

## M.SC. APPLIED MICROBIOLOGY

(With effect from 2022 – 2023)

### Programme outcomes

S.No.	Out comes
Po1	To understand the scope and relevance of Microbiology as a scientific discipline
Po2	To get acquainted with various Sterilization and Disinfection methods
Po3	Gain knowledge on the various classification of bacteria
Po4	study the morphology and structure of viruses.
Po5	To get acquainted with basic concepts of microbial metabolism
Po6	Gain advanced knowledge of applied biological sciences and microbial biochemical nature as to enable them find solutions for complex molecular functions and physiology.
Po7	Graduates and their microbial natural recycling knowledge would contribute towards the improvement of soil quality and agricultural output through sustainable microbiological applications.
Po8	Shine as an entrepreneur by using microbes as biofertilizers and biocontrol agents, microbial by-products as pharmaceutically potent molecules and microbes as nutritionally rich sources of food.
Po9	Create self-confidence to develop an entrepreneurship avenue by providing technical and entrepreneurship skills. Skill focused lab courses would highly assist in disease diagnosis, treatment and prevention
Po10	Understanding of human ethical principles and responsibilities, moral and social values in personal life would bring out a culturally rich and civilized personality.

### Programme specific outcomes

S.No.	Out comes
Pso1	To provide an insight on the fundamentals of Microbiology To create and design modern application of the concept learned
Pso2	To practice continuous learning to maintain and achieve personal excellence To use current microbial technologies and methods for economic development
Pso3	To practice continuous learning to maintain and achieve personal excellence To use current microbial technologies and methods for economic development

Pso4	To use current microbial technologies and methods for the betterment of human welfare To use current microbial technologies and methods for the betterment of environment
Pso5	To apply the knowledge in nation building To have an understanding of professional and ethical responsibility To have an ability to function in multidisciplinary environment

## M.Sc. Applied Microbiology

Semester: I

Paper code:

Name of the Paper: GENERAL MICROBIOLOGY AND MICROBIAL PHYSIOLOGY

Credit: 4

Total Hours per Week: 5

semester	Course name	Course credit	Course outcomes
I Regulation (2022-2023)	General microbiology and microbial physiology	4	Co1-the student will be able to understand the principles and uses of microscopes Co2-the student will be able to understand the growth of microorganisms Co3-the student will be able to classify microorganisms Co4-the student will be able to relate the morphological features of different microorganisms Co5- the student will be able to appreciate the metabolic diversity of microorganisms

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	S
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	M	S	M	M	S	M
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcomes S – Strong, M – Medium, L – Low

### Semester: I

Paper type: Core2

Paper code:

Name of the Paper: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Credit: 4

Total Hours per Week: 5

Course Out Comes

Semester	Course name	Course credit	Course outcomes
I Regulation(2022-2023)	Immunology and immunotechnology	4	Co1- the student will be able to describe various cells and Organs of the Immune System Co2-, the student will be able to characterize Antigen and Antibodies Co3- the student will be able to explain Major Histocompatibility Complex Co4- the student will be able to narrate the concept of Immunomodulation Co5- the student will be able to make use of Immunological Techniques

## Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	S
CO3	S	M	S	M	S	S	M	S	M	M
CO4	S	M	S	S	S	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: I**

**Paper type: Core Paper code:**

**Name of the Paper: FOOD AND DAIRY MICROBIOLOGY**

**Credit: 4**

**Total Hours per Week:**

**Course Out Comes**

semester	Course name	Course credit	Course outcomes
I Regulation(2022-2023)	<b>food and dairy microbiology</b>	4	<p>co1, the student will be able to list out Microorganisms important in foodmicrobiology</p> <p>co2- the student will be able to describe the Principles of food preservation</p> <p>co3, the student will be able to devise mechanisms to control Contamination, and spoilage of foods</p> <p>co4, the student will be able to describe Dairy Microbiology</p> <p>co5, the student will be able to predict Foodborne diseases and control them</p>

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	S	S	M	S	S	M
CO3	S	M	S	M	M	S	S	S	S	M
CO4	S	M	S	S	S	S	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome S – Strong , M – Medium, L – Low

**Semester: I Paper type: Elective**

**Paper code:**

**Name of the Paper: A. COMPUTATIONAL BIOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

Semester	Course name	Course credit	Course outcomes
I Regulation(2022-2023)	<b>computational biology</b>	3	CO1-the student will be able to know the uses of computers in the field of biology CO-2, the student will be able to make use of Sequence databases CO-3, the student will be able to perform sequence analysis CO-4, the student will be able to analyse and interpret protein structures using tools CO-5, the student will be able to appreciate the use of microarrays

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	M	S	M	S	S	M	S	M	M
CO4	S	M	S	S	M	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: I Paper type: Elective**

**Paper code:**

**Name of the Paper: B. ALGAL TECHNOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Course name	Course credit	Course outcomes
I Regulation(2022-2023)	<b>ALGAL TECHNOLOGY</b>	3	CO-1, the student will be able to characterize CO-2, the student will be able to list out the significance and uses of algae CO-3, the student will be able to describe algal cultivation methods CO-4, the student will be able to appreciate the role of algae in food and feed CO-5, the student will be able to suggest algal control measures

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	S	S	M	M
CO2	M	S	M	S	S	S	M	S	S	S
CO3	S	M	S	M	M	S	S	S	S	M
CO4	S	M	S	S	S	S	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: I Paper type: Elective**

**paper code:**

**Name of the Paper: C. BIOSAFETY**

**Credit: 3**

**Total Hours per Week: 3**

## Course Out Comes

Semester	Course name	Course credit	Course outcomes
I Regulation(2022-2023)	<b>BIOSAFTEY</b>	3	CO1-the student will be able to describe the concept of Biosafety CO-2, the student will be able to list out various biohazards CO-3, the student will be able to narrate Bio containment methods CO4-4, the student will be able to employ the concept of Biosafet CO-5, the student will be able to interpret and apply Biosafety Guidelines

### Course Material: website links, e-Books and e-journals

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	M	S	S	M	S	M	M	S	M
CO5	S	M	M	S	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: I

Paper type: Open Elective Paper code:

Name of the Paper: A. MICROSCOPIC TECHNIQUES

Credit: 3

**Total Hours per Week: 3**

### Course Out Comes

semester	Course name	Course credit	Course outcomes
I Regulation(2022-2023)	<b>MICROSCOPIC TECHNIQUES</b>	3	<p>CO-1, the student will be able to explain the principle of microscopes</p> <p>CO-2, the student will be able to describe the principle and use of Bright field Microscope</p> <p>CO3, the student will be able to describe the principle and use of Phase contrast and Fluorescence Microscopes</p> <p>CO-4, the student will be able to distinguish TEM and SEM</p> <p>CO-5, the student will be able to appreciate the use of Atomic Microscopy</p>

### Course Material: website links, e-Books and e-journals

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	M	S	S	M	S	M	M	S	M
CO5	S	M	M	S	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: I

OpenElectivePaper code:

Name of the Paper: B. BASICS OF MICROBIOLOGY

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**



Semester	Course name	Course credit	Course outcomes
I Regulation(2022-2023)	<b>Basics of microbiology</b>	3	<p>CO-1, the student will be able to narrate the contribution of scientists in the field of microbiology</p> <p>CO-2, the student will be able to appreciate the use of microscopy and staining in microbiology</p> <p>CO-3, the student will be able to compare the characteristics of algae and fungi</p> <p>CO-4, the student will be able to explain the role of protozoans as microbes</p> <p>CO-5, the student will be able to appreciate the uniqueness of viruses</p>

Course Material: website links, e-Books and e-journals Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	M	S	S	S	S	S
CO4	S	M	S	S	M	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: I

Paper type: Open Elective Paper code:

Name of the Paper: C. MOLECULAR BIOLOGY

Credit: 3

Total Hours per Week: 3

### Course Out Comes

semester	Coursename	Course credit	Course outcomes
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I Regulation(2022- 2023)	<b>MOLECULAR BIOLOGY</b>	3	<p>CO1-1, the student will be able to relate DNA, RNA and proteins</p> <p>CO-2, the student will be able to appreciate the structure of proteins</p> <p>CO-3, the student will be able to narrate the events in DNA replication</p> <p>-CO4, the student will be able to describe the Molecular aspects of geneexpression</p> <p>CO-5, the student will be able to distinguish various gene transfer mechanisms</p>
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**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	S	S	M	S	S	S	M	M
CO3	S	M	S	M	M	S	M	M	S	S
CO4	S	M	S	S	M	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: I

Paper type: Practical Paper code:

Name of the Paper: LAB COURSE - 1

Credit: 5

Total Hours per Week: 10

### Course Out Comes

Semester	Coursename	Course credit	Course outcomes
I Regulation(2022 -2023)	<b>L A B C O U R S E</b>	5	-CO1, the student will be able to make use of sterilization in experiments  CO-2, the student will be able to observe the morphology of different microorganisms  CO -3, the student will be able to identify and enumerate different blood cell  - CO 4, the student will be able to demonstrate Immuno diffusion  CO5, the student will be able to isolate and identify bacteria from spoiledfoods

### Course Material: website links, e-Books and e-journals

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	M	M	S	M	S	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	M	M	S	S	M
CO4	S	M	S	S	M	M	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: IPaper type: CorePaper code:

Name of the Paper: MEDICAL BACTERIOLOGY AND MYCOLOGY

Credit: 4

Total Hours per Week: 5

semester	Coursename	Course credit	Course outcomes
II Regulation(2022-2023)	<b>medical bacteriology and mycology</b>	4	<p>-1, the student will be able to elaborate the mechanisms involved in disease transmission by bacteria</p> <p>CO-2, the student will be able to describe the mechanisms of transmission, virulence, pathogenicity of bacteria</p> <p>CO-3, the student will be able to describe the mechanisms of transmission, virulence, pathogenicity of bacteria</p> <p>CO-4, the student will be able to elaborate the mechanisms involved in disease transmission by fungi</p> <p>-CO5, the student will be able to describe the mechanisms of transmission, virulence, pathogenicity of fungi</p>

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	M	S	M	S	S	M
CO4	S	M	S	S	M	S	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: I

Paper type: CorePaper code:

Name of the Paper: INDUSTRIAL MICROBIOLOGY

Credit: 4

Total Hours per Week: 5

### Course Out Comes

semester	Coursename	Course credit	Course outcomes
II Regulation(2022-2023)	<b>INDUSTRIAL MICROBIOLOGY</b>	4	<p>CO-1, the student will be able to narrate theoretical and practical aspects of industrial microbiology.</p> <p>CO-2, the student will be able to explain the design of fermentors, factors affecting growth and production</p> <p>CO-3, the student will be able to appreciate the rationale in medium formulation and design for microbial fermentation</p> <p>CO-4, the student will be able to comprehend the techniques and the underlying principles in downstream processing.</p> <p>-CO5, the student will be able to appreciate how microbiology is applied in the manufacture of industrially significant products.</p>

**Course Material: website links, e-Books and e-journals**

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	M	S	M	S	M	M	S	M	M
CO4	S	S	S	S	S	M	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: II**

**Paper type:**

**Core Paper code:**

**Name of the Paper: MOLECULAR BIOLOGY AND MICROBIAL GENETICS**

**Credit: 4**

**Total Hours per Week: 4**

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
II Regulation(2022-2023)	<b>MOLECULAR BIOLOGY AND MICROBIAL GENETICS</b>	4	CO-1, the student will be able to narrate the structure of DNA  - CO 2, the student will be able to explain the process of replication  - CO 3, the student will be able to elaborate the process of transcription  - CO 4, the student will be able to decipher the process of cloning  - CO 5, the student will be able to appreciate the applications of molecular techniques

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	M	S	M	S	S	S	M	S
CO3	S	M	S	M	S	S	M	S	S	M
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	M	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: II Paper type: Elective  
 Paper code:  
 Name of the Paper: A. MUSHROOM CULTIVATION  
 Credit: 3  
 Total Hours per Week: 3

### Course Out Comes

semester	Coursename	Course credit	Course outcomes
II Regulation(2022-2023)	MUSHROOM CULTIVATION	3	<ul style="list-style-type: none"> <li>- CO 1, the student will be able to differentiate edible and non edible mushroom</li> <li>- CO 2, the student will be able to describe spawn preparation</li> <li>- CO 3, the student will be able to explain the process of cultivation of important Mushroom</li> <li>- CO 4, the student will be able to appreciate the nutritional value of Mushroom</li> <li>- CO 5, the student will be able to apply the Economic concept of mushroom cultivation</li> </ul>

### Course Material: website links, e-Books and e-journals

#### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	M	S	M	S
CO2	M	S	M	S	M	S	S	S	S	M
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	M	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: I  
 Paper type:  
 Elective Paper code:  
 Name of the Paper: B. BIOFERTILIZER TECHNOLOGY  
 Credit: 3  
 Total Hours per Week: 3

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
II Regulation(2022-2023)	<b>BIOFERTILIZER TECHNOLOGY</b>	3	<ul style="list-style-type: none"> <li>- CO 1, the student will be able to characterize the microorganisms used as biofertilizers</li> <li>- CO 2, the student will be able to describe Biofertilization processes</li> <li>- CO 3, the student will be able to elaborate on Nitrogenous Biofertilizers</li> <li>- CO 4, the student will be able to appreciate role of Cyanobacteria in biofertilizer</li> <li>- CO 5, the student will be able to describe the role of Mycorrhizae as biofertilizer</li> </ul>

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	M	S	M	M	S	S	S	S
CO3	S	M	S	M	S	S	M	S	S	M
CO4	S	M	S	S	S	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: II Paper type: Elective**

**Paper code:**

**Name of the Paper: C. INTELLECTUAL PROPERTY RIGHTS**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**



semester	Coursename	Course credit	Course outcomes
II Regulation(2022-2023)	<b>INTELLECTUAL PROPERTY RIGHTS</b>	3	-CO1, the student will be able to emphasize the importance of IPR - CO 2, the student will be able to understand the Nature of Copyright - CO 3, the student will be able to explain the concept of Patents and Elements of Patentability - CO 4, the student will be able to understand importance of Traditional Knowledge - CO 5, the student will be able to apply the knowledge for Patenting Biotechnological and Pharmaceutical products

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	S	S	M	M
CO2	M	S	M	S	S	S	S	S	S	M
CO3	S	M	S	M	S	S	M	S	S	M
CO4	S	S	S	S	M	S	M	M	S	S
CO5	S	M	M	S	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: II

Paper type: Open Elective Paper code:

Name of the Paper: A. FOOD PROCESSING TECHNOLOGY

Credit: 3

Total Hours per Week: 3

**Course Out Comes**

semester	Coursename	Course	Course outcomes
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		credit	
II Regulation(2022- 2023)	<b>FOOD PROCESSING TECHNOLOGY</b>	3	<p>-CO1, the student will be able to explain the methods of Preservation and processing of food</p> <p>- CO 2, the student will be able to narrate the Effect of Freezing and drying onFoods</p> <p>- CO 3, the student will be able to appreciate Irradiation of food</p> <p>- CO 4, the student will be able to describe the process of Packaging of foods</p> <p>- CO 5, the student will be able to employ Material handling in food industry</p>

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	S
CO3	S	M	S	M	S	M	M	S	M	M
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: I

Paper type: Open Elective

Paper code:

Name of the Paper: B. INFECTIOUS DISEASES AND ITS CONTROL

Credit: 3

Total Hours per Week: 3

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
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II Regulation(2022- 2023)	<b>INFECTIOUS DISEASES AND ITS CONTROL</b>	3	<ul style="list-style-type: none"> <li>-CO1, the student will be able to comprehend basic concepts of health</li> <li>- CO 2, the student will be able to emphasize the prevention of diseases transmitted by air and vectors</li> <li>- CO 3, the student will be able to emphasize the prevention of diseases transmitted by food and water</li> <li>- CO 4, the student will be able to plan the prevention of diseases transmitted by animals</li> <li>- CO 5, the student will be able to appreciate the ways of disease prevention by antibiotics and vaccines</li> </ul>
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**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	M	S	S	S	S	S	S	S
CO3	S	S	S	M	S	S	M	S	S	M
CO4	M	M	S	S	S	S	S	S	S	S
CO5	S	M	S	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: II

Paper type: Open Elective Paper code:

Name of the Paper: C. MICROBIAL ECOLOGY

Credit: 3

Total Hours per Week: 3

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
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II Regulation(2022- 2023)	MICROBILA ECOLOGY	3	<p>-CO1, the student will be able to comprehend the basic concepts of Microbialecolgy</p> <p>CO2, the student will be able to explain the Microbial diversity in Normal environments</p> <p>- CO 3, the student will be able to explain the Microbial diversity in extremeenvironments</p> <p>- CO 4, the student will be able to decipher the Microbial Degradation of pollutants</p> <p>- CO 5, the student will be able to appreciate the Interactions among Marine Microbes</p>
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**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	M	S	M	S	S	M	S	S	M
CO4	S	M	S	S	S	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Paper code:

Name of the Paper: LAB COURSE - 2

Credit: 5

Total Hours per Week: 8

### Course Out Comes

semester	Coursename	Course credit	Course outcomes
II Regulation(2022-2023)	LAB COURSE	5	CO1- isolate pathogens from clinical specimens and perform Antibiotic sensitivity tests  CO 2carry out industrial fermentations  CO 3isolate enzyme producing bacteria  CO 4isolate DNA and RNA  CO 5quantify DNA, RNA and proteins

### Course Material: website links, e-Books and e-journals

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	M	M
CO2	M	S	M	S	S	S	S	S	S	S
CO3	S	M	S	M	S	S	M	S	M	M
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: III Paper type

CorePaper code:

Name of the Paper: MEDICAL VIROLOGY AND PARASITOLOGY

Credit: 5

Total Hours per Week: 5

### Course Out Comes

semester	Coursename	Course credit	Course outcomes
III Regulation(2022-2023)	<b>medical virology and parasitology</b>	5	CO1- the student will be able to describe the characteristics of viruses  -CO2, the student will be able to explain viral diseases and their clinical manifestaion  - CO 3, the student will be able to explain the diseases caused by parasites  - CO 4, the student will be able to plan strategies for the control of viral diseases  - CO 5, the student will be able to plan strategies for the control of parasitic diseases

### Course Material: website links, e-Books and e-journals

### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	S	S	M	S	S	M	S	S
CO3	S	M	S	M	S	M	M	S	M	M
CO4	S	M	S	S	S	S	S	M	M	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: III Paper type: Core**

**Paper code:**

**Name of the Paper: AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY**

**Credit: 4**

**Total Hours per Week:**

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
III Regulation(2022-2023)	<b>agricultural and environmental microbiology</b>	4	CO 1 the student will be able to know the diverse group of soilmicroorganisms  - CO 2, the student will be able to understand the nutrient sources and cycles  - CO 3, the student will be able to know the concept of disease, causal agent, identification methods and management-  CO 4, the student will be able to understand microbial life in aquatic environments  CO 5, the student will be able to apply microbial treatment of waste water

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	M	S	M	S	S	M	S	M
CO3	S	M	S	M	S	S	M	S	M	M
CO4	S	M	S	M	S	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: III Paper type: Core**

**Paper code:**

**Name of the Paper: BIOTECHNOLOGY**

**Credit: 4**

**Total Hours per Week: 4**

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
III Regulation(2022-2023)	<b>biotechnology</b>	4	CO -1, the student will be able to appreciate plant genetic engineering and production of transgenic plants - CO 2, the student will be able to describe various gene transfer technologies in animals - CO 3, the student will be able to elaborate on Medical Biotechnology -4, the student will be able to appreciate the role of microorganisms in bioremediation CO -5, the student will be able to describe the role of microorganisms in pharmaceutical biotechnology

**Course Material: website links, e-Books and e-journals Mapping**

**with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	S	M	S	M	S	S	M
CO2	M	S	M	S	S	S	S	S	M	S
CO3	S	M	S	M	S	S	M	S	M	M
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low



**Semester: III Paper type: Elective**

**Paper code:**

**Name of the Paper: A. BIOREMEDIATION**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
III Regulation(2022-2023)	BIOREMEDIATION	3	CO 1, the student will be able to list out the diverse group of microorganisms involved in bioremediation - CO 2, the student will be able Toexplain the consequences of Bioaccumulationand biomagnification processes CO 3, the student will be able to appreciate the use of use of genetically engineered microorganism in bioremediation - CO 4, the student will be able to describe phyto-remediation - CO 5, the student will be able to apply phyto-extraction

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	S	S	M	S	S	M
CO2	M	S	M	M	M	S	S	S	S	S
CO3	S	M	S	S	S	M	M	S	S	S
CO4	S	M	S	S	S	S	S	M	S	S
PO – Programme Outcome, CO – Course outcome	S	M	M	S	M	S	S	M	S	M

S – Strong , M – Medium, L – Low

**Semester: III Paper type:**

**Elective Paper code:**

**Name of the Paper: B. RESEARCH METHODOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	Course outcomes
III Regulation(2022-2023)	<b>RESEARCH METHODOLOGY</b>	3	CO1the student will be able to collect literature and design experiments -co2, the student will be able to write research report -co3, the student will be able to measure central tendency -co4, the student will be able to perform Correlation analysis -co5, the student will be able to apply Sampling theory

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	S	M
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	M	S	M	S	S	M	S	S	M
CO4	S	M	S	S	S	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: III Paper type: Elective**

**Paper code:**

**Name of the Paper: C. MARINE MICROBIOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES
III Regulation(2022-2023)	<b>MARINE MICROBIOLOGY</b>	3	-co1, the student will be able to characterize and differentiate marine Microbial Habitats co -2, the student will be able to appreciate the importance of Marine extremophiles - co 3, the student will be able to describe various methods of Cultivation of Marine Microbes - co 4, the student will be able to understand Marine Pollution and suggest Bioremediation - co 5, the student will be able to emphasize the use of Microbial Products from Sea

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	S	M	S	M	M
CO2	M	S	S	S	M	S	M	S	S	S
CO3	S	M	S	M	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	M	S	S
CO5	S	M	M	S	S	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: III Paper type: Open Elective**

**Paper code:**

**Name of the Paper: A. MUSHROOM CULTIVATION**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES
III Regulation(2022-2023)	<b>MUSHROOM CULTIVATION</b>	3	-co 1, the student will be able to differentiate edible and non edible mushroom , co2 the student will be able to describe spawn preparation - co 3, the student will be able to explain the process of cultivation of importantMushroom - co 4, the student will be able to appreciate the nutritional value of Mushroom - co 5, the student will be able to apply the Economic concept of mushroom cultivation

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	M	S	M	S
CO2	M	S	M	S	M	S	S	S	S	M
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	S	S	S	M	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: III Paper type: Open Elective**

**Paper code:**

**Name of the Paper: B. PUBLIC HEALTH MICROBIOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES
III Regulation(2022-2023)	<b>PUBLIC HEALTH MICROBIOLOGY</b>	3	- co 1, the student will be able to describe common waterborne diseases - co 2, the student will be able to understand common air-borne disease - co 3, the student will be able to know the concept of food borne infections - co 4, the student will be able to describe common vector-borne diseases - co 5, the student will be able to prevent the common nosocomial infections

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	M	S	M	M
CO2	M	S	S	S	M	S	S	S	S	S
CO3	S	M	S	M	S	S	S	S	S	M
CO4	S	S	S	S	S	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: III Paper type: Open Elective**

**Paper code:**

**Name of the Paper: C. INTELLECTUAL PROPERTY RIGHTS**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES

III Regulation(2022- 2023)	<b>INTELLECTUAL PROPERTY RIGHTS</b>	3	<ul style="list-style-type: none"> <li>- co 1, the student will be able to emphasize the importance of IPR</li> <li>- co 2, the student will be able to understand the Nature of Copyright</li> <li>- co 3, the student will be able to explain the concept of Patents and Elements of Patentability</li> <li>- co 4, the student will be able to understand importance of Traditional Knowledge</li> <li>- co 5, the student will be able to apply the knowledge for Patenting Biotechnological and Pharmaceutical products</li> </ul>
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**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	S	S	M	M
CO2	M	S	M	S	S	S	S	S	S	M
CO3	S	M	S	M	S	S	M	S	S	M
CO4	S	S	S	S	M	S	M	M	S	S
CO5	S	M	M	S	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: III Paper type: Practical**

**Paper code:**

**Name of the Paper: Lab course - 3**

**Credit: 5**

**Total Hours per Week: 10**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES

III Regulation(2022- 2023)	<b>: Lab course - 3</b>	5	<ul style="list-style-type: none"> <li>- co 1, the student will be able to identify parasites in clinical specimen</li> <li>- co 2, the student will be able to demonstrate viruses through indirect procedures like antigen detecting ELISA, haemagglutination</li> <li>- co 3, the student will be able to isolate bacteria beneficial to plant growth</li> <li>- co 4, the student will be able to demonstrate Rhizosphere effect and microbes present in Rhizosphere</li> <li>- co 5, the student will be able to ensure the quality of water by tests</li> </ul>
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**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	M	S	M	S
CO2	M	S	M	S	M	S	S	S	S	M
CO3	S	M	S	M	S	M	M	S	S	S
CO4	S	M	S	S	S	S	S	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: IV Paper type: Core**

**Paper code:**

**Name of the Paper: RECOMBINANT DNA TECHNOLOGY**

**Credit: 5**

**Total Hours per Week: 5**

course outcomes

semester	Coursename	Course credit	COURSE OUT COMES
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III Regulation(2022- 2023)	<b>recombinant dna technology</b>	5	- co 1, the student will be able to know the diverse components in r-DNAtech - co 2, the student will be able to list out the Techniques and enzymes in genetic recombination - co 3, the student will be able to describe Gene C - co 4, the student will be able to elaborate on PCR methods and Applications - co 5, the student will be able to apply Protein engineering to develop Pharmaceutical products
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### Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	S	S	M	M
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	M	S	S	S	S	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: IV Paper type: Elective**

**Paper code:**

**Name of the Paper: A. DIAGNOSTIC MICROBIOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**



semester	Coursename	Course credit	COURSE OUT COMES
Iv Regulation(2022-2023)	<b>DIAGNOSTIC MICROBIOLOGY</b>	3	<ul style="list-style-type: none"> <li>- co 1, the student will be able to organize a clinical microbiology laboratory</li> <li>- co 2, the student will be able to collect clinical specimens</li> <li>- co 3, the student will be able to examine and process clinical specimens</li> <li>- co 4, the student will be able to understand the concept and principles of Serological Methods</li> <li>- co 5, the student will be able to apply the knowledge of antimicrobial resistance in reducing</li> </ul>

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	M	M	M
CO2	M	S	M	S	S	S	M	S	S	M
CO3	S	M	S	M	M	S	M	S	M	S
CO4	S	M	S	S	S	S	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: IV Paper type: Elective**

**Paper code:**

**Name of the Paper: B. MICROBIAL NANOTECHNOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

Course Out Comes

semester	Coursename	Course credit	COURSE OUT COMES
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IV Regulation(2022- 2023)	<b>MICROBIAL NANOTECHNOLOGY</b>	3	- co 1, the student will be able to understand the role of nanotechnology co 2, the student will be able to employ different ways of nanoparticlesynthesis co 3, the student will be able to characterize Nanoparticles - co 4, the student will be able to appreciate applications of nanoparticles inbiology and medicine - co 5, the student will be able to assess Environmental effects of nanoparticles
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**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	S
CO3	S	M	S	M	S	S	M	S	S	S
CO4	S	M	S	S	M	S	M	S	S	M
CO5	S	M	M	S	S	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: IV Paper type: ElectiveE**

**Paper code:**

**Name of the Paper: C. BIOETHICS**

**Credit: 3**

**Total Hours per Week:**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES
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IV Regulation(2022- 2023)	<b>BIOETHICS</b>	3	<ul style="list-style-type: none"> <li>- co 1, the student will be able to describe the concept of 'bioethics'</li> <li>- co 2, the student will be able to explain Universal Declaration on Bioethics and Human Rights</li> <li>- co 3, the student will be able to analyse the composition and functioning of Ethics committees</li> <li>- co 4, the student will be able to interpret consequences of discrimination and stigmatization</li> <li>- co 5, the student will be able to apply the knowledge in Social responsibility and health</li> </ul>
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**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	M	S
CO3	S	M	S	M	S	S	S	S	S	M
CO4	S	M	S	S	S	S	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: IV Paper type: Open Elective**

**Paper code:**

**Name of the Paper: A. COMPUTATIONAL BIOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES
IV Regulation(2022-2023)	<b>COMPUTATIONAL BIOLOGY</b>	3	- co 1, the student will be able to know the uses of computers in the field of biology co 2, the student will be able to make use of Sequence databases - co 3, the student will be able to perform sequence analysis - co co 4, the student will be able to analyse and interpret protein structures using tools co 5, the student will be able to appreciate the use of microarrays

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	M	S	M	S	S	M	S	M	M
CO4	S	M	S	S	M	S	M	M	S	S
CO5	S	M	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: IV Paper type: Open Elective**

**Paper code:**

**Name of the Paper: B. BIOSAFETY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES
IV Regulation(2022- 2023)	BIOSAFETY	3	- co 1, the student will be able to describe the concept of Biosafety - co 2, the student will be able to list out various biohazards co 3, the student will be able to narrate Biocontainment methods - co 4, the student will be able to employ the concept of Biosafety Management co 5, the student will be able to interpret and apply Biosafety Guidelines

**Course Material: website links, e-Books and e-journals**

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	M
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	M	S	S	M	S	M	M	S	M
CO5	S	M	M	S	S	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**Semester: IV**

**Paper type: Open Elective**

**papercode:**

**Name of the Paper: ALGAL TECHNOLOGY**

**Credit: 3**

**Total Hours per Week: 3**

**Course Out Comes**

semester	Coursename	Course credit	COURSE OUT COMES
IV Regulation(2022-2023)	<b>ALGAL TECHNOLOGY</b>	3	co 1, the student will be able to characterize and classify Algae co2, the student will be able to list out the significance and uses of algae co3, the student will be able to describe algal cultivation methods co-4, the student will be able to appreciate the role of algae in food and feed co5, the student will be able to suggest algal control measures

**Mapping with Programme Outcomes**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	S	S	M	M
CO2	M	S	M	S	S	S	M	S	S	S
CO3	S	M	S	M	M	S	S	S	S	M
CO4	S	M	S	S	S	S	M	M	S	M
CO5	S	M	M	S	M	S	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

**PAPER -****SUBJECT NAME: PROJECT/ DISSERTATION WITH VIVA VOCE****SUBJECT CODE: MAM45****NO.OF.HOURS/ WEEK: 05****CREDITS: 05****TOTAL HOURS: 65**

Semester	Course Name	Course Credit	Course Outcomes
II Regulation (2020-2021) I	PROJECT/D ISSERTATI ON WITH VIVA VOCE	03	CO1- The student to learn the knowledge and practice of public health research activity.
			CO2- Students will be enable them to carry out researches and solve research related problems and to help them in writing thesis and defend their work.
			CO3- Students will able to demonstrate Strategy of recombinant DNA technology
			CO4- Students will able to understand Gene transfer technologies.
			CO5- Students will able to learn tDNA chips and microarray gene screen technology.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	S	M	S	S	S	S	S	M
CO2	M	S	S	S	S	S	M	S	S	S
CO3	S	M	S	S	S	S	S	M	M	L
CO4	S	M	S	S	S	S	M	M	L	S
CO5	S	S	S	S	S	S	S	S	S	M

**PO- Programme outcome, CO- Course outcome**  
**S- Strong, M- Medium, L- Low ( may be avoided)**