Objectives and Outcomes: Bachelor of Science (B.Sc.)

Objectives	**Outcomes**
To produce graduates who will be able to work both on cross-disciplinary teams and function independently as specialists in a science field.	Graduates can able to work both on cross-disciplinary teams and function independently as specialists in a science field.
To produce graduates who can effectively apply the scientific method.	Graduates can able to analyze a problem, and identify and define the requirements appropriate to its solution
To prepare the graduates for entering a career in a chosen field.	Graduates can able to choose their carrier field and acquainted with potential entry-level work in chosen area.
To develop communication skills to effectively promote their ideas, goals or products	Graduates can have good communication skill.

Programme Specific Objectives and Outcomes: B.Sc. Biotechnology

Objectives	**Outcomes**
To provide an intensive and in depth learning to the students in field of Biotechnology.	Students can learn and acquire the knowledge of biotechnology
Beyond simulating, learning, understanding the techniques, the course also addresses the underlying recurring problems of disciplines in today scientific and changing world.	Students can able to solve the problems of society through their research mind. They can be able to address the problems in biotechnology discipline.
To develop awareness & knowledge of different organization requirement and subject knowledge through varied branches and research methodology in students.	Student can able to work with Scientific Research Organizations
To train the students to take up wide variety of roles like researchers, scientists, consultants, entrepreneurs, academicians, industry leaders and policy.	The successful students will be able to establish research organizations with the help of Agriculture, environment protection and also their own industry for Biofertilizer, microbial by products, Clinical pathology, transgenic plant and animals, vaccines, antibiotics etc.

Course Objectives and Outcomes:

B.Sc. I (Theory) Semester – I (w.e.f. 2019-20)

Course Name: English (communication skill) **Course Code:** BT101	
Objectives	**Outcomes**
To introduce to the students various forms of communication.	Through various forms of communication students communicate with each other easily
To make the teaching of English more practical and student centric.	Students learned the various types of the poems.
To introduce to the students poems from across the globe.	Students understood with different forms of prose.
To acquaint the students with different language skills.	Students learned different language skills.

To introduce to the students various forms of communication.	Through various forms of communication students communicate with each other easily

Course Name: Biochemistry **Course Code:** BT102	
Objectives	**Outcomes**
To understand the structure, properties and roles of biomolecules.	Students can identify structures of biomolecules, they can define the properties of bimolecule. They are also able to give the roles of biomolecules.
To study the basics concepts in enzymology.	Students can understand the structure, function, mechanism of enzyme. They can able to classify the enzyme.
To understand the vitamin types, structure and role in living system.	Students are able to distinguish water soluble and fat soluble vitamins. They can also understand the physiological role of vitamins and deficiency disorder.

Course Name: Metabolism **Course Code:** BT103	
Objectives	**Outcomes**
To understand the metabolic process of living system	Students can understand metabolic reactions of biomolecules, their energetic and significance.
To understand the concept of oxidative phosphorylation.	Students are able to understand the ATP synthesis mechanism in living cell.
To study the hormonal regulation of metabolic reactions.	Students can get knowledge of Metabolic regulation by means of hormones.

Course Name: Cell Biology Paper-I **Course Code:** BT104	
Objectives	**Outcomes**
To understand the structure of cell.	Students can able to identify prokaryotic and eukaryotic cell structure.
To study the structure and permeability of membrane.	Students can get knowledge of membrane composition, its structure and permeability properties of membrane.
To study the structure and function of endoplasmic reticulum, Golgi body and lysosomes.	Students can understand the structure and function of endoplasmic reticulum, Golgi body and lysosomes.

Course Name: Cell Biology Paper-II **Course Code:** BT105	
Objectives	**Outcomes**
To study the structure and function of cell organelles like nucleus, mitochondria, chloroplast and ribosomes.	Students can understand the structure and function of cell organelles like nucleus, mitochondria, chloroplast and ribosomes.
To understand the concept of cell growth.	Students can understand the events of cell cycle, process of cell differentiation, synchronous growth and apoptosis concept.
To study the composition and role of extra cellular matrix.	Students can get knowledge of composition and role of extra cellular matrix.

To study the concept of carcinogenicity.	Students can get knowledge of carcinogen, molecular basis of cancer development.

Course Name: Developmental Biology Paper-I **Course Code:** BT106	
Objectives	**Outcomes**
To understand the process of gametogenesis and fertilization in animals.	Students can understand the mechanism of gametogenesis and fertilization in animals.
To study the early embryonic development and metamorphic movements during development.	Students can understand the cleavage, bastulation and grastrulation process in animals.
To study the developmental process in plant.	Student gets knowledge of patterning in plants with respect to *Arabidopsis thaliana*.
To understand the plant development response to climate change.	Students can able to understand the effects of climate change on plant development.

Course Name: Developmental Biology Paper-II **Course Code:** BT107	
Objectives	**Outcomes**
To understand the mechanism of embryonic cell differentiation	Students get the knowledge of mechanism of embryonic cell differentiation
To study the embryonic induction and organogenesis in animals	Students can understood the embryonic induction and organogenesis in animals
To study the seed development and fruit growth in plants	Students get the knowledge of mechanism of seed development and fruit growth in plants

Course Name: Chemical Sciences **Course Code:** BT108	
Objectives	**Outcomes**
To study the types of chemical bonds and their formation.	Students are acquainted with knowledge of chemical bonds.
To study the concept of hybridization in covalent bond formation	Students are acquainted with knowledge of hybridization in covalent bond formation
To understand the different types of solution and preparation of solution of different concentration.	Students understood the different types of solution and preparation of solution of different concentration
To understand the concept of chemical equilibrium and colligative properties of solution.	Student can understood the concept of chemical equilibrium and colligative properties of solution
To understand the concept of pH, Buffer and chemical kinetics.	Student can understood the concept of pH, Buffer and chemical kinetics.

Course Name: Biophysics **Course Code:** BT109	
Objectives	**Outcomes**
To study the molecular structure and physicochemical properties of water.	Students are acquainted with knowledge of molecular structure and physicochemical properties of water
To understand the concept of thermodynamics.	Students can understood the thermodynamics concept.
To study the macrmolecular interaction.	Students get knowledge of molecular interaction and cooperativity concept in molecular interaction.
To understand the ligand-receptor interaction.	Students understood the ligand-receptor interaction.

B.Sc. I (Theory) Semester-II (w.e.f. 2019-20)

Course Name: English (communication skill) **Course Code:** BT110	
Objectives	**Outcomes**
To introduce to the students various forms of communication.	Through various forms of communication students communicate with each other easily
To make the teaching of English more practical and student centric.	Students learned the various types of the poems.
To introduce to the students poems from across the globe.	Students understood with different forms of prose.
To acquaint the students with different language skills.	Students learned different language skills.
To introduce to the students various forms of communication.	Through various forms of communication students communicate with each other easily

Course Name: Mammalian Physiology Paper-I **Course Code:** BT111	
Objectives	**Outcomes**
To study the digestive system of mammals.	Students can acquainted with knowledge of digestive system and digestion mechanism in mammals.
To understand the circulatory system in mammals.	Students can understood the blood, its composition, heart structure and functioning.
To understand the respiration in mammals.	Students can understood the respiratory system and mechanism of respiration in mammals.
To understand the skeletal system in mammals.	Students can understand the role of bone and joints in human skeleton.

Course Name: Mammalian Physiology Paper-II **Course Code:** BT112	
Objectives	**Outcomes**
To understand the muscle physiology of mammals	Students can understood the muscle physiology of mammals.
To understand the osmoregulation in mammals	Students can understood the osmoregulation in mammals.
To study the co-ordination system in mammals.	Students can are acquainted with knowledge of nervous and hormonal coordination.
To understand the structure and function of sensory organs in mammals	Students can understood the structure and function of sensory organs in mammals

Course Name: Plant Physiology Paper-I **Course Code:** BT113	
Objectives	**Outcomes**
To understand the anatomical features of plant.	Students can understood the anatomical features of different parts of plant.
To study the plant water relationship	Students can be acquainted with knowledge of absorption, diffusion, osmosis, plasmolysis, imbibition, guttation, transpiration in plant.
To study the nutrients of plant.	Students can be acquainted with knowledge of micro and macro nutrients of plants. They also gets

	knowledge of uptake and transport of nutrients in plants.

Course Name: Plant Physiology Paper-II **Course Code:** BT114	
Objectives	**Outcomes**
To study the photosynthesis and photorespiration in plants.	Student can gets knowledge of process of photosynthesis and photorespiration.
To understand the nitrogen metabolism in plants.	Students can understood mechanism of nitrogen fixation and assimilation of nitrogen.
To understand the growth and development in plants.	Students can understood the process of plant growth and gets the knowledge of effect of growth hormones on plant.
To study the dormancy in plants.	Student can study the seed dormancy. They also can gets knowledge of dormancy breakdown.

Course Name: Computer **Course Code:** BT115	
Objectives	**Outcomes**
To introduce the computer knowledge in students.	Student can get basic knowledge of computer.
To understand the software and hardware of computers.	Students can understood different software and hardware of computers.
To make able the students for use of internet.	Students can be able to use the internet.

Course Name: Biostatistics **Course Code:** BT116	
Objectives	**Outcomes**
To study the classification, tabulation and representation of data.	Students can classify and arrange the data in tabular form. They can represent the data by graphical or diagrammatic way.
To study the measures of central tendency.	Students can find out mean, median and mode of given data.
To study the measures of dispersion.	Students are able to find range, mean deviation and standard deviation of data.
To study the correlation and regression analysis of data.	Students can find out the correlation between two variables.
To study the probability and distribution.	Students can use probability method.
To study the hypothesis testing	Students are able to test the hypothesis (parametric and non-parametric)

Course Name: Animal Tissue Culture **Course Code:** BT117	
Objectives	**Outcomes**
To understand basics of animal tissue culture and important equipments required for animal cell culture	Students can understood characteristics of animal cell in culture, substrate for cell growth and important equipments required for animal cell culture.
To understand media preparation for animal tissue culture.	Students can be able to prepare sterilized animal cell culture media.

To understand process of Primary cell culture: Criteria for subculture, Types of organs culture, Methods for Cell synchronization	Students can understood process of Primary cell culture: Criteria for subculture, Types of organs culture, Methods for Cell synchronization
To understand technical aspects of cell culture: Cell lines selection, maintenance, counting, monitoring, and different techniques used for same	Students can understood technical aspects of cell culture: Cell lines selection, maintenance, counting, monitoring, and different techniques used for same
To understand the concept of cell line identification	Students can understand the use of karyotyping, isoenzyme, radiolabelling in cell line identification.

Course Name: Plant Tissue Culture **Course Code:** BT118	
Objectives	**Outcomes**
To get introduced to plant tissue culture and general laboratory set up for plant tissue culture.	Students will get knowledge about history and scope of tissue culture. They understood the importance of aseptic conditions, practices and requirements in plant tissue culture laboratory.
To understand media preparation and different plant tissue culture techniques.	Students can understood the Concept of totipotency, Culture media, media composition with significance and preparation. They got knowledge about different plat tissue Culture techniques.
To get knowledge of protoplast culture and somaclonal variation.	Students can understood fundamental concepts and techniques in Protoplast culture. They also understood the application aspects with respect to Production of hybrids & cybrid. They got knowledge about concept of Somaclonal variation.
To understand the concept of micropropagation, organogenesis, somatic embryogenesis, Plant hardening and artificial seed production.	Student will get knowledge about Micropropagation technique, its stages & applications. They got knowledge about concepts of Organogenesis, somatic embryogenesis, Plant hardening, Artificial seed production.
To cryopreservation technique used in plant tissue culture.	Students will understood the importance, techniques and advantages of Cryopreservation.

Course Name: Democracy, Elections and Good Governance **Course Code:** BT111	
Objectives	**Outcomes**
The rationale of the study is to make the pupils aware of the importance of democracy. What constitute democracy, what is its importance from the point of view of the role of individual and what exactly can a individual get if he performs his role well in the society.	Students can aware with importance of democracy. What constitute democracy, what is its importance from the point of view of the role of individual and what exactly can a individual get if he performs his role well in the society.
This module also aims to make the individual understand the different aspects of democracy and its implications in the overall development of the state.	Student will understand the different aspects of democracy and its implications in the overall development of the state.
The syllabus is introduced from the point of view that	The syllabus helped to introduced from the point of

all students upon entering into the college, enroll themselves as voters and encourage and enthuse other members of the society to participate not only in election process but also electoral and political process in general.	view that all students upon entering into the college, enroll themselves as voters and encourage and enthuse other members of the society to participate not only in election process but also electoral and political process in general.

B.Sc. I (Practical) Semester- I & II (w.e.f. 2019-20)

Course Name: Laboratory Course I **Course Code:** BP101	
Objectives	**Outcomes**
To study the activity of enzymes	Students can study enzyme activity and factors affecting enzyme activity.
To study the qualitative analysis of biomolecules.	Students can analyze the presence of biomolecules by qualitative method.
To study the quantitative analysis of biomolecules.	Students can estimate the quantity of biomolecules.
To study the routine hematology of blood sample	Students can able to examine the blood cell count, Hb content.
To study the biochemical analysis for pathological symptoms.	Students can estimate serum bilirubin, transaminase activity and urine creatinine.

Course Name: Laboratory Course II **Course Code:** BP102	
Objectives	**Outcomes**
To study the membrane properties.	Students can demonstrate permeability, osmosis and plasmolysis concept.
To study the prokaryotic and eukaryotic cell structure.	Students can demonstrate prokaryotic and eukaryotic cell structure
To study the cell division	Students can demonstrate and identify the stages of cell cycle.
To study the photosynthetic pigments in plants	Students can separate photosynthetic pigments by chromatography.
To study the seed germination time.	Students can demonstrate the seed germination time.

Course Name: Laboratory Course III **Course Code:** BP103	
Objectives	**Outcomes**
To study the developmental stages of different animals	Students can identify the development stage of animals.
To study the floral patterning in plants	Students can understand the different floral pattern in plants.
To use the MS-Excel for data representation and to find central tendency	Students can use MS-Excel for data representation and calculation of Central tendency.
To study the creating email Id and sending email	Students can create their own email and can send their emails to others.
To prepare the presentation on MS-Power Point presentation	Students can prepare their own power point presentation.
To find out the measures of dispersion for biological	Students can find measures of dispersion for biological

data.	data.

Course Name: Laboratory Course IV **Course Code:** BP104	
Objectives	**Outcomes**
To prepare the buffer solution of different pH and solutions of different concentration	Students can prepare the buffer solutions and different concentration solutions.
To determine the physical properties of liquids	Students can find out viscosity, temperature and surface tension of liquid and conductivity of solution
To prepare the plant and animal tissue culture media.	Students can prepare sterile plant and animal tissue culture media.
To study the different plant tissue culture techniques.	Students can do aseptic seed germination and ovule/ anther culture. They can isolate protoplast.
To separate the cells from tissue and cell counting.	Students can use trypsinization process of cells separation. They can able to count the cells.

B.Sc. II (Theory) Semester – III (w.e.f. 2017-18)

Course Name: Paper I : Inheritance Biology **Course Code:** BT201	
Objectives	**Outcomes**
To understand Mendelism, Mendelian experiments, crosses, laws of inheritance	Students get the knowledge Mendelism and concepts of inheritance
To understand Genetic Linkage and Chromosome Mapping and related theories and significance	Students understood the concept of genetic linkage, mapping, related theories and significance
To understand Extrachromosomal inheritance and alleles, genetic system in cell organelles, concept of multiple alleles	Students understood the concept of extrachromosomal inheritance and aspects of alleles.
To understand Sex linked Inheritance, chromosomes and genes involved, determination of sex	Students get the knowledge of sex linked inheritance and related aspects with respect to chromosomes and genes.
To understand genetics of bacteria, genetic organization and bacterial recombination	Students understood the concept of bacterial genetics, its organization and bacterial recombination.

Course Name: Paper II Basics of Molecular Biology **Course Code:** BT 201	
Objectives	**Outcomes**
To understand The Central Dogma, DNA structure; Salient features of double helix, Types of DNA	Students are acquainted with knowledge Central Dogma, DNA structure; Salient features of double helix, Types of DNA
To understand the basic unit of genetic elements and their related aspects.	Students are known to concepts related to structure, nature of genetic elements and their related aspects
To understand the replication process involved in prokaryotes.	Students understood the mechanism of prokaryotic DNA replication, factors involved, stages, and modes of replication
To understand the replication process involved in eukaryotes.	Students understood the mechanism of eukaryotic DNA replication, factors involved, stages of replication

To understand DNA damage and its repair system in living cell.	Students understood the concept of Mutability and Repair of DNA and its aspects of mechanism.

Course Name: Paper I Biophysical Instruments **Course Code:** BT 202	
Objectives	**Outcomes**
To understand principle and working of spectroscopy technique and its applications.	Students can understood concept of electromagnetic spectrum and spectroscopic techniques based on principle use of electromagnetic waves.
To understand the measurement of pH and centrifugation techniques used for biological work.	Students can understood measurement of pH, as well as principle, types and working of Centrifuge.
To understand principle and working of optical and electron microscopes.	Students can understood concept of optical and electron microscopy.
To study the radioactivity concept used for biological work.	Students understood Nature of Radioactivity –types of radioactive decay. Students gain knowledge of principles of Radioactivity detection techniques and understood Hazardous effects, Safety measures.

Course Name: Paper II Animal Tissue Culture **Course Code:** BT 202	
Objectives	**Outcomes**
To understand basics of animal tissue culture and important equipments required for animal cell culture	Students can understood characteristics of animal cell in culture, substrate for cell growth and important equipments required for animal cell culture.
To understand media preparation for animal tissue culture.	Students can be able to prepare sterilized animal cell culture media.
To understand process of Primary cell culture: Criteria for subculture, Types of organs culture, Methods for Cell synchronization	Students understood process of Primary cell culture: Criteria for subculture, Types of organs culture, Methods for Cell synchronization
To understand technical aspects of cell culture: Cell lines selection, maintenance, counting, monitoring, and different techniques used for same	Students understood technical aspects of cell culture: Cell lines selection, maintenance, counting, monitoring, and different techniques used for same
To understand the concept Genetic engineering of animal cells in culture	Students can understand the use of Genetic engineering of animal cells in culture.

Course Name: Paper I Bioenergetics and Enzymology **Course Code:** BT 203	
Objectives	**Outcomes**
To study the concept of bioenergetics.	Students understood concept of thermodynamics and energy flow in biological system.
To understand types and mechanism of common biochemical reactions and their role in energy exchange in biological systems.	Students understood types and mechanism of common biochemical reactions and their role in energy exchange in biological systems.
Understanding the structure, classification, role and activity of enzyme.	Students understood the importance and role of enzymes as biocatalysts, their structure and classification, concepts related to enzyme activity.

To understand kinetic properties of enzyme, factors affecting enzyme activity and inhibition of enzyme activity.	Students get acquainted with knowledge of enzyme's kinetic properties like Km and Vmax; they also enriched with knowledge of factors affecting enzyme activity and inhibition of enzyme activity.
Understanding the mechanisms of modes of enzyme regulation, biological role and importance of enzymes from their application point of view.	Students understood the mechanisms of modes of enzyme regulation, biological role and importance of enzymes from their application point of view.

Course Name: Paper II Fundamentals of Immunology **Course Code:** BT 203	
Objectives	**Outcomes**
To understand the concept of Hematopoisis, Cells and Organs of immune system.	Students understood the concept of Hematopoisis: factors involved in hematopoisis, Importance of Cells of immune system Organs of immune system their structure and functions.
To understand the concepts of Native or Innate immunity, First and Second line of Defense, nonspecific defense mechanism	Students understood the concepts of Native or Innate immunity, First and Second line of Defense –Cellular Processes in nonspecific defense mechanism
To study Antigen, immunogenicity, Major Histocompatibility Complex, cytokines.	Students understood the concept of Antigen, its properties and role in immunogenicity, importance of adjuvant, epitope. Major Histocompatibility Complex, Properties and functions of cytokines
To study about antibody structure, classes and their function.	Students got knowledge about the concept of Antibody: basic structure and biological function of antibody classes, antigenic determinants.
To understand Antigen antibody interactions and its applications.	Students understood principles and applications of antigen antibody interactions. They got knowledge about diagnostic techniques based on antigen antibody interactions.

B.Sc. III (Theory) Semester – IV (w.e.f. 2017-18)

Course Name: Paper I : **Cyto-Genetics and Population Genetics Course Code:** BT204	
Objectives	**Outcomes**
To understand characteristics of chromosomes and cell division.	Students understood the details about Chromosome Structure, Morphology, Organization, different forms, role in heredity. They can understand Mitosis, Meiosis
To study the concept of mutation in living system.	Students understood the concept mutation and gene level and chromosomal level.
To inculcate the knowledge of transposable elements.	Students understood the details about Transposable elements, their transposition, types and structure,
To understand basic of Population Genetics and Genetic basis of evolution.	Students understood the concept of Population Genetics as well as genetic basis of evolution.
To understand the concept of Quantitative Genetics.	Students can understand Multiple factor hypothesis, Transgressive segregation, Handling of quantitative

	data: mean, range, Variance, Standard deviation, Coefficient of Variation. Effects of the environment on quantitative traits.

Course Name: Paper II Mechanisms in Molecular Biology	**Course Code:** BT 204
Objectives	**Outcomes**
To understand the mechanism of transcription in living organisms.	Student gets knowledge of transcription in prokaryotes and eukaryotes.
To study the regulation of transcription process in prokaryotes and concept of operon.	Students can understood the mechanism of transcription regulation in Prokaryotes as well as concept of operon.
To study the regulation of transcription process in eukaryotes.	Students can understand the mechanism of eukaryotes transcription regulation.
To understand the post transcriptional modification in RNA and its transport process.	Students can understand the RNA splicing, editing etc. as a part of post transcriptional modification. They can also able to understand the transport of RNA in cell.
To study the translation process in prokaryotes and eukaryotes.	Students can understand the molecular mechanism of translation in both prokaryotes and eukaryotes. They can also understand post translational modification.

Course Name: Paper I Analytical Techniques	**Course Code:** BT 205
Objectives	**Outcomes**
To understand electrophoresis and blotting techniques.	Students can able to perform electrophoresis and can use different blotting techniques.
To study the use of chromatography techniques for purification.	Students can understand technical aspects of Chromatography with respect to Principle, instrumentation, working and applications of different types of chromatography.
To understand Protein Purification Techniques.	Student can purify proteins by using techniques of Cell disruption, Ammonium sulphate precipitation. Dialysis and Ultrafiltration.
To study the methods of quantitative estimation of biomolecules such as Carbohydrates, Protein, Lipid and Nucleic acids.	Students can be capable of use of suitable estimation method for specific biomolecules.
To understand Tools used in Proteomic study.	Students can understand importance and application of different tools used in Proteomics.

Course Name: Paper II Plant Tissue Culture	**Course Code:** BT 205
Objectives	**Outcomes**
To get introduced to plant tissue culture and general laboratory set up for plant tissue culture.	Students can get knowledge about history and scope of tissue culture. They understood the importance of aseptic conditions, practices and requirements in plant tissue culture laboratory.

To understand media preparation and different plant tissue culture techniques.	Students understood the Concept of totipotency, Culture media, media composition with significance and preparation. They got knowledge about different plat tissue Culture techniques.
To get knowledge of protoplast culture and somaclonal variation.	Students understood fundamental concepts and techniques in Protoplast culture. They also understood the application aspects with respect to Production of hybrids & cybrid. They got knowledge about concept of Somaclonal variation.
To understand the concept of micropropagation, organogenesis, somatic embryogenesis, Plant hardening and artificial seed production.	Student got knowledge about Micropropagation technique, its stages & applications. They got knowledge about concepts of Organogenesis, somatic embryogenesis, Plant hardening, Artificial seed production.
To cryopreservation technique used in plant tissue culture.	Students understood the importance, techniques and advantages of Cryopreservation.

Course Name: Paper I Metabolism **Course Code:** BT 206	
Objectives	**Outcomes**
To understand important biochemical pathways of carbohydrate metabolism their energetics and significance.	Students understood important biochemical pathways of carbohydrate metabolism their energetics and significance.
To understand structure and role of components involved in and mechanism oxidative phosphorylation.	Students understood structure and role of components involved in, and mechanism oxidative phosphorylation.
To understand structure and role of components involved in and mechanism of photosynthesis.	Students understood structure and role of components involved in, and mechanism of photosynthesis.
To understand important biochemical reactions and pathways of amino acid and nucleotide metabolism.	Students understood important biochemical reactions and pathways of amino acid and nucleotide metabolism.
To understand important biochemical reactions and pathways of lipid metabolism	Students understood important biochemical reactions and pathways of lipid metabolism

Course Name: Paper II Mechanisms in Immunology **Course Code:** BT 206	
Objectives	**Outcomes**
To understand the mechanisms of Humoral immunity.	Students understood concepts and mechanisms of Humoral immunity, Primary and secondary immune response, Antigen processing and presentation, role of T cells; B cell receptor, maturation, activation, differentiation.
To study the Complement system of immune system and monoclonal antibodies.	Students understood the importance and mechanism of action of Complement system. They can also understand production and applications of monoclonal antibodies.
To understand the mechanism of Cell mediated immunity.	Students can understand the Processing of Endogenous Antigens; Also can understand about T

	cells with respect to receptors, types, development and role in immunity,
To understand the concept of Hypersensitivity and Autoimmunity.	Students can understand the nature, types and mechanisms of Hypersensitivity. They can also understood Nature, types and mechanisms of Autoimmunity with examples
To study about immunization, Vaccines as well as Principles of Immunohematology and its diagnostic applications	Students understood the concept of active and passive immunization, They got knowledge about importance and types of Vaccines, Principles of Immuno-hematology and its diagnostic applications

Course Name: Environmental Science **Course Code:** AECC	
Objectives	**Outcomes**
To introduce environmental studies, Scope and importance, Concept of sustainability and sustainable development	Students are aware with environmental studies, Scope and importance, Concept of sustainability and sustainable development
To study structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.	Students studied structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession
To introduce Natural Resources, Biodiversity and Conservation.	Students introduced Natural Resources, Biodiversity and Conservation.
To make aware the students about the Environmental Pollution, Policies &Practices.	Students are aware the students about the Environmental Pollution, Policies &Practices.
To introduce Human Communities and the Environment	Students are familiar with Human Communities and the Environment

B.Sc. II (Practical) Semester – III & IV (w.e.f. 2017-18)

Course Name: Laboratory Course V **Course Code:** BP201	
Objectives	**Outcomes**
To understand the different phases cell division.	Students can demonstrate the mitosis and meiosis in *Allium cepa*. They can identify the stages of cell division.
To study the Mendelian and non-Mendelian traits.	Students can solve the problems based on mendelian and non-mendelian inheritance.
To study the population genetics.	Students can solve the problems based on Hardey-Weinbergs principle.
To study the isolation of chromosomal and extra-chromosomal DNA/RNA from animal/plant/yeast.	Students can isolation of chromosomal and extra-chromosomal DNA/RNA from animal/plant/yeast
To demonstrate the gene transfer in microorganism.	Students can demonstrate the conjugation, transduction and transformation in microorganism.

Course Name: Laboratory Course VI **Course Code:** BP202	
Objectives	**Outcomes**
To study the protein isolation, purification and characterization techniques.	Students can isolate protein by cell disruption method, and purify the ammonium precipitation and can characterize by DSD-gel electrophoresis technique.
To study the methods of estimation for protein and nucleic acid.	Students can estimate the proteins and nucleic acid by spectroscopy method.
To study the techniques of chromatography	Students can handle paper chromatoghraphy and thin layer chromatography techniques.
To prepare the media for animal and plant tissue culture.	Students can prepare the sterilized media for animal and plant tissue culture.
To study the different cell culture techniques.	Students can do cell suspension culture, ovule culture, anther culture.

Course Name: Laboratory Course VII **Course Code:** BP203	
Objectives	**Outcomes**
To deal with practical skill in enzymology.	Students can do efficiently the practicals based on enzymology.
To study the estimation method for urea, cholesterol, chlorophyll, glucose.	Students can estimate urea, cholesterol, chlorophyll, glucose y using specific methods on colorimetry.
To understand the hematological study of blood.	Students can do total RBC, WBC count, they can find out Hb content, enumerate different leukocytes and determine the clotting time of blood.
To study the immunological tests used for disease diagnosis.	Students can perform Latex agglutination test, Coomb's test, Ouchterlony test, Counter current immunoelectrophoresis, Rocket immuneelectro-phoresis, Widal Test, VDRL Test.

B.Sc. III (Theory) Semester – V (w.e.f. 2018-19)

Course Name: Compulsory English **Course Code:** BT300A	
Objectives	**Outcomes**
To enhances the skills of reading, writing, speaking and listening	Students are improving Listening, Speaking, Reading and Writing skills.
To teach the students various skills in class and tests these skills for a constant monitoring of their proficiency	Throughout various types of skills students are improved proficiency.
To broadens the horizon of understanding with the help of prose and poems	Students understood the prose and poems easily.
To enhances the creativity of the student.	Students use various types of events in their class
To gives them a composite view of good communication	Students are participating debate competition, one act play, some seminar also given by students

Course Name: Plant Development **Course Code:** BT301	
Objectives	**Outcomes**
To understand the Gametophyte, Pollination and Fertilization in plants.	Students understood the male and female gametophyte of plants. They also understood the process of pollination and fertilization in plants.
To study the Seed development and fruit growth.	Students gets knowledge of Seed development and fruit growth in plants.
To understand plant patterning in model plant *Arabidopsis thaliana*.	Students understood Root and shoot and floral patterning in *Arabidopsis thaliana*.
To study the Phytohormones and Plant Tissue development.	Students can understand the mode of action of plant hormones and plant tissue development.
To understand technologies based on plant development	Students understood the seed technology and production of secondary metabolites of plants.

Course Name: Fermentation Technology **Course Code:** BT302	
Objectives	**Outcomes**
To introduce the structure and components of fermentor and fermentation media.	Students are known to fermentor working, they can prepare the fermentation media.
To study the screening for industrial important strains, strain improvement.	Students can do screening and strain improvement for industrial application.
To understand the types of fermention process.	Students get understood the different types of fermention process.
To study the Downstream processes of fermentation.	Students gets knowledge of downstream process of fermentation
To study the microbial production of industrial products.	Students gets the knowledge of microbial production Citric acid, Ethanol, Penicillin, Vitamin B12, amylase, bioinsecticide.

Course Name: Tools and Techniques **Course Code:** BT303	
Objectives	**Outcomes**
To get introduction to basic techniques on genetic engineering.	Students get introduced to basic techniques on genetic engineering like electrophoresis and blotting techniques.
To study the enzymes used in Genetic engineering.	Students can get acquainted with knowledge of enzymes used in genetic engineering like exonucleases, endonucleases, polymerases, ligases etc.
To study the vectors used in Genetic engineering.	Students can understood structure and role of different plasmids used in genetic engineering.
To understand the gene transfer techniques.	Students can understood DNA transfer techniques like Transformation, Transfection and Transduction
To understand the advance techniques in genetic engineering	Students can understand the advance techniques in genetic engineering like DNA fingerprinting, PCR, DNA sequencing etc.

Course Name: Recent Trends in Biotechnology **Course Code:** BT304-A	
Objectives	**Outcomes**
To study the environmental impact assessment (EIA)	Student understood the component of environmental impact assessment, environmental monitoring and sampling methods in EIA
To understand the environmental remedies.	Students are acquainted with knowledge of bioremediation, phytoremediation, industrial waste water treatment process etc.
To study the molecular pharming and regenerative medicine.	Students are inculcated with knowledge of molecular pharming and regenerative medicine.
To understand the enzyme engineering, immobilization and metabolic engineering.	Students understood the strategy and applications of metabolic engineering, enzyme engineering and enzyme immobilization.
To study the concept of clinical biotechnology	Student gets knowledge of clinical biochemical analysis, importance of laboratory tests in different diseases and biochemical aids to clinical diagnosis.

Course Name: Introduction to Biotechnology based Industries **Course Code:** BT304-B	
Objectives	**Outcomes**
To understand general structure & organization of biotechnology industry.	Students understood different departments, units, process and positions in biotechnology industry.
To understand industrial terminologies and concepts Good manufacturing practice (GMP)	Students understood concepts Good manufacturing practice and various industrial terminologies.
To understand the various regulatory authorities associated with biotechnology.	Students gets knowledge of International and national regulatory authorities associated with biotechnology.
To understand types of biotech industries based on products	Students are aware of biotech industries based on products such as Pharmaceutical and Bio-medical industries, Paper and Pulp industries, Distilleries & Beverages, Animal Husbandry and veterinary medicines, Agriculture Industry, Bioengineering & Equipment Design, Nanotechnology and Genetics based industries etc.
To make aware about national and international scholarships and fellowship for research in biotechnology.	Students are known to national and international scholarships and fellowship for research in biotechnology.

B.Sc. III (Theory) Semester – VI (w.e.f. 2018-19)

Course Name: Compulsory English **Course Code:** BT300B	
Objectives	**Outcomes**
To enhances the skills of reading, writing, speaking and listening	Students are improving Listening, Speaking, Reading and Writing skills.
To teach the students various skills in class and tests these skills for a constant monitoring of their proficiency	Throughout various types of skills students are improved proficiency.

To broadens the horizon of understanding with the help of prose and poems	Students understood the prose and poems easily.
To enhances the creativity of the student.	Students use various types of events in their class
To gives them a composite view of good communication	Students are participating debate competition, one act play, some seminar also given by students

Course Name: Animal Development **Course Code:** BT305	
Objectives	**Outcomes**
To understand the history and scope of animal development.	Students are exposed to importance and current scenario in animal development.
To understand the molecular process of gametogenesis in animals.	Students understood the molecular process of gametogenesis in animals.
To study the process of fertilization and cleavage in animals.	Students get knowledge of process of fertilization and cleavage in animals.
To understand morulation, blastulation, fate maps, gastrulation.	Students understood the mechanism and importance of morulation, blastulation, gastrulation. They also understand the fate map in embryonic development.
To study development in model organisms and to understand development genetics.	Students studies model organisms to understand development process and developmental genetics.

Course Name: Food and Dairy Technology **Course Code:** BT306	
Objectives	**Outcomes**
To understand the food spoilage and its preservation techniques.	Students understood the reasons and process of food spoilage. They can use general method for food preservation.
To understand the dairy plant design, normal microbial flora of milk and its pasteurization.	Students understood the dairy plant design. They also understood the normal microbial flora present in milk and pasteurization process of milk.
To study the methods for the microbiological examination of foods.	Students can use different laboratory tests for microbiological examination of foods.
To understand the nutritional value and analysis of food.	Students can understood the significance of nutritional values and factors affecting these values. They can also understood methods of analysis of nutritional values.
To study the production of fermented dairy products and other foods.	Students have the knowledge of production of Yoghurt, Cheese, Sauerkraut, Beer, Vinegar, Bread, Pickles.

Course Name: Bioinformatics and Nanotechnology **Course Code:** BT307	
Objectives	**Outcomes**
To introduce the basic concepts of bioinformatics.	Students are introduced to bioinformatics, sequences of proteins and nucleic acids.
To study the biological databases.	Students get knowledge of protein and nucleic acid sequence and structure databases.
To study the sequence analysis tools used in	Students gets cleared the concept of sequence

bioinformatics.	alignment and phylogenetic analysis with required tools.
To understand the fundamental science behind nanotechnology.	Students understood the fundamental science behind nanotechnology.
To understand the synthesis, characterization, classification and application of nanomaterials.	Student understood the synthesis methods, characterization techniques, classification and application of nanomaterials

Course Name: Applications of Biotechnology **Course Code:** BT308-A	
Objectives	**Outcomes**
To understand the use of genetic engineering in environment.	Students understood the application of genetic engineering for degradation of xenobiotics, phytoremediation etc.
To understand the use of genetic engineering in microbes for industrial applications.	Students understood the role of Genetic engineering in strain improvement required for biosynthesis of Rubber, Xanthan Gum production, production of Interleukine-10, bioinsecticides production.
To study the use of rDNA technology in plants.	Students studies the role of rDNA technology for production of insect and herbicide resistant plants, and for molecular pharming.
To study the use of rDNA technology in animals.	Students studied production of transgenic animals, use of rDNA for therapy in animals.

Course Name: Quality Standard Practices in Biotechnology **Course Code:** BT308-B	
Objectives	**Outcomes**
To understand the quality control procedures for drinking water.	Students understood the quality control procedures for drinking water
To understand the quality control procedures for milk and dairy products.	Students understood the quality control procedures for milk and dairy products.
To understand the quality standard practices for food safety.	Students understood the quality standard practices for food safety.
To understand the quality control procedures for Pharmaceutical products.	Students understood the quality control procedures for Pharmaceutical products.
To understand the quality control procedures for stem cell lines.	Students understood the quality control procedures for stem cell lines.

B.Sc. III (Practical) Semester – V & VI (w.e.f. 2018-19)

Course Name: Laboratory Course VIII **Course Code:** BP301	
Objectives	**Outcomes**
To develop the practical skill to study plant development	Students can do practicals based on plant development.
To study the isolation, quantification of genomic and plasmid DNA	Students can isolate and quantify genomic and plasmid DNA
To study the PCR techniques	Students can demonstrate the PCR techniques.
To understand the restriction mapping and molecular weight determination.	Students can do restriction mapping and molecular weight determination

To develop the practical skill to study animal development	Students can do practicals based on animal development.

Course Name: Laboratory Course IX **Course Code:** BP302	
Objectives	**Outcomes**
To study the fermentation technology for production different products.	Students can produce citric acid and amylase by fermentation process.
To study the isolation of different microorganisms for industrial use.	Students can do primary screening of microorganisms for industrial application
To study the different methods for food and milk quality analysis.	Students can determine Direct microscopic somatic cell count of milk, Acid degree value of milk, Laboratory pasteurization count of milk, Standard Plate count of milk.
To study the retrival of gene sequence from GenBank and performing its sequence alignment by BLAST and FASTA	Student can retrieve gene sequence and perform sequence analysis by BLAST and FASTA.
To study the synthesis of silver and ZnO nanoparticles.	Students can synthesize silver and ZnO nanoparticles.

Course Name: Laboratory Course X **Course Code:** BP303	
Objectives	**Outcomes**
To study the diagnostic test used for human.	Students can perform SGPT and SGOT for liver function test.
To study the quality of industrial waste water.	Students can perform BOD and COD of industrial waste water.
To understand the dead stock register, its maintenance and SOP and safety measures in laboratories.	Students can use and maintain dead stock register, they are aware of SOP for instrument handling and safety measure for laboratories.
To study the DNA ligation and blotting techniques.	Students can perform DNA ligation as well as southern and northern blotting techniques.
To study the quality analysis of drinking water for biological indicator.	Students can do MPN test, Presumptive and confirmatory test for Fecal contamination of water, check for presence of chlorine.
To study the quality analysis of food.	Students can do check food adulteration in wheat flour / milk and milk products. They can also able to check limit test of lead/chloride/iron/heavy metals/arsenic.

Course Name: Laboratory Course XI (Project Work) **Course Code:** BP304	
Objective	**Outcomes**
To carry out short project work in the field of Biotechnology.	Students understand concepts in detail of their projects and develop practical skills.
	Students understand report writing and develop their presentation skills.
	Visit to various research centers during project work will give exposure to students to understand the functioning of research lab.

B.Sc. III (Theory) Semester – IV (w.e.f. 2021-22)

Course Name: Bioprocess Technology **Code:** DSE-1A	
Objectives	**Outcomes**
This course gives technical and biological aspects of fermentation process	After completion of this course students will be able to perform and control fermentation process.
This course helps to introduce industrial applications of bioprocess technology	Students can design protocols for industrial fermentations.

Course Name: Recombinant DNA Technology **Code:** DSE-2 A	
Objectives	**Outcomes**
To familiarize the student with emerging field of biotechnology i.e. Recombinant DNA Technology.	On completion of this course, students will have the knowledge and skills to explain the key concepts in genetic modification of living organisms, Techniques in Recombinant DNA Technology
To create understanding and expertise in wet lab techniques in genetic engineering.	Acquire skills on techniques of construction of recombinant DNA - Cloning vectors and isolation of genes of interest.
	Identify problems associated with production of recombinant proteins and devising strategies to overcome problems.

Course Name: Bioinformatics **Code:** DSE 3 A	
Objectives	**Outcomes**
This course gives technical and biological aspects of Bioinformatics and its possible use in allied science areas	Students will get background of bioinformatics.
	Students will get knowledge of biological databases.
	Students will able to retrieve information from nucleic acid and protein sequence.
	Students can predict the structure of proteins from their sequence.

Course Name: Intellectual Property Rights **Code:** DSE – 4A	
Objectives	**Outcomes**
The course envisages information on IPR	To learn, understand and analyze the Laws and Relations relating to Intellectual Property Rights in India along with the glimpse of International practices. Apply intellectual property law principles (including copyright, patents, designs and trademarks) to real problems.
	To Analyze the social impact of intellectual property law and policy.
	To Analyze ethical and professional issues which arise in the intellectual property law context.
	To create public awareness about the economic, social and cultural benefits of IPRs.

Course Name: -Bio-Analytical Tools **Code:** DSE 1B	
Objectives	**Outcomes**
To develop the skills to understand the theory and practice of bio analytical techniques.	After successfully completing this course, the students will be able to: To be able to use selected analytical techniques.
To provide scientific understanding of analytical techniques and detail interpretation of results.	To get knowledge of working principals, tools and techniques of analytical techniques
To understand basic instruments used in Bioanalytical sciences laboratory	To understand the advantages, disadvantages and creative use of techniques for problem-solving

Course Name: Genomics and Proteomics **Code** : DSE- 2B	
Objectives	**Outcomes**
To acquaint the student with genome organization, gene identification, Expression and application of genomics analysis.	On the completion of this course students will have the knowledge and skill to explain the key concepts in genomics and proteomics.
To acquaint the student with proteomics, it's analysis and its applications.	The course will provide comprehensive knowledge in genome analysis and proteomic analysis
	The student will understand the applications of genomics and proteomics in Drug development, Glycobiology and Plant genetics and breeding.

Course Name: Evolutionary Biology **Code:** DSE 3B	
Objectives	**Outcomes**
The course provides information about the patterns and processes of evolution above the species level. Besides elaborating the process of speciation, it also categorically differentiates between the three methods of phylogenetic analysis viz., evolutionary systematics, phonetics and cladistics.	At the end of the course the students will be able to Understand the historical development of systematics past to the present.
	Understand the similarities and differences of different types of data.
	Understand the uses and limitations of phylogenetic trees.
	Appreciate the complexities and difficulties of various species concepts.
	Gain a basic grasp on the rules and philosophy of nomenclature.

Course Name: Environmental Biotechnology **Code** : DSE- 4B	
Objectives	**Outcomes**
This course gives technical and biological aspects of Environmental Biotechnology.	On completion of this course, students will have the knowledge and skills to explain the key concepts in Understanding the current applications of biotechnology to environmental quality evaluation, monitoring and remediation of contaminated environments.
This course helps to introduce industrial applications of Environmental Biotechnology.	