B.Sc. Part I (Microbiology)

Course outcome

SEMESTER-I

Program Specific Outcomes of Microbiology:

1. Acquired knowledge and understanding of the microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others.

2. Demonstrate key practical skills/competencies in working with microbes for study and use in the laboratory as well as outside, including the use of good microbiological practices.

3. Competent enough to use microbiology knowledge and skills to analyze problems involving microbes, articulate these with peers/ team members/ other stake holders, and undertake remedial measures/studies etc.

4. Developed a broader perspective of the discipline of Microbiology to enable him to identify challenging societal problems and plan his professional career to develop innovative solutions for such problems

Course I **DSC 25A**	**Introduction to Microbiology**
Course Objective	1. To develop a good knowledge of the development of the discipline of Microbiology and the contributions made by prominent scientists in this field. 2. To develop a very good understanding of the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory. 3. To explain the useful and harmful activities of the microorganisms and scope of different branches of Microbiology. 4. To describe characteristics of bacterial cells, cell organelles and various appendages like capsules, flagella or pili.
Course Outcome	At the end of the course, students will study- 1. Contribution of various scientist in microbiology. 2. Types of microorganisms and their nomenclature. 3.Useful and harmful activities of the microorganisms 4. Characteristics of bacterial cells, cell organelles
Course II **DSC 26 A**	**Basic Techniques in Microbiology**
Course Objective	1. To study the staining techniques for the observation of bacteria and bacterial cell components 2. To study the working principle, handling and use of microscopes for the study of microorganisms 3. To understand the principles of sterilization and

	disinfection of culture media, glassware and plastic ware and other objects to be used for microbiological work.
Course Outcome	At the end of the course, students will study- 1. Bacterial morphology using various staining techniques. 2. Working and handling of microscope. 3. Principles of sterilization and disinfection of objects used for microbiological work.

Course III DSC 25 B	**Bacteriology**
Course Objective	1. To describe the nutritional requirements of bacteria and other microbes which grow under extreme environments. 2. To understand the basic laboratory experiments to isolate, cultivate and differentiate bacteria 3. To study the preservation of bacteria in the laboratory
Course Outcome	At the end of the course, students will study- 1. Bacterial nutrition 2. Bacterial isolation, cultivation and differentiation. 3. Preservation methods of bacteria
Course IV DSC 26 B	**Microbial Biochemistry**
Course Objective	1. To develop a very good understanding of various biomolecules which are required for development and functioning of a bacterial cell. 2. To develop the knowledge of how the carbohydrates make the structural and functional components such as energy generation and as

	storage food molecules for the bacterial cells 3. To make well conversant about multifarious structures and functions of proteins, enzymes, lipids and nucleic acids. 4. To differentiate the concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms.
Course Outcome	At the end of the course, students will study- 1. Detailed knowledge of biomolecules. 2. Role of carbohydrates in bacterial cell. 3. In detail structures and functions of proteins, enzymes, lipids and nucleic acids. 4.Various metabolic pathways in microorganisms.

Course outcome

Program Specific Outcomes of Microbiology:

1) To promote understanding of basic and advanced concepts in Microbiology and expose the students to various emerging areas of Microbiology.

2) To expose the students to different processes used in industries and in research field.

3) To develop their ability to apply the knowledge of Microbiology in day to day life and to prepare the students to accept the challenges in life sciences.

4) To develop skills required in various industries, research labs and in the field of human health.

SEMESTER-III

Course V	Microbial Physiology & Metabolism
Course Objective	1) To Study Growth curve and the effect of environmental factors on the growth of microorganisms. 2) To know the various transport mechanisms in microbes. 3) To Describe the metabolic pathways in microbes. 4) To Distinguish between various fermentation mechanisms in microbes and understand the Bacterial electron transport chain.
Course Outcome	1) Overview of different growth phases and How various environmental factors affect the microbial growth. 2) Conceptual knowledge of transport across cell membrane. 3) To understand the catabolism of glucose 4) To learn the lactic acid fermentation mechanism and Structure and function of ETC

Course VI	Applied Microbiology
Course Objective	1) To understand sources and examination of microbes in air and water. 2) To know Microbiological examination of milk. 3) To learn about basic concepts of fermentation and screening of microbes, 4) To understand fermentation media
Course Outcome	1)To get acquainted with skills of sampling methods of air and routine bacteriological analysis of water. 2) To learn the nutritional value ,the quality of milk and process of pasteurization. 3) Elaborate the knowledge of concept of metabolites, typical fermentor design,types of fermentation and factors affecting fermentation process. 4) To gain knowledge about fermentation media with respect to types, component used and their role.

SEMESTER-IV

Course VII	Microbial Genetics & Molecular Biology
Course Objective	1) To become familiar with the basic concepts related to DNA and genes. 2) To Know in detail Mutation and types of mutation 3) To gain the knowledge about Gene transfer in bacteria through plasmid and DNA repair 4) To understand Gene expression in prokaryotes using Lac operon
Course Outcome	1) To Aquire knowledge about the forms of DNA, gene types and genetic code. 2) To study basic concepts of mutation and role of different mutagens in mutations. 3) To understand modes of gene transfer, types and applications of different plasmids and DNA repair mechanism. 4) To know Role of operator, promoter and inhibitor in expression of Lac operon.

Course VIII	Basics in Medical Microbiology & Immunology
Course Objective	1) To Gain information about the concepts of medical Microbiology. 2) To introduce general principles of microbial disease and study normal flora of human body. 3) To Understand the fundamental concepts of immunity and non specific defence mechanism 4) To Know the types and characters and reactions of antigen and antibody.
Course Outcome	1) To understand different types of infection and modes of transmission of diseases. 2) To know prevention and control of Microbial diseases. 3) To gain knowledge about immunity and mechanisms of non specific defence. 4) To aquire knowledge of Types of antigens, antibody and Antigen-antibody reactions .

B.Sc. Part III (Microbiology)

Course outcome

Program Specific Outcomes of Microbiology:

1) To make the students knowledgeable with respect to the subject and its practicable
applicability.
2) To promote understanding of basic and advanced concepts in microbiology.
3) To expose the students to various emerging areas of Microbiology.
4) To prepare students for further studies helping in their bright career in the subject
5) To expose the students to different processes used in industries and in research field
6) To develop their ability to apply the knowledge of microbiology in day to day life.
7) To prepare the students to accept the challenges in life sciences.
8) To develop skills required in various industries, research labs and in the field of human
health.

B. Sc. III Microbiology Semester V

Paper IX	**DSE – E 49VIROLOGY** **(CREDITS: 02)**	
	OBJECTIVES -: 1. To understand the basic structural properties and technique used for isolation, cultivation and purification and enumeration of viruses. 2. To study reproduction of bacteriophages, animal virus and plant virus. 3. To study lytic cycle of phage. 4. To study the basic concept of oncogenesis, types and characteristics of cancerous cells. 5. To understand role of DNA, RNA viruses in cancer.	**Outcome-:** 1. This point helps students to understand the basic aspects of structural properties and technique used for isolation, cultivation and purification and enumeration of viruses. 2. Student become familiar with process in reproduction of bacteriophages, animal virus and plant virus. 3. Students get the knowledge about lytic cycle of lambda phage. 4. Students learn about basic concept of oncogenesis, types and characteristics of cancerous cells. 5. This point widen the fundamental aspects of role DNA, RNA viruses in cancer.

Paper X	**DSE – E 50IMMUNOLOGY** **(CREDITS: 02)**	
	OBJECTIVES -: 1. To understand cells and organs of the immune system and mechanism of antibody production. 2. To study the complement system and its activation. 3. To study concept, types, production, and application of monoclonal antibody 4. To learn about the cytokines and interferon	**OUTCOMES -:** 1. Students become familiar with many elements of cells and organs of the immune system along with molecular mechanisms of antibody production. 2. This point helps students to understand basic aspects of the complement system. 3. Students are given the knowledge on concept, types, production, and application of monoclonal antibody.

	5. To understand about concept and types of immunological tolerance, autoimmunity and hypersensitivity.	4. Sections on cytokines and interferon, are also covered 5. Basic concept and types of immunological tolerance, autoimmunity and hypersensitivity are also covered in these sections.

Paper XI	**DSE – E 51FOOD AND INDUSTRIAL MICROBILOGY** **(CREDITS: 02)**	
	OBJECTIVES -: 1. To understand food as a microbial substrate and microbial food poisoning and infections. 2. To study food preservation and use of microbes as probiotics. 3. To study techniques of industrial microbiology like the strain improvement, scale up, microbiological assays, stock culture maintenance, preservation, and maintenance of culture. 4. To study industrial production of penicillin, grape wine, and alcohol. 5. To understand the principles downstream processes and product recovery processes as well as the principles for testing of product.	**OUTCOME -:** 1. Students get the knowledge about significance and activities of microorganisms in food as their substrate and microbial food poisoning and infections. 2. Students become familiar with many food preservation and use of microbes as probiotics. 3. Sections on basic concept strain improvement, scale up, types of microbiological assays, stock culture maintenance and preservation method and culture collection centers are also covered. 4. Students are given the basic knowledge on industrial production of penicillin, semi-synthetic penicillin and grape wine and alcohol. 5. Students become familiar with the principles and various product recovery processes as well as testing of sterility, pyrogen, carcinogenicity, toxicity, and allergens.

Paper XII	**DSE – E 52AGRICULTURE MICROBIOLOGY** **(CREDITS: 02)**	
	OBJECTIVES -: 1. To understand physical, chemical characteristics of soil and role of microorganism in soil fertility. 2. To understand microbial interaction in the soil, 3. To study the biochemical mechanisms of Carbon, Nitrogen, Phosphorus cycles as well as biodegradation of cellulose and pesticides. 4. To study in detail nitrogen fixation and phosphate solubilizing microbes as biofertilizers and *B. thuringiensis, Trichoderma, Beauveria bassiana* as biopesticide. 5. To study the types, common symptom, mode of transmission of plant diseases.	**OUTCOME-:** 1.This point emphasizes physical, chemical characteristics of soil microbiology, microbiology of soil fertility such as microbial degradation of organic matter and soil nutrient transformations. 2. Students become familiar with many plant microbe interactions in the soil. 3. Students are given the basic knowledge on biochemical mechanisms of Carbon, Nitrogen, Phosphorus cycles as well as biodegradation of cellulose and pesticides along with the role of microorganism in reclamation of soil. **4.** Sections on the types, mechanisms and production techniques, applications and uses of nitrogen fixation by *Azotobacter, Rhizobium, Azospirillum* and phosphate solubilizing microbes as biofertilizers and *B. thuringiensis, Trichoderma, Beauveria bassiana* as biopesticide are also covered. 5. This point looks at the types, common symptom, mode of transmission of plant diseases like Citrus Canker, Tikka diseases and Bacterial blight.

Semester VI

Paper XIII	**DSE –F49MICROBIAL GENETICS** **(CREDITS: 02)**	
	OBJECTIVES -: 1. To understand basic concept of bacterial genome, molecular mechanism of gene expression. 2. To study basic concept of expression and suppressor of mutation and isolation and detection of mutants. 3. To understand Cis-trans test along with extra-chromosomal inheritance. 4. To study various techniques in molecular biology. 5. To study basic concepts, tools, techniques, application of genetic engineering.	**OUTCOME-:** 1.This point emphasizes the basic concept of bacterial genome, molecular mechanism of gene expression 2. The point provides knowledge about expression and suppressor of mutation with examples along with method for isolation and detection of mutants. 3. Sections on concept of Cis-trans test in genetic complementation along with basic of extra-chromosomal inheritance are also covered. 4. The point adds knowledge on techniques involved in molecular biology 5. This point induces students to develop strong foundation in genetics engineering.

Paper XVI	**DSE –F50 MICROBIAL BIOCHEMISTRY** **(CREDITS: 02)**	
	OBJECTIVES -: **1.** To study basics of enzyme, allosteric enzymes, classification, extraction as well as purification and assay techniques. **2. To** understand factor affecting enzyme activity, regulation of enzyme synthesis. **3.** To study enzyme kinetics and assimilation of carbon, nitrogen and sulfur. **4.** To study DNA, RNA, protein and peptidoglycan biosynthesis. **5.** To study basic carbohydrates metabolism	**OUTCOME-:** 1. The point adds knowledge on the basic concept, structure, specificity, mechanism of action, classification, extraction, purification and assay techniques of the enzyme and allosteric enzyme. 2. The point helps to encourage students to the understanding of factor affecting enzyme activity, regulation of enzyme synthesis. 3. Student become familiar with the kinetics of single substrate-enzyme catalyzed reaction and assimilation of carbon, nitrogen and sulfur. 4. This point covers the basics of DNA, RNA,

	pathways in microorganism.	protein and peptidoglycan biosynthesis. 5.Sections on the basic carbohydrates metabolism pathways in microorganism is also covered in this course.

Paper XIII	**DSE –F51ENVIRONMENTAL MICROBIOLOGY** **(CREDITS: 02)**	
	OBJECTIVES -: 1. To study general characteristics of liquid, solid waste as per MPCB. 2. To study sewage microbiology. 3. To study characteristics and treatment of waste generated by sugar industry, distillery industry, dairy industry, hospitals eutrophication. 4. To study basic purpose of environment monitoring along with biological safety measures in laboratory. 5. To understand environmental impact assessment, bioremediation and bioleaching.	**OUTCOME-:** 1. The point adds knowledge on general characteristics of liquid, solid waste along with standards as per MPCB. 2. This point covers the basics of physio-chemical and biological characteristics and aerobic and anaerobic procedure used for treatment of sewage. 3. The point helps to encourage students to the understand characteristics and treatment of waste generated by sugar industry, distillery industry, dairy industry and hospitals along with basic concept, classification, consequence and control of eutrophication. 4. The point helps students obtain information about environment monitoring along with biological safety measures in laboratory. 5. The point adds knowledge on the basic concept, importance and applications of environmental impact assessment, bioremediation and role of microbes in purification of low-grade ores.

Paper XIII	**DSE –F52MEDICAL MICROBIOLOGY** **(CREDITS: 02)**	
	OBJECTIVES -: 1. To understand Bacterial diseases. 2. To understand Protozoal, Viral and Fungal diseases. 3. To understand general principles of chemoprophylaxis and chemotherapy. 4. To understand mode of action of antimicrobial agents and drug resistance among pathogens. 5. To understand concept of immunoprophylaxis.	**OUTCOME -:** 1. The course helps students obtain information about themorphology, cultural and biochemical characteristics, antigenic structure, mode of transmission, pathogenesis, symptoms, laboratory diagnosis, prevention and control of bacterial diseases. 2. Students obtain information about the morphology, cultural and biochemical characteristics, antigenic structure, mode of transmission, pathogenesis, symptoms, laboratory diagnosis, prevention and control of protozoal, viral and fungal diseases. 3. The purpose of this course is to inculcate general knowledge about general principles and chemoprophylaxis of chemotherapy. 4. The course tries to provide detailed information on mode of action of antimicrobial agents and reasons along with mechanism of drug resistance. 5. Students are made aware of the information needed to understand vaccine and immunesera.