Course outcomes

BS 403 Essential of Molecular Biology

On completion of course students are able to understand

- Concept of gene, gene cistron relationship in prokaryotes and eukaryotes,
- DNA regulation and replication
- Types of DNA damage, DNA repair pathways
- Transcription in prokaryotes
- Reverse transcription
- Repeated sequences
- Transposons types and transposition mechanism

BS201 Metabolism

On completion of course students are able to understand

- Characteristic of Enzymes, enzyme inhibition and kinetics
- Carbohydrate metabolism, significance of glycolysis and ETC, untreated diabetes
- Lipid metabolism and production of ketone bodies
- Protein metabolism, role of urea cycle and errors of protein metabolism
- Biosynthesis and degradation of purine and pyrimidine

BS306 Applied Biotechnology

On completion of course students are able to understand

- Genomics and Proteomics and gene expression
- Drug Discovery and Designing: Drug and target identification, target validation
- Bioprospecting and conservation: importance of biodiversity
- Free Radical Biology: General theory of free radical and antioxidants
- Significance of IPR; Requirement of a patentable novelty and Detailed, information on patenting biological products and biodiversity

BS202 Biophysical Chemistry

On completion of course students are able to understand

- Concept of electromagnetic radiation, absorption spectrum, Beer's law and Lamberts law
- Principle, working and applications of spectrophotometer and AAS
- Concepts of chromatography and concept of partition coefficient
- Principle, methodology and application of various chromatographic techniques
- Centrifugation and Electrophoresis-Principles and applications
- Importance of radioactivity in biological studies, GM counters and Scintillation counting.

BS404 Biophysical and Biochemical Methods

On completion of course students are able to understand

- Different types of Microscopy, fluorescent activated cell sorting (FACS) and Freeze drying
- Radiotracer technology, Geiger-Muller counter, Liquid scintillation counter and autoradiography,
- X-ray crystallography and Biosensors
- Centrifugation & Electrophoresis:Principle, techniques and applications, Isoelectric focusing and isotachophoresis,

- Different techniques of protein Sequencing, N & C terminal and Edman degradation
- Different types of chromatography techniques and applications.
- Photometry: Theory, instrumentation and applications of visible photometry. Basic Principles of mass spectrometry, CD, ORD.

BS 212 Molecular Biology

On completion of course students are able to understand

- Concept of gene, pseudogene, cryptic gene and split gene
- DNA replication and regulation in prokaryotes and eukaryotes
- Transcription in prokaryotes and eukaryotes
- Translation in prokaryotes and eukaryotes
- Post translation and transcriptional mechanism
- Gene expression in prokaryotes using Lap operon and in Eukaryotes by Trp operon.

BS 412 Enzymology and Enzyme kinetics

On completion of the course, students are able to understand

- Enzymes classification and nomenclature, isolation, purification and large scale production, mechanisms of enzyme action. Coenzymes and cofactor, structure and function
- Enzyme Kinetics, enzyme activity, specificity, Vmax, Km, unisubstrate and multisubstrate kinetics, MM equation, LB plot, Briggs Haldane hypothesi, Hill and Satchard plots
- Allosteric enzymes mechanism of allosteric enzymes, enzyme inhibition, feedback inhibition, immobilization of enzyme and its industrial applications.
- Immobilization of enzymes and application.

BS 452 Molecular Biology

On completion of course students are able to understand

- Experiments to prove DNA is a genetic material Concept of gene, pseudogene, cryptic gene and split gene
- DNA replication and regulation in prokaryotes and eukaryotes
- Transcription in eukaryotes
- Translation in prokaryotes and eukaryotes
- Post translation and transcriptional mechanism
- Gene expression in prokaryotes using Lap operon and in Eukaryotes by Trp operon.

BS 112 Fundamental of Biochemistry

On completion of course students are able to understand

- Basics of biomolecules
- Basics of carbohydrate, its classification and
- Basics of Amino acid & protein
- Basics of lipids
- Basics of Nucleic Acid
- Basics of Vitamins

BS 204 IPR and Biosafety
On completion of course students are able to understand

BS Industrial Biotechnology
On completion of course students are able to understand

BS Environmental biotechnology
On completion of course students are able to understand

- Experiments to prove DNA is a genetic material Concept of gene, pseudogene, cryptic gene and split gene
- DNA replication and regulation in prokaryotes and eukaryotes
- Transcription in eukaryotes
- Translation in prokaryotes and eukaryotes
- Post translation and transcriptional mechanism
- Gene expression in prokaryotes using Lap operon and in Eukaryotes by Trp operon.

BS322 Comparative Anatomy and Developmental Biology
On completion of course students are able to understand

- Main trends of thought and history of comparative vertebrate anatomy
- History of embryology
- Phases of fertilization and the difference between sexual and asexual reproduction
- Formation of extra-embryonic membranes and their functions, as well as their fate
- Process by which major organ-systems occur

BS132 Animal diversity I "Nonchordates"
On completion of course students are able to understand

- Diversity of invertebrates, Phylogeny of invertebrates
- External as well as internal characters of non chordates
- Larval forms of the invertebrates
- Locomotion in Protozoa
- Canal system in sponges
- Colonial and social life in invertebrates
- Organization of coelom and its types
- Correlates the physiological processes of animals and relationship of organ systems
- Understand the concepts-Metamorphosis, regeneration and autotomy

BS221 "Chordates" Animal Diversity-II
On completion of course students are able to understand

- Origin and phylogeny of the vertebrates
- Vertebrates, their adaptations and associations in relation to their environment
- Parental care and migration in vertebrates, identification of poisonous and non poisonous snakes
- Various systems, adaptation and dentition in Mammals

BS233 Animal Physiology

On completion of course students are able to understand

- Functions of important physiological systems including the cardio-respiratory, renal, reproductive and metabolic systems

- Interactions and interdependence of physiological and biochemical processes

- How these separate systems interact to yield integrated physiological responses to challenges such as exercise, fasting and ascent to high altitude, and how they can sometimes fail

BS215 Food Biotechnology

- After the end of the course, the students will be able to recognize sources of microorganisms and food borne illness.

- To learn food processing and preservation techniques.

- Comprehend the interrelationships among different components of beverages technology and assess food laws and quality control at international standards.

BS101 Plant Sciences

On completion of this course, students will be able to understand:

- The concept of origin of life and evolution.

- The structure and functioning of Plant Cells and tissue.

- Morphology and physiology of plants.

BS162 Algae, Fungi And Bryophytes

On completion of this course, students will be able to

- Identify and classify the algae, fungi, lichens, mycorrhiza and bryophytes.

- Understand the morphology, anatomy and life cycle of various genera of algae, fungi and bryophytes.

- Know the economic importance of algae, fungi and bryophytes.

BS445 Soil and Agricultural Microbiology

On completion of this course, students will be able to understand

- The importance of physical, chemical and biological properties of soil.
- Role of microorganisms in biogeochemical cycling.
- Microbiology and physiology of degradation of native and organic matter and Nitrogen fixation.
- The mechanism of plant growth promotion.
- Production, application and use of microbes as biofertilizers.

BS453 Industrial Microbiology and Fermentation Technology
On completion of this course, students will be able to understand

- Microbes involved in fermentation.
- The basics of fermentation technology.
- General design of fermenter, media and the process of fermentation.
- Optimization of fermentation process.
- Use of microbes for production of important industrial products.
- The basic knowledge of intellectual property rights specially patents.

BS222 Angiosperm morphology and Taxonomy

- On completion of this course, students will be able to identify and classify the flowering plants.

- To know the phylogenetic relationship of angiosperms.

- This course helps to learn the taxonomic evidences from numerical and chemical taxonomy and detailed description of dicot and monocot families.

BS321 Plant Anatomy and Embryology

- To understand the basic concepts with ability to identify and distinguish various features related to anatomy and embryology.

- Course component will provide an ample understanding on the evolution of concept of organization of shoot and root apex.

- To evaluate the structural organization of flower and the process of pollination and fertilization, structure and development of dicot and monocot embryos.

BS231 Ecology and Adaptation

- The students will be able to learn the approaches to the study of ecology.

- To understand the role and importance of biotic and abiotic environment factors in the sustenance of plant life.

- The course will impart importance of phytogeography and zoogeography to teach managing regional flora.

BS 232 Plant Physiology

- Upon completing this course, students will be familiar with contemporary concepts in plant Physiology and the physiological mechanisms controlling plant growth and development.
- Students will have an understanding of movement of water and solutes in plant.
- Understand the plant movements
- Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.
- Learn about the movement of sap and absorption of water in plant body.

B.Sc Biotechnology
Medical Biotechnology (BS-304) B.Sc (BT) III
Course outcome:
By the end of the course the student will be able to:

- Understand about pathogenic microbes and differentiate them with that of non-pathogenic ones.
- Understand and learn about different viral diseases as well as fungal disease.
- Acquire information about blood and parts of brain along with blood cancer and brain cancer as well.
- Get the basic knowledge about development of cancer, cancer vaccines
- Know about pathology of different pandemic diseases.
- About different therapy methods for above diseases.
- Gain the knowledge regarding various chemotherapeutic agents.
- Understand the medico-legal aspects and some ethical issues in human life.
- Discuss the scope and role of medical biotechnology in the healthcare industry

B.Sc Biotechnology
Biophysical (BS-202) B.Sc (BT) II
Course outcome:
By the end of the course the student will be able to:

- Describe the process of gel electrophoresis and explain how the characteristicsof nucleic acids affect their migration through a gel.
- Describe the structure of proteins, including the significance of amino acid Rgroupsand their impact on the three-dimensional structure of proteins.
- Explain the relationship between absorbance and transmittance in spectrophotometry.
- Demonstrate broad knowledge in modern analytical instrumentation with deep knowledge in its core concepts and its applications.
- Acquire knowledge about the basics and latest developments in the instrumentation techniques of Centrifugation, Electrophoresis (IEF, 2D PAGE) and Chromatography and their applications in various research fields.
- Learn about basic Radioactivity principles, measurement method and its biological applications.
- Acquire cognitive, technical and creative skills which enables students to gain an established knowledge and practice concerning modern analytical instrumentation and measurement techniques.
- Understand the importance and applications of advanced biochemical instrumentation techniques in modern day research.

B.Sc Biotechnology
Cell biology and genetics (BS-203) B.Sc (BT) II
Course outcome:
By the end of the course the student will be able to:

- Develop an understanding of the Cytoskeleton and Cell Membrane.
- Discuss the structure of Microtubules, microfilaments.
- Distinguish between the cellular organization of prokaryotic and eukaryotic cells
- Would have deeper understanding of cell at structural and functional level.
- Would have broad knowledge on the molecular interaction between cells.
- Would demonstrate a clear understanding of the signal transduction, secondary messengers.

B.Sc Biochemistry
Fundamental of Genetics (BS-241)

Course outcome:
By the end of the course the student will be able to:

- Develop an understanding of the genetics of bacteria and virus.
- Discuss the genetic control of development and how sex is determined in various orgnaism.
- Understand structure of chromosomes and its function.
- Discuss interaction of genes through various Mendelian crosses.
- Understand mutation and variation along with different genetic disorders.

B.Sc Biotechnology
Animal Science (BS-111) I yr/II sem
Course outcome:

By the end of the course the student will be able to:

- Understand Formation of urine and gain perception on the various renal function tests and renal disorders.
- Understand the pathophysiological processes responsible for common biochemical disorders such as jaundice, Pancreatitis, Fatty liver etc.
- Understanding the enzyme patterns in diseases of various organs such as pancreas, liver, bones, heart and muscle.
- Examine and identify acid-base balance and the regulatory mechanisms within the body to include the analyte, physiology involved, and clinical significance.
- Describe and explain the role of liver function in bilirubin metabolism and identify the tests used for bilirubin analysis, and relate laboratory results to clinical diagnosis.
- Describe the general function of each organ system.
- Have in-depth understanding of anatomy and physiology of respiratory, digestive, and vascular system.
- Understand about various animal cultures.
- Understand host-parasite relationship.

M.Sc Biochemistry
Physiological and Clinical biochemistry (BS-523) III semester
Course outcome:
By the end of the course the student will be able to:

- Understand Formation of urine and gain perception on the various renal function tests and renal disorders.
- Describe of the blood clotting pathways and the blood clotting disorders.
- Enumerate of the different types of anemias based on aetiology.
- Understand the pathophysiological processes responsible for common biochemical disorders such as jaundice, Pancreatitis, Fatty liver etc.
- Understanding the enzyme patterns in diseases of various organs such as pancreas, liver, bones, heart and muscle.
- Examine and identify acid-base balance and the regulatory mechanisms within the body to include the analyte, physiology involved, and clinical significance.
- Describe and explain the role of liver function in bilirubin metabolism and identify the tests used for bilirubin analysis, and relate laboratory results to clinical diagnosis.
- Describe the general function of each organ system.
- Have in-depth understanding of anatomy and physiology of respiratory, digestive, and vascular system.

M.Sc Biotechnology
rDNA Technology (BS-501)

Course outcome:
By the end of the course the student will be able to:

- Know the role of the several molecular tool applied in gene cloning for construction of recombinant molecules (DNA and Vectors)
- Several techniques involved in production of CDNA and Genomic library and primer synthesis
- Classification and properties of an ideal plasmid , plasmid as cloning vector
- Different types of cloning vectors used in genetic engineering
- Different types of screening and selection procedure of identifying recombinants.
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M. Sc Biochemistry
Genetic Engingeering (BS 521)

Course outcome:

- This syllabus will introduced and give an insight to student with several techniques employed in DNA and RNA sequencing
- Principle, types and application of PCR and various blotting and hybridization techniques
- Types of DNA markers and their application
- Vectors types, properties and identification of bacterial colonies having recombinant molecules (plasmid, RE and bacteriophage)
- Application of genetic engineering in improvement of crop productivity and Different methods used for production of transgenic animal
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B.Sc Life Sciences
Genetic Engingeering (BS 303)

Course outcome:

- Students after going through this syllabus students will developed an understanding of several cloning vectors of Plasmid, Bacteriophage and DNA manipulative enymes such as Restriction enzymes and DNA Ligases
- Construction of recombinant DNA molecules including P^{BR322}, in vitro synthesis of r – DNA and different techniques employed for transformation of this r- DNA
- Immunological screening and colony hybridization techniques employ for Screening of recombinants, Various steps involved in contruction of Genomic and cDNA cloning techniques
- Diffferent molecular techniques such as Electrophoretic techniques, Polymerase Chain reaction, Site Directed Mutagenesis, DNA sequencing techniques and Blotting techniques including Southern, Western and Northern Blot
- Application of r- DNA technique in Human Health such as production of insulin, recombinant vaccines (Hepatitis-B) and growth hormones

BS305 Genomics, Proteomics & Metabolomics

Course Outcome:
On completion of the course students will be able to understand:

- Genome sequencing, various types of sequencing technologies and sequencing approaches. Pros and cons of different sequencing technologies
- Major genome databases and methods of Genome analysis and their applications
- Basics and application of structural genomics, comparative genomics and functional genomics
- Various techniques of proteomics like 2D and MALDI. Methods of protein separation, detection and quantitation.
- Technologies in metabolomics, Role of Spectroscopy, Electrophoretic and Chromatographic techniques in metabolic profiling
- Various applications of genomics and proteomics in agriculture, human health and industry

BS444 Microbial Cytology and Genetics
Course Outcome:
On completion of the course students will be able to understand:

- The cell organization in prokaryotes: structure and synthesis of bacterial cell wall and other cell organelles or structures present in bacteria. Importance of antibiotics, their mode of action and development of antibiotic resistance.
- The cell organization in eukaryotes: structure, function and protein transport of membrane, structure and functions of other cell organelles, cytoskeleton, genetic organization and concept of protein targeting.
- Cell division in eukaryotes i.e. Mitosis and Meiosis. Cell cycle and its regulation. Mechanism and pathways of cell proliferation and apoptosis.
- Basics of signal transduction. Role of second messengers and protein kinases in signal transduction. Mechanism of Quorum sensing. Production and application of Biofilms.
- Various methods of gene transfer in bacteria and their mechanism: Transduction, Transformation and Conjugation. Transposons present in prokaryotes and their mechanism of transposition. Types and role of Retrotransposons.

BS504 Advanced Molecular Techniques
Course Outcome:
On completion of the course students will be able to understand:

- Polymerase chain reaction (PCR) and its application. Modifications of PCR. Site directed mutagenesis and its types.
- Various methods of gene silencing in plants and animals: RNA interference, antisense technology and ribozymes.

- Genome sequencing, various types of sequencing technologies and sequencing approaches. Pros and cons of different sequencing technologies.
- Molecular markers and their types. Advantage, disadvantage and application of various types of molecular markers. Principle and application of Proteomics techniques like yeast two hybrid system, protein microarray etc.
- Principle, instrumentation and application of various methods used for introduction of DNA into living cells like chemical transformation etc.

B.Sc. (HONOURS) BIOCHEMISTRY SEMESTER –III
INTRODUCTION TO CELL BIOLOGY (BS242)

Objectives:
The course deals with an understanding of microscopy and studying in depth the characteristic and various components of cell and regulation of cell-cycle.

Course Outcomes:
UNIT I The students will learn about the basics of prokaryotic and eukaryotic cells and use of different types of microscopy for biochemical analysis of the samples accompanied by microscopic examination of tissue, cell or organelle preparations which forms the basis for several research purposes.
UNIT II The students will learn about the organization and chemical composition of biological membrane and the movement of various types of molecules across the semi-permeable membrane. Moreover, they will also gain knowledge of different organelles and their functions carried inside the cell.
UNIT III The students will understand the structure and organization of various cytoskeleton proteins and movement of cilia and flagella. Besides this, they also learnt about the basic mechanism by which the proteins are transported to their respective organelles.
UNIT IV The students will learn about cell wall composition of prokaryotic and eukaryotic cell and the various cell-cell interactions. Furthermore, they will understand the cell communication and the role of cAMP, G-proteins and inositol phosphates in signal transduction.
UNIT V This topic will provide an insight about the cell cycle, apoptosis and cell division processes.

M.Sc. BIOTECHNOLOGY SEMESTER –I
ESSENTIALS OF MOLECULAR BIOLOGY (BS 403)

Objectives:
The objective of the course is learning and understanding the fundamentals of molecular biology. The application of the course focuses on fundamental concepts on DNA replication, Transcription and Translation and also the concept of classes of DNA sequences. This course encompasses methods and techniques used to study and analyze life on the molecular level.
Course Outcomes (CO): After completion of the course, a student will be able to achieve these outcomes.
UNIT I and UNIT II To study about the process of replication in both prokaryotes and eukaryotes and also the mitochondrial and chloroplast DNA replication.
UNIT III To make them understand the outline of transcription in prokaryotes.
UNIT IV To give an insight of different classes of DNA sequences such as unique, repeatitive DNA sequences and transposons.

Course objective

BS322 Comparative Anatomy and Developmental Biology

Objective: On completion of the course, students are able to understand:

- Ontogenetic and phylogenetic developmental in vertebrates
- the structural comparisons of vertebrate systems in major groups of vertebrates
- the terms: Gametogenesis, Fertilization and early development
- cleavage and its types based upon egg organization, cell types and cell patterns
- stem cells, cell potency, cell competence, embryonic induction and cell determination

BS132 Animal diversity I "Nonchordates"

Objective: On completion of the course, students are able to understand:

- the general taxonomic rules on animal classification and the complex interactions among animals of different phyla
- Classification of Protista and Phylum Porifera to Echinodermata with taxanomic keys
- Distinguishing characters of non chordates
- Complex evolutionary processes and behaviour of different animals

BS221 "Chordates" Animal Diversity-II

Objective: On completion of the course, students are able to understand:

- Organization of Protochordata, Urochordata and Cephalochordata
- Classification of various classes of vertebrates i.e. Pisces, Reptiles, Aves and Mammals
- External morphology and sexual dimorphism in chordates

BS233 Animal Physiology

Objective: On completion of the course, students are able to understand:

- about various metabolic and physiological mechanisms of the human body
- the mechanisms that work to keep the human body alive and functioning
- The course also prepare students for a number of Part II Natural Science courses, principally Physiology, Development & Neuroscience, but also Pharmacology, Pathology and Zoology, among others

BS215 Food Biotechnology

- This course aims to impart an insight into the classification, ingredients and additives of food.
- Importance of studying this paper is highlighted reflecting on the current changing needs of the students by providing latest information of food processing and preservation techniques.

- To understand production of fermented food and beverages.
- To study international and national food laws, standards.

BS222 Angiosperm morphology and Taxonomy

- This course aims to impart an insight into the habit, vegetative characters and diversity.
- To study internal structure and reproduction of the most evolved group of plants, the Angiosperm.
- This course helps the students to understand the distinguishing features of angiosperm families and get an insight in to the fruit, seed development and inflorescence.

BS321 Plant Anatomy and Embryology

- This paper deals to understand the scope and importance of plant anatomy and embryology of angiospermic plant.
- Importance of studying this paper is highlighted reflecting on the current changing needs of the students by providing latest information of various tissue systems, anomalous secondary growth in plants.
- To understand structure and development in microsporangium and megasporangium, process of microsporogenesis and megasporogenesis.
- To know fertilization, endosperm and embryogeny.

BS231 Ecology and Adaptation

- To provide introductory knowledge on plant communities.
- To study ecological adaptations along with biotic and abiotic environmental factors.
- This course helps to learn about phytogeographic and zoogeographic realms, vegetation types of India, plant types and succession.
- To study adaptation in animals along with their behavior.

BS 232 Plant Physiology

- To explain principle of plant functions covering physiological processes in plants, such as biochemical metabolism, secondary products, water and solute.
- Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.
- To know the importance of the photosynthesis as related to harvesting solar energy and plant productivity.
- To study plant hormone and its relation with plant growth and development.

Medical Biotechnology (BS-304) B.Sc (BT) III

Course objective

- The objective of this course is to have a firm foundation in the basics of different microbial diseases along with its therapies and some medico-legal aspects and ethical issues.

B.Sc Biotechnology
Biophysical (BS-202) B.Sc (BT) II

Course objective

- Advanced instrumental techniques are used to understand the theoretical principles involved in Bioinstrumentation which may be used for the determination of nutrients, major ions and trace elements, biological samples together with the analytical techniques. Some of these techniques are particularly useful for the detailed analysis of recent methodologies used in the chemical analysis of biota.

B.Sc Biotechnology
Cell biology and genetics (BS-203) B.Sc (BT) II

Course objective

- The objective of this course is to have a firm foundation in the fundamentals of genetics and cell biology and its behaviour.

B.Sc Biochemistry
Fundamental of Genetics (BS-241)

Course objective

- The objective of this course is to have a firm foundation in the fundamentals of genetics and *Drosophila* development.

B.Sc Biotechnology
Animal Science (BS-111) I yr/II sem

Course objective

- To understand the inter relationships within and between anatomical and physiological systems of the human body.
- To understand the importance of economic zoology.

M.Sc Biochemistry

Physiological and Clinical biochemistry (BS-523) III semester

Course objective

- The objectives of this course are to demonstrate, through lectures and other lab based methods, how basic biochemistry and analytical chemistry can be applied to medical diagnosis, treatment and management. It will use examples within human system to demonstrate clinical disorders, the biochemical consequences of particular disease process and the response to therapy.
- To understand the inter relationships within and between anatomical and physiological systems of the human body.

M.Sc Biotechnology

rDNA Technology (BS-501)

Objective: The objective of this course is to gave students a basic understanding of various components required for gene cloning.

N. Sc Biochemistry

Genetic Engingeering (BS 521)

Objective: The objective of this course is to give a deeper insight in the various techniques employed in genetic engineering including their application.

B.Sc Life Sciences

Genetic Engingeering (BS 303)

Objective: The objective of this course to give a brief outlook of various tools and procedure required in gene cloning along with their application in human health

BS305 Genomics, Proteomics & Metabolomics

Course Objective:

To provide students a proper understanding of techniques used in genomics, proteomics and metabolomics and their application in various fields.

BS444 Microbial Cytology and Genetics

Course Objective:

- To give students a proper understanding of prokaryotic and eukaryotic cell organization.

- To develop in students the understanding about mechanism and regulation of eukaryotic cell cycle and signal transduction.
- To explain students about various methods of gene transfer in bacteria.

BS504 Advanced Molecular Techniques
Course Objective:
To develop in students the understanding about advanced techniques used in molecular biology and biotechnology and their application.