



Annai College of Arts & Science

Quality Education for Today & Tomorrow

Kovilacheri, Kumbakonam. 612 503. Ph: 0435 2453007

Accredited by NAAC with "B" Grade & Recognized by UGC under Section 2(f) & 12(B)
Affiliated to Bharathidasan University, Tiruchirappalli. E-Mail: acasdmn@gmail.com

DEPARTMENT OF BIOSCIENCE

Programme outcome, Programme Specific outcome

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Course outcome

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UG DEPARTMENT OF BIOTECHNOLOGY

Programme Outcome:

PO1: Students develop global competencies in the area of basic and applied biological sciences.

PO2: Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.

PO3: Know various Culture media and their applications are also understand various physical and chemical means of sterilization.

PO4: Biotechnology teaches about biological sciences with engineering technologies that manipulate living organisms and biological systems to produce products that advance healthcare, medicine, agriculture, food, Pharmaceuticals and environment control.

PO5: Master aseptic techniques are able to perform routine culture handling tasks safely and effectively.

PO6: Understand the microbial transport systems, the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy.

PO7: Discern the replication strategies of representative viruses from the seven Baltimore classes.

PO8: To enrich students' knowledge and train them in various branches of Biotechnology such as genetics, molecular biology, biochemistry, immunology, fermentation technology, environmental biotechnology and tissue culture techniques.

PO9: To groom the students to meet futuristic challenges and national interests.



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UG DEPARTMENT OF BIOTECHNOLOGY

Programme Specific Outcome:

PSO1: Emphasis on the application of recombinant DNA technology to animals, plants and microbial organisms. to gain knowledge about the application of various types of Microscopy to classify and explain the structure and general characteristics of microorganisms.

PSO2: To explain the microbial degradation of pesticides, bioremediation and biofertilizers.

PSO3: The course describes the use of genetically engineered products to solve environmental Problems and cure human diseases.

PSO4: Understand the applications of biotechnology and advances in the different areas like Medical, microbial, environmental, bioremediation, agricultural, plant, animal and forensic sciences. Learn the concept and applications of monoclonal antibody technology

PSO5: Learn how to use mammalian cells for the production of pharmaceutical products

PSO6: Explain the general principles of generating transgenic plants, animals and microbes.

PSO7: Students will possess hands-on technical skills necessary to support biotechnology

PSO8: Research activity. Have hands-on experience of basic techniques like agarose and poly acryl amide gel

PSO9: A general course emphasizing distribution, morphology and physiology of microorganisms in addition to skills in aseptic procedures, isolation and identification. This course also includes sophomore level material covering immunology, virology, and epidemiology and DNA technology.



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PG DEPARTMENT OF BIOTECHNOLOGY

Programme Outcome:

PO1: Ability to carry out research /investigation independently in specialized area of Biotechnology.

PO2: Able to demonstrate a degree of mastery in the area of biotechnology to enable them in collaborative and multidisciplinary research.

PO3: Ability to write and present a substantial technical report/document.

PO4: enable them in collaborative and multidisciplinary research. PO4 Recognise the need for continuous learning and will prepare oneself to create, select, learn and apply appropriate techniques, resources, and modern instrumentation to solve complex biotechnological activities with an understanding of the limitations.

PO5: Know various Culture media and their applications are also understand various physical and chemical means of sterilization.

PO6: Demonstrate knowledge of biotechnology and management principles and apply to manage projects efficiently and economically with intellectual integrity and ethics for sustainable development of society.



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PG DEPARTMENT OF BIOTECHNOLOGY

Programme Specific Outcome:

PSO1: Apply fundamental knowledge of biological sciences for the human Welfare.

PSO2: Demonstrate the application of biotechnological processes of industrial biochemical processes that are of social and industrial importance.

PSO3: Exhibit skills of handling microbial processes, biochemical analysis by making use of state of the instruments.

PSO4: Acquire skills of handling plants and in vitro culturing and genetic engineering process which are important for addressing biotic and abiotic structure and social issues.

PSO5: Committed for developing a student's self-reliance, creativity, leadership, ethical standards, and capacity for professional and intellectual growth.

PSO6: Exhibit strong, independent learning, analytical and problem solving skills with special emphasis on design, communication and an ability to work in teams.

PSO7: A key component of the program is directed to research on cutting edge problems under the guidance of national and international scientists.



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UG DEPARTMENT OF MICROBIOLOGY

Programme Outcome:

PO1: Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures.

PO2: Formulate, articulate, retain and apply specialized language and knowledge relevant to the core concepts in microbiology.

PO3: Apply the Microbiology discipline through involvement in research or internship activities

PO4: Understand the basic microbial structure, functions and study the comparative characteristics of prokaryotes and eukaryotes and also understand the structural similarities and differences among various physiological groups of bacteria/*archaea*.

PO5: Evaluate examples of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human wellbeing.

PO6: Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae.

PO7: Comprehend the various methods for identification of unknown microorganisms.

PO8: Understand the microbial transport systems, the modes and mechanisms of energy conservation in microbial metabolism – Autotrophy and heterotrophy.

PO9: Know the various Physical and Chemical growth requirements of bacteria and get equipped with various methods of bacterial growth measurement.

PO10: Know how viruses are classified, understand the architecture of viruses and know the methods used in studying viruses.



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UG DEPARTMENT OF MICROBIOLOGY

Programme Specific Outcome:

PSO1: A general course emphasizing distribution, morphology and physiology of microorganisms in addition to skills in aseptic procedures, isolation and identification.

PSO2: This course also includes sophomore level material covering immunology, virology, and epidemiology and DNA technology.

PSO3: Understand fundamental principles involved in Microbiology.

PSO4: Acquire detail knowledge of microorganisms, their types and significance.

PSO5: Understand metabolic and structural significance of bio-molecules.

PSO6: Acquaint with concepts of Immunity, Antigen, Antibody and Immune system.

PSO7: Understand importance and applications of various enzymes in replication transcription and translations.

PSO8: Acquire detail knowledge of industrial production of enzymes, antibiotics and vitamins.



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PG DEPARTMENT OF MICROBIOLOGY

Programme Outcome:

PO1: Get ability to apply the process of science by formulating hypotheses and design experiments based on the scientific method.

PO2: Analyze and interpret results from a variety of microbiological methods.

PO3: Use quantitative reasoning by using mathematical calculations and graphing skills to solve problems in microbiology.

PO4: Communicate and collaborate with other disciplines by effectively communicating the fundamental concepts of microbiology in written and oral format.

PO5: Identify credible scientific sources to interpret and evaluate the evidences.

PO6: Understand the relationship between science and society by recognizing and discussing logical, scientific and ethical issues in microbiology.

PO7: Apply the Microbiology discipline through involvement in research or internship activities

PO8: Evaluate examples of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human wellbeing.

PO9: Know how viruses are classified, understand the architecture of viruses and know the methods used in studying viruses.



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PG DEPARTMENT OF MICROBIOLOGY

Programme Specific Outcome:

PSO1: Apply the knowledge of biological, microbial and biochemical fundamentals to find the solution for complex molecular functions and physiology.

PSO1: Developing skilled persons in the sector of Disease diagnosis, treatment and prevention.

PSO1: Pest control using microbes and improving soil quality and agricultural output through sustainable microbiological applications.

PSO1: To train the students in both theory and practical to accommodate them in both higher education and industries.

PSO1: To augment problem-solving skills of students through industry oriented training programmes at various levels.

PSO1: To enrich the Graduates with solid fundamentals of microbiology and advanced technologies.

PSO1: To enable them to employ the acquired theoretical knowledge wherever necessary.

PSO1: To occur hands on skills in Industry and/or Institutes, to better placement.



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UG DEPARTMENT OF BIOCHEMISTRY

Programme Outcome:

PO1: Students are able to understand the synthesis of proteins, lipids, nucleic acids and carbohydrates and their role in metabolic pathways.

PO2: Ability to apply the fundamental knowledge of Biomolecules, protein, biochemical techniques in the area of biochemistry.

PO3: ability to identify, formulate and solve the problems in the area of biochemistry.

PO4: In-depth and detailed functional knowledge of the fundamental theoretical concepts and experimental methods of Biochemistry.

PO5: Apply/implement interface between, on the one hand, the history of Biochemistry and natural science and, on the other hand, issues pertaining to the areas of modern technology, health, and environment.

PO6: Skills in planning and conducting advanced chemical experiments and applying structural-chemical characterization techniques.

PO7: Skill in examining specific phenomena theoretically and/or experimentally.

PO8: Generation of new scientific insights or to the innovation of new applications of Biochemistry research.

PO9: knowledge of contemporary issues in the area of biochemistry.



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UG DEPARTMENT OF BIOCHEMISTRY

Programme Specific Outcome:

PSO1: Application of the principles of thermodynamics and chemical kinetics in chemical reactions.

PSO2: Ability to analyze the various biological components through analytical tools in living cells and molecular machinery.

PSO3: Acquire practical skills that will prepare for a future career in the interdisciplinary subjects.

PSO4: Understanding of the applications of Biochemistry in various fields such as Clinical Biochemistry, Genetic Engineering, Molecular biology & Biotechnology.

PSO5: Understanding of the scientific basis of life process and orientation towards the application of knowledge acquired in solving clinical problem.

PSO6: Students shall be able to identify, formulate and solve the problems of endocrine disorders in the area of hormone biochemistry.

PSO7: Students shall be able to conduct the clinical biochemistry, Diagnostic biochemistry experiments as well as to analyze and interpret the results



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Course Outcomes:

Name of the Course With Subject Code	Course Outcomes
CELL BIOLOGY/ 16SCBT1	<p>CO1: How you demonstrate membrane transport?</p> <p>CO2: Explain the nature of polymers and their integrity in cell structure.</p> <p>CO3: How do you explain that external signals are amplified within the cells?</p> <p>CO4: Explain the importance of cellular Lipid recycling?</p> <p>CO5: How the Cells are Communicating?</p> <p>CO6: Discuss the complexity of cell specialization in everyday life.</p> <p>CO7: Describe the structure and function of ribosomes.</p> <p>CO8: Reveal nuclear organization.</p> <p>CO9: Brief cytoskeleton and cell appendages.</p>
BASIC MICROBIOLOGY/16SACMB1	<p>CO1: Learning the morphology and ultra structure of microorganisms.</p> <p>CO2: Understanding the concept of classification and contributions of microbiologist.</p> <p>CO3: Exploring the various types of microscopes and its applications.</p> <p>CO4: List out the applications of microbial metabolism in industrial applications.</p> <p>CO5: Understand the Ultra structure of prokaryotic and eukaryotic cells.</p>



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<p>MOLECULAR BIOLOGY/16SCCBT2</p>	<p>CO1: Explain the biology has a basis in chemistry, physics and mathematics.</p> <p>CO2: How do you correlate biochemistry and genetics with the function of cell?</p> <p>CO3: How the chemical and molecular processes that occur in and between cells-explain.</p> <p>CO4: How do you explain the advancement in rDNA technology?</p> <p>CO5: How do you perform the molecular and cell based experiment either to confirm or reject the hypotheses.</p> <p>CO6: How do you explain the role of cell adhesion molecules?</p>
<p>APPLIED MICROBIOLOGY/16SACMB2</p>	<p>CO1: Explain the classification of Microorganisms, prokaryotes, and eukaryotes.</p> <p>CO2: Describe the morphology and general properties of bacteria, actinobacteria, cyanobacteria.</p> <p>CO3: Narrates the morphology, cultivation, life cycle of protozoa.</p> <p>CO4: Describe the structure and nutrition, life cycle of yeast and mold.</p> <p>CO5: Explain the symbiotic microorganisms.</p> <p>CO6: Narrates the cultivable and uncultivable microorganisms.</p>
<p>RDNA TECHNOLOGY /16SCCBT3</p>	<p>CO1: Explains Restriction endonucleases –Type I, II & III and DNA Manipulative Enzymes.</p> <p>CO2: Classify cloning vectors.</p> <p>CO3: Pinpoint various cloning methods.</p> <p>CO4: Explain PCR and its types.</p> <p>CO5: Discuss PCR in molecular diagnostics.</p> <p>CO6: Write down PCR for mutagenesis.</p> <p>CO7: Identify methods of DNA sequencing.</p> <p>CO8: Explain gene silencing and gene therapy.</p>
<p>BIOMOLECULES/16SACBT1</p>	<p>CO1: To list out the structure and functions of biological macromolecules.</p> <p>CO2: To learn the metabolism and integration of biomolecules that</p>



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	<p>takes place in human system.</p> <p>CO3: Integrate the various aspects of metabolism and their regulatory pathways.</p> <p>CO4: Students can understand the fundamental energetic of biochemical processes.</p> <p>CO5: To elaborate the relation between biochemical defects and metabolic disorders.</p> <p>CO6: To enumerate the organization of signaling pathways.</p> <p>CO7: Overall, To grasp the processes of metabolic.</p>
<p>IMMUNOLOGY / 16SCCBT4</p>	<p>CO1: How you identify the component of the immune system.</p> <p>CO2: Explain the cross reactivity and cross linking - correlate with antigen-antibody interaction.</p> <p>CO3: Discuss-MHC and peptide interaction is direct kill or recruitment of killers.</p> <p>CO4: Processing of antigen by endogenous/ exogenous pathway.</p> <p>CO5: How you can describe the role of co-receptor and adhesion molecule in immune response.</p> <p>CO6: Integrate knowledge of each subsystem to see their contribution to the functioning of higher-level systems in health and disease.</p> <p>CO7: Translate understanding of basic mechanisms into identification of biological, clinical and therapeutic implications</p>
<p>APPLIED BIOCHEMISTR Y/16SACBT2</p>	<p>CO1: To list out the structure and functions of biological macromolecules.</p> <p>CO2: Describe classification and properties of enzymes.</p> <p>CO3: To elaborate the relation between biochemical defects and metabolic disorders.</p> <p>CO4: To elaborate the relation between biochemical defects and metabolic disorders.</p> <p>CO5: To enumerate the organization of signaling pathways.</p> <p>CO6: To learn the metabolism and integration of biomolecules that</p>



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	takes place in human system.
PLANT BIOTECHNOLOGY/ 16SCCBT5	<p>CO1: MS medium preparation and sterilization</p> <p>CO2: Explains basic techniques in plant tissue culture.</p> <p>CO3: Narrate Organogenesis and Somatic embryogenesis</p> <p>CO4: Describes Practical applications of somatic embryogenesis and cryopreservation.</p> <p>CO5: Details of Micro propagation and production microbe free plants.</p> <p>CO6: Basics of Androgenesis, development of Androgenic haploids and Haploid application in plant breeding.</p> <p>CO7: In vitro seed germination.</p> <p>CO8: Adventitious shoot production.</p> <p>CO9: Callus induction and Cell suspension culture.</p> <p>CO10: Agrobacterium mediated genetic transformation..</p>
ANIMAL BIOTECHNOLOGY/ 16SCCBT6	<p>CO1: Discuss about different cell culture and its storage.</p> <p>CO2: Discuss about transgenic animals.</p> <p>CO3: Give the importance of stem cell biology</p> <p>CO4: Elaborate hybridization technique.</p> <p>CO5: Detail note on viral vectors.</p> <p>CO6: Write down the application of gene therapy.</p> <p>CO7: Discuss about embryonic stem cell differentiation.</p>
BIOSATISTIC AND BIOSAFETY/ 16SCCBT7	<p>CO1: Understand biological databases and how to retrieve the information from the Databases</p> <p>CO2: Learn about algorithms and matrices in global and local alignment</p> <p>CO3: Construct phylogentic tree using multiple sequence alignment</p> <p>CO4: Knowledge about virtual screening. Molecular modelling and dynamics</p>



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	<p>CO5: Apply basic biostatistics.</p> <p>CO6: Know bioethics concepts in animal and modern biotechnology.</p>
<p>MICROBIAL BIOTECHNOLOGY/ 16SCCBT8</p>	<p>CO1: Explain in detail about industrial microbes.</p> <p>CO2: Describe the process of screening commercial microbes.</p> <p>CO3: Elaborate anaerobic fermentation process.</p> <p>CO4: Discuss the fermentation of dairy products.</p> <p>CO5: Discuss about microbial leaching.</p> <p>CO6: Elaborate recombinant microbial products..</p>
<p>IPR AND BIOETHICS/ 16SCCBT9</p>	<p>CO1: Pinpoint national and international legal trademark in IPR.</p> <p>CO2: Identify national and international agencies in IPR.</p> <p>CO3: Know Budapest treaty and culture collection.</p> <p>CO4: The students once they complete their academic projects, they get awareness of acquiring the patent and copyright for their innovative works.</p> <p>CO5: They also get the knowledge of plagiarism in their innovations which can be questioned legally.</p>
<p>FOOD BIOTECHNOLOGY/ 16SMBEBT2</p>	<p>CO1: Better understanding of cause of microbes in food spoilage.</p> <p>CO2: Gets information regarding food preservation?</p> <p>CO3: Apply regulatory techniques in real time scenarios.</p> <p>CO4: Acquire an understanding in industrial operations in food, role of microbes.</p>
<p>IMMUNOTECHNOLOGY/ 16SMBEBT3</p>	<p>CO1: How you identify the component of the immune system.</p> <p>CO2: Explain the cross reactivity and cross linking - correlate with antigen-antibody interaction.</p> <p>CO3: Discuss-MHC and peptide interaction is direct kill or recruitment of killers.</p> <p>CO4: Processing of antigen by endogenous/ exogenous pathway.</p> <p>CO5: How do you distinguish- Classical and non-classical antigen fragments?</p>



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Name of the Course With Subject Code	Course Outcomes
CELL BIOLOGY/ PI6BT11	<p>CO1: Biology of plasmids. Discovery, types & Structure of R, RIP, COL factors & Ti plasmids. Replication, Incompatibility & Copy number.</p> <p>CO2: Natural & Artificial Plasmid. Transfer & their Applications.</p> <p>CO3: Discovery, Early experiments of McClintock in Maize.</p> <p>CO4: Insertion sequence in prokaryotes.</p> <p>CO5: Complex transposons (Tn10, Tn5, Tn3 & Tn9 as examples).</p> <p>CO6: Mechanisms, Control, Consequences and applications of transposition by simple & complex elements.</p> <p>CO7: Structural organization of prokaryotic cell – Pili & Fimbria.</p> <p>CO8: list out the immunodeficiency disorders.</p>
MICROBIOLOGY/ PI6BT12	<p>CO1: Explain the classification of Microorganisms, prokaryotes, and eukaryotes.</p> <p>CO2: Describe the morphology and general properties of bacteria, actinobacteria, cyanobacteria.</p> <p>CO3: Narrates the morphology, cultivation, life cycle of protozoa.</p> <p>CO4: Describe the structure and nutrition, life cycle of yeast and mold.</p>



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	<p>CO5: Describe classification and properties of enzymes.</p> <p>CO6: To elaborate the relation between biochemical defects and metabolic disorders.</p> <p>CO7: To enumerate the organization of signaling pathways.</p>
<p>BIOCHEMISTRY/ PI6BT13</p>	<p>CO1: To list out the structure and functions of biological macromolecules.</p> <p>CO2: Students can understand the fundamental energetic of biochemical processes.</p> <p>CO3: To elaborate the relation between biochemical defects and metabolic disorders.</p> <p>CO4: To learn the metabolism and integration of biomolecules that takes place in human system.</p> <p>CO5: To enumerate the organization of signaling pathways.</p> <p>CO6: The structures of amino acids, their chemical properties and their organization into Polypeptides and proteins. Methods for isolating and characterizing proteins the basic elements of protein structure key.</p>
<p>MOLECULAR BIOLOGY/ PI6BT14</p>	<p>CO1: How do you explain the advancement in rDNA technology?</p> <p>CO2: Explain the biology has a basis in chemistry, physics and mathematics.</p> <p>CO3: How do you correlate biochemistry and genetics with the function of cell?</p> <p>CO4: How do you perform the molecular and cell based experiment either to confirm or reject the hypotheses.</p> <p>CO5: How do you explain the role of cell adhesion molecules?</p> <p>CO6: How the chemical and molecular processes that occur in and between cells-explain.</p>
<p>rDNA TECHNOLOGY/ PI6BT21</p>	<p>CO1: Narrate enzymes and molecules used in Rdna.</p> <p>CO2: Classify cloning vectors.</p> <p>CO3: Pinpoint various cloning methods.</p> <p>CO4: Discuss PCR in molecular diagnostics.</p>



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	<p>CO5: Explain PCR and its types.</p> <p>CO6: Write down PCR for mutagenesis.</p> <p>CO7: Explain gene silencing and gene therapy.</p> <p>CO8: Identify methods of DNA sequencing.</p>
<p>IMMUNOLOGY/ PI6BT22</p>	<p>CO1: Describe antigenicity, self and non self immunity.</p> <p>CO2: Reveal lymphoid organs and tissues.</p> <p>CO3: Identify primary and secondary immune systems.</p> <p>CO4: Explain B and T cell immunity.</p> <p>CO5: Narrate immunoglobulins and genetics of antibody diversity.</p> <p>CO6: Brief MHC and transplantation biology.</p> <p>CO7: Classify immune disorders.</p>
<p>PLANT BIOTECHNOLOGY/ PI6BT31</p>	<p>CO1: Describe the laboratory requirements and concepts and basic techniques applied in plant tissue culture including cell, tissue, organ and suspension cultures.</p> <p>CO2: Explain micro propagation, organogenesis, somatic embryogenesis and haploid production in plant tissue culture.</p> <p>CO3: Narrate the types of protoplast fusion and protoplast culture.</p> <p>CO4: State the production and classification of secondary metabolites and application of cell suspension, immobilized, and elicitors, hairy root and biotransformation.</p> <p>CO5: Write on Agrobacterium transformation and types of gene transformation in plant cells.</p> <p>CO6: Discuss about reporters genes and promoters, genetic engineering of plants for disease free resistance like antifungal, virus resistance, insect resistance, Bt genes, and herbicide tolerance.</p> <p>CO7: Write an outline of ACC oxidizes for delayed fruit ripening and merits and demerits of GM crops.</p>



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<p>ANIMAL BIOTECHNOLOGY/ PI6BT32</p>	<p>CO1: Discuss about different cell culture and its storage. CO2: Discuss about transgenic animals. CO3: Give the importance of stem cell biology. CO4: Elaborate hybridization technique. CO5: Detail note on viral vectors. CO6: Write down the application of gene therapy. CO7: Discuss about embryonic stem cell differentiation. CO8: Explain tissue engineering and regeneration.</p>
<p>BIOPROCESS TECHNOLOGY/ PI6BT41</p>	<p>CO1: Explain the growth cycle of microbes. CO2: Discuss about fermentation media. CO3: Describe immobilization techniques. CO4: Elaborate the design and types of fermentor. CO5: Write down the applications of recombinant products. CO6: Discuss about fermentation economics. CO7: Explain different classes of fermenters. CO8: Discuss fermenter design and operation.</p>
<p>FOOD TECHNOLOGY/ PI6BT42</p>	<p>CO1: Acquire an understanding of relevance of food components, CO2: Acquire an understanding application and detection techniques in food. CO3: Apply regulatory techniques in real time scenarios. CO4: Acquire an understanding in industrial operations in food, role of microbes.</p>



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UG DEPARTMENT OF MICROBIOLOGY

Course Outcomes:

Name of the Course With Subject Code	Course Outcomes
FUNDAMENTALS OF MICROBIOLOGY/ 16SACCMB1	<p>CO1: Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology.</p> <p>CO2: Identify ways microorganism's play an integral role in disease, and microbial and immunological methodologies are used in disease treatment and prevention.</p> <p>CO3: Explain the classification of Microorganisms, prokaryotes, and eukaryotes.</p> <p>CO4: Describe the morphology and general properties of bacteria, actinobacteria, cyanobacteria.</p> <p>CO5: Narrates the morphology, cultivation, life cycle of protozoa.</p> <p>CO6: Describe the structure and nutrition, life cycle of yeast and mold.</p>
BIOCHEMISTRY I/ 16SACBC1	<p>CO1: Describe various types of Biomolecules.</p> <p>CO2: Pinpoint biochemical characteristics of amino acids.</p> <p>CO3: Write down biochemical characteristics of proteins and enzymes.</p> <p>CO4: List out biochemical characteristics of Carbohydrates.</p> <p>CO5: Narrate biochemical characteristics of Lipids.</p> <p>CO6: Write down biochemical characteristics of Nucleic acids.</p> <p>CO7: Explain the concept of energy and thermodynamics.</p> <p>CO8: Apply thermodynamics in biology - photosynthesis and respiration.</p>



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<p>MICROBIAL METABOLISM/ 16SCCMB2</p>	<p>CO1: Understand regulation of blood glucose level.</p> <p>CO2: Describe major pathways like Glycolysis, TCA cycle, Urea cycle etc.</p> <p>CO3: Discuss amino acid catabolism like transamination, transmethylation, decarboxylation etc.</p> <p>CO4: Understanding the concept of classification and contributions of microbiologist.</p> <p>CO5: Exploring the various types of microscopes and its applications.</p> <p>CO6: List out the applications of microbial metabolism in industrial applications.</p> <p>CO7: Basics of nitrogen fixation and its application in agricultural improvement.</p>
<p>BIOCHEMISTRY II/ 16SACBC2</p>	<p>CO1: Describe classification and properties of enzymes</p> <p>CO2: Understand industrial applications of enzymes.</p> <p>CO3: List out biochemical characteristics of Carbohydrates.</p> <p>CO4: Narrate biochemical characteristics of Lipids.</p> <p>CO5: To enumerate the organization of signaling pathways.</p> <p>CO6: The structures of amino acids, their chemical properties and their organization into Polypeptides and proteins. Methods for isolating and characterizing proteins the basic elements of protein structure key.</p>
<p>IMMUNOLOGY/ 16SCCMB3</p>	<p>CO1: Demonstrate an understanding of key concepts in immunology.</p> <p>CO2: Understand the concept of Immune system, Immunity, Immune response</p> <p>CO3: Describe the structure and, functions of antigen and antibody.</p> <p>CO4: Explain the humoral and cell mediated immune response.</p> <p>CO5: Narrates the antigen, antibody reactions.</p>



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	<p>CO6: Explain the transplantation immunology.</p> <p>CO7: Describe the autoimmune diseases.</p> <p>CO8: Explain the hypersensitivity reactions.</p> <p>CO9: list out the immunodeficiency disorders.</p>
<p>BIOSTATISTIC AND INFORMATISTIC/ 16SACBS1</p>	<p>CO1: Understand basic terms and applications of biostatistics.</p> <p>CO2: Represent the DATA diagrammatically.</p> <p>CO3: Understand limitations of graphic representation.</p> <p>CO4: Measure central tendencies like mean, mode and median and their relationship.</p>
<p>INTRODUCTORY VIROLOGY/ 16SCCMB4</p>	<p>CO1: Explain the historical background of virus, taxonomy, nomenclature, evaluation and classification.</p> <p>CO2: Learning the life cycle, replication strategies and application of bacterial and plant viruses.</p> <p>CO3: Understanding the strategies of anti-viral agents and viral vaccination.</p> <p>CO4: Analyzing the pre-cautions and issues of vaccination.</p> <p>CO5: Explain the basics of cyano, myco and phycophages.</p> <p>CO6: Understand the plant viral diseases and its control measures.</p> <p>CO7: List out the application of cyano, myco and phycophages.</p> <p>CO8: Analyze the Pre-cautions and issues of vaccination.</p>
<p>BIOINFORMATICS AND COMPUTER APPLICATIONS IN BIOLOGY/ 16SACBS2</p>	<p>CO1: Explain in detail about UNIPROT Database.</p> <p>CO2: Define Dynamic programming and explain the Smith waterman algorithm.</p> <p>CO3: What are the methods of Phylogenetic tree construction?</p> <p>CO4: Explain SCOP and CATH databases.</p> <p>CO5: Write about PRINTS, BLOCKS and PRODOM Databases.</p> <p>CO6: Explain the Resources at the EMBL-EBI.</p> <p>CO7: Appreciate the basic nature and diversity of microbial, plant and animal life.</p> <p>CO8: Understanding the classification of organisms, their</p>



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	<p>structure and function.</p> <p>CO9: The students will be able to explain the major steps in pairwise and multiple sequence alignment, explain the principle for, and execute pairwise sequence alignment by dynamic programming.</p>
<p>MEDICAL MICROBIOLOGY/ 16SCCMB5</p>	<p>CO1: Exploring the role of microbiology in medicine.</p> <p>CO2: Skilled at diagnosis of bacterial, viral, protozoan and other parasitic diseases.</p> <p>CO3: Learning the concept, etiology and epidemiology of infections.</p> <p>CO4: List out the prevention of medically important microbes.</p> <p>CO5: Understand the Host-microbe interactions.</p> <p>CO6: Analyze the molecular biology of animal virus and various antiviral agents.</p> <p>CO7: Describe the various types of parasite and its control measures.</p> <p>CO8: To analyze the micro biome's role in diseases.</p>
<p>AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY/ 16SCCMB6</p>	<p>CO1: Learning and exploration of site specific microbes and its application through met genomic approach.</p> <p>CO2: Basics of aerobiology and aquatic microbiology ant its applications.</p> <p>CO3: Exploring the microbes for waste water treatment and sustainable agriculture development.</p> <p>CO4: Understanding the plant microbe interaction and strengthening the below ground diversity.</p> <p>CO5: Learn the basic concept of Microbial adaptation in natural and extreme condition.</p> <p>CO6: To explain the difference between bioremediation. bioadsorption, bioaccumulation and biomagnifications.</p> <p>CO7: To narrate the Outline of biogeochemical cycles.</p>



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<p>MOLECULAR BIOLOGY AND MICROBIAL GENETICS/ 16SCCMB7</p>	<p>CO1: Narrate the concept of DNA, gene and mutation. CO2: Observe and gaining knowledge of genetic code and protein. CO3: Understanding the basics of operon concepts and gene regulations. CO4: Application of genetic research in crop improvement and pest control. CO5: Explain the basics and regulation of DNA replication. CO6: Describe the Signal sequences and protein transport. CO7: Analyse the concept of transcription and translation. CO8: Fathom the genome organization and control of gene expressions in prokaryotes and eukaryotes.</p>
<p>FOOD MICROBIOLOGY/ 16SCCMB8</p>	<p>CO1: Learn the fundamental principles and concepts of food microbiology. CO2: Understand the beneficial role of microorganisms in fermented foods and in food processing and the microbiology of different types of fermented food products – dairy, pickles, Legume and cereal based food products. CO3: Basics of food borne diseases and its economic importance. CO4: Understanding food control agencies and its regulations. CO5: Familiar with the concept of food hygiene/control and their role in retail trade. CO6: Understand the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in foods CO7: Know the spoilage mechanisms in foods and thus identify methods to control deterioration and spoilage.</p>
	<p>CO1: Get equipped with a theoretical and practical understanding of industrial microbiology. CO2: Apply the knowledge of molecular biology and microbial genetics to develop industrially important microorganism. CO3: Recognize the fundamentals of fermentor and fermentation</p>



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<p>INDUSTRIAL MICROBIOLOGY/ 16SCCMB9</p>	<p>technology.</p> <p>CO4: Use the most common equipment, materials and methods related to fermentation processes, microbial growth and cultivation and sterilization.</p> <p>CO5: Appreciate how microbiology is applied in manufacture of industrial products.</p> <p>CO6: Know how to source for microorganisms of industrial importance from the environment.</p> <p>CO7: Know about design of bioreactors, factors affecting growth and production, heat transfer, oxygen transfer.</p>
<p>RECOMBINANT DNA TECHNOLOGY/ 16SMBEMB2</p>	<p>CO1: Exploring the basic techniques of rDNA technology.</p> <p>CO2: Skilled at hybridization and restriction mapping and its application in pharmaceutical and food industries.</p> <p>CO3: Concept of protein engineering and its clinical application.</p> <p>CO4: Understanding the application of rDNA technology in disease diagnostics and gene therapy.</p> <p>CO5: Basic knowledge on ethical, legal and social issues of genetically modification.</p> <p>CO6: Acquire basic knowledge of DNA sequencing methods from conventional (Sanger sequencing) to High throughput Next generation sequencing technology, their principle, chemistry, theory and types.</p> <p>CO7: To understand the role, use and types of different DNA modifying enzymes viz. Polymerases, Nucleases, restriction endonuclease, ligases etc.</p> <p>CO8: Students will able to understand the strategies and steps involved in construction of genomic and cDNA library, essential tools and role of each and every constituents.</p>



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**MICROBIAL
BIOTECHNOLOGY
AND BIOETHICS/
16SMBEMB3**

CO1: Define microbial taxonomy with phenotype.

CO2: How do you classify the nutrients?

CO3: How do you calculate the CFU

CO4: Discuss about beneficiary microbes in everyday life.

CO5: Discuss the possibility to use the microorganism to solve environmental problems.

CO6: Discuss the survival mechanism of pathogenic microorganism in environment.

CO7: Culture of different culture nutrient media.

CO8: Equipped with aseptic techniques.



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PG DEPARTMENT OF MICROBIOLOGY

Course Outcomes:

Name of the Course With Subject Code	Course Outcomes
GENERAL MICROBIOLOGY/ PI6MB12	<p>CO1: Significant knowledge will be obtained about various microbes including cell structure.</p> <p>CO2: Complete information about cell cycles, reproduction in bacteria and aspects of bacterial growth.</p> <p>CO3: A firm grasp of the basics of microscopy and the principles, working and applications of bright field microscopes and electron microscopes.</p> <p>CO4: Explain the classification of Microorganisms, prokaryotes, and eukaryotes.</p> <p>CO5: Describe the morphology and general properties of bacteria, actinobacteria, cyanobacteria.</p> <p>CO6: Narrates the morphology, cultivation, life cycle of protozoa.</p> <p>CO7: Describe the structure and nutrition, life cycle of yeast and mold.</p>
VIROLOGY/ PI6MB13	<p>CO1: Understand the architecture of viruses.</p> <p>CO2: Explain the historical background of virus, taxonomy, nomenclature, evaluation and classification.</p> <p>CO3: Learning the life cycle, replication strategies and application of bacterial and plant viruses.</p> <p>CO4: Understanding the strategies of anti-viral agents and viral vaccination.</p> <p>CO5: Analyzing the pre-cautions and issues of vaccination.</p>



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	<p>CO6: Explain the basics of cyano, myco and phycophages.</p> <p>CO7: Understand the plant viral diseases and its control measures.</p> <p>CO8: Analyze the Pre-cautions and issues of vaccination.</p> <p>CO9: List out the application of cyano, myco and phycophages.</p>
<p>GENERAL BIOCHEMISTRY/ PI6MB14</p>	<p>CO1: Describe various types of Biomolecules.</p> <p>CO2: Pinpoint biochemical characteristics of amino acids.</p> <p>CO3: Write down biochemical characteristics of proteins and enzymes.</p> <p>CO4: Explain the concept of energy and thermodynamics.</p> <p>CO5: Apply thermodynamics in biology - photosynthesis and respiration.</p> <p>CO6: List out biochemical characteristics of Carbohydrates.</p> <p>CO7: Narrate biochemical characteristics of Lipids.</p> <p>CO8: To enumerate the organization of signaling pathways.</p> <p>CO9: The structures of amino acids, their chemical properties and their organization into Polypeptides and proteins. Methods for isolating and characterizing proteins the basic elements of protein structure key.</p>
<p>MICROBIAL PHYSIOLOGY/ PI6MB21</p>	<p>CO1: Explain the principles of the energy-yielding and consuming reactions, the various catabolic and anabolic pathways, the transport systems and the mechanisms of energy conservation in microbial metabolism.</p> <p>CO2: Identify the various physiological groups of bacteria/<i>archaea</i> with their special features, their applications and ways to study them.</p>



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<p>ENVIRONMENTAL & AGRICULTURE MICROBIOLOGY/ PI6MB22</p>	<p>CO1: Learning and exploration of site specific microbes and its application through met genomic approach.</p> <p>CO2: Basics of aerobiology and aquatic microbiology ant its applications.</p> <p>CO3: Exploring the microbes for waste water treatment and sustainable agriculture development.</p> <p>CO4: Understanding the plant microbe interaction and strengthening the below ground diversity.</p> <p>CO5: Learn the basic concept of Microbial adaptation in natural and extreme condition.</p> <p>CO6: To explain the difference between bioremediation. bioadsorption, bioaccumulation and biomagnifications.</p> <p>CO7: To narrate the Outline of biogeochemical cycles.</p>
<p>IMMUNOLOGY/ PI6MB32</p>	<p>CO1: Demonstrate an understanding of key concepts in immunology.</p> <p>CO2: Understand the concept of Immune system, Immunity, Immune response</p> <p>CO3: Describe the structure and, functions of antigen and antibody.</p> <p>CO4: Explain the humoral and cell mediated immune response.</p> <p>CO5: Narrates the antigen, antibody reactions.</p> <p>CO6: Explain the transplantation immunology.</p> <p>CO7: Describe the autoimmune diseases.</p> <p>CO8: Explain the hypersensitivity reactions.</p> <p>CO9: list out the immunodeficiency disorders.</p>
<p>MEDICAL MICROBIOLOGY/ PI6MB41</p>	<p>CO1: Exploring the role of microbiology in medicine.</p> <p>CO2: Skilled at diagnosis of bacterial, viral, protozoan and other parasitic diseases.</p> <p>CO3: Learning the concept, etiology and epidemiology of infections.</p> <p>CO4: List out the prevention of medically important microbes.</p>



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	<p>CO5: Understand the Host-microbe interactions.</p> <p>CO6: Analyze the molecular biology of animal virus and various antiviral agents.</p> <p>CO7: Describe the various types of parasite and its control measures.</p> <p>CO8: Understand the description and pathology of Mycotic diseases.</p>
<p>BIOPROCESS TECHNOLOGY/ PI6MB42</p>	<p>CO1: Explain the growth cycle of microbes.</p> <p>CO2: Discuss about fermentation media.</p> <p>CO3: Describe immobilization techniques.</p> <p>CO4: Elaborate the design and types of fermentor.</p> <p>CO5: Write down the applications of recombinant products.</p> <p>CO6: Discuss about fermentation economics.</p> <p>CO7: Explain different classes of fermenters.</p> <p>CO8: Discuss fermenter design and operation.</p>



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UG DEPARTMENT OF BIOCHEMISTRY

Course Outcomes:

Name of the Course With Subject Code	Course Outcomes
BIOMOLECULES/ 16SCCBC1	<p>CO1: To list out the structure and functions of biological macromolecules.</p> <p>CO2: To learn the metabolism and integration of biomolecules that takes place in human system.</p> <p>CO3: Integrate the various aspects of metabolism and their regulatory pathways.</p> <p>CO4: Students can understand the fundamental energetic of biochemical processes.</p> <p>CO5: To elaborate the relation between biochemical defects and metabolic disorders.</p> <p>CO6: To enumerate the organization of signaling pathways.</p> <p>CO7: To explain the role of membrane processes in metabolism.</p> <p>CO8: Overall, To grasp the processes of metabolic transformation at the molecular level and how these processes are studied.</p>



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<p>CHEMISTRY I / 16SACCH1</p>	<p>CO1: Define chemistry as the study of the composition, structure, properties, and reactions of matter.</p> <p>CO2: Identify methods and instruments that can be used to study chemistry.</p> <p>CO3: Understand the Group theory - Concepts, Elements of group theory – definition – group multiplication tables – conjugate classes, conjugate and normal subgroups</p> <p>CO4: Evaluate data generated by experimental methods for chemical characterization.</p> <p>CO5: Group Theory: Applications Symmetry aspects of molecular orbital theory – planar π-systems – symmetry factoring of Huckel determinants.</p> <p>CO6: Understand the Reaction Kinetics, Enzyme catalysis: Michaelis–Menton kinetics for single substrate reactions. Introduction to LFER. Significance of reaction coordinate and potential energy surfaces. Basic kinetic concepts - Theories of reaction rates-collision theory - Transition State theory and its applications.</p>
<p>HUMAN PHYSIOLOGY/ 16SCCBC2</p>	<p>CO1: The students will be exposed to anatomy of different organs Paper helps the students to understand the physiological functions of the biological systems</p> <p>CO2: Describe the structure of major human organs and explain their role in the maintenance of healthy individuals.</p> <p>CO3: Explain the interplay between different organ systems and how organs and cells interact to maintain biological equilibrium in the face of a variable and changing environment.</p> <p>CO4: Use complex electronic equipment including Power labs and Bioamplifiers to record human physiological data, and responses to experimental stimuli.</p> <p>CO5: Interpret and draw inferences from experimental</p>



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	<p>measures of physiological function including electrocardiograms and spirometry read-outs.</p> <p>CO6: Apply experimental design skills to understanding population responses and interpreting quantitative data</p> <p>CO7: Explain physiological processes accurately and concisely in journal-style format and orally, using relevant scientific terminology and nomenclature.</p>
<p>CHEMISTRY II/ 16SACCH2</p>	<p>CO1: Use quantitative measures of solution concentration in describing colligative, acid-base, solubility, and electrochemical principles of aqueous solutions.</p> <p>CO2: Interpret nuclear processes such as radioactivity, fission, and fusion in terms of kinetic and thermodynamic principles.</p> <p>CO3: Understand the Electrophilic Substitution Reactions Aromatic electrophilic substitution: Orientation, reactivity and mechanisms – Synthetic applications.</p> <p>CO4: Substitutions in thiophene and pyridine –Quantitative treatment of the structural effects on reactivity – substituents effect – Origins of Hammett equation –Principles of Hammett correlation – Effect of structure on reaction mechanisms Hammett parameters and modified forms of Hammett equation – Taft Equation. Aliphatic electrophilic substitution: S E 1, S E 2, S E i mechanisms</p> <p>CO5: Oxidation – Sharpless asymmetric epoxidation and ozonolysis. Addition to carbonyl and conjugated carbonyl systems – Mechanism –Grignard reagents – 1,2 and 1,4-additions (dimethyl lithium cuprate type).</p> <p>CO6: Addition to carbon-oxygen double bond.</p>
	<p>CO1: The units of this paper are crucial for implementation of research ideas at molecular level.</p> <p>CO2: It trains the students in adopting various techniques in</p>



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<p>BIOCHEMICAL TECHNIQUES/ 16SCCBC3</p>	<p>biological research.</p> <p>CO3: This significantly enhances the employability of the candidates in Biotechnological, Pharmaceutical Industries and Analytical Laboratories and research institutes.</p>
<p>ENZYMES/ 16SCCBC4</p>	<p>CO1: Students will obtain basic knowledge about the relationship between properties and structure of the enzymes, their mechanism of action and kinetics of enzymatic reactions.</p> <p>CO2: The student could able to analyse the structure/function relationships in biocatalysed reactions.</p> <p>CO3: The student would able to describe the principles and methods of metabolic engineering of (micro)organisms to produce industrial chemicals.</p> <p>CO4: Students able to research a contemporary application of enzyme technology or metabolic engineering and present the results in a well-structured oral presentation.</p> <p>CO5: Students can understand to compare and contrast the historical uses of enzyme technology with current applications in a diverse range of industries.</p> <p>CO6: At the end of the course students will be explored to understand the use of enzymes in medicine, food, organic synthesis, genetics and other areas sectors that favor a wide reach for them.</p> <p>CO7: To integrate the practical aspects of enzymology with the kinetic theories to provide a mechanistic overview of enzyme activity and regulation in cells.</p> <p>CO8: It is important to study enzymes, the rate limiting molecule of all the chemical reactions and understanding enzymes could pave research ideas.</p>
	<p>CO1: Understand the differences between anabolic and</p>



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<p>BIOENERGETICS AND METABOLISM / 16SCCBC5</p>	<p>catabolic processes in metabolism.</p> <p>CO2: Understand redox and electron transfer reactions in biological systems</p> <p>CO3: Understand that reaction coordinate diagrams are useful for thermodynamics of coupling anabolic and catabolic processes in metabolism.</p>
<p>CELL AND MOLECULAR BIOLOGY/ 16SCCBC6</p>	<p>CO1: To have a basic understanding about the morphology of cell & cell organelles and its function in detail.</p> <p>CO1: To learn the structure, function and molecular mechanism of the genetic material.</p> <p>CO1: Students could able to describe the general principles of gene organization and expression in both prokaryotic and eukaryotic organisms.</p> <p>CO1: To learn how to Interpret the outcome of experiments that involves the use of recombinant DNA technology and other common gene analysis techniques.</p>
<p>MICROBIOLOGY/ 16SCCBC7</p>	<p>CO1: Students will acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and analysis.</p> <p>CO2: Students will communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.</p>



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	<p>CO3: To understand how to relate properties of cancerous cells to mutational changes in gene function.</p> <p>CO4: To enumerate receptor subclasses and their possible uses in cell signaling.</p> <p>CO5: Students will know the mechanisms by which different messenger-receptor interactions bring about long or short-term changes in cell state.</p> <p>CO6: Students can make the Knowledge of the relationship between structure and function at organ and/or organism level, of important cell biological communication principles and processes, and how they are regulated.</p>
<p>PHARMACEUTICAL BIOCHEMISTRY/ 16SMBEC1</p>	<p>CO1: Helps in correlating between pharmacology of a disease and its mitigation or cure.</p> <p>CO2: To understand the drug metabolic pathways, adverse effect and therapeutic value of drugs</p> <p>CO3: To know the structural activity relationship of different class of drugs.</p> <p>CO4: Well acquainted with the synthesis of some important class of drugs.</p>
<p>IMMUNOLOGY /16SCCBC8</p>	<p>CO1: Describe the basic mechanisms, distinctions and functional interplay of innate and adaptive immunity.</p> <p>CO2: Define the cellular/molecular pathways of humoral/cell-mediated adaptive responses.</p> <p>CO3: Define the basic mechanisms that regulate immune responses and maintain tolerance.</p> <p>CO4: To demonstrate the molecular basis of complex, cellular</p>



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	<p>processes involved in inflammation and immunity, in states of health and disease.</p> <p>CO5: Describe basic and state-of-the-art experimental methods and technologies.</p> <p>CO6: Integrate knowledge of each subsystem to see their contribution to the functioning of higher-level systems in health and disease.</p> <p>CO7: Apply understanding of basic and state-of-the-art experimental methods and technologies in the design of research plan to test specific hypotheses.</p> <p>CO8: Translate understanding of basic mechanisms into identification of biological, clinical and therapeutic implications.</p>
<p>CLINICAL IOCHEMISTRY/ 16SCCBC9</p>	<p>CO1: An advanced understanding and applied knowledge of the theory and practice of clinical biochemistry.</p> <p>CO2: The student will be able to describe the structure, function and metabolic pathways for carbohydrates, amino acids and lipids.</p> <p>CO3: To learn the alterations in lipid and carbohydrate metabolism that occurs as a result of diabetes.</p> <p>CO4: Explain the metabolism of lipoproteins, medical problems associated with abnormal lipoprotein levels and therapeutic agents used to treat lipid disorders.</p> <p>CO5: To make the students biochemistry of membranes including chemical composition and structure of biological membranes, as well as drug transporters.</p> <p>CO6: To impart thorough knowledge about the biochemical</p>



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	<p>basis of various diseases and disorders.</p> <p>CO7: To study various diagnostic and therapeutic methodologies available for diseases and disorders.</p> <p>CO8: Students can apply biochemistry concepts to solve clinical scenarios.</p> <p>CO9: Describe intercellular and intracellular signal transductions and explain the molecular mechanism of drug actions.</p>
<p>ENDOCRINOLOGY/ 16SMBEBC2</p>	<p>CO1: Students will be expected to gain knowledge and understanding of the structure and function of mammalian endocrine tissues</p> <p>CO2: The manner in which the regulatory control and actions of individual endocrine tissues are integrated to maintain appropriate physiological and metabolic responses to changes in the internal and external environment.</p>
<p>BASIC BIOTECHNOLOGY/ 16SMBEBC3</p>	<p>CO1: To understand principles of animal culture, media preparation.</p> <p>CO2: To explain invitro fertilization and embryo transfer technology.</p> <p>CO3: To describe meristem culture and clonal propagation of plants on a commercial scale.</p>



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