as Grace marks to the candidate in accordance to the University Rules as applicable to all other Under Graduate examinations. Minimum requirement of lectures completing each core theory and compulsory paper shall be 78 hours, and for each practical 156 hours.

BIOTECH PRACTICALS – (I, II, III)

Distribution of Marks

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

	REGULAR	**EX-STUDENT**
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

BBT - 01 Basic Bioscience (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

Biodiversity of plant kingdom. The classification up to the level of order. Binomial nomenclature. Algae (*Volvox, Oscillatoria*, Fungi (*Albugo/Puccinia*), Bryophytes (*Riccia*), Pteridophytes (*Lycopodium*), Gymnosperm (*Cycas*) and Angiosperm – monocot (Wheat), dicot (Sunflower)

Unit-2

Anatomy-Internal structure of stem, leaf and root of Angiosperm and Gymnosperm. Differences in Angiosperm and Gymnosperm. Differences in dicot and monocot, Structure and function of different cells (parenchyma, collenchyma, sclerenchyma) Xylem and phloem. The concept of annual and perennials. Annual ring and wood formation.

Unit-3

Morphology of seed plants, General organization of plant body such as aerial and under ground parts. Inflorescence. Flower and function of each part of flower. Fruit – Types of fruits, formation of fruits, parthenocarpy. Seed - Formation of seed, seed germination and dormancy.

Unit-4

Biodiversity of animals, Classification and taxonomy of animals, Binomial nomenclature –Five kingdom approach. Taxonomy hierarchy, Concept of species.

Study of animal types: Paramecium, Hydra and Earthworm – Classified, morphology, nutrition, respiration, reproduction. Elementary idea of Vermiculture, Sericulture, Apiculture and Pearl industry.

Unit-5

Human anatomy, physiology of following organ system- digestive, respiratory, circulatory, nervous and sense organ. Developmental history (from fertilization to blastocyst stage).

BBT - 02 Mathematics and Biostatistics (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

Sets: theory, properties of sets. Complex number, Metrics.

Calculus: Integration: general introduction, significance and application for simple algebraic and trigonometric function. Extension of differential equations including homogenous and linear ODE's.

Convergence of series, Taylor's theorem, partial differentiation and local exterma of function of two variables.

Unit-2

Linear algebra: Linear system of equations, row reduction algorithm, linear dependence of vectors and subspace of Euclidean n- space, eigen values and eigen vectors, diadonalisation of matrices, application to population growth models and mechanical systems.

Unit-3

Introduction to biostatistics and its scope. Sampling techniques. Collection of data, Frequency distribution, tabulation, graphical representation of data by histogram, frequency polygon curve and cumulative frequency curve.

Measure of central tendency – mean, median, mode.

Unit-4

Measure of dispersion, Mean deviation, Standard deviation and standard error, variance.

Analysis of variance.

Descriptive statistics scatter plots, correlation, line of best fit.

Unit-5

Probability: Concept, calculation and theories.

Regression analysis, multiple linear regressions.

Confidence intervals and hypothesis, tests using normal t-tests.

BBT - 03 Fundamentals of Chemistry and Biochemistry (Theory)

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

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

Unit-1

Gaseous State: Kinetic theory of gases and derivation of kinetic gas equation. principles of oxidation- reduction, EMF and its measurement, single electrode potential, calculation of single electrode potential, thermodynamics of electro-potentials, classification of electrodes, amalgam, gas, metal/insoluble salts and oxidation- reduction electrodes, electrochemical cells.

Unit-2

Atomic chemistry

Bonding and structure: types of bonds (Ionic, Covalent, Coordinate). Bonding theories. Structure of inorganic and organic molecules, bonding and reactivity in organic molecules,

Reaction Mechanism: Nucleophilic substitution catalysis in chemical and biological reactions

Organic Chemistry: Structure, bonding and reactivity in organic molecules, alcohol and Phenols, Aldehydes and Ketones and Acids.

Esters, acid and base catalyzed hydrolysis, mechanism and action of serine hydrolases.

Unit-3

Introduction: Biological molecules, Molecular interactions as a basis for biological functions. Chiral interactions, pH, pK. Buffer and colloids.

Carbohydrates: Definition, Classification, Structure of simple and complex carbohydrates.

Polysaccharides: Structure and linking in di- and Polysaccharides, Energy reserve and structural Polysaccharide.

Unit-4

Lipid: Structure of fatty acids (Palmitic acid, Stearic acid), lipids, oils and fats.

Vitamins fat and water-soluble.

Structure and properties of amino acids, their nature, peptide bond.

Determination of primary and secondary structure of proteins. The nature of tertiary and quaternary structure, methods of determining protein structure.

Unit-5

Protein purification: Principle functions; precipitation with salts and organic solvents, Chromatographic and electro-phoretic methods.

Nucleotides, nucleosides, purines, pyrimidines, structure of nucleic acids, B and Z form of DNA.

Enzymes and their role in metabolism, Anabolism and catabolism, Enzymes as catalysts, types of enzymes and their classification.

BBT - 04 Fundamentals of Physics and Computers (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

Elasticity: Stress and strain in solids. Hook's law, stress- strain curve, Properties of fluids, Viscosity: Streamline and turbulent flow, equation of continuity, flow of liquids through capillaries, Poiseulies equation, Reynolds number, Concept of pressure energy, Bernoulli's theorem and its applications, Venturi meter, Pilot's tube. Viscosity estimation by Oswald's viscometer, rotating cylinder, cone and plate.

Unit-2

Surface tension: Surface tension surface energy, capillary action, angle of contact, relation between surface tension, excess pressure and curvature, Surface tension by Soap bubble jaeger's method, Quincke's method. Temperature dependence of surface tension.

Refrigeration: Introduction to refrigeration principles, coefficient of performance, simple structure of gas refrigerator. The molecule organization of membranes and the role of lipids and carbohydrates. The importance of membrane in metabolism.

Unit-3

Spectral Identification: Quantitative and qualitative analysis.

Thermometry: Principles of thermometry, platinum resistant thermometer, thermocouple thermometers. Atomic structure: Bohr's II atom model, atomic nucleus.

Current electricity: DC circuits, concept to circuits AC. Resister, Capacitor.

Optics, Diffraction, Polarization, Interference, Lasers, Semiconductors, Semiconductor devices, Digital electronics.

Binary BCD number system, basic logic gates, fundamentals of measurement units.

Unit-4

Introduction to computer: Use of computers in modern society e.g. weather forecasting, censure oil exploration, speech recognition, banking, publishing, accounting, research etc.

Information concepts and processing – evaluation of information processing-data, information, languages and communication, computer arithmetic operations.

Multi-user, multitasking, multiprocessing and real time operating systems.

Unit-5

Computer networking, modern components of LAN and WAN.

Development and classification of computer, Advances, Spreadsheets.

Algorithms: Definition and properties, Flowcharts, principle-converting algorithm to flowcharting. Key Boards, storage devices, monitor interfacing, bus architecture and its effects on system performance. Use of basic programming in biology.

BBT - 05 Biophysics and Instrumentation (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

Bioenergetics: Energy and its various forms, principle of Thermodynamics, energy exchange, conservation of energy.

Photobiology: Nature of light, Primary photochemical reactions, Photosynthesis, flowering, Solarization, Photo dynamism, Strategies in light reception, Photoreceptor in microbes. Plants and animals.

Unit-2

Biophysics of vision, vision fault and correlations, Bioluminance.

Biophysics of sound vibration, Phono-receptor, Auditory function, Location and origin of sound, Hearing aids.

Membrane conductivity, Diffusion, Active transport, Osmosis, Diffusion pressure, deficit, Biosorption, Electrical properties of biological compartments, Electrochemical gradients, membrane potentials.

Unit-3

Molecular interaction: Intra- molecular and Inter- molecular interaction, Attractive and repulsive forces operating within molecules and their overall effects on molecular interactions.

Radiations and their interaction with matter, Electromagnetic radiation, Ultraviolet and visible spectroscopy, Raman spectra, Nuclear magnetic Resonance, Electrophoresis, Radioactive tracer techniques, Autoradiography.

Unit-4

Instruments, basic principle and usage: colorimeter, spectrophotometry, Centrifuges, Analytical and differential pH meters, GM counter.

Microscopy: Compound microscope, Phase contrast, Dark field, Fluorescent and Electron microscopy

Unit-5

Elucidation of intact biological structures in living organisms: Ultrasound. Optical filters, X-ray, X-ray diffraction, Computerized Axial Tomography, Electrocardiography, Electro-encephalography.

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BBT - 06 Microbiology (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, History of microbiology (including prokaryotes).
Origin and evolution of microorganism.
Classification and distribution of microorganisms.

Unit-2

Structure, growth, nutrition, metabolism, physiology, genetics of viruses, mycoplasma, bacteria, fungi, protozoa and lichens.
Microbiology of soil and geo-chemical cycles.
Microbiology of air.

Unit-3

Microbiology of water.
Microbiology of food.
Microbiology of dairy and dairy products.
Industrial microbiology.

Unit-4

Plant pathogenic microbes, disease causes and control.
Human pathogenic microbes, disease causes and control.
Host parasite relationships.

Unit-5

Microbial economics.
Method of sterilization and disinfection.
Preparation and inoculation of culture media.
Microbial staining techniques.

PRACTICAL

BBT - 07: Basic bioscience + mathematics and biostatistics

Study of examples of each type: Algae, Fungi, Bryophytes, Pteridophytes, Angiosperm, and Gymnosperm.
Study of different parts of the plant: morphology and anatomy of root, stem and leaves, flower, Inflorescence. Fruit and seed types.
Study of Paramecium: W.M., Binary fission, conjugation
Hydra: W.M., LS and TS.
Earthworm ovary, Nervous system and Spermatheca, Sectional slides.
Drosophila characters, sexual dimorphism, eye and wing mutation.
Insect collection, preservation and presentation.

Microscopic slides of VS skin, oesophagus, stomach, liver, pancreas, lung, kidney, testis, ovary, spinal cord, endocrine gland and blastocyst of mammals.
Permanent slides of vegetative and reproductive organs of plant types in theory.
Exercise based on mathematics and biostatistics.
Exercise based on frequency distribution and graphic representation.
Exercise based on Chi- square test. Staining techniques.

PRACTICAL

BBT - 08: Chemistry and Biochemistry + Physics and Computer

Preparation of solution and buffer.
Acid- base titration, molarity, molality, normality, sensitivity, specific accuracy.
Unit volume and weight measurement
Spot test for carbohydrates.
Spot test for amino acids.
Spot test for soil.
Reducing sugar estimation by Benedict's method and using Fehling's solutions.
Quantitative estimation of amino acid.
Protein estimation.
Saponification of fats.
Estimation of cholesterol.
Enzyme assays.
Viscosity measurements using thermocouple, RTD.
Absorption spectrum of proteins.
Iso-electric point of amino acids.
Counting statistics using GM counter.
Flat spiral spring: Y and n.
Y of a rectangular thin bar by bending.
Computer: Working and operating knowledge.
Installing a computer: Using spread sheets.
Use of Internet, e-mail, websites.
Use of standard packages.
Use of multimedia.

Practical

BBT - 09: Biophysics and Instrumentation + Microbiology

Absorption
Adsorption
Osmosis: Potato osmoscope
Transport across membrane
Study of DNA melting
Sterilization technique
Preparation of culture media.
Cultivation and enrichment of microorganisms.
Identification of microorganisms.
Biochemical testing
Quantitation of microorganisms.
Transpiration: Ganong's potometer, four leaf method.
Photosynthesis: Demonstration of Oxygen evolution.
Light/Carbon dioxide necessary for photosynthesis.
Detection of coliform for demonstration of purity of water.

Principles and application of instruments:
PH meters (digital).
Light and phase contrast microscope.
Colorimeter.
Spectrophotometer (Visible and UV).
Sound level meter.
Audiometer.
GM counter and Scintillation counter
Incubator
Shaker
Laminar flow bench
Hearing aids

B.Sc. Biotechnology Part II Exam - 2017

TEACHING AND EXAMINATION SCHEME FOR B.SC. BIOTECHNOLOGY PART II

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, PPLOs, 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, career proteins, Na+ Ka+ pump, ATPase, ABC transportors, 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.

Unit-4

Gene expression – Translation (mechanism in prokaryotes and eukaryotes), 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, Catabolic repression) and Eukaryotes (transcriptional factors. RNA editing and RNA – interference).

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, Mendel's law of inheritance; transfer of genetic material in prokaryotes.

Unit-2

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

Unit-3

Transformation: competence, mechanism of transformation, conjugation: Role of surface properties in conjugation, the conjugal transfer process; high frequency re-combination (HFR) strains.

Unit-4

The order of chromosomes transfer; transduction: generalized transduction; aborative transduction, specialized transduction (LFT lysates and HFT lysates).

Genetic recombination- mechanism of recombination; general recombination (Holidaymodel).

Unit-5

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*. Antibody mediated effector function like opsonization ADCC.

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 occular 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.

B.Sc. Biotechnology Part III Exam.- 2017

TEACHING AND EXAMINATION SCHEME B. SC. BIOTECHNOLOGY PART III

Paper Name (Theory)	**Lecture** Hrs/week	**Exam** hrs	**Max** Marks
BBT-19 Plant and Animal tissue culture	3	3	50
BBT-20 Trends in Biotechnology I	3	3	50
BBT-21 Trends in Biotechnology II	3	3	50
BBT-22 Genetic Engineering and r DNA Technology	3	3	50
BBT-23 Biotechnology of crop improvement	3	3	50
BBT-24 Industrial Biotechnology	3	3	50
Total of theory papers			**300**
Paper Name (Practicals)			
BET-25 Plant and Animal tissue culture + Trends in Biotechnology I		3	50
BBT-26 Trends in Biotechnology II + Genetic Engineering and r DNA Technology		3	50
BBT-27 Biotechnology of crop improvement + Industrial Biotechnology		3	50
Total of Practicals			**150**
Grand Total (Theory + Practicals)			**450**

BBT - 19 Plant and Animal tissue culture (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-I

Tissue culture laboratory organization. Concept of totipotency, Cyto-differentiation and its importance.Culture media and stock solutions. Principle and protocol and importance of organ culture, Callus culture, Cell suspension culture.

Unit-II

Embryo culture. Anther culture. Plant protoplast culture. Protoplast fusion. Somaclonal and Gametoclonal variable selection. Micro propagation: Clonal propagation. Plant improvement and plant tissue culture. Preservation of plant genetic resources.

Unit-III

Transgenic plants and Gene transfer methods..Selection of transformed cells. Marker and reporter genes in screening methods. RFLP, RAPD and other molecular markers.

Unit-IV

Tissue culture laboratory organization. Animal tissue culture media. Commonly used cell lines-their origin and characteristics. Anchorage dependence and non- anchorage dependent cell growth. Growth kinetics of animal cells in cultures. Primary cultures. Secondary cultures. Transformed animal cells- established continuous cell lines.

Unit-V

Plant secondary metabolites and their production. Hairy root culture for production of useful metabolites Applications of plants biotechnology in breeding and crop improvement. Application of animal cells cultures for studies of gene expression.

BBT - 20 Trends in Biotechnology – I (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- I

Techniques in molecular biology. Gene synthesis. Gene sequencing. Northern, southern and western blotting. Hybridization. Site directed mutagenesis.
Molecular probes and their applications. Basic principles of protein engineering and its application.

Unit- II

Immobilization of enzymes: Introduction, Methods, Analytical, medical and industrial application. Brief idea about Abzymes, Ribozymes and Synzymes.
Monoclonal antibodies and their applications.

Unit- III

Bioreactors: Single, batch and continuous. Loop and fluidized bed reactors.
Biopesticides: Microbial, algal, fungal, bacterial, higher plants and animal based biopesticides with an emphasis on BT toxin. Biopolymers (beta hydroxy butyrate). Biopolysaccharide (Xanthium gum)
Immunity to infection of disease: vaccines (attenuated and recombinant) and vaccination

Unit- IV

Immunological techniques: ELISA, RIA. Autoimmune diseases: Rheumatoid arthritis, IDS, Hashimoto's thyroidities. Basic concept of single cell protein.

Unit- V

Drug designing, Gene therapy. Enzyme in food processing: amylase, protease, and resins. Organic acid: Citric, Lactic acid.

BBT - 21 Trends in Biotechnology - II (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- I

Restriction mapping
Molecular marker: RAPD, RFLP, AFLP, SNP. Use of Biotechnology in forensic science. DNA finger printing. Chloroplast engineering. Mitochondria engineering.

Unit- II

Human genome project: History and salient features. Arabidopsis as a model plant for genetic engineering. Stem cells: Current status.

Unit- III

Recombinant vaccines: Malaria, AIDS, Fertility regulation. Antisense RNA technology.
Gene tagging, Cassette vectors. Biology of aging. Biology of oncogenes and other retrovirus.

Unit- IV

Proteomics and metabolomics. Prions.
Terminator seed technology. Seed storage proteins. Therapeutic proteins. Petro plants.

Unit- V

Genetically modified food, Hazards of genetically modified food. Molecular biology of genetic disorders. Sickle cell anaemia, Down syndrome, Thalasemia, Huntington's disease. Biosensors. DNA Chips.

BBT - 22 Genetic Engineering and DNA Technology (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- I

Introduction and historical background of genetic engineering. Isolation and purification of DNA from bacterial, plant and animal cells.
Vectors: Plasmids, Cosmids and Phages.

Unit- II

Restriction enzymes: Ligases, SL nucleases, DNA polymerase. Reverse transcriptase.
C-DNA synthesis and cloning: m-DNA enrichment reverse transcription, primers.

Unit- III

Linkers, Adaptors, Blunt and Ligation. Homopolymer tailing. C-DNA library construction and screening.
Cloning and expression gene of foreign genes in prokaryotes (E.coli).

Unit- IV

Cloning and expression gene of foreign genes in eukaryotes (Yeast).
Brief idea about gene cloning in plant and mammalian cells.

Unit- V

Solid phase automated synthesis of DNA. Application of transposons in gene tagging. Application of bio informatics in search for DNA homology. Patents and Biosafety guidelines.

BBT -23 Biotechnology of crop improvement (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- I

The green revolution. Basic problem in development of useful crop varieties. Gene transfer through hybridization. Methods for crop improvement- cell fusion, somatic hybridization, and Engineering techniques. Gene for disease resistance.

Unit- II

Application of tissue culture in increasing salt tolerance.
Crop improvement- Tea, Coffee, and Cardamom, pepper, ginger.
Plantation crop- Cashew, tuber. - Sweet Potato, Cassava, Colocassia, Banana, Mango, Citrus, Sugarcane, Rice.

Unit- III

Application of plant tissue culture in forestry for fuel wood, forage, timber and pulp wood improvement.
Biotechnology for Nitrogen fixation & plant productivity- Diazotropic microorganisms. Biological nitrogen fixation, Asymbiotic nitrogen fixation, Symbiotic nitrogen fixation. Nitrogen converters in soil.

Unit - IV

Regulation of nitrogen fixation genes.
Enzymes and agro-biotechnology: properties of enzymes, occurrence of enzymes, mechanism of enzyme action. Nutrient media for enzyme production. Application of enzyme action in agro-biotechnology.

Unit- V

Agro-industrial biotechnology. Fermentation technology for the production of alcoholic beverages- wine, beer, whisky, organic acids, glycerol, vitamins.
Vermitechnology- Vermiculture, Vermicomposting & Vermiwash- production & benefits.

BBT - 24 Industrial Biotechnology (Theory)

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

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

Unit- I

Microbiology and biochemistry of waste water treatment. Bioreactor for wastewater treatment: Anaerobic and aerobic. Removal of specific pollutants: Nitrogen, phosphorus, oil and grease, Heavy metals.

Unit- II

Bioenergy production from waste – Methane, alcohol, petroleum and biodiesel. Biotechnology for pesticide industry. Tannery industry and biotechnology. Paper industry and biotechnology.

Unit- III

Antibiotic penicillin production from microbes. Biotechniques for air pollution abatement and odour control: Deodourisation, bioscrubber, biobeds, biotrickling filters.

Unit- IV

Biotechnology for waste treatment of food and allied industry. SCP and biomass from waste. Waste water treatment using aquatic plants. Role of Trichoderma in municipal waste composting.

Unit - V

Mushroom cultivation on agro-wastes. Root zone technology for water pollution abatement. Aiming for biodegradable and eco-friendly products. Biodegradable plastics (Bioplastics).

PRACTICAL

BBT - 25 Plant and Animal tissue culture + Trends in Biotechnology

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

Sterilization techniques for non-living, plant and animal material. Tissue culture media preparation: MS/White/Gamborg/Schenk & Hildbrandt media.
Slant preparation.
Excission of embryo / ovule / Anther and their inoculation. Preparation of aseptic plant and animals. Aseptic techniques.
Inoculation of culture. Root culture. Leaf culture. Shoot tip and meristem culture. Flower bud and flower culture. Isolated ovary culture. Callus induction and regeneration. Suspension culture.
Mechanical isolation of protoplast. Enzymatic isolation of protoplast and culture. Role of macronutrients: Nitrogen, amino acids, sulphur, phosphorus, potassium, magnesium, calcium and sodium in culture media.

PRACTICAL

BBT - 26 Trends in Biotechnology II + Genetic Engineering & rDNA Technology

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

Protoplast fusion. Anther culture and Haploid production. Protein separation by electrophoresis.

Isolation of DNA from:

(a) Bacteria (genomic)
(b) Bacteria (Plasmid)
(c) Virus
(d) Plants

Digestion of DNA with restriction enzymes. Agro bacterium mediated transformation. Fragmentation of DNA by mechanical shearing. Isolation of DNA by shot- gun method. Insertion of gene into appropriate vector. Engineering of the plasmids. Transferring genes into mammalian cells by microinjection.

PRACTICAL

BBT - 27 Biotechnology of crop improvement + Industrial Biotechnology

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

Isolation of agriculturally useful mutants. Production of Pathogen free plants. Isolation of secondary metabolites from tissue culture:

a) Alkaloids
b) Phenolics

Use of haploid cultures in pharmacotoxicology. Isolation of hepatocytes.
Production of Monoclonal antibodies. Hairy root transformation. Polyacrylamide gel electrophoresis.
Tropane alkaloid production from tissue culture.
Production of transgenic crops for disease resistance.
Genetically modified crop plants production & their usefulness.