Sem	Course	Syllabus	Modules
1st	CC1	Introduction to Microbiology and Microbial Diversity	Unit 1 History of Development of MicrobiologY
			Unit 2 Diversity of Microbial World
	CC2	BACTERIOLOGY	Unit 1 Cell organization
			Unit 2 Bacteriological techniques
			Unit 3 Microscopy
			Unit 4 Growth and nutrition
			Unit 5 Reproduction in Bacteria
			Unit 6 Bacterial Systematics
			Unit 5 Important archaeal and eubacterial groups
2nd	MAJOR	BIOCHEMISTRY	Unit 1 Bioenergetics
			Unit 2 Carbohydrates
			Unit 3 Lipids
			Unit 4 Protein Unit 5. Enzymes
	CC3		Unit 6. Vitamins
	CC4	VIROLOGY	Unit 1 Nature and Properties of Viruses
			Unit 2 Bacteriophages

			Unit 3 Viral Transmission, Salient features of viral nucleic
			Unit 4 Viruses and Cancer Unit 5 Prevention & control of viral diseases
			Unit 6 Unit 6 Applications of Virology
3rd	CC5	MICROBIAL PHYSIOLOGY AND METABOLISM (	Unit 1 Microbial Growth and Effect of Environment on Microbial Growth
			Unit 2 Nutrient uptake and Transport
			Unit 3 Chemoheterotrophic Metabolism - Aerobic Respiration Unit 4 Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation Unit 5 Chemolithotrophic and Phototrophic Metabolism Unit 6 Nitrogen Metabolism - an overview
	CC6	Cell iology	Unit 1 Structure and organization of Cell
			Unit 2 Nucleus nit 3 Protein Sorting and Transpor Unit 4 Cell Signalling Unit 5 Cell Cycle, Cell Death and Cell Renewal
	CC7	MOLECULAR BIOLOGY	Unit 1 Structures of DNA and RNA / Genetic Material
			Unit 2 Replication of DNA (Prokaryotes and Eukaryotes)
			Unit 3 Transcription in Prokaryotes and Eukaryotes Unit 4 Post-Transcriptional Processing Unit 5 Translation (Prokaryotes and Eukaryotes)

		Unit 6 Regulation of gene Expression in Prokaryotes and Eukaryotes
Sec	MICROBIAL QUALITY CONTROL IN FOOD AND PHARMACEUTICAL INDUSTRIES	Unit 1 Microbiological Laboratory and Safe Practices
		Unit 2 Determining Microbes in Food / Pharmaceutical Samples
		Unit 3 Pathogenic Microorganisms of Importance in Food & Water
		Unit 4 HACCP for Food Safety and Microbial Standards
CC8	MIcroblial Genetics	Unit 1 Genome Organization and Mutations
		Unit 2 Plasmids
		Unit 3 Mechanisms of Genetic Exchange
		Unit 4 Phage Genetics
		Unit 5 Transposable elements
CC9	ENVIRONMENTAL MICROBIOLOGY	Unit 1 Microorganisms and their Habitats
		Unit 2 Microbial Interactions
		Unit 3 Biogeochemical Cycling
		Unit 4 Waste Management
		Unit 5 Microbial Bioremediation
		Unit 6 Water Potability
CC10	FOOD AND DAIRY MICROBIOLOGY	Unit 1 Foods as a substrate for microorganisms
		Unit 2 Microbial spoilage of various foods
		Unit 3 Principles and methods of food preservation
		Unit 4 Fermented foods

		Unit 5 Food borne diseases (causative agents, foods involved, symptoms and preventive measures) Unit 6 Food sanitation and control
Sec	MICROBIAL DIAGNOSIS IN HEALTH CLINICS	Unit 1 Importance of Diagnosis of Diseases
		Unit 2 Collection of Clinical Samples Unit 3 Direct Microscopic Examination and Culture Unit 4: Serological and Molecular Methods Unit 5: Kits for Rapid Detection of Pathogens Unit 6: Testing for Antibiotic Sensitivity in Bacteria
CC11	MICROBIOLOGY	Unit 1 Introduction to industrial microbiology Unit 2 Isolation of industrially important microbial strains and fermentation media
		Unit 3 Types of fermentation processes, bio-reactors and measurement of fermentationparameters
		Unit 5 Microbial production of industrial products (micro-organisms involved, media, fermentation conditions, downstream processing and uses) Unit 6 Enzyme immobilization
CC12	IMMUNOLOGY	Unit 1 Immune Cells and Organs
		Unit 2 Antigens
		Unit 3 Antibodies Unit 4 Major Histocompatibility Complex Unit 5 Generation of Immune Response Unit 7 Immunological Disorders and Tumor Immunity Unit 8Immunological Techniques
DSE1	INSTRUMENTATION AND BIOTECHNIQUES	Unit 1 Microscopy

			Unit 2 Chromatography
			Unit 3 Electrophoresis
			Unit 4 Spectrophotometry Unit 5 Centrifugation
	DSE2	MICROBIAL BIOTECHNOLOGY	Unit 1 Microbial Biotechnology and its Applications
			Unit 2 Therapeutic and Industrial Biotechnology
			Unit 3 Applications of Microbes in Biotransformations
			Unit 4 Microbial Products and their Recovery
			Unit 5 Microbes for Bio-energy and Environment Unit 6 RNAi Unit 7 Intellectual Property Rights
6th Semest	CC13	MICROBIOLOGY	pathogen interaction Unit 2 Sample collection, transport and diagnosis
			Unit 3 Bacterial diseases Unit 4 Viral diseases Unit 5 Protozoan diseases Unit 6 Fungal diseases Unit 7 Antimicrobial agents: General characteristics
	CC14	RECOMBINANT	Unit 1 Introduction to Genetic Engineering Unit 2 Molecular Cloning- Tools and Strategies
			Unit 3 Methods in Molecular Cloning Unit4 DNA Amplification and DNA sequencing cDNA libraries

		Unit 6 Applications of Recombinant DNA Technology
DSE3	INTELLECTUAL	Unit 1 Biosafety
		Unit 2 Biosafety Guidelines
		Unit 3 AERB/RSD/RES guidelines
		Unit 4 Introduction to Intellectual Property:
		Unit 5 Grant of Patent and Patenting Authorities:
		Unit 6 Agreements and Treaties:
DSE4	MICROBES IN	Unit 1 Soil Microbiology
		Unit 2 Mineralization of Organic & Inorganic Matter in Soil
		Unit 3 Microbial Activity in Soil and Green House Gases
		Unit 4 Microbial Control of Soil Borne Plant Pathogens
		Unit 5 Biofertilization, Phytostimulation, Bioinsecticides
		Unit 6 Secondary Agriculture Biotechnology
		Unit 7 GM crops

Outcome

The students will understand the developments in Microbiology and list the contributions of various scientists. They will understand the diversity of microbial world and learn the general characteristics of acellular microorganisms, algae, fungi and bacteria

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The students will gain knowledge on the cellular organization of bacterial cell wall. They will learn the different bacteriological techniques like pure culture isolation, streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures. They will utilize the principles and applications of different types of microscopes, apply various staining procedures for visualising microorganisms under the microscope. They will analyse the nutritional requirement of microorganisms and their cultivation techniques under laboratory conditions. They will also learn the implication of various sterilisation procedures and bio safety measures in clinical labs and industries.

It will help students to understand the classification of organic compounds like carbohydrates, lipids and proteins, to understand the chemistry of different kinds of carbohydrates. The students will learn the importance of vitamins to human body and their deficiency syndrome and the mechanism of enzyme

The students will gain knowledge about viruses and the chemical nature of viruses, different types of viruses infecting animals, plants and bacteria - Bacteriophages . They will learn about the mode of

replication of different types viruses, about the emerging viral diseases. The students will understand the role of viruses in the causation of the cancer. Gain wider knowledge on clinical aspects and related implications of viral diseases, viral vaccines and antiviral drugs.

The students will comprehend the various physiological processes exhibited by different microorganisms. They will understand the microbial transport systems and the modes and mechanisms of energy conservation in microbial metabolism and learn about the mechanism of aerobic and anaerobic respiration.

The students will learn about the structure and function of various cell organelles of the eukaryotic cells. They will also get the thorough knowledge about cell cycle, cell signalling pathways. They will be able to get the practical knowledge of cell division, polyploidy by studying different stages of Mitosis and meiosis.

The students will understand the properties, structure and function of genes in living organisms at the molecular level. They will learn about the structures of DNA and RNA, central dogma of life. They will have a conceptual knowledge about DNA as a genetic material, enzymology, and replication strategies. They will understand the

The students will learn about Microbiological Laboratory and Safe Practices, methods for determination of microbes in food, Pathogenic Microorganisms of Importance in Food & Water and HACCP for Food Safety and Microbial Standards

The students will understand the genome organization of *E. coli and Saccharomyces. To understand* Mutations and its types. They will understand plasmid and its types. They will gain knowledge on mechanisms of genetic Exchange like transformation, transduction and conjugation. They will

The students will learn about different microorganisms and their habits. They will understand microbial interaction, biogeochemical cycling and its types. They will also have knowledge on waste management, microbial remediation and water potability.

The students will be able to know the principles and methods of food preservation, production of different fermented foods, different food borne diseases: their causative agents, foods

The students will learn about Microbiological Laboratory and Safe Practices, methods for determination of microbes in food, Pathogenic Microorganisms of Importance in Food & Water and HACCP for Food Safety and Microbial Standards

To isolate the industrially important microbial strains and fermented media. They also have the knowledge about the fermentation processes, bio-reactors and measurement of fermentation parameters. They also well-known about microbial production of industrial products, downstream processing & enzyme immobilization. The students will visit industries to have practical knowledge on fermenters.

Students will gain knowledge on antigens, antibodies, complement System, major histocompatibility Complex, different immune cells and organs. They will also able to know about the generation of immune response, immunological disorders, autoimmunity and tumor immunity. The students will also learn about different immunological techniques through performing experiments.

The students will learn about different instruments and techniques to function them. The students will learn about the working principle and types of Microscopes, Chromatography, electrophoresis, Spectrophotometry and Centrifugation.

The students will learn about microbial biotechnology and its applications. The students will learn about Therapeutic and Industrial Biotechnology, applications of Microbes in Biotransformation, Microbial Products and their Recovery, Microbes for Bio-energy and Environment, RNAi and Intellectual Property Rights.

Students will acquire a thorough knowledge about the diseases caused by various bacteria, virus, protozoa and fungi. They also enrich about the antimicrobial agents, their characteristics, mode of action etc. They will acquire a clear understanding about host pathogen interaction, normal microflora in human body, different sample collection & diagnosis. They will also enrich by hands on training about these techniques through these practical classes.

Through completion the course the students will capable the acquire the knowledge about the genetic engineering, different methods in molecular cloning, DNA amplification, DNA sequencing, Construction and Screening of Genomic and cDNA libraries and its applications.

cDNA libraries and its applications

The students will learn about biosafety, biosafety guidelines, AERB/RSD/RES guidelines, Intellectual Property, Patent and Patenting Authorities, Agreements and Treaties

The students gain knowledge on soil Microbiology, Mineralization of Organic & Inorganic Matter in Soil, Microbial Activity in Soil and Green House Gases, Microbial Control of Soil Borne Plant Pathogens, Biofertilization, Phytostimulation, Bioinsecticides, Secondary Agriculture Biotechnology and GM crops.

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Programme Outcome

Outcome

In depth knowledge / ability / skill of Microbiology enabling them to make Vertical Progression to Masters. The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in a wide-ranging context which involve the Acquiring knowledge / ability / skill for teaching enabling them to make progression to teachers training • Critical thinking: It will elicit the critical thinking and take informed actions after identifying the assumptions by Obtaining skill and abilities in communication to make progression to jobs like

Research Scientist:

Experiments, data analysis, and result interpretation fall under the purview of a research scientist. Microbiology research scientists can be employed in a range of institutions, including public and commercial sectors. Their areas of specialization may include immunology, virology, or bacteriology, among other branches of microbiology.