

# Department of Microbiology (UG)

## SYLLABUS AND REGULATIONS

Under

### OUTCOME-BASED EDUCATION

2020

(Effective for the Batch of Students Admitted from 2020-2021)



### AUXILIUM COLLEGE (Autonomous)

*(Accredited by NAAC with A<sup>+</sup> Grade with a CGPA of 3.55 out of 4 in the 3<sup>rd</sup> Cycle)*

**Gandhi Nagar, Vellore-632 006.**

**AUXILIUM COLLEGE (Autonomous)**(Accredited by NAAC with A<sup>+</sup> Grade with a CGPA of 3.55 out of 4 in the 3<sup>rd</sup> Cycle)**Gandhi Nagar, Vellore – 632006****OUTCOME BASED EDUCATION****B.Sc. MICROBIOLOGY****(Effective for the students admitted from the academic year 2020-2021)****LIST OF COURSES****Structure of the course and scheme of Examination**

SEM	Part	Paper Code	Title	Hours/week	Exam		Credits	Marks
					Th	Pr		
I	I	ULTAA20	Tamil Paper I	6	3	-	3	40+60
	II	UENGA20	English Paper I	6	3	-	3	40+60
	III	UCMBA20	Fundamentals of Microbiology	6	3	-	5	40+60
	III	UCMBC20	Core Practical I: Basic Techniques in Microbiology	3	-	-	-	-
	III	UABCA20	Allied I: Biochemistry I	4	3	-	4	40+60
	III	UABCC20	Allied Practical : Biochemistry	2	-	-	-	-
	IV		Skill- Based Elective I	2	2	-	2	40+60
	IV		Value Education	1	-	-	-	-
<b>Total</b>							<b>17</b>	<b>500</b>
II	I	ULTAB20	Tamil Paper II	6	3	-	3	40+60
	II	UENGB20	English Paper II	6	3	-	3	40+60
	III	UCMBB20	Microbial Physiology and Metabolism	6	3	-	5	40+60
	III	UCMBC20	Core Practical I: Basic Techniques in Microbiology	3	-	6	4	40+60
	III	UABCB20	Allied II: Biochemistry II	4	3	-	4	40+60
	III	UABCC20	Allied Practical : Biochemistry	2	-	3	2	40+60
	IV		Skill- Based Elective II	2	2	-	2	40+60
	IV	UVEDA20	Value Education	1	-	-	-	-
<b>Total</b>							<b>23</b>	<b>700</b>
III	I	ULTAC20	Tamil Paper III	6	3	-	3	40+60
	II	UENGC20	English Paper III	6	3	-	3	40+60
	III	UCMBD20	Basic Immunology and Microbial genetics- I	6	3	-	5	40+60
	III	UCMBF20	Core Practical II: Basic and Applied Immunology	3	-	-	-	-
	III	UABSA20	Allied III: Biostatistics I	6	3	-	5	40+60
	IV	USMBA20/ USMBB20	Skill- Based Elective III	2	2	-	2	40+60
	IV		Value Education	1	-	-	-	-
<b>Total</b>							<b>18</b>	<b>500</b>
IV	I	ULTAD20	Tamil Paper IV	6	3	-	3	40+60
	II	UENGD20	English Paper IV	6	3	-	3	40+60

	III	UCMBE20	Applied Immunology and Microbial genetics- II	5	3	-	5	40+60
	III	UCMBF20	Core Practical II: Basic and Applied Immunology	3	-	6	4	40+60
	III	UABSB20	Allied III: Biostatistics II	6	3	-	5	40+60
	IV	USMBA20/ USMBB20	Skill- Based Elective IV	2	2	-	2	40+60
	IV	UNEV20	Environmental studies	2	2	-	2	40+60
	IV		Value Education	1	-	-	-	-
<b>Total</b>							<b>24</b>	<b>700</b>
V	III	UCMBG20	Medical Bacteriology and Mycology	5	3	-	5	40+60
	III	UCMBH20	Food, Dairy and Industrial Microbiology	5	3	-	5	40+60
	III	UCMBI20	Molecular Biology and rDNA Technology	4	3	-	5	40+60
	III	UCMBL20	Core Practical III: Medical Microbiology	3	-	-	-	-
	III	UCMBM20	Core Practical IV: Ecology, Food and Dairy Microbiology	3	-	-	-	-
	III	UEMBA20	Elective I A: Fundamentals of cell biology	4	3	-	4	40+60
	III	UEMBB20	Elective I B: Entrepreneurial Microbiology					
	IV		Non-Major Elective I	3	3	-	2	40+60
	IV	USMBC20/ USMBD20	Skill Based Elective V	2	2	-	2	40+60
	IV		Value Education	1	-	-	-	-
<b>Total</b>							<b>23</b>	<b>600</b>
VI	III	UCMBJ20	Medical Virology and Parasitology	5	3	-	5	40+60
	III	UCMBK20	Microbial Ecology and Soil Microbiology	5	3	-	5	40+60
	III	UEMBC20	Elective IIA: Marine Microbiology	4	3	-	4	40+60
		UEMBD20	Elective II B: Microbial Nanotechnology					
	III	UEMBE20	Elective III A: Cyanobacteriology	4	3	-	4	40+60
		UEMBF20	Elective III B : Advanced Microbiology					
	III	UCMBL20	Core Practical III: Medical Microbiology	3	-	6	5	40+60
	III	UCMBM20	Core Practical IV: Ecology, Food and Dairy Microbiology	3	-	6	5	40+60
	IV		Non-Major Elective II	3	3	-	2	40+60
	IV	USMBC20/ USMBD20	Skill Based Elective VI	2	2	-	2	40+60
	IV		Value Education	1	2	-	2	40+60
<b>Total</b>							<b>34</b>	<b>900</b>

	V		Extension Activities ( 90 Hours)				1	
<b>Grand Total</b>							<b>140</b>	<b>3900</b>

### Programme Outcomes (PO)

On completion of the UG Programme, students will be able to;

**PO1:** Attain knowledge and understand the principles and concepts in the respective discipline.

**PO2:** Acquire and apply analytical, critical and creative thinking, and problem-solving skills

**PO3:** Effectively communicate general and discipline-specific information, ideas and opinions.

**PO4:** Appreciate biodiversity and enhance eco-consciousness for sustainable development of the society.

**PO5:** Emulate positive social values and exercise leadership qualities and team work.

**PO6:** Pursue higher knowledge, qualify professionally, enhance entrepreneurial skills and contribute towards the needs of the society.

### Programme Specific Outcomes (PSO)

On completion of the UG Programme in Microbiology, students will be able to;

**PSO1:** Acquire an in depth knowledge on the fundamental concepts and scope of Microbiology and its related fields.

**PSO2:** Realize the application oriented aspects of Microbiology and assimilate the technical skills in basic, medical and applied microbiology.

**PSO3:** Develop and execute oral and writing skills necessary for effective communication of discipline specific information and experimental results.

**PSO4:** Understand and explain the diversity of microorganisms and its interaction with the environment for sustainable development.

**PSO5:** Efficiently work as a team involving multiple disciplines with social and ethical values.

**PSO6:** Attain higher knowledge by developing competency in the field of Microbiology assuring and enhancing entrepreneurial skills for the betterment of the society.

PSO/PO	PO1	PO2	PO3	PO4	PO5	PO6
<b>PSO1</b>	H	M	H	M	L	H
<b>PSO2</b>	H	H	H	L	L	M
<b>PSO3</b>	H	M	H	H	M	L
<b>PSO4</b>	H	L	H	H	M	L
<b>PSO5</b>	H	L	H	L	L	M
<b>PSO6</b>	H	H	H	H	H	H

**H – HIGH (3) M – MODERATE (2) L – LOW (1)**

## SEMESTER – I

### UCMBA20 - FUNDAMENTALS OF MICROBIOLOGY

Year I	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: I	UCMBA20	Fundamentals of Microbiology	Theory	Core	6	5	100

#### Course Objective:

To provide basic knowledge on the structure of bacteria, fungi, algae, protozoa, virus along with the principles of microscopy and the control of microbial growth by physical and chemical methods.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline the history, recent developments and scope of Microbiology.

**CO2:** Demonstrate microscopy with deep knowledge on the sample preparation and staining techniques.

**CO3:** Discuss important aspects of microbial evolution and diversity by employing classical techniques of microbial identification.

**CO4:** Explain the ultra-structure, arrangement and function of a bacterial cell.

**CO5:** Perform the sterilization and disinfection techniques

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	L	H
CO2	H	H	H	L	H	M
CO3	H	M	H	H	H	L
CO4	H	L	H	H	H	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	M	L	H
CO2	H	H	H	L	L	M
CO3	H	M	H	H	L	L
CO4	H	L	H	H	L	L
CO5	H	L	H	L	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

## **COURSE SYLLABUS**

### **UNIT I: History and Scope of Microbiology. (15 hours)**

- 1.1 Definition and Scope of Microbiology. (K1,K2)
- 1.2 History and recent developments- Spontaneous generation Vs Biogenesis. (K1,K2)
- 1.3 Contribution of Louis Pasteur, Robert Koch, Antony Van Leewenhoek. (K1,K2)
- 1.4 Sergei N. Winogradsky, Joseph Lister, Wilkn Beijerink. (K1,K2)
- 1.5 Alexander flemming, Selman A. Waksman, Emil Christian Hansen, Hans Christian Gram. (K1,K2)
- 1.6 Impact of Microbiology and the future. (K1,K2)

### **UNIT II: Microscopy and Staining methods. (15 hours)**

- 2.1 Microscopy and principle of working - Simple, compound, Dark Field, Phase contrast. (K1,K2, K3)
- 2.2 Fluorescent and Electron Microscope - its types (SEM and TEM). (K1,K2, K3)
- 2.3 Staining methods: Dyes and its uses – Simple staining. (K1,K2, K3)
- 2.4 Differential staining - Gram staining and Acid fast staining (Zeihl Neelson method). (K1,K2, K3)
- 2.5 Special staining techniques - Spore staining, Capsule staining (negative staining). (K1,K2, K3)
- 2.6 Flagella staining and Alberts staining for metachromatic granules. (K1,K2, K3)

### **UNIT III: Microbial evolution and diversity. (15 hours)**

- 3.1 Microbial evolution & diversity - Endosymbiotic theory. (K1,K2)
- 3.2 Binomial Nomenclature of Microbes. (K1,K2, K3)
- 3.3 Classification Five Kingdom concept (Whittaker Classification) - Eight Kingdom concept (Cavalier smith). (K1,K2)
- 3.4 Prokaryotes and eukaryotes – their differences. (K1,K2)
- 3.5 Classical techniques of Microbial identification- Morphological, Physiological and biochemical properties. (K1,K2, K3,K4)
- 3.6 General introduction to Fungi, Algae, Virus and protozoa. (K1,K2)

### **UNIT IV: Morphology and Anatomy of Bacteria. (15 hours)**

- 4.1 Morphological shape, structure and arrangement of bacteria- Anatomy of Bacteria. (K1,K2)
- 4.2 Ultrastructure and functions of cell wall (Gram positive and Gram negative cell wall). (K1,K2)
- 4.3 Cytoplasmic membranes. (K1,K2)
- 4.4 Flagella- structure and arrangement, Pili / fimbriae. (K1,K2)

4.5 Capsule - Slime layer, cytoplasmic inclusions and granules. (K1,K2)

4.6 Spore - process of sporulation. (K1,K2)

**UNIT V: Methods of Sterilization and Disinfection.**

**(15 hours)**

5.1 Overview on Sterilization– Principles and Methods of Sterilization. (K1,K2, K3)

5.2 Dry heat sterilization - Incineration and Hot air Oven- principle and uses. (K1,K2, K3)

5.3 Moist heat sterilization – Pasteurization, Tyndallization and Autoclave- principle and uses.  
(K1,K2, K3)

5.4 Filtration, Radiation- ionizing and non-ionizing and Sterilization control. (K1,K2, K3)

5.5 Disinfection - Chemical disinfectants and its uses – fumigation. (K1,K2, K3)

5.6 Phenol coefficient test. (K1,K2, K3, K4)

**TEXT BOOKS:**

1. Pelczar Jr .M.J., Chan E.C.S and Kreig, N.R (2006). Microbiology. 6<sup>th</sup> Edition, McGraw Hill Inc., Newyork.
2. Lansing M. Prescott, John P. Harley, Donald Klein. (2011) .Microbiology. 8<sup>th</sup> Edition, McGraw Hill Inc., New York.

**REFERENCE BOOKS:**

1. Dubey R.C and Maheswari D.K (2012). A Text of Microbiology. Revised edition, S.Chand & Company Ltd., New Delhi.
2. Geeta Sumbali and Mehrotra R.S (2009). Principles of Microbiology. 1<sup>st</sup> edition, Tata McGraw Hill P. Ltd., New Delhi.
3. Robert F. Boyd (2000). General Microbiology. 2<sup>nd</sup> Edition, Times Mirror / Moshy College publishing, Virginia.

**OER:**

E-books

1. [www.gutenberg.org](http://www.gutenberg.org)
2. [www.free-ebooks.net](http://www.free-ebooks.net)
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com)

Video lessons

1. [www.learnerstv.com](http://www.learnerstv.com)
2. [www.webcast.berkeley.edu](http://www.webcast.berkeley.edu)
3. [www.cosmolearning.org](http://www.cosmolearning.org)

## SEMESTER – II

### UCMBB20 -MICROBIAL PHYSIOLOGY AND METABOLISM

Year I	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: II	UCMBB20	Microbial Physiology and Metabolism	Theory	Core	6	5	100

#### Course Objective:

The course is designed to familiarize students with basic concepts of microbial growth and metabolism along with an in-depth knowledge on the morphology and reproduction of fungi and algae.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Discuss on various physical and chemical growth requirements of bacteria.

**CO2:** Practically apply the knowledge in preparation of culture media for bacterial growth and identification.

**CO3:** Equip with various techniques employed to measure microbial growth and evaluate different classes of antibiotics and their mode of actions.

**CO4:** Explain the structural similarities and differences among various groups of fungi and algae along with its physiological properties.

**CO5:** Outline microbial transport systems and mechanisms of energy conservation in metabolism.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	L	H
CO2	H	H	M	L	M	M
CO3	H	M	L	L	L	L
CO4	H	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	M	L	L	L
CO2	H	H	M	L	L	L
CO3	H	M	M	L	L	L
CO4	H	L	M	L	L	L
CO5	H	L	M	L	L	L

H – HIGH (3), M – MODERATE (2), L – LOW (1)



## **COURSE SYLLABUS**

### **UNIT I: Nutrition requirement and types of Microorganisms. (15 hours)**

- 1.1 Nutritional requirement of Microorganisms- Macro and Micro elements (K1,K2)
- 1.2 Nutritional types of Microorganisms – phototrophs and chemotrophs. (K1,K2)
- 1.3 Nutritional types of Microorganisms lithotrophs and organotrophs. (K1,K2)
- 1.4 Nutritional types of Microorganisms autotrophs and heterotrophs. (K1,K2)
- 1.5 Uptake of nutrients into the cell -Transport of nutrients by active method. (K1,K2)
- 1.6 Uptake of nutrients into the cell -Transport of nutrients by passive method. (K1,K2)

### **UNIT II: Culture media, types and culture techniques. (15 hours)**

- 2.1 Culture Media and its types. (K1,K2,K3)
- 2.2 Preparation of culture media. (K1,K2,K3)
- 2.3 Pure culture techniques - Streak, spread, pour plate techniques. (K1,K2,K3)
- 2.4 Factors affecting growth of bacteria- pH, temperature, oxygen. (K1,K2,K3)
- 2.5 Capnophilic organisms. (K1,K2,K3)
- 2.6 Preservation of cultures- aerobic and anaerobic culture techniques- Lyophilization. (K1,K2,K3)

### **UNIT III: Microbial growth and Antimicrobial chemotherapy. (15 hours)**

- 3.1 Microbial growth (Population doubling time / generation time) – Growth curve of Bacteria. (K1,K2,K3)
- 3.2 Measurement of microbial growth (cell number, cell mass). (K1,K2,K3)
- 3.3 Batch and continuous culture- Synchronous growth. (K1,K2,K3)
- 3.4 Control of microbial growth by antimicrobial drugs & Antibiotics- An introduction. (K1,K2)
- 3.5 Drugs inhibiting cell wall, cell membrane, protein and nucleic acid synthesis. (K1,K2)
- 3.6 Antimicrobial drug resistance. (K1,K2)

### **UNIT IV: Morphology, reproduction and cultivation of fungi and algae. (15 hours)**

- 4.1 Fungi- Morphology, reproduction and cultivation of yeast (*Saccharomyces*). (K1,K2,K3)
- 4.2 Morphology, reproduction and cultivation of Molds (*Aspergillus*, *Penicillium*, *Rhizopus* and *Mucor*). (K1,K2,K3)
- 4.3 Algae- Morphology and reproduction of *Chlamydomona* and *Volvox*. (K1,K2)
- 4.4 Algae- Morphology and reproduction of *Chlorella*, *Ulothrix* and *Diatoms*. (K1,K2)
- 4.5 Classification and Salient feature of Cyanobacteria. (K1,K2)
- 4.6 Cultivation of Cyanobacteria. (K1,K2, K3)

**UNIT V: Microbial metabolism.****(15 hours)**

- 5.1 Enzymes – classification- coenzymes (functions of TPP, NAD, NADP, FMN, FAD and Coenzyme A). (K1,K2)
- 5.2 Basic concepts of Microbial Metabolism – enzymes involved. (K1,K2)
- 5.3 Mechanism of ATP Synthesis- Krebs cycle. (K1,K2)
- 5.4 Glycolysis. (K1,K2)
- 5.5 Electron transport chain – oxidative phosphorylation. (K1,K2)
- 5.6 Photophosphorylation- types (Cyclic and Non-cyclic). (K1,K2)

**TEXT BOOKS:**

1. Lansing M. Prescott, Harley J. P and Klein D.A (2005). Microbiology. 6<sup>th</sup> edition, International edition, McGraw Hill. New York.
2. Pelczar T.R, Chan M.J and Kreig N.R (2006). Microbiology.6<sup>th</sup> edition, Tata McGraw-Hill INC., New York.

**REFERENCE BOOKS:**

1. Dubey R.C and Maheswari D.K (2012). A Text of Microbiology. Revised edition, S. Chand andCompany Ltd., New Delhi.
2. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology, 4<sup>th</sup> edition, A John Wiley sons, Inc. publication. New Delhi.
3. David white (2011).The physiology and biochemistry of prokaryotes. 4<sup>th</sup> edition, Oxford university press, UK
4. Sale A.J (1992). Fundamental principles of Bacteriology, 7<sup>th</sup> edition, McGraw Hill Publishing Co. Ltd., New York.

**OER:**

## E-books

1. [www.gutenberg.org](http://www.gutenberg.org)
2. [www.free-ebooks.net](http://www.free-ebooks.net)
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com)

## Video lessons

1. [www.learnerstv.com](http://www.learnerstv.com)
2. [www.webcast.berkeley.edu](http://www.webcast.berkeley.edu)
3. [www.cosmolearning.org](http://www.cosmolearning.org)

## SEMESTER –II

### UCMBC20 – CORE PRACTICAL I: BASIC TECHNIQUES IN MICROBIOLOGY

Year I	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: II	UCMBC20	Basic techniques in Microbiology	Practical	Core	3	4	100

#### Course Objective:

The candidate will gain hands-on training and acquire adequate skill required to identify microorganism through staining techniques, sterilize and prepare culture media, inoculate observe and distinguish the growth patterns of microorganisms in different media.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Perform cleaning, sterilization of glasswares and prepare culture media.

**CO2:** Examine the different morphological forms of microbes.

**CO3:** Analyze and employ different staining methods for the identification of bacteria.

**CO4:** Competently cultivate bacteria in different types of media and identify their sensitivity and resistance.

**CO5:** Use Classical techniques for the identification of bacteria based on their biochemical properties.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	M	H	M	M
CO3	M	M	L	H	L	L
CO4	M	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	H	L	M
CO3	H	H	H	H	L	M
CO4	H	H	H	H	L	M
CO5	H	H	H	H	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

1. Sterilization: Principle & Methods –Dry heat, Moist heat, Filtration, fumigation and radiation.
2. Microscopy – Bright field Microscope.
3. Smear Preparation and simple staining technique.

4. Differential staining - Gram Staining and Acid fast staining.
5. Negative staining for capsule.
6. Motility Demonstration in Hay infusion broth.
7. Culture media preparation - Basal media, Enriched media, Differential media and selective media.
8. Pure culture techniques – Serial dilution, pour plate, spread plate & streak plate techniques.
9. Demonstration of Bio-chemical Characteristics - Indole, Methyl red, Voges Proskauer, Citrate, TSI test, Urease test and Sugar fermentation test.
10. Antibiotic sensitivity test – Kirby Bauer Disc Diffusion method.
11. Morphology of Fungi - LPCB wet mount preparation.
12. Examination of pond water sample – algae and protozoa.

#### **REFERENCE BOOKS:**

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007). Mackie and McCartney Practical Medical Microbiology, 14<sup>th</sup> edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology. 13<sup>th</sup> edition, Mosby Publishers, United states.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. 6<sup>th</sup> edition, Published by Pearson Education, United States.
4. Monica Cheesbrough. (2005) District Laboratory Practice in Tropical Countries –Part I and II. 2<sup>nd</sup> edition, Cambridge University Press, New Delhi.

#### **OER:**

#### **VIRTUAL LABS/ INTERACTIVE SIMULATIONS:**

1. [www.vlab.co.in](http://www.vlab.co.in)
2. [www.aview.in/aview](http://www.aview.in/aview)
3. [www.pbs.org](http://www.pbs.org)
4. [www.micro.magnet.fsu.edu/primer/java/scienceopticsu](http://www.micro.magnet.fsu.edu/primer/java/scienceopticsu)

## SEMESTER – III

### UCMBD20 - BASIC IMMUNOLOGY AND MICROBIAL GENETICS- I

Year II	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: III	UCMBD20	Basic Immunology and Microbial Genetics -I	Theory	Core	6	5	100

#### Course Objective:

The syllabus is designed to provide basic knowledge on immunity and organs of immune system, types of antigens and antibody interactions and the role of DNA as a basic unit of gene expression.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline the history of immunology and immunohaematology.

**CO2:** Discuss the overall organization of the immune system and differentiate the humoral and cell mediated immune mechanisms.

**CO3:** Explain about types of antigen, antibody and apply the principles and techniques involved in antibody production.

**CO4:** Describe the structure of DNA & RNA with their physical & chemical properties.

**CO5:** Familiarize with the process involved in the replication of DNA.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	L	H
CO2	H	L	M	L	M	M
CO3	H	M	L	M	M	M
CO4	H	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	L	M	L	L	H
CO3	H	H	M	L	L	L
CO4	H	L	M	L	L	M
CO5	H	L	H	L	L	L

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

#### UNIT I: History of immunology and Immunohaematology. (15 hours)

1.1 History of Immunology- contributions of Elie metchnikoff. (K1,K2)

1.2 Contributions of Louis Pasteur and Edward Jenner. (K1,K2)

1.3 Immunohaematology- blood grouping, Rh typing. (K1,K2)

- 1.4 Rh incompatibility- Haemolytic disease of the newborn. (K1,K2)
- 1.5 Normal Microbial flora of the human body and its function. (K1,K2)
- 1.6 Gnotobiotic animals, their interaction and uses. (K1,K2)

**UNIT II: Structure and function of immune system. (15 hours)**

- 2.1 Structure and functions of cells of the immune system- B cells, T cells. (K1,K2)
- 2.2 Functions of NK cells, phagocytic cells, Mast cells. (K1,K2)
- 2.3 Primary Lymphoid organs (Thymus and Bone marrow). (K1,K2)
- 2.4 Secondary Lymphoid organs (Lymph node and Spleen), MALT, GALT, BALM. (K1,K2)
- 2.5 Immunity – Types of Immunity – Humoral and Cell mediated immunity. (K1,K2)
- 2.6 Innate and Acquired immunity. (K1,K2)

**UNIT III: Antigen and Antibodies, types and function. (15 hours)**

- 3.1 Antigens- properties, types of antigen- haptens, adjuvants. (K1,K2)
- 3.2 Immunoglobulins- General Structure. (K1,K2)
- 3.3 Types of immunoglobulins, properties and its functions. (K1,K2)
- 3.4 Theories of antibody formation. (K1,K2)
- 3.5 Monoclonal and polyclonal antibodies. (K1,K2)
- 3.6 Production of Monoclonal antibodies and their applications. (K1,K2,K3)

**UNIT IV: Introduction to genetics and nucleic acids, its types and function. (15 hours)**

- 4.1 Genetics – Historical Introduction – Discovery of DNA Structure, Nucleic acids – DNA & RNA as Genetic Material. (K1,K2)
- 4.2 Nucleosomes, Repetitive DNA, highly repetitive DNA, Satellite and mini satellite DNA - forms of DNA. (K1,K2)
- 4.3 Types of RNA- mRNA, tRNA ,rRNA. (K1,K2)
- 4.4 Post transcriptional and translational modification. (K1,K2)
- 4.5 Genetic code. (K1,K2)
- 4.6 Central Dogma of Molecular biology. (K1,K2)

**UNIT– V: Functioning of bacterial genetic material. (15 hours)**

- 5.1 Organization & functioning of bacterial genetic material. (K1,K2)
- 5.2 Gene and Gene concept. (K1,K2)
- 5.3 Plasmids – characteristics, Structure, types and functions. (K1,K2)
- 5.4 Mechanism of DNA Replication- enzymes involved. (K1,K2)
- 5.5 Semi conservative method of replication- experimental proof. (K1,K2)
- 5.6 Types of replication- rolling circle and theta model of replication. (K1,K2)

**TEXT BOOKS:**

1. Kuby J Richard A. Goldsby, Thomas J. Kindt (2006). Immunology. 6<sup>th</sup> edition, W.H. Freeman and company, New York.
2. Richard M.Hyde (2011).Immunology. 3<sup>rd</sup> edition, Williams & Wilkins, Philadelphia.
3. Robert H Tamarin (2002). Principles of Genetics. 7<sup>th</sup> edition, Tata McGraw Hill P. Ltd., New Delhi.

**REFERENCE BOOKS:**

1. Bashir S.F (2011). Text Book of Immunology. 1<sup>st</sup> edition, PHI Learning Private limited, New Delhi.
2. Ananthanarayan R & Paniker C.K.J (2013). Text Book of Microbiology, 9th edition, Universities Press, Hyderabad
3. Tizard K (1995). Immunology. An Introduction. 1<sup>st</sup> edition, Saunders college publishing, Philadelphia.
4. Benjamin A. Pierce (2002). Genetics: A Conceptual Approach. W.H.Freeman and Company, United States.
5. Gardner Simion Snustad (2005). Principles of Genetics. 8<sup>th</sup> edition, John Wiley and Sons Inc, New York.
6. Peter Snustad D and Michael J Simmons (2003). Principles of Genetics. 3<sup>rd</sup> edition, John Wiley and Sons, Inc. publication, New Delhi.

**OER:****VIDEOS/VIDEO LESSONS / E-CONTENT FOR LEARNING:**

1. <http://www.learnerstv.com/>
2. <http://webcast.berkeley.edu/>
3. <http://cosmolearning.org/>
4. <http://www.world-lecture-project.org/>
5. <http://cec.nic.in/>
6. <http://epgp.inflibnet.ac.in/>
7. <http://www.co-learn.in/>

**SEMESTER – IV**  
**UCMBE20 – APPLIED IMMUNOLOGY AND MICROBIAL GENETICS- II**

Year II	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : IV	UCMBE20	Applied Immunology and Microbial Genetics -II	Theory	Core	5	5	100

**Course Objective:**

The syllabus is designed to familiarize students on the antigen antibody reactions *in vivo* and *ex vivo* and an in depth understanding on the central dogma of molecular biology.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Outline and apply the basic principle and mechanism of antigen and antibody reactions.

**CO2:** Discuss on the significance of autoimmune diseases, hypersensitivity reactions and interpret on different types of vaccine and vaccination schedule.

**CO3:** Explain the gene transfer mechanisms between the prokaryotes and eukaryotes.

**CO4:** Identify mutations and DNA repair mechanisms.

**CO5:** Comprehend the process of protein synthesis and the methods of gene expression.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	M	L	H
CO2	H	L	M	M	M	L
CO3	H	M	L	M	M	L
CO4	H	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	L
CO2	H	M	H	L	L	L
CO3	H	H	H	L	L	L
CO4	H	H	H	L	L	L
CO5	H	M	H	L	L	L

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

**COURSE SYLLABUS**

**UNIT I: Antigen –Antibody reactions.**

**(15 hours)**

- 1.1 Antigen and Antibody interaction *in vitro* – Zone phenomenon- Lattice hypothesis. (K1,K2,K3)
- 1.2 Agglutination reactions- Direct, indirect, Haemagglutination inhibition test, Coombs test. (K1,K2,K3)
- 1.3 Precipitation reactions- Ring test, slide test, tube test, Precipitation reaction in gel-immunoelectrophoresis, CIE, Single diffusion in one dimension, double diffusion in one



dimension, single diffusion in two dimension and double diffusion in two dimension, Counter Immunoelectrophoresis. (K1,K2,K3)

1.4 ELISA- direct and indirect. (K1,K2,K3)

1.5 RIA and flow cytometry. (K1,K2,K3)

1.6 Western blotting. (K1,K2,K3)

**UNIT II: Complements cascade and Antigen- antibody reactions invivo. (15 hours)**

2.1 Complements, components and pathways (classical and alternate pathways). (K1,K2)

2.2 Hypersensitivity reactions and its types ((Types I to V). (K1,K2)

2.3 Transplantation immunology. (K1,K2)

2.4 Autoimmune diseases (Rheumatoid Arthritis, Systemic Lupus Erythematosus, Myasthinia gravis, Thrombocytopaenia and Hashimoto thyroiditis). (K1,K2)

2.5 Vaccine- Definition, types and functions. (K1,K2)

2.6 Immunization Schedule. (K1,K2,K3)

**UNIT III: Gene transfer mechanisms. (15 hours)**

3.1 Gene transfer mechanism – Griffith experiment. (K1,K2)

3.2 Transformation – Definition, competent cell, transfection. (K1,K2, K3)

3.3 Mechanism of transformation and transformation frequency. (K1,K2,K3)

3.4 Transduction – Definition, generalized, abortive and specialized transduction. (K1,K2,K3)

3.5 Conjugation – Definition, U Tube experiment (K1,K2,K3)

3.6 Hfr, F<sup>+</sup>, F<sup>-</sup>, F' conjugation. (K1,K2,K3)

**UNIT IV: Mutation and DNA repair mechanisms. (15 hours)**

4.1 Mutation and its types – transition, transversion. (K1,K2)

4.2 Spontaneous (Frame shift mutation, mis sense mutation and non sense mutation). (K1,K2)

4.3 Induced mutation. (K1,K2,K3)

4.4 Detection and isolation of auxotrophic mutants - Replica plating and Ames test. (K1,K2,K3)

4.5 DNA repair mechanisms- photoreactivation, (K1,K2)

4.6 Excision repair and SOS repair. (K1,K2)

**UNIT V: Gene expression system. (15 hours)**

5.1 Protein synthesis (initiation, elongation, termination) in Prokaryotes. (K1,K2)

5.2 Protein synthesis (initiation, elongation, termination) in Eukaryotes. (K1,K2)

5.3 Operon- Definition, structure and function. (K1,K2)

5.4 Overview on the Gene expression system. (K1,K2)

5.5 Concept of Lactose operon. (K1,K2)

5.6 Tryptophan operon – Attenuation control. (K1,K2)

**TEXT BOOKS:**

1. Kuby J Richard A. Goldsby, Thomas J. Kindt (2006). Immunology. 6<sup>th</sup> edition, W.H. Freeman and company, New York.
2. Richard M.Hyde (2011).Immunology. 3<sup>rd</sup> edition, Williams & Wilkins, Philadelphia.
3. Robert H Tamarin (2002). Principles of Genetics. 7<sup>th</sup> edition, Tata McGraw Hill P. Ltd., New Delhi.

**REFERENCE BOOKS:**

1. Bashir S.F (2011). Text Book of Immunology. 1<sup>st</sup> edition, PHI Learning Private limited, New Delhi.
2. Ananthanarayan R & Paniker C.K.J (2013). Text Book of Microbiology, 9th edition, Universities Press, Hyderabad
3. Tizard K (1995). Immunology. An Introduction. 1<sup>st</sup> edition, Saunders college publishing, Philadelphia.
4. Benjamin A. Pierce (2002). Genetics: A Conceptual Approach. W.H.Freeman and Company, United States.
5. Gardner Simion Snustad (2005). Principles of Genetics. 8<sup>th</sup> edition, John Wiley and Sons Inc, New York.
6. Peter Snustad D and Michael J Simmons (2003). Principles of Genetics. 3<sup>rd</sup> edition, John Wiley and Sons, Inc. publication, New Delhi.

**OER:****VIDEOS/VIDEO LESSONS / E-CONTENT FOR LEARNING:**

1. <http://www.learnerstv.com/>
2. <http://webcast.berkeley.edu/>
3. <http://cosmolearning.org/>
4. <http://www.world-lecture-project.org/>
5. <http://cec.nic.in/>
6. <http://epgp.inflibnet.ac.in/>
7. <http://www.co-learn.in/>

## SEMESTER – IV

### UCMBF20 – CORE PRACTICAL II: BASIC AND APPLIED IMMUNOLOGY

Year II	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : IV	UCMBF20	Basic and Applied Immunology	Practical	Core	3	4	100

#### Course Objective:

To impart hands on training on various agglutination and precipitation reaction and to provide an insight in identifying the cells of immune system.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Identify the ABO blood groups and its Rh types.

**CO2:** Enumerate and observe various granulocytic and agranulocytic cells of immune system.

**CO3:** Perform serological diagnosis for the detection of typhoid, syphilis, rheumatoid factor and anti streptolysin 'o'.

**CO4:** Demonstrate the direct and indirect pregnancy testing procedure.

**CO5:** Quantitate the antigens and antibodies by performing immunodiffusion techniques.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	L	M	L	L	H
CO3	H	M	L	M	M	H
CO4	H	L	M	H	M	H
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	H	L	L	L
CO2	H	L	H	M	M	L
CO3	H	H	H	M	M	L
CO4	H	M	H	L	L	L
CO5	H	H	H	L	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

1. Blood Grouping & Rh typing.
2. Differential counting.
3. Enumeration of WBC using Haemocytometer.
4. Enumeration of RBC using Haemocytometer.

5. Isolation of Buffy coat by wintrobes tube.
6. Widal test (Qualitative slide test and Quantitative tube test).
7. Rapid Plasma Reagin test.
8. Pregnancy test –Direct dip stick method and Indirect slide test.
9. Latex Agglutination- Anti Streptolysin ‘o’ test.
10. Latex Agglutination-Rheumatoid factor.
11. Treponema Pallidum Haemagglutination test (TPHA).
12. Precipitation reaction in Gel -Ouchterlony Double Diffusion.
13. Precipitation reaction in Gel - Radial Immuno Diffusion.

#### **REFERENCE BOOKS:**

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology, 13<sup>th</sup> edition, Mosby Publishers, United States.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education, United States.
4. Monica Cheesbrough (2005). District Laboratory Practice in Tropical Countries - Part I and II. 2<sup>nd</sup> edition, Cambridge University Press, New Delhi.

#### **OER:**

#### **VIRTUAL LABS/ INTERACTIVE SIMULATIONS:**

1. [www.vlab.co.in](http://www.vlab.co.in)
2. [www.aview.in/aview](http://www.aview.in/aview)
3. [www.pbs.org](http://www.pbs.org)
4. [www.micro.magnet.fsu.edu/primer/java/scienceopticsu](http://www.micro.magnet.fsu.edu/primer/java/scienceopticsu)

## SEMESTER V

### UCMBG20- MEDICAL BACTERIOLOGY AND MYCOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : V	UCMBG20	Medical Bacteriology and Mycology	Theory	Core	5	5	100

#### Course Objective:

To enable students understanding on medically important bacteria and fungi, the concepts, epidemiology and development of microbial diseases and the principles behind prevention and treatment of such diseases.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline the importance of Host-Parasite relationships and demonstrate the collection of various clinical specimens and processing it.

**CO2:** Explain about the diseases caused by the bacterial pathogens, prevention and treatment.

**CO3:** Discuss the different modes of transmission of bacterial diseases and its preventive measures.

**CO4:** Compare the morphological classification of fungi, and isolation of fungi from clinical specimen.

**CO5:** Compile the common mycotic diseases, their pathogenicity and various antifungal agents used for treatment.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	L	M	L	L	H
CO3	H	M	L	M	M	H
CO4	H	M	M	H	M	H
CO5	H	M	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	M	L	M
CO3	H	H	H	L	L	L
CO4	H	H	H	M	L	M
CO5	H	H	H	L	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

## **COURSE SYLLABUS**

### **UNIT I: Infection, its types and processing of clinical specimens. (10 hours)**

- 1.1 Normal Microbial flora of human body. (K1,K2)
- 1.2 Host parasite relationship. (K1,K2)
- 1.3 Infection and types of infection (Primary, Secondary, Reinfection , cross infection, Nosocomial and Iatrogenic infection). (K1,K2)
- 1.4 Virulence factors of bacteria causing infection. (K1,K2)
- 1.5 Specimen collection, Transport and storage. (K1,K2,K3)
- 1.6 Specimen processing (Blood, Urine, CSF, Sputum and other body fluids). (K1,K2,K3)

### **UNIT II: Bacterial pathogens-I. (20 hours)**

- 2.1 Morphology, classification, antigenic structure, cultural characteristics, pathogenicity, laboratory diagnosis, preventive measures and treatment of Human pathogens – *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus pneumoniae*. (K1,K2,K3)
- 2.2 *Neisseriae meningitidis* and *Neisseriae gonorrhoeae*, *Corynebacterium diphtheria*. (K1,K2,K3)
- 2.3 *Mycobacterium tuberculosis* and *Mycobacterium leprae*, *Bacillus anthracis*. (K1,K2,K3)
- 2.4 *Clostridium botulinum*, *Clostridium tetani* and *Clostridium perfringens*. (K1,K2,K3)
- 2.5 Family – Enterobacteriaceae- *Escherichia coli* and *Klebsiella*. (K1,K2,K3)
- 2.6 Family – Enterobacteriaceae - *Salmonella*, *Shigella* and *Proteus*. (K1,K2,K3)

### **UNIT III: Bacterial pathogens –II and Hospital waste disposal. (15 hours)**

- 3.1 Morphology, classification, antigenic structure, cultural characteristics, pathogenicity, laboratory diagnosis, preventive measures and treatment of *Vibrio cholerae* and *Vibrio parahaemolyticus*, *Pseudomonas aeruginosa*. (K1,K2,K3)
- 3.2 *Brucella abortus*, *Bordetella pertussis*, *Haemophilus influenzae*. (K1,K2,K3)
- 3.3 *Treponema pallidum*, *Chlamydiae* and *Rickettsiae*. (K1,K2,K3)
- 3.4 Zoonotic diseases. (K1,K2,K3)
- 3.5 Hospital acquired infection and their control. (K1,K2,K3)
- 3.6 Hospital waste disposal. (K1,K2,K3)

### **UNIT IV: General Mycology - yeasts of Medical importance. (15 hours)**

- 4.1 General introduction to Mycology. (K1,K2)
- 4.2 Morphology of fungi. (K1,K2,K3)
- 4.3 Classification of fungi of medical importance. (K1,K2)
- 4.4 Detection and recovery of fungi from clinical specimens. (K1,K2,K3)
- 4.5 Yeasts of medical importance – *Candida albicans*, (K1,K2,K3)
- 4.6 *Cryptococcus neoformans*. (K1,K2,K3)

**UNIT V: Common Mycotic diseases.****(15 hours)**

- 5.1 Dermatophytes and agents of superficial mycosis – *Trichophyton*, *Epidermophyton* and *Microsporum*. (K1,K2,K3)
- 5.2 Dimorphic fungi causing systemic mycoses – Histoplasmosis. (K1,K2)
- 5.3 Coccidioidomycosis. (K1,K2)
- 5.4 Blastomycosis. (K1,K2)
- 5.5 Mycotic mycetoma. (K1,K2)
- 5.6 Antifungal agents. (K1,K2,K3)

**TEXT BOOKS:**

1. Ananthanarayan R & Paniker C.K.J. (2013). Text Book of Microbiology, 9<sup>th</sup> edition, Universities Press, Hyderabad.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology, 13<sup>th</sup> edition, Mosby Publishers, United States.
3. Jawetz, Melnick, & Adelberg's. (2013). Medical Microbiology. 26<sup>th</sup> edition. McGraw-Hill, New York.
4. Mehrotra RS and Aneja KR (2006). An Introduction to Mycology. 1<sup>st</sup> edition, New age international publishers, Chennai.

**REFERENCE BOOKS:**

1. Chakraborty P (2003). A Text book of Microbiology. 2<sup>nd</sup> edition, Published by New central Agency (P) Ltd., Kolkata.
2. Satish Gupte (2005). The Short Textbook of Medical Microbiology. 8<sup>th</sup> edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
3. Rajan S (2009). Medical Microbiology. 1<sup>st</sup> edition, MJP Publishers, Chennai.
4. Rajesh Bhatia and Ratan Lalchhpujani (2004). Essentials of Medical Microbiology. 3<sup>rd</sup> edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
5. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries. Part 1 & 2, Cambridge University Press.
6. Jagadish Chander (1996). A text book of Medical Mycology. 1<sup>st</sup> edition. Interprint, New Delhi.

**OER:****E-BOOKS:**

1. <http://www.gutenberg.org/>
2. <http://www.free-ebooks.net/>
3. <http://www.bookrix.com>
4. <http://www.e-booksdirectory.com/>
5. <http://bookboon.com/>
6. <http://www.freebooks.com/ebooks/>

## SEMESTER V

### UCMBH20 - FOOD, DAIRY AND INDUSTRIAL MICROBIOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V	UCMBH20	Food, Dairy and Industrial microbiology	Theory	Core	5	5	100

#### Course Objective:

To provide basic knowledge on food preservation, causes of spoilage, control and preventive measures from harmful microorganisms. The course is also designed for the learners to acquire idea about fermentation technology and commercially important microbial products.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Understand the role of microorganisms in food and the factors influencing their growth

**CO2:** Apply the principles and procedures involved in preservation of food.

**CO3:** Identifying the spoilage causing microorganisms in various foods and analysing the significance of food borne and milk borne diseases in association with public health.

**CO4:** Formulate knowledge on the fermentation process with adequate information on the fermentors and identifying industrially important microorganisms.

**CO5:** Discuss on the industrial production and purification of sauerkraut, cheese, yoghurt, organic solvents, beverages, vitamins and growth factors

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	L	M	L	L	H
CO3	H	M	L	M	M	H
CO4	H	M	M	H	M	H
CO5	H	M	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	M	H	L	L	H
CO3	H	H	M	L	L	H
CO4	H	M	M	L	L	H
CO5	H	H	H	L	M	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**



## **COURSE SYLLABUS**

### **UNIT I: Microorganism important in food microbiology and food preservation methods.**

**(15 hours)**

- 1.1 Food as Substrate for Microorganisms.(K1,K2)
- 1.2 Microorganisms important in food microbiology; Molds, yeasts and bacteria – General characteristics- Classification and importance. (K1,K2)
- 1.3 Principles of food preservation – Asepsis – Removal of microorganisms – anaerobic conditions. (K1,K2, K3)
- 1.4 Food preservation using high temperature – Canning. (K1,K2, K3)
- 1.5 Food preservation using low temperature. (K1,K2, K3)
- 1.6 Food preservation by Drying – Food additives. (K1,K2, K3)

### **UNIT II: Contamination and spoilage of foods.**

**(15 hours)**

- 2.1 Contamination, spoilage and preservation of cereal and cereal products. (K1,K2, K3)
- 2.2 Contamination, spoilage and preservation of vegetables and fruits. (K1,K2, K3)
- 2.3 Contamination, spoilage and preservation of meat and meat products. (K1,K2, K3)
- 2.4 Contamination, spoilage and preservation of milk and milk products. (K1,K2, K3)
- 2.5 Contamination, spoilage and preservation of Poultry, fish and other sea foods.(K1,K2,K3)
- 2.6 Spoilage of canned foods. (K1,K2,K3)

### **UNIT III: Food and milk borne diseases.**

**(15 hours)**

- 3.1 Food borne illness – General introduction to etiological agents, treatment, prevention and control measures (K1,K2,K3)
- 3.2 Food intoxication and Food infection. (K1,K2,K3)
- 3.3 Bacterial food borne diseases. (K1,K2,K3)
- 3.4 Non – bacterial food borne diseases (viral and parasitic). (K1,K2,K3)
- 3.5 Mycotoxicosis and Mycotoxins. (K1,K2,K3)
- 3.6 Milk borne diseases. (K1,K2,K3)

### **UNIT IV: Bioreactors and fermentation.**

**(15 hours)**

- 4.1 Bioreactors – Principle, types. (K1,K2,K3)
- 4.2 Design and functional Characteristics of bioreactors. (K1,K2,K3)
- 4.3 Mode of operation and control. (K1,K2,K3)
- 4.4 Primary and secondary metabolites. (K1,K2)
- 4.5 Fermentation – Types of fermentation – Batch and continuous fermentation. (K1,K2,K3)
- 4.6 Dual (or) multiple, surface and submerged fermentation. (K1,K2,K3)

**UNIT V: Fermented products and industrial production of organic solvents, beverages, vitamins and growth factors. (15 hours)**

5.1 Fermentation- fermented vegetables – sauerkraut. (K1,K2,K3)

5.2 Fermented dairy products – cheese, yoghurt. (K1,K2,K3)

5.3 Production of organic solvents: ethanol, acetone. (K1,K2,K3)

5.4 Beverages: wine, beer. (K1,K2,K3)

5.5 Organic acid: citric acid, acetic acid. (K1,K2,K3)

5.6 Production of Vitamins and growth factors: Vitamin B2 (Riboflavin), Vitamin B12, Vitamin C. (K1,K2,K3)

**TEXT BOOKS:**

1. Frazier W.C. and West Hoff D.C (2008). Food Microbiology. 4<sup>th</sup> edition, Mc Graw Hill, New York.
2. Vijaya Ramesh K (2007). Food Microbiology. 1<sup>st</sup> edition, MJP Publishers, Chennai.
3. Patel A.H (2001). Industrial Microbiology. 3<sup>rd</sup> edition, Mac Millan India Ltd, Chennai.

**REFERENCE BOOKS:**

1. Adam M.R. and Moss M.O (2004). Food Microbiology. 2<sup>nd</sup> edition, New international pvt. Ltd., publishers.UK.
2. Casida J.E (1986). Industrial Microbiology, 1<sup>st</sup> edition. Wiley Eastern publishers.UK
3. Stanbury P.F., Whitaker A and Hall S.J (1995). Principles of Fermentation technology. 1<sup>st</sup> edition, Pergamon, UK.
4. Banwart G. J (2004). Basic Food Microbiology. 2<sup>nd</sup> edition, CBS Publishers and Distributors, New Delhi.
5. James M. Jay (2003). Modern Food Microbiology. 4<sup>th</sup> edition, CBS Publishers, New Delhi.

**OER:**

**DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## SEMESTER V

### UCMBI20 - MOLECULAR BIOLOGY AND rDNA TECHNOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : V	UCMBI20	Molecular biology and rDNA technology	Theory	Core	4	5	100

#### Course Objective:

Familiarize the students understanding on the concepts of recombinant DNA technology and strategies involved in gene manipulations.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Compare the use of various cloning vectors in gene cloning techniques and the application of genetic engineering and strain improvement using mutational rDNA technology.

**CO2:** Apply the strategies of gene cloning techniques and identify rDNA clones.

**CO3:** Compile the techniques of nucleic acid hybridization and DNA amplification.

**CO4:** Explain the procedure involved and applications of enzyme and algal biotechnology.

**CO5:** Discuss on the methods involved in the Production, of pharmaceutical products and the importance of Gene therapy.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	M	M	L
CO4	H	H	H	H	M	M
CO5	H	H	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	M
CO4	H	H	H	M	L	H
CO5	H	H	H	L	M	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT I: Vectors - cloning and expression.

(15 hours)

1.1 Historical perspectives – Plasmids – Vectors. (K1,K2,K3)

1.2 Psc101, P<sup>BR322</sup>, Ti plasmid. (K1,K2,K3)

1.3 Bacteriophage vectors-  $\lambda$  (lamda) and M 13 phage. (K1,K2,K3)

1.4 cosmid (pJB8), YAC (pYAC3). (K1,K2,K3)

- 1.5 Introduction to principles and applications of genetic recombinant technology. (K1,K2,K3)
- 1.6 Strain improvement in the production of biotechnologically useful products (mutational rDNA technology). (K1,K2,K3)

**UNIT II: Strategies of gene cloning techniques. (15 hours)**

- 2.1 Restriction endonucleases- nomenclature, its types. (K1,K2,K3)
- 2.2 Enzyme Ligase and its function. (K1,K2,K3)
- 2.3 DNA manipulative enzymes- DNA Polymerases and its types. (K1,K2,K3)
- 2.4 DNA modifying enzymes- Alkaline phosphatase, polynucleotide kinase, Terminal deoxynucleotidyl transferase. (K1,K2,K3)
- 2.5 Gene cloning techniques – Isolation and identification of rDNA clones. (K1,K2,K3)
- 2.6 Genomic and cDNA libraries. (K1,K2,K3)

**UNIT III: Nucleic acid hybridization and DNA amplification. (15 hours)**

- 3.1 Overview on Nucleic acid hybridization. (K1,K2)
- 3.2 Solution and Filter hybridization – Dot blot. (K1,K2,K3)
- 3.3 Insitu hybridization -colony and plaque hybridization. (K1,K2,K3)
- 3.4 Southern, northern, western methods of hybridization. (K1,K2,K3)
- 3.5 DNA amplification technique – Polymerase Chain Reaction. (K1,K2,K3)
- 3.6 Restriction Fragment Length Polymorphism. (K1,K2,K3)

**UNIT IV: Enzyme and algal biotechnology. (15 hours)**

- 4.1 Enzyme biotechnology – source selection. (K1,K2,K3)
- 4.2 Extraction and purification of enzymes. (K1,K2,K3)
- 4.3 Enzyme immobilization techniques (physical binding, cross linking, entrapment) - their application – products produced. (K1,K2,K3)
- 4.4 Microbial algal technology – Cultivation methods of *Spirulina*. (K1,K2,K3)
- 4.5 Exploitation of microalgae for food and feed. (K1,K2,K3)
- 4.6 Fuel (Methane, hydrogen) and Drug production from microalgae.(K1,K2,K3)

**UNIT V: Biotechnological application in the production of pharmaceuticals.(15 hours)**

- 5.1 Production of Humulin. (K1,K2)
- 5.2 Production of Interferon. (K1,K2)
- 5.3 Tissue plasminogen Activator. (K1,K2)
- 5.4 Recombinant vaccine (HBs Ag). (K1,K2)
- 5.5 Production of antibiotics- Penicillin, Streptomycin and Tetracycline. (K1,K2)
- 5.6 Gene therapy- Definition, Gene therapy methods. (K1,K2)

## **TEXT BOOKS:**

1. Brown T. A (2016). Gene cloning and DNA analysis- An introduction. 7<sup>th</sup> edition, Black wiley, United States.
2. Old R.S and Primrose S.B (2001). Principles of Gene Manipulation: An introduction to Genetic Engineering. 6<sup>th</sup> edition, Blackwell Scientific publication, London.

## **REFERENCE BOOKS:**

1. Jogdnand S.N (2005). Gene biotechnology. 2<sup>nd</sup> edition, Himalaya Publishing House, Mumbai.
2. Satyanarayana U (2005). Biotechnology. 1<sup>st</sup> edition, Books and Allied (P) Ltd., Kolkata.
3. Dubey R.C (2005). A Text of Biotechnology. Multicolour Illustrative edition, S.Chand and Company Ltd., New Delhi.
4. Bernad R Glick and Pasternak, J.J (2003). Molecular Biotechnology - Principles and Applications of Recombinant DNA.3<sup>rd</sup> edition, ASM Press, Washington, D.C.
5. Hugo W.B and Russell A.D (2002). Pharmaceutical Microbiology. 4<sup>th</sup> edition, Blackwell scientific publications / oxford, London.

## **OER:**

### **VIDEOS/VIDEO LESSONS / E-CONTENT FOR LEARNING**

1. <http://www.learnerstv.com/>
2. <http://webcast.berkeley.edu/>
3. <http://cosmolearning.org/>
4. <http://www.world-lecture-project.org/>
5. <http://cec.nic.in/>
6. <http://epgp.inflibnet.ac.in/>
7. <http://www.co-learn.in/>

## SEMESTER V

### UEMBA20- ELECTIVE I A: FUNDAMENTALS OF CELL BIOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : V	UEMBA20	Elective I A: Fundamentals of Cell Biology	Theory	Core Elective	4	4	100

#### Course Objective:

To facilitate the students understanding on the basic concepts and principles of cell biology.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Compare the difference between plant cell and animal cell.

**CO2:** Analyze the basic components of prokaryotic and eukaryotic cells and the chemistry of its macromolecules and differentiate the roles of each cell organelles with its functions.

**CO3:** Compile the ultrastructure and function of nucleus and nucleolus.

**CO4:** Discuss on the different stages of cell division in prokaryotic and eukaryotic cells.

**CO5:** Outline the basic principles of osmosis, cell signalling and signal transduction.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	M	M	L
CO4	H	H	H	M	M	M
CO5	H	H	H	M	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	H	L	M
CO2	H	M	H	M	L	M
CO3	H	M	H	L	L	L
CO4	H	M	H	L	L	L
CO5	H	M	H	L	L	L

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT I: Cell organization.

**(12 hours)**

1.1 Overview of Cell organization and types of cell. (K1,K2)

1.2 Structural organization of prokaryotic cell. (K1,K2)

1.3 Structural organization of eukaryotic cell. (K1,K2)

1.4 Structure of plant cell. (K1,K2)

1.5 Structure of animal cell. (K1,K2)

1.6 Structure of Virus cell. (K1,K2)

**UNIT II: Components and functions of organelles. (12 hours)**

2.1 Structure and function of mitochondria. (K1,K2)

2.2 Structure and function of endoplasmic reticulum- rough and smooth. (K1,K2)

2.3 Structure and function of ribosomes and golgi vesicles. (K1,K2)

2.4 Lysosomes, chloroplast, peroxisomes and glyoxysomes. (K1,K2)

2.5 Extracellular matrix- collagen, microtubules, microfilaments. (K1,K2)

2.6 Centrioles, basal bodies, cilia and flagella. (K1,K2)

**UNIT III: Cytogenetics. (12 hours)**

3.1 Nucleus- Nuclear membrane, Nucleolus, Nuclear pore and annulus. (K1,K2)

3.2 Cytogenetics- an overview. (K1,K2)

3.3 Structure of chromosomes. (K1,K2)

3.4 Nucleosomes - Giant chromosomes. (K1,K2)

3.5 Polytene Chromosomes. (K1,K2)

3.6 Lamp brush chromosomes. (K1, K2)

**UNIT IV: Mitosis and Meiosis I and II. (12 hours)**

4.1 Overview of Cell cycle. (K1, K2)

4.2 Cell division- Mitosis. (K1, K2)

4.3 Meiosis I and II. (K1, K2)

4.4 Cytoplasmic matrix- compounds of matrix- inorganic compound-water. (K1, K2)

4.5 Organic compound- carbohydrates, lipids and proteins. (K1, K2)

4.6 Protein structure and synthesis. (K1, K2)

**UNIT V: Molecular organization of animal cell membrane. (12 hours)**

5.1 Cell biology- Overview on molecular organization of animal cell membrane. (K1, K2)

5.2 Membrane lipids,proteins and carbohydrates. (K1, K2)

5.3 The fluid mosaic model and artificial membranes. (K1, K2)

5.4 Mitochondrial membrane. (K1, K2)

5.5 Red cell membrane. (K1, K2)

5.6 Cell wall components and role of cell wall. (K1, K2)

**TEXT BOOKS:**

1. De Robertis E.D.P (2010). Cell and Molecular Biology.8<sup>th</sup> edition, Lippincott Williams, Philadelphia.
2. Powar.C.B (2006) .Cell biology. 1<sup>st</sup> edition ,Himalaya publishing house, New Delhi
3. Verma.P.S and Agarwal.V.K.(2005). Cell biology, Genetics, Molecular Biology, Evolution and Ecology.1<sup>st</sup> edition. S.Chand and company Ltd, Chennai.

**REFERENCE BOOKS:**

1. Gerald Karp (2013). Cell Biology. 7<sup>th</sup> edition, Wiley Blackwell publishers, United States.
2. Stephen R. Bolsover, Elizabeth A. Shephard, Hugh A. White, Jeremy S. Hyams (2011). Cell Biology: A Short course. 3<sup>rd</sup> edition, Wiley Blackwell publishers, United States.
3. John K.Young (2010).Introduction to Cell Biology.1<sup>st</sup> edition, World Scientific publishing company, Singapore.
4. George Plopper (2014). Principles of Cell Biology.2<sup>nd</sup> edition, John and Bartlett publishers, London.

**OER:**

1. [www.gutenberg.org](http://www.gutenberg.org)
2. [www.free-ebooks.net](http://www.free-ebooks.net)
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com)



## SEMESTER V

### UEMBB20 - ELECTIVE I B: ENTREPRENEURIAL MICROBIOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V	UEMBB20	Elective I B: Entrepreneurial Microbiology	Theory	Core Elective	4	4	100

**Course Objective:** To facilitate the students understanding on the concepts of entrepreneurship such as Planning, decision making, leadership, organizations and authority.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Explain the historical development of industrial microbiology and outline on the importance of entrepreneur development and risk assessment.

**CO2:** Analyze the microbial cells as fermented products.

**CO3:** Demonstrate the procedures involved in mushroom cultivation and its storage method.

**CO4:** Utilize various microorganisms as biofertilizers.

**CO5:** Design and use patent in the development of entrepreneurship.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	H	L	L	H
CO3	H	M	M	M	M	M
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	H	H
CO2	H	H	H	H	M	H
CO3	H	M	H	M	L	M
CO4	H	H	H	M	L	H
CO5	H	H	H	L	L	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT I: Entrepreneur Development.

(12 hours)

1.1 Entrepreneur development and activity. (K1,K2,K3,K4)

1.2 Institutes involved in Entrepreneurial development. (K1,K2,K3,K4)

1.3 Government contributions to Entrepreneurs. (K1,K2,K3,K4)

- 1.4 Risk assessment in Entrepreneurship. (K1,K2,K3,K4)
- 1.5 Industrial Microbiology- Definition and History. (K1,K2)
- 1.6 Scope of Industrial Microbiology. (K1,K2,K3)

**UNIT II: Microbial cells as fermented products. (12 hours)**

- 2.1 Microbial cells as fermentation products – Brewers and Baker’s yeast. (K1,K2,K3)
- 2.2 Food and feed yeasts. (K1,K2,K3)
- 2.3 Bacterial insecticides. (K1,K2,K3)
- 2.4 Legume inoculants - Algae. (K1,K2,K3)
- 2.5 Enzymes as fermentation products- bacterial and fungal amylases. (K1,K2,K3)
- 2.6 Enzymes as fermentation products - proteolytic enzymes. (K1,K2,K3)

**UNIT III: Mushroom cultivation. (12 hours)**

- 3.1 History of Mushroom cultivation in India. (K1,K2)
- 3.2 Common edible mushrooms cultivated in India. (K1,K2)
- 3.3 Preparation of compost and composting. (K1,K2,K3)
- 3.4 Spawn and spawning. (K1,K2,K3)
- 3.5 Methods used in Cultivation of *Agaricus bisporous* and *Agaricus campestris*. (K1,K2,K3)
- 3.6 Methods used in Cultivation *Volvoriella volvaciae*. (K1,K2,K3)

**UNIT IV: Biofertilizers. (12 hours)**

- 4.1 Chemical fertilizers versus biofertilizers. (K1,K2)
- 4.2 Biofertilizer- Historical background. (K1,K2)
- 4.3 Organic farming. (K1,K2,K3)
- 4.4 Methods involved in the production of Bacterial biofertilizers. (K1,K2,K3)
- 4.5 Methods involved in the production of algal biofertilizers. (K1,K2,K3)
- 4.6 The importance of *Rhizobium* sp., *Azospirillum* sp., *Azotobacter* sp., as biofertilizers. (K1,K2)

**UNIT V: Patenting and Fermentation economics. (12 hours)**

- 5.1 Patent and secret process. (K1,K2)
- 5.2 History of patenting. (K1,K2)
- 5.3 Composition, subject matter for patenting. (K1,K2)
- 5.4 Characteristics of a patent, inventor, infringement, cost of patent. (K1,K2)
- 5.5 Patents in India and other countries. (K1,K2)
- 5.6 Fermentation economics. (K1,K2)

**TEXT BOOKS:**

1. Arora (2009). Entrepreneurial Development .1<sup>st</sup> edition, Himalaya Publishing House, New Delhi.
2. Arora R and Sood S.K (2010). Entrepreneurship Development. 1<sup>st</sup> edition, Kalyani Publishers, New Delhi.
3. Batra G.S and Dangal R.C (2000). Entrepreneurship and Small Scale Industries. 1<sup>st</sup> edition, Deep & Deep Publications, New Delhi

**REFERENCE BOOKS:**

1. Casida J.R (2005). Industrial Microbiology. 2<sup>nd</sup> edition, New Age International (P) Ltd., New Delhi.
2. SubbaRao NS (1997). Biofertilizer in Agriculture and Forestry, 3<sup>rd</sup> edition, Oxford & IBU Publications. New Delhi
3. Aneja K.R (2010). Experiments in Microbiology, Plant Pathology, Tissue Culture and Mushroom Production Technology, 6<sup>th</sup> edition, New age International Publication.
4. Anand Saxena (2005). Entrepreneurship Motivation, Performance, Reward. 1<sup>st</sup> edition, Deep & Deep Publication, New Delhi.
5. Anil Kumar S, Poornima S.C, Mini K and Jayashree K (2006). Entrepreneurship Development. 1<sup>st</sup> edition, New age international Publishers, New Delhi.
6. Batra G.S (2002). Development of entrepreneurship. 1<sup>st</sup> edition, Deep & Deep Publication, New Delhi.

**OER:****E- CONTENT FOR LEARNING:**

1. <http://www.learnerstv.com/>
2. <http://webcast.berkeley.edu/>
3. <http://cosmolearning.org/>
4. <http://www.world-lecture-project.org/>
5. <http://cec.nic.in/>
6. <http://epgp.inflibnet.ac.in/>
7. <http://www.co-learn.in/>

## SEMESTER VI

### UCMBJ20: MEDICAL VIROLOGY & PARASITOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : VI	UCMBJ20	Medical Virology and Parasitology	Theory	Core	5	5	100

#### Course Objective:

To provide in depth knowledge on diseases caused by medically important, its epidemiology and control measures.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Explain the properties, classification and cultivation of viruses.

CO2: Outline on the zoonotic and arthropod borne diseases.

CO3: Discuss about the oncogenic viruses and brief out on the importance of antiviral drugs and vaccines.

CO4: Describe the classification of parasites and demonstrate the laboratory diagnosis of parasitic diseases.

CO5: Compile the information on common parasites, protozoan and metazoan diseases.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	H	L	L	H
CO3	H	M	M	M	M	M
CO4	H	H	H	M	M	H
CO5	H	H	H	M	M	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	H	L	M
CO2	H	L	H	M	L	M
CO3	H	M	H	L	L	M
CO4	H	H	H	M	L	L
CO5	H	L	H	L	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT I: General properties of virus.

**(15 hours)**

1.1 General properties of virus. (K1,K2)

1.2 Detection of viruses and antigens in clinical specimens. (K1,K2,K3)

1.3 Serological diagnosis of virus infections. (K1,K2,K3)

1.4 Cultivation of viruses – egg inoculation and tissue culture. (K1,K2,K3)

1.5 Structure and properties of viroids. (K1,K2)

1.6 Prions. (K1,K2)

**UNIT II: Viral diseases - I.**

**(15 hours)**

2.1 Arthropod borne virus (Chickungunya virus, Dengue, Japanese Encephalitis, West Nile fever, Yellow fever). (K1,K2)

2.2 Rodent borne viral diseases (Lassa, Hanta and Ebola virus). (K1,K2)

2.3 Picorna viruses (Polio, Rhino Virus). (K1,K2)

2.4 Hepatitis viruses ( Type A, B and C), Rabies virus. (K1,K2)

2.5 Orthomyxo ( H1N1 Influenza) and Paramyxo viruses ( Measles, Mumps). (K1,K2)

2.6 SARS, MERS, SARS CoV2. (K1,K2)

**UNIT III: Viral diseases -II.**

**(15 hours)**

3.1 Pox viruses, Adeno viruses, Herpes Simplex virus. (K1,K2)

3.2 Reo virus, Rota virus. (K1,K2)

3.3 Human immunodeficiency virus. (K1,K2)

3.4 Oncogenic virus (Papilloma virus and Polyoma virus). (K1,K2)

3.5 Antiviral drugs and Interferon. (K1,K2)

3.6 Viral vaccines. (K1,K2)

**UNIT IV: Introduction to Medical parasitology and common protozoan diseases. (15 hours)**

4.1 Introduction to Medical Parasitology – Classification of parasites. (K1,K2)

4.2 Laboratory diagnosis of common parasitic diseases. (K1,K2)

4.3 Common protozoan diseases – Amoebiasis, Giardiasis. (K1,K2)

4.4 Trypanosomiasis. (K1,K2)

4.5 Malaria. (K1,K2)

4.6 Toxoplasmosis and Leishmaniasis. (K1,K2)

**UNIT V: Common metazoan diseases.**

**(15 hours)**

5.1 Morphology, Pathogenicity, clinical manifestation and Lab diagnosis of Ascariasis. (K1,K2, K3)

5.2 Hookworm. (K1,K2,K3)

5.3 Filariasis. (K1,K2,K3)

5.4 Hydatidosis. (K1,K2,K3)

5.5 Fasciolopsis. (K1,K2,K3)

5.6 Taenia infection.(K1,K2,K3)

**TEXT BOOKS:**

1. Jawetz, Melnick, & Adelberg (2013). Medical Microbiology. 26<sup>th</sup> edition, Mc Graw-Hill. New York.
2. Ananthanarayan R & Paniker C.K.J. (2013). Text Book of Microbiology, 9<sup>th</sup> edition, Universities Press, Hyderabad.
3. Subhash Chandra Parija (2013). Text book of Medical Parasitology. 4<sup>th</sup> edition, All India Publishers and Distributors (Medical Books Publishers), New Delhi.
4. Chatterjee K.D (2016). Parasitology, Protozoology& Helminthology. 13<sup>th</sup> edition. Joe media Publishers. Calcutta.

**REFERENCE BOOKS:**

1. Dimmok N.J and Primrose S.B (1994). Introduction to modern virology 4<sup>th</sup> edition, Blackwell scientific company publications, United States.
2. Saravanan P (2006). Virology. 1<sup>st</sup> edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
3. Luria S.E, Darnell J.E, Baltimore D and Compare A (1978). General virology. 3<sup>rd</sup> edition, John Wiley and Sons, New York.
4. Jayaram Paniker C.K (2004). Text book of Medical Parasitology. 5<sup>th</sup> edition, Jaypee Brothers Publishers (P) Ltd., New Delhi.
5. Karyakarte R.P and Damle AS (2005). Medical Parasitology. Revised edition, Books and Allied (P) Ltd., Kolkata.

**OER:**

1. <http://www.gutenberg.org/>
2. <http://www.free-ebooks.net/>
3. <http://www.bookrix.com>
4. <http://www.e-booksdirectory.com/>
5. <http://bookboon.com/>
6. <http://www.freebooks.com/ebooks/>

## SEMESTER VI

### UCMBK18 - MICROBIAL ECOLOGY AND SOIL MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : VI	UCMBK20	Microbial Ecology and Soil Microbiology	Theory	Core	5	5	100

#### Course Objective:

To facilitate students understanding on the microorganisms present in their environments and their habitat, microbial interaction, biogeochemical cycling and waste management.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Compare the role of microbial communities in the environment and discuss on the significance of Aero and Water Microbiology

**CO2:** Assess on the microbiological aspects of management of sewage and design the treatment procedures.

**CO3:** Outline on the importance of bioremediation and biodegradation of xenobiotic compounds.

**CO4:** Familiarize with microorganisms of soil and their role in biogeochemical cycle.

**CO5:** Comprehend the importance of plant- microbe interactions.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	M
CO2	H	H	H	L	L	M
CO3	H	M	M	H	M	M
CO4	H	M	H	H	M	M
CO5	H	M	H	M	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	H	L	M
CO2	H	L	H	M	L	M
CO3	H	M	H	L	L	M
CO4	H	H	H	M	L	L
CO5	H	L	H	L	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT I: Aero Microbiology and Water Microbiology.

(15 hours)

- 1.1 Microbes of air, Droplet, Droplet nuclei, aerosol. Assessment of air quality, solid- liquid impingement method. (K1,K2,K3,K4)
- 1.2 Brief account of air borne transmission of microbes and diseases. (K1,K2)
- 1.3 Microbiology of water – Types of water- potability of water (K1,K2)

- 1.4 Microbial assessment of water quality. (K1,K2,K3,K4)
- 1.5 Brief account on water borne diseases. (K1,K2)
- 1.6 Municipal water treatment method process. (K1,K2,K3,K4)

**UNIT II: Sewage treatment. (15 hours)**

- 2.1 Sewage– Chemical and Microbiological characteristic of sewage. (K1,K2)
- 2.2 Types of wastes - Characterization of solid and liquid waste (K1,K2)
- 2.3 Sewage treatment methods– Primary treatment. (K1,K2,K3)
- 2.4 Sewage treatment - Secondary, anaerobic – methanogenesis, aerobic – trickling filters , activated sludge, oxidation pond. (K1,K2,K3)
- 2.5 Tertiary treatment- sewage disinfection. (K1,K2,K3)
- 2.6 Utilization of solid and liquid wastes- saccharification – gasification – composting. (K1,K2,K3)

**UNIT III: Biodeterioration and remediation. (15 hours)**

- 3.1 Bioaugmentation, recalcitrants/xenobiotic compounds -Bioremediation, biodeterioration- Definition. (K1,K2)
- 3.2 Deterioration of paper. (K1,K2,K3)
- 3.3 Deterioration of leathers. (K1,K2,K3)
- 3.4 Deterioration of wood. (K1,K2,K3)
- 3.5 Deterioration of textiles /fabrics. (K1,K2,K3)
- 3.6 Metal corrosion – Biocorrosion. (K1,K2,K3)

**UNIT IV: Microbiology of soil. (15 hours)**

- 4.1 Microorganisms in soil – qualitative and quantitative microflora of different soils. (K1,K2,K3)
- 4.2 Role of microorganisms in soil fertility. Enumeration of microorganisms in soil. (K1,K2,K3)
- 4.3 Factors affecting soil microflora – moisture, pH, temperature, organic matter, agronomic practices. (K1,K2,K3)
- 4.4 Bio-Geo chemical cycles – Nitrogen cycle (K1,K2)
- 4.5 Phosphorus cycle and sulphur cycle. (K1,K2)
- 4.6 Carbon cycle and iron cycle. (K1,K2)

**UNIT V: Plant - Microbe interactions. (15 hours)**

- 5.1 Overview on Plant Microbe interactions. (K1,K2)
- 5.2 Inter relationships between plants and Microorganisms – Rhizosphere, Rhizoplane, Phyllosphere, Spherosphere – their importance in plant growth. (K1,K2)
- 5.3 Mycorrhiza – ecto and endo mycorrhiza – AM fungi – distribution and importance. (K1,K2, K3)
- 5.4 Lichens and their role. (K1,K2)



5.5 Symbiotic Nitrogen fixation - Root nodule bacteria. (K1,K2, K3)

5.6 Non- symbiotic nitrogen fixation (K1,K2,K3)

**TEXT BOOKS:**

1. Vijaya Ramesh K (2004). Environmental Microbiology. 1<sup>st</sup> edition, MJP publishers. Chennai
2. Joseph C. Daniel (1999). Environmental aspects of Microbiology. 1<sup>st</sup> edition, Bright Sun publications, Chennai.
3. Subba Rao N.S (2004). Soil Microbiology. 4<sup>th</sup> edition, Oxford and BH Publishing Co.Pvt. Ltd., New Delhi.

**REFERENCE BOOKS:**

1. Murugesan A.G and Rajakumari C (2005). Environmental Science and Biotechnology. 1<sup>st</sup> edition, MJP Publishers, Chennai.
2. Singh D.P and Dwivedi S.K (2005). Environmental Microbiology and Biotechnology. 1<sup>st</sup> edition, New Age International (P) Ltd., New Delhi.
3. Mishra RR (2004). Soil Microbiology. 1<sup>st</sup> edition, CBS Publishers and distributors, New Delhi.
4. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. 4<sup>th</sup> edition, PHI Learning (P) Ltd., New Delhi.
5. Atlas R.M. and Bartha R (1992). Microbial Ecology, Fundamental and Application, 3<sup>rd</sup> edition, Bengamin and Cummings. United States.

**OER:**

**E- CONTENT FOR LEARNING:**

1. <http://www.learnerstv.com/>
2. <http://webcast.berkeley.edu/>
3. <http://cosmolearning.org/>
4. <http://www.world-lecture-project.org/>
5. <http://cec.nic.in/>
6. <http://epgp.inflibnet.ac.in/>
7. <http://www.co-learn.in/>

## SEMESTER VI

### UEMBC20- ELECTIVE II A: MARINE MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UEMBC20	Elective II A: Marine Microbiology	Theory	Core Elective	4	4	100

#### Course Objective:

To facilitate students understanding on the ecological role of microorganisms in marine environment.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline about the different marine environment and compare the microbial communities in the aquatic environment.

**CO2:** Discuss adaptations strategies of various extremophilic microorganisms, extremozymes and their importance in biotechnology.

**CO3:** Identify the kinetics of aquatic microbial population and microbial interactions – symbiosis and antagonism.

**CO4:** Describe about the marine food borne and water borne pathogens.

**CO5:** Explain the production and biotechnological applications of novel marine microbial products.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	L	M
CO2	H	H	H	L	L	M
CO3	H	M	M	H	H	M
CO4	H	M	H	H	H	M
CO5	H	L	M	M	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	L	L
CO2	H	M	H	M	L	L
CO3	H	M	H	H	L	L
CO4	H	M	H	M	L	L
CO5	H	H	H	H	L	H

H – HIGH (3), M – MODERATE (2), L – LOW (1)

#### COURSE SYLLABUS

##### UNIT I: The marine environment.

(12 hours)

1.1 Marine environment - sea-benthic & littoral zone. (K1,K2)

1.2 Saltpan. (K1,K2)

1.3 Mangroves. (K1,K2)

- 1.4 Estuarine microbes. (K1,K2)
- 1.5 Microbial loop. (K1,K2)
- 1.6 Marine microbial community - planktons, bacteria, fungi, protozoa. (K1,K2)

**UNIT II: Extremophiles and their growth environment. (12 hours)**

- 2.1 Survival at extreme environments – starvation. (K1,K2)
- 2.2 Adaptive mechanisms in thermophilic, psychrophilic microorganisms. (K1,K2)
- 2.3 Alkalophilic microorganisms. (K1,K2)
- 2.4 Barophilic microorganisms and Osmophilic microorganisms. (K1,K2)
- 2.5 Hyperthermophiles microorganisms. (K1,K2)
- 2.6 Halophiles - importance in biotechnology. (K1,K2)

**UNIT III: Microbe- Microbe interactions. (12 hours)**

- 3.1 Microbe-microbe interactions – Lichens. (K1,K2)
- 3.2 Antagonistic interactions - amensalism, mycoparasitism. (K1,K2)
- 3.3 Animal-microbe interaction - Ectosymbiosis of Protozoa, Ruminant symbiosis. (K1,K2)
- 3.4 Plant-microbe interaction – *Rhizobium*. (K1,K2)
- 3.5 Plant-microbe interaction – *Mycorrhizae*. (K1,K2)
- 3.6 *Anabaena* - sponge. (K1,K2)

**UNIT IV: Marine pathogens. (12 hours)**

- 4.1 Marine food borne pathogens & Water borne pathogens – An overview. (K1,K2)
- 4.2 *Aeromonas*. (K1,K2)
- 4.3 *Vibrio*. (K1,K2)
- 4.4 *Salmonella*. (K1,K2)
- 4.5 *Pseudomonas*. (K1,K2)
- 4.6 *Leptospira*. (K1,K2)

**UNIT V: Marine microbial products. (12 hours)**

- 5.1 Production and applications of marine microbial products - pigments – Astaxanthin. (K1,K2)
- 5.2 Production and applications of marine microbial products -  $\beta$  carotene. (K1,K2)
- 5.3 Production and applications of marine microbial products – enzymes. (K1,K2)
- 5.4 Production and applications of marine microbial products – antibiotics. (K1,K2)
- 5.5 Production and applications of marine microbial products – polysaccharide. (K1,K2)
- 5.6 Sea food preservation methods. (K1,K2)

**TEXT BOOKS:**

1. Lansing M. Prescott, John P. Harley, Donald Klein (2011) .Microbiology. 8<sup>th</sup> edition. McGraw Hill Inc., New York.
2. Bhakuni D.S. and Rawat D.S. (2005). Bioactive marine natural products. 1<sup>st</sup> edition, Anamaya Publishers, New Delhi.
3. James W. Nybakker (2001). Marine Biology.1<sup>st</sup> edition, Benjamin Cumming Publications, United States.

**REFERENCE BOOKS:**

1. Raina M. Maier, Ian L. Pepper, Charles, P. Gerba (2006). Environmental Microbiology. 1<sup>st</sup> edition, Academic press, United States.
2. Shimshon Belkin and Rita R. Colwell (2005). Ocean and Health: Pathogens in the marine environment. 1<sup>st</sup> edition, Springer, United States.
3. Scheper T. (2005). Advances in Biochemical Engineering/Biotechnology-Marine Biotechnology I. 1<sup>st</sup> edition, Springer, United States.

**OER:****DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## SEMESTER VI

### UEMBD20 - ELECTIVE II B: MICROBIAL NANOTECHNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UEMBD20	Elective II B: Microbial Nano Technology	Theory	Core Elective	4	4	100

#### Course Objective:

To facilitate students understanding on microbial nanotechnology and its applications.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline evolution of nanoscience and hurdles in the development of nanotechnology.

**CO2:** Understand the use spectroscopy for nanotechnology research.

**CO3:** Discuss the role of microscopy in nanotechnology research.

**CO4:** Utilize nano materials for drug development and its application in nuclear medicine.

**CO5:** Apply nanotechnology for air and water treatment and become familiar with nanoscience education in India and abroad.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	H
CO2	H	H	H	L	L	M
CO3	H	M	M	H	L	M
CO4	H	M	H	H	M	M
CO5	H	L	M	M	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	M	M	M
CO5	H	H	H	M	H	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT I: History and evolution of Nano Science.

(12 hours)

1.1 Definition – Evolution of Nano science. (K1,K2)

1.2 Need of Nano technology. (K1,K2)

1.3 Hurdles for Nanotechnology development. (K1,K2)

1.4 Factors affecting the manufacturing process of nano materials. (K1,K2)

1.5 Role of physicists, chemists, computer scientists, engineers in nanotechnology. (K1,K2)

1.6 Role of Medical doctors, biologists in nano technology. (K1,K2)

**UNIT II: Spectroscopy in nanotechnology research. (12 hours)**

- 2.1 Spectroscopy- An overview. (K1,K2)
- 2.2 Importance of spectroscopy in nano technology research. (K1,K2)
- 2.3 Mass spectroscopy. (K1,K2)
- 2.4 Infra-red spectroscopy. (K1,K2)
- 2.5 Raman spectroscopy. (K1,K2)
- 2.6 Ultra violet-visible spectroscopy. (K1,K2)

**UNIT III: Microscopy in nanotechnology research. (12 hours)**

- 3.1 Microscopy in nanotechnology research- An over view. (K1,K2)
- 3.2 Atomic force microscope. (K1,K2)
- 3.3 Scanning electron microscope. (K1,K2)
- 3.4 Transmission electron microscope. (K1,K2)
- 3.5 Magnetic resonance force microscopy. (K1,K2)
- 3.6 Nano probes for nucleic and hybridization detection. (K1,K2)

**UNIT IV: Nanotechnology for drug development and medical applications. (12 hours)**

- 4.1 Nanotechnology for drug development and medical applications. (K1,K2)
- 4.2 Nanotechnology for drug solubilization and drug delivery. (K1,K2)
- 4.3 Diagnosis using nanomaterials. (K1,K2)
- 4.4 Nanotherapy for cancer treatment. (K1,K2)
- 4.5 Nanotherapy for interior artery embolisms. (K1,K2)
- 4.6 Radioactive tubereene cages in Nuclear medicine. (K1,K2)

**UNIT V: Cleaning the air with nanotechnology. (12 hours)**

- 5.1 Cleaner environment with Nanotech. Cleaning the air with Nanotechnology. (K1,K2)
- 5.2 Nanotechnology for water treatment. (K1,K2)
- 5.3 Microbial nanoparticles used in cleaning air. (K1,K2)
- 5.4 Nanocarbon ball as deodorizer in fermentation process. (K1,K2)
- 5.5 Possible harm from Nanomaterials. (K1,K2)
- 5.6 Nanoscience in India – Nanoscience education abroad – ethics and society. (K1,K2)

**TEXT BOOKS:**

1. Richard Brooker and Earl Boysen (2006). Nanotechnology. 1<sup>st</sup> edition, Wiley Publishing Inc., India.
2. Bernd H.A.Rehm (2006). Microbial Bionanotechnology: Biological self-assembly systems and Biopolymer Based Nanostructures. 1<sup>st</sup> edition, Horizon Bio Science.UK.
3. Nicola Cioffi and Mahendra Rai (2012). Nano - Antimicrobials.1<sup>st</sup> edition, Springer. United States.

**REFERENCE BOOKS:**

1. Duckruix, A. and R. Giege (1992). Crystallization of Nucleic acids and Proteins. A practical approach, 1<sup>st</sup> edition, Oxford University Press, England.
2. Vadlapudi Varahalarao and Nayak B.K (2017). Microbial Nanotechnology: Mycofabrication of Nano particles and their Novel Applications.1<sup>st</sup> edition.IGI global publishers. India.
3. Nicola Cioffi and Mahendra Rai (2012). Nano - Antimicrobials.1<sup>st</sup> edition, Springer. United States
4. Anton Ficai and Alexandru Grumaezescu.(2017) .Nanostructures for Antimicrobial Therapy. 1<sup>st</sup> edition, Elsevier. Netherlands.

**OER:****DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## SEMESTER VI

### UEMBE20: ELECTIVE III A: CYANOBACTERIOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UEMBE20	Elective III A: Cyanobacteriology	Theory	Core Elective	4	4	100

#### Course Objective:

To provide an understanding on the structure, genomics, molecular regulation and applications of Cyanobacteria.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline the diversity of cyanobacteria.

**CO2:** Discuss on the genomics of Cyanobacteria.

**CO3:** Explain the molecular biology of Cyanobacteria.

**CO4:** Describe the molecular regulation in Cyanobacteria.

**CO5:** Demonstrate the mass cultivation and applications of Cyanobacteria.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	H
CO2	H	H	H	L	L	M
CO3	H	M	M	H	L	M
CO4	H	M	H	H	M	M
CO5	H	H	M	M	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	L	H
CO2	H	M	H	M	L	H
CO3	H	M	H	M	L	M
CO4	H	M	H	M	L	M
CO5	H	H	H	H	H	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT-I: Introduction to cyanobacteria.

(12 hours)

- 1.1 Overview on cyanobacteriology. (K1,K2)
- 1.2 Introduction: Origins of life. (K1,K2)
- 1.3 Photosynthesis in cyanobacteria. (K1,K2)
- 1.4 Diversity of cyanobacteria. (K1,K2)
- 1.5 Fossil history of cyanobacteria. (K1,K2)
- 1.6 The Oceanic Cyanobacterial Picoplankton. (K1,K2)

##### UNIT-II: Genomics of Cyanobacteria.

(12 hours)

- 2.1 Gene transfer in cyanobacteria in nature. (K1,K2)
- 2.2 Gene transfer to cyanobacteria in lab. (K1,K2,K3)



- 2.3 Molecular ecology of Cyanobacteria. (K1,K2)
- 2.4 Environmental genomics of cyanobacteria. (K1,K2)
- 2.5 Comparative genomics of marine cyanobacteria. (K1,K2)
- 2.6 Stress response-regulatory system and regulated genes. (K1,K2)

**UNIT-III: Molecular Biology of Cyanobacteria. (12 hours)**

- 3.1 Molecular Biology of Cyanelles and Chloroplast Origins and Evolution. (K1,K2)
- 3.2 Supramolecular Membrane Organization. (K1,K2)
- 3.3 Phycobilisome and Phycobiliprotein Structures. (K1,K2)
- 3.4 The Use of Cyanobacteria in the Study of the Structure and Function of Photosystem II. (K1,K2)
- 3.5 The Cytochrome Complex. (K1,K2)
- 3.6 Photosystem I in Cyanobacteria. (K1,K2)

**UNIT-IV: Biochemistry and molecular regulation in cyanobacteria. (12 hours)**

- 4.1 The Biochemistry of cyanobacteria. (K1,K2)
- 4.2 Molecular Regulation of Carbon Dioxide Metabolism in Cyanobacteria. (K1,K2)
- 4.3 Genetic Analysis of Cyanobacteria. (K1,K2)
- 4.4 Heterocyst development. (K1,K2)
- 4.5 Heterocyst Metabolism. (K1,K2)
- 4.6 Differentiation of Hormogonia. (K1,K2)

**UNIT-V: Applications of Cyanobacteria. (12 hours)**

- 5.1 Mass cultivation of cyanobacteria under outdoor and indoor conditions. (K1,K2)
- 5.2 Cyanobacteria as a source of fine chemicals: polysaccharides and bioactive molecules. (K1,K2,K3)
- 5.3 Cyanobacteria as a source of pigments and antioxidants. (K1,K2,K3)
- 5.4 Cyanobacteria as a source of lipids and polyunsaturated fatty acids. (K1,K2,K3)
- 5.5 Cyanobacteria as biofertilizer for paddy cultivation. (K1,K2,K3)
- 5.6 Hydrogen production by cyanobacteria: Mechanism, progress and prospects. (K1,K2)

**TEXT BOOKS:**

1. Samit Ray. (2006). Cyanobacteria. 1<sup>st</sup> edition. New Age International Pvt Ltd Publishers.
2. Percy M. Gault and Harris J. Marler. (2009) .Handbook on Cyanobacteria: Biochemistry, Biotechnology and Applications (Bacteriology Research Developments), Nova Science publishers, Inc.

**REFERENCE BOOKS:**

1. Antonia Herrero and Enrique Flores. (2008). The Cyanobacteria: Molecular Biology, Genomics and Evolution, Caister academic press.
2. T. A. Sarma. (2012) Handbook of Cyanobacteria, CRC press.

3. D.A. Bryant. (1995). The Molecular Biology of Cyanobacteria (Advances in Photosynthesis and Respiration) Springer.

**OER:**

**DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## SEMESTER VI

### UEMBF20 - ELECTIVE III B - ADVANCED MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UEMBF20	Elective III B: Advanced Microbiology	Theory	Core Elective	4	4	100

#### Course Objective:

To provide the learners an overview on the advanced aspects of Microbiology

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Utilize microorganisms in the preparation of cosmetics.

**CO2:** Evaluate the biological potential in samples return from satellites and solar system.

**CO3:** Discuss the role of antimicrobial fabrics, carpets, tiles, colourants and produce bacteriostatic sanitary napkins and towels.

**CO4:** Comprehend on paper, rubber and plastic Microbiology

**CO5:** Analyze the methods for producing its antimicrobial products.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	H
CO2	H	H	M	L	L	M
CO3	H	M	L	H	M	H
CO4	H	M	L	H	M	H
CO5	H	H	M	M	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	M	L	L
CO3	H	H	H	L	M	H
CO4	H	M	H	L	M	H
CO5	H	H	H	L	H	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

##### UNIT-I: Cosmetic Microbiology.

(12 hours)

1.1 Definition; Preparations of Skin whitening compositions from microbes like Ascomycetes and Black yeast. (K1,K2, K3)

1.2 Preparations of Skin whitening compositions- enzymes. (K1,K2, K3)

1.3 Preparations of Skin whitening compositions- Mineral yeast ferments. (K1,K2,K3)

1.4 Microbial Production of Alpha Arbutin. (K1,K2,K3)

1.5 Microbial production of Hyaluronic acid. (K1,K2,K3)

1.6 Kojic acid and their use in Cosmetics preparations. (K1,K2)

**UNIT–II: Space Microbiology. (12 hours)**

2.1 Introduction to Space Microbiology. (K1,K2)

2.2 Monitoring of astronauts microbial flora. (K1,K2,K3)

2.3 Alterations in the load of medically important microorganisms. (K1,K2)

2.4 ESA STONE experiment. (K1,K2,K3,K4)

2.5 Evaluating the Biological Potential in Samples Returned from Planetary Satellites. (K1,K2, K3,K4)

2.6 Evaluating the Biological Potential of Small Solar System Bodies. (K1,K2,K3,K4)

**UNIT–III: Textile Microbiology. (12 hours)**

3.1 Introduction to Textile Microbiology. (K1,K2)

3.2 Antimicrobial fabrics. (K1,K2)

3.3 Antimicrobial garments. (K1,K2)

3.4 Antimicrobial carpets. (K1,K2)

3.5 Antimicrobial colorants. (K1,K2)

3.6 Bacteriostatic sanitary napkins and towels. (K1,K2,K3)

**UNIT–IV: Paper and Rubber Microbiology. (12 hours)**

4.1 Paper Microbiology- Introduction & Definition. (K1,K2)

4.2 Antimicrobial papers and its production. (K1,K2)

4.3 Antimicrobial currency. (K1,K2)

4.4 Rubber Microbiology – Introduction & Definition. (K1,K2)

4.5 Note on Antimicrobial rubbers. (K1,K2)

4.6 Antimicrobial rubber compositions. (K1,K2)

**UNIT–V: Plastic Microbiology. (12 hours)**

5.1 Definition- Bacteriostatic plastics. (K1,K2)

5.2 Antimicrobial plastic composition and production. (K1,K2)

5.3 Antiseptic plastics. Fungistatic plastics: Definition and production. (K1,K2)

5.4 Production of plastics materials from microorganisms. (K1,K2,K3)

5.5 Methods for producing anti-microbial plastic product. (K1,K2,K3,K4)

5.6 Plastic article containing a metallic bactericidal agent. Casein plastic. (K1,K2,K3)

**TEXT BOOKS:**

1. Vimaladevi M (2015) Text book of Herbal Cosmetics.1<sup>st</sup> edition, CBS Publishers and Distributors, New Delhi.
2. Alfonso F Davila (2010). Astromicrobiology.1<sup>st</sup> edition, John Wiley & Sons, Inc. New Delhi.
3. Srikanth Pilla (2011). Handbook of Bioplastics and Biocomposites Engineering and Applications.1<sup>st</sup> edition, John Wiley and Sons Inc., New Delhi.
4. Nierstrasz V and Cavaco Paulo A (2010). Advances in Textile Biotechnology. 1<sup>st</sup> edition, Elsevier, London.

**REFERENCE BOOKS:**

1. Philip A. Geis (2006) *Cosmetic Microbiology: A Practical Approach*. 2<sup>nd</sup> edition, CRC Press, Taylor and Francis Group, New York, London.
2. David M. Klaus (2003). *Space Microbiology: Microgravity and Microorganisms*. 1<sup>st</sup> edition, John Wiley & Sons, Inc. New Delhi
3. Ashish Kumar Sen (2007). *Coated Textiles: Principles and Applications*. 2<sup>nd</sup> edition, CRC Press, New Delhi
4. Tappi (2007). *Monograph on Microbiology of Papermaking systems*. Tappi publishers, New York.
5. Roberts A.D (1988). *Natural Rubber Science and Technology*. 1<sup>st</sup> edition, Oxford University Press. UK.
6. Chen, George Guo- Qiang (2010). *Plastics from Bacteria: Natural Functions and Applications*. 1<sup>st</sup> edition, Springer, United States.

**OER:****DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## SEMESTER VI

### UCMBL20- CORE PRACTICAL III: MEDICAL MICROBIOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : VI	UCMBL20	Medical Microbiology	Practical	Core	3	4	100

#### Course Objective:

To provide hands on training on laboratory skills in the field of Diagnostic Microbiology.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Demonstrate collection, transport and processing of clinical specimens.

**CO2:** Perform staining techniques for the identification of bacteria.

**CO3:** Isolate and identify the bacterial pathogens from various clinical specimens.

**CO4:** Prepare culture media for the cultivation of microorganisms.

**CO5:** Analyze the clinical specimens for the examination of pathogenic fungi and parasites.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	H	L	L	M
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	M	L	M
CO3	H	H	H	L	L	H
CO4	H	H	H	M	L	H
CO5	H	H	H	M	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

#### COURSE SYLLABUS

1. General requirements of collections transport of clinical specimens – Direct examinations – Staining of specimens – Methods of enriched, Selective and enrichment culture techniques used to isolate organisms from clinical materials.
2. Simple, differential and special staining of clinical materials ie., Throat Swab, vaginal Swab, pus, urine, sputum, stool etc.,
3. Quantitative urine analysis.

4. Isolation and identification of bacterial pathogens from clinical specimens their biochemical reactions- catalase, oxidase, coagulase, IMViC, TSI, urease and MMTP.
5. Antimicrobial Sensitivity testing and determination of MIC and quality control.
6. Wet mount examinations of stool for parasites (saline and iodine).
7. KOH and LPCB preparation for skin and nail scrapings, for fungi.
8. Estimation of worm burden in stool. Floatation and sedimentation techniques of stool examination.
9. Germ tube test, Assimilation, fermentation tests for yeasts.
10. Identification of pathogenic microbes including viruses in slides \ smears \ Specimens as Spotters.

#### **REFERENCE BOOKS:**

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007). Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology, 13<sup>th</sup> edition, Mosby Publishers, United States.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. 6<sup>th</sup> edition, Published by Pearson Education, United States.
4. Monica Cheesbrough. (2005) District Laboratory Practice in Tropical Countries - Part I and II. 2<sup>nd</sup> edition, Cambridge University Press, New Delhi.

#### **OER:**

#### **VIRTUAL LABS/ INTERACTIVE SIMULATIONS:**

1. [www.vlab.co.in](http://www.vlab.co.in)
2. [www.aview.in/aview](http://www.aview.in/aview)
3. [www.pbs.org](http://www.pbs.org)
4. [www.micro.magnet.fsu.edu/primer/java/scienceopticsu](http://www.micro.magnet.fsu.edu/primer/java/scienceopticsu)

**SEMESTER VI**  
**UCMBM20 - CORE PRACTICAL IV: ECOLOGY, FOOD AND DAIRY**  
**MICROBIOLOGY**

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : VI	UCMBM20	Ecology, food and Dairy Microbiology	Practical	Core	3	4	100

**Course Objective:**

To provide hand on experience on isolation and characterization of microbes from different food sources, agricultural and environmental samples.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Assess the microbiological quality of raw milk by MBRT and Standard Plate Count test.

**CO2:** Identify and enumerate bacteria and fungi from the spoiled foods and Rhizosphere soil.

**CO3:** Apply the technique for the isolation of yeast from food sources.

**CO4:** Analyze the potability of water by MPN test.

**CO5:** Perform the microbial test to detect soil fertility and isolate, cultivate Rhizobium from root nodule.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	L	L	H
CO2	H	H	H	M	L	M
CO3	H	H	H	M	L	M
CO4	H	H	H	M	L	H
CO5	H	H	H	H	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	M	L	M
CO3	H	H	H	M	L	M
CO4	H	H	H	M	L	H
CO5	H	H	H	H	M	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

**COURSE SYLLABUS**

1. Isolation of microorganisms from air by Settle plate technique.
2. Isolation and counting of faecal bacteria from water.
3. Water analysis by MPN technique
  - i. Presumptive coli form test



- ii. Confirmed coli form test
  - iii. Completed coli form test.
4. Enumeration of number of bacteria in milk by Standard plate count method.
  5. Methylene blue reductase test to assess the quality of milk.
  6. Isolation of Lactobacilli and Staphylococcus from curd.
  7. Examination of common house hold mold – LPCB wet mount.
  8. Isolation of bacteria and fungi from Spoiled food.
  9. Isolation of yeast from food sources – Grapes and Sugarcane juice.
  10. Isolation & Enumeration of bacteria and fungi from Rhizosphere soil.
  11. Microbial test for Soil fertility – Phosphate Solubilization and Nitrate reduction test.
  12. Isolation of *Rhizobium* from root nodule.

#### **REFERENCE BOOKS:**

1. Dubey R.C and Maheswari D.K (2004). Practical Microbiology 1<sup>st</sup> edition, S.Chand & Company Ltd., New Delhi.
2. Kannan N (2003). Handbook of Laboratory Culture Media, Reagents, Stains and Buffers. Panima Publishing Corporation, New Delhi.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. 6<sup>th</sup> edition, Published by Pearson Education, United States.
4. Monica Cheesbrough (2005) District Laboratory Practice in Tropical Countries - Part I and II. 2<sup>nd</sup> edition, Cambridge University Press, New Delhi.

#### **OER:**

#### **VIRTUAL LABS/ INTERACTIVE SIMULATIONS:**

1. [www.vlab.co.in](http://www.vlab.co.in)
2. [www.aview.in/aview](http://www.aview.in/aview)
3. [www.pbs.org](http://www.pbs.org)
4. [www.micro.magnet.fsu.edu/primer/java/scienceopticsu](http://www.micro.magnet.fsu.edu/primer/java/scienceopticsu)

**SKILL BASED ELECTIVE**  
**(B.SC MICROBIOLOGY- SEMESTER III & IV)**  
**USMBA20 – SKILL BASED ELECTIVE: MUSHROOM TECHNOLOGY**

Year II	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
<b>SEM: III</b>	USMBA20	Mushroom Technology	Theory	Skill Based Elective	2	2	100

**Course Objective:**

The course will provide adequate hands on experience in handling and cultivation of edible mushrooms. The subject content is designed to develop an entrepreneur.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Communicate information about scope and importance of mushrooms.

**CO2:** Formulate media used for cultivation of mushroom and select the appropriate methods for spawn production.

**CO3:** Demonstrate mushroom cultivation technology and its preservation

**CO4:** Compile in detail about edible and poisonous mushrooms.

**CO5:** Utilize the nutritional and medicinal values of mushrooms.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	H	M	H	M	M	H
<b>CO2</b>	H	M	H	H	M	H
<b>CO3</b>	H	H	H	H	L	H
<b>CO4</b>	H	M	M	M	L	H
<b>CO5</b>	H	M	H	M	M	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO1</b>	H	M	H	M	M	H
<b>CO2</b>	H	M	H	H	M	H
<b>CO3</b>	H	H	H	H	L	H
<b>CO4</b>	H	M	M	M	L	H
<b>CO5</b>	H	M	H	M	M	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

**COURSE SYLLABUS**

**UNIT I: History and scope of mushroom cultivation. (6 hours)**

- 1.1 Introduction to mushroom cultivation. (K1,K2)
- 1.2 History to mushroom cultivation. (K1,K2)
- 1.3 Scope and importance of mushroom cultivation. (K1,K2)
- 1.4 Present status of mushroom industry in India. (K1,K2)
- 1.5 Mushroom research and development. (K1,K2)

1.6 National and international agencies. (K1,K2)

**UNIT II: Pure culture for spawn production. (6 hours)**

2.1 Pure Culture- Media- Preparation. (K1,K2,K3)

2.2 Maintenance of mother culture in test tube slants -Petri plates - saline bottle - poly propylene bags. (K1,K2,K3)

2.3 Spawn production- spawning. (K1,K2,K3)

2.4 Types of spawning. (K1,K2,K3)

2.5 Compost and composting. (K1,K2,K3)

2.6 Storage and transportation. (K1,K2,K3)

**UNIT III: Cultivation technology. (6 hours)**

3.1 Cultivation Technology - Infrastructure - culture rack. (K1,K2,K3)

3.2 Thatched house. (K1,K2,K3)

3.3 Substrates – vessels. (K1,K2,K3)

3.4 Inoculation methods. (K1,K2,K3)

3.5 Mushroom bed preparation. (K1,K2,K3)

3.6 Preservation technology- long term storage - short term storage. (K1,K2,K3)

**UNIT IV: Edible mushrooms cultivated in India. (6 hours)**

4.1 Types and importance of edible mushroom cultivated in India. (K1,K2)

4.2 *Agaricus bisporus*. (K1,K2,K3)

4.3 *Pleurotus* spp. (K1,K2,K3)

4.5 *Volvariella volvacea* (K1,K2,K3)

4.6 *Calocybe indica*. (K1,K2,K3)

4.7 Mushroom contamination.(K1,K2)

**UNIT V: Nutritional and Medicinal Value of mushroom. (6 hours)**

5.1 Nutritional value of mushrooms. (K1,K2)

5.2 Medicinal values of Mushroom. (K1,K2)

5.3 Preparation of low calorie foods – the mushroom recipes. (K1,K2, K3)

5.4 Marketing values of mushrooms in India. (K1,K2)

5.5 Export value of mushrooms. (K1,K2)

5.6 Poisonous Mushrooms. (K1,K2)

**TEXT BOOKS:**

1. Shu-Ting Chang, Philip G.Miles, Chang S. T (2004).Mushrooms: Cultivation, nutritional value, medicinal effect and environmental impact, 2<sup>nd</sup> edition, CRC press. United States.
2. Suman B.C and Sharma V.P (2005) Mushroom Cultivation, Processing and Uses. 1<sup>st</sup> edition, Agribios (India) Publishers, Jodhpur.

**REFERENCE BOOKS:**

1. Paul Stamets J.S and Chilton J. S. (2004.) Mushroom Cultivation: A practical guide to growing mushroom. Agarikon Press, Sathome.
2. Dubey R.C and Maheswari D.K (2012). A Text of Microbiology. Revised edition, S. Chand and Company Ltd., New Delhi.
3. Marimuthu, *et al.*, (1991). Oyster Mushroom. Department of Plant Pathology, TNAU, Coimbatore.
4. Tewari and Pankaj Kapoor S.C (1988). Mushroom Cultivation. 1<sup>st</sup> edition, Mittal Publication, Delhi.

**OER:****DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## SKILL BASED ELECTIVE

(B.Sc Microbiology - Semester IV)

### USMBB20 – SKILL BASED ELECTIVE: BIOINSTRUMENTATION

Year II	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM : IV	USMBB20	Bioinstrumentation	Theory	Skill Based Elective	2	2	100

#### Course Objective:

To provide an in depth knowledge on handling various laboratory instruments with a keen idea about its principle of working.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline the working principles of various laboratory equipment.

**CO2:** Demonstrate various types of centrifugation.

**CO3:** Discuss on the different techniques of gel electrophoresis and comprehend the methods of blotting

**CO4:** Compile the techniques of chromatography.

**CO5:** Explain principle and usage of various spectrophotometres.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	L	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	L	L	M
CO5	H	H	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	L	L	M
CO5	H	H	H	L	L	M

H – HIGH (3), M – MODERATE (2), L – LOW (1)

#### COURSE SYLLABUS

##### UNIT I: Basic science equipments and its uses.

(6 hours)

1.1 Buffers, molar and normal solutions. (K1,K2)

1.2 pH meter, pH electrodes - calomel and glass electrodes. (K1, K2)

1.3 Hot Air oven, Autoclave. (K1, K2, K3)

1.4 Incubator. (K1, K2, K3)

1.5 Water bath shaker. (K1, K2, K3)

1.6 Laminar air flow- its application and uses. (K1, K2, K3)

**UNIT II: Centrifuge and its application.**

**(6 hours)**

1.1 Centrifugation- Definition- Principle. (K1, K2, K3)

1.2 Types of centrifuges - low speed and high speed. (K1, K2, K3)

1.3 Ultra centrifuge. (K1, K2, K3)

1.4 Differential centrifugation. (K1, K2, K3)

1.5 Density gradient centrifugation. (K1, K2, K3)

1.6 Applications of centrifuge. (K1, K2, K3)

**UNIT III: Electrophoresis.**

**(6 hours)**

3.1 Electrophoresis - SDS – PAGE. (K1, K2, K3)

3.2 Agarose gel electrophoresis. (K1, K2, K3)

3.3 Southern blotting. (K1, K2, K3)

3.4 Northern blotting. (K1, K2, K3)

3.5 Western blotting. (K1, K2, K3)

3.6 DOT blotting. (K1, K2, K3)

**UNIT IV: Chromatographic techniques.**

**(6 hours)**

4.1 Chromatography – paper. (K1, K2, K3)

4.2 Thin layer chromatography. (K1, K2, K3)

4.3 Column chromatography. (K1, K2, K3)

4.4 Ion exchange chromatography. (K1, K2, K3)

4.5 Gas chromatography. (K1, K2, K3)

4.6 HPLC- its application and uses. (K1, K2, K3)

**UNIT V: Spectrophotometry.**

**(6 hours)**

5.1 Colorimetry, (K1, K2, K3)

5.2 Spectrometry – Principle of work. (K1, K2, K3)

5.3 Types- UV and visible spectrophotometer. (K1, K2, K3)

5.4 Flame photometry. (K1, K2, K3)

5.5 FACS. (K1, K2, K3)

5.6 Biosensors – its application and uses. (K1, K2, K3)

**TEXT BOOKS:**

1. Bajpai P.K (2010). Biological Instrumentation and Methodology. Revised edition, S.Chand & Co.Ltd., New Delhi.
2. John G Webster (2004). Bioinstrumentation. Student edition. John Wiley and Sons, Ltd., New Delhi.

**REFERENCE BOOKS:**

1. Palanivelu P (2004). Analytical Biochemistry and Separation techniques. 3<sup>rd</sup> edition, MKU Coop, Press Ltd., Palkalai Nagar, Madurai.
2. Gurumani N (2006). Research Methodology for Biological Sciences. 1<sup>st</sup> edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
3. Subramanian M.A (2005). Biophysics - Principles and Techniques. 1<sup>st</sup> edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
4. Ravishankar S (2001). A Text Book of Pharmaceutical Analysis. 3<sup>rd</sup> edition. Rx Publications, Tirunelveli.

**OER:****WEB RESOURCES:**

## E-books

1. [www.gutenberg.org](http://www.gutenberg.org)
2. [www.free-ebooks.net](http://www.free-ebooks.net)
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com)

## Video lessons

1. [www.learnerstv.com](http://www.learnerstv.com)
2. [www.webcast.berkeley.edu](http://www.webcast.berkeley.edu)
3. [www.cosmolearning.org](http://www.cosmolearning.org)

**SKILL BASED ELECTIVE**  
(B.Sc Microbiology- Semester V & VI)

**USMBC20 – SKILL BASED ELECTIVE: DIAGNOSTIC MICROBIOLOGY**

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
<b>SEM:</b> V & VI	USMBC20	Diagnostic Microbiology	Theory	Skill Based Elective	2	2	100

**Course Objective:**

To provide the learners an overview on clinical Microbiology, laboratory organization and various diagnostic approaches from traditional to molecular methods.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Explain general safety regulations and guidelines of microbiology laboratory.

**CO2:** Apply procedures in the collection and transport of clinical specimens.

**CO3:** Examine and identify the pathogenic microorganisms from clinical specimens.

**CO4:** Perform serological and molecular methods for the diagnosis of diseases.

**CO5:** Determine the sensitivity and resistance pattern of bacterial pathogens to various antibiotics.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	H	H	H	L	H	H
<b>CO2</b>	H	H	H	L	M	M
<b>CO3</b>	H	H	H	L	M	M
<b>CO4</b>	H	H	H	L	M	M
<b>CO5</b>	H	H	H	L	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO1</b>	H	H	H	L	H	H
<b>CO2</b>	H	H	H	L	M	M
<b>CO3</b>	H	H	H	L	M	M
<b>CO4</b>	H	H	H	L	M	M
<b>CO5</b>	H	H	H	L	M	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**



## **COURSE SYLLABUS**

### **UNIT I: Philosophy of Diagnostic Microbiology. (5 hours)**

- 1.1 Purpose and philosophy of Diagnostic Microbiology. (K1,K2)
- 1.2 Organization of clinical microbiology laboratory. (K1,K2)
- 1.3 Responsibility of clinical microbiology laboratory. (K1,K2)
- 1.4 Laboratory safety: General safety considerations – biohazards. (K1,K2)
- 1.5 Practices specific to Microbiology. (K1,K2)
- 1.6 Classification of biological agents on the basis of hazards. (K1,K2)

### **UNIT II: Collection of clinical specimens. (5 hours)**

- 2.1 Collection of bacterial, viral, fungal and protozoan diseases associated clinical specimens- An overview.(K2,K3,K4)
- 2.2 Oral cavity and throat swab. .(K2,K3,K4)
- 2.3 Skin Scrapping. .(K2,K3,K4)
- 2.4 Blood. .(K2,K3,K4)
- 2.5 CSF.(K2,K3,K4)
- 2.6 Urine and faeces. (K2,K3,K4)

### **UNIT III: Examination and processing of clinical samples. (5 hours)**

- 3.1 Examination of clinical sample by staining - Gram stain. (K2,K3,K4)
- 3.2 Ziehl – Neelson staining for tuberculosis. (K2,K3,K4)
- 3.3 Giemsa stained thin blood film for malaria. (K2,K3,K4)
- 3.4 LPCB for fungal identification (K2,K3,K4)
- 3.5 Culture based techniques- processing of various clinical specimens. (K2,K3,K4)
- 3.6 Culture for the growth of fungi. (K2,K3,K4)

### **UNIT IV: Serological and Molecular diagnosis. (9 hours)**

- 4.1 Serological Methods – Agglutination based methods: WIDAL. (K2,K3,K4)
- 4.2 Automated methods: ELISA. (K2,K3,K4)
- 4.3 Immunodiffusion. (K2,K3,K4)
- 4.4 Immunoelectrophoresis. (K2,K3,K4)
- 4.5 Western blotting. (K2,K3,K4)
- 4.6 Nucleic acid based methods - PCR. (K2,K3,K4)

### **UNIT V: Antimicrobial sensitivity. (6 hours)**

- 5.1 Importance and determination of resistance/sensitivity of bacterial pathogens using disc diffusion method. (K2,K3,K4)
- 5.2 Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method and E test – importance of MIC determination. (K2,K3,K4)
- 5.3 Antimycotic susceptibility testing –reporting and resulting. (K2,K3,K4)
- 5.4 Computerization. (K1,K2,K3)
- 5.5 Quality assurance. (K1,K2,K3)
- 5.6 Safe disposal of specimens and biohazards. (K1,K2,K3)

**TEXT BOOKS:**

1. Tille P. (2013). Bailey's and Scott's Diagnostic Microbiology, 13<sup>th</sup> edition, Mosby publishers, United States.
2. Collee J.G, Fraser, A.G, Marmion B.P and Simmons A (2007). Mackie and McCartney Practical Medical Microbiology, 14<sup>th</sup> edition, Elsevier publishers. London.

**REFERENCE BOOKS:**

1. Ananthanarayan R and Paniker C.K.J (2009). Textbook of Microbiology, 8<sup>th</sup> edition, Universities Press Private Ltd. Hyderabad.
2. Brooks G.F, Carroll K.C, Butel J .S, Morse S.A and Mietzner T. A (2013). Jawetz, Melnick and Adelberg's Medical Microbiology. 26<sup>th</sup> edition. McGraw Hill Publication.
3. Betty A Forbes, Daniel F Sahn and Alice S Weissfeld (2007). Bailey and Scott's Diagnostic Microbiology, 12<sup>th</sup> edition, Mosby publishers, United States.
4. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries - Part I and II. 2<sup>nd</sup> edition, Cambridge University Press, New Delhi.

**OER:****E-BOOKS:**

1. <http://www.gutenberg.org/>
2. <http://www.free-ebooks.net/>
3. <http://www.bookrix.com>
4. <http://www.e-booksdirectory.com/>
5. <http://bookboon.com/>
6. <http://www.freebooks.com/ebooks/>

**USMBD20 – SKILL BASED ELECTIVE: NUTRACEUTICALS AND FUNCTIONAL FOODS**

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
<b>SEM:</b> V & VI	USMBD20	Nutraceuticals and functional foods	Theory	Skill Based Elective	2	2	100

**Course Objective:** To familiarize students on the basic nutraceutical constituents of different foods and its role in health benefits.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Explain the historical perspective, classification, scope and future prospects of nutraceuticals.

**CO2:** Discuss the nutraceuticals constituents present in various food products and the role of probiotics and prebiotics as nutraceuticals.

**CO3:** Analyze food as remedies for the common disorders.

**CO4:** Outline genetically modified plants which are commercially available and their applications.

**CO5:** Communicate the pharmaceutical applications of genetically engineered plants.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	H	H	H	L	L	H
<b>CO2</b>	H	H	H	H	L	H
<b>CO3</b>	H	H	H	L	M	M
<b>CO4</b>	H	M	H	M	M	M
<b>CO5</b>	H	M	H	M	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO1</b>	H	H	H	L	L	H
<b>CO2</b>	H	H	H	H	L	H
<b>CO3</b>	H	H	H	L	M	M
<b>CO4</b>	H	M	H	M	M	M
<b>CO5</b>	H	M	H	M	M	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

## **COURSE SYLLABUS**

### **UNIT I: Basics of nutraceuticals. (6 hours)**

- 1.1 Introduction to nutraceuticals – The link between nutrition and medicine. (K1,K2)
- 1.2 Historical perspective. (K1,K2)
- 1.3 Sources of nutraceuticals. (K1,K2)
- 1.4 Classification of nutraceuticals. (K1,K2)
- 1.5 Scope. (K1,K2)
- 1.6 Future prospects of Nutraceuticals. (K1,K2)

### **UNIT II: Colonic functional foods. (6 hours)**

- 2.1 Colonic functional foods – Probiotics. (K1,K2)
- 2.2 Prebiotics. (K1,K2)
- 2.3 Synbiotics – Health aspects of functional colonic foods. (K1,K2)
- 2.4 Milk ingredients as functional foods. (K1,K2)
- 2.5 Brief idea about some Nutraceutical rich supplements e.g. Caffeine. (K1,K2).
- 2.6 Green tea. (K1, K2)

### **UNIT III: Food as remedies. (6 hours)**

- 3.1 Food as Remedies- An overview. (K1,K2)
- 3.2 Nutraceutical remedies for common disorders like Arthritis. (K1,K2)
- 3.3 Bronchitis and circulatory problems. (K1,K2)
- 3.4 Hypoglycemia and nephrological disorders. (K1,K2)
- 3.5 Liver disorders and Osteoporosis. (K1,K2)
- 3.6 Psoriasis and Ulcers. (K1,K2)

### **UNIT IV: Genetically modified foods as nutraceuticals. (6 hours)**

- 4.1 Wild crop and genetically modified crops- Definition and uses. (K1,K2)
- 4.2 Nutraceuticals from genetically modified foods: *Bacillus thuringiensis* corn. (K1,K2)
- 4.3 Indian Bt egg plant. (K1,K2)
- 4.4 Purple tomato - tearless onion. (K1,K2)
- 4.5 Rainbow cauliflower. (K1,K2)
- 4.6 Calgene- FLAVR SAVR tomato. (K1,K2)

### **UNIT V: Plant pharmaceuticals as nutraceuticals**

- 5.1 Nutraceuticals from plant pharmaceuticals. (K1,K2)
- 5.2 Beta-carotene in rice (Golden rice). (K1,K2)
- 5.3 Transgenic “heart-healthy” Canola oil. (K1,K2)
- 5.4 Edible vaccine. (K1,K2)
- 5.5 Hepatitis B vaccine in maize. (K1,K2)

## 5.6 Cholera vaccine in potatoes. (K1,K2)

### **TEXT BOOKS:**

1. Robert E.C. Wildman (2016). Handbook of Nutraceuticals and Functional Foods. 2<sup>nd</sup> edition, CRC Press, Taylor and Francis Group. New York, London.
2. Kramer, Hoppe and Packer (2001). Nutraceuticals in Health and Disease Prevention. 1<sup>st</sup> edition, Marcel Dekker. Inc., New York.
3. Functional Foods Concept to product. Edited by Gibson R and Christine M Williams. Woodhead Publishing Limited.

### **REFERENCE BOOKS:**

1. Sukhcharn Singh, Riar C.S and Saxena D.C (2015). Functional foods and Nutraceuticals. 1<sup>st</sup> edition, New India Publishing Agency, New Delhi.
2. Rotimi E.Aluko (2012). Functional foods and Nutraceuticals. 1<sup>st</sup> edition, Springer, New York.
3. Lillian E.Forman (2009). Genetically Modified foods. 1<sup>st</sup> edition, ABDO Publishing Company, Edina, United States.
4. Functional foods, nutraceuticals and natural products. Concepts and Applications. Edited by Dhiraj A. Vattam, Vatsala Maitin.

### **OER:**

### **DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## USMBE20 – SKILL BASED ELECTIVE: COSMETOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V & VI	USMBE20	Cosmetology	Theory	Skill Based Elective	2	2	100

### Course Objective:

To provide adequate knowledge on cosmeceuticals, personal care and hygiene products and familiarize with the skills in formulation science required to scientifically design and develop products.

### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Give information about significance of cosmetics and adulteration of natural products.

**CO2:** Formulate face packs, hair oils for different types of skin and hair.

**CO3:** Analyze the structure, function and types of skin.

**CO4:** Outline the biology of hair, hair growth cycle and scalp hygiene and utilize the natural herbs for skin, hair and oral care preparations.

**CO5:** Communicate the cosmeceutical applications of micro and macroalgae.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	L	L	H
CO2	H	M	H	L	L	H
CO3	H	M	H	L	L	H
CO4	H	M	H	L	L	H
CO5	H	M	H	L	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	L	L	H
CO2	H	M	H	L	L	H
CO3	H	M	H	L	L	H
CO4	H	M	H	L	L	H
CO5	H	M	H	L	L	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

### COURSE SYLLABUS

#### UNIT I: Cosmetics and its significance.

(6 hours)

1.1 Cosmetics – Definition and purpose. (K1,K2)

1.2 Classification of cosmetics. (K1,K2)

1.3 Significance and its importance. (K1,K2)

- 1.4 Stability of product forms and quality control. (K1,K2)
- 1.5 Adulteration of Natural products: Qualitative method of detection. (K1,K2)
- 1.6 Quantitative methods of detection of adulteration. (K1,K2)

**UNIT II: Role of cosmetics in facial skin care. (6 hours)**

- 2.1 Structure and function of skin. (K1,K2)
- 2.2 Types of Skin. (K1,K2)
- 2.3 Differences between baby's skin and adult skin. (K1,K2)
- 2.4 Formulations of face packs for dry, oily and normal skins. (K1,K2, K3)
- 2.5 Herbal remedy for skin disorders- pimple, acne, boils, black heads, white heads, and open pores. (K1,K2, K3)
- 2.6 Skin care in different seasons. (K1,K2, K3)

**UNIT III: Hair Care. (6 hours)**

- 3.1 Structure and function of hair. (K1,K2)
- 3.2 Types of hair and Hair growth cycles. (K1,K2)
- 3.3 Defects in hair shaft. (K1,K2)
- 3.4 Processes involved in hair growth and color formation in hair. (K1,K2)
- 3.5 Role of scalp hygiene. (K1,K2)
- 3.6 Formulations of hair oils and hair tonics- remedy for dandruff, premature greying and hair loss. (K1,K2,K3)

**Unit IV: Role of Herbs in Cosmetics / Herbal cosmetics. (6 hours)**

- 4.1 Hair care preparation: Henna, Amla (K1,K2,K3)
- 4.2 Hibiscus, Bhringaraj. (K1,K2,K3)
- 4.3 Skin Care preparation: Aloe vera. (K1,K2,K3)
- 4.4 Turmeric, Sandal wood. (K1,K2,K3)
- 4.5 Oral care preparation: Babool. (K1,K2,K3)
- 4.6 Neem, Clove. (K1,K2,K3)

**UNIT V: Algae in Cosmetics. (6 hours)**

- 5.1 Microalgae and macroalgae- An introduction. (K1,K2)
- 5.2 Chlorophyceae (green algae). (K1,K2)
- 5.3 Phaeophyceae (brown algae). (K1,K2)
- 5.4 Rhodophyceae (red algae). (K1,K2)
- 5.5 Applications of algae in cosmetics: sunscreen, moisturizer, anti-aging,whitening and hair care. (K1,K2,K3)
- 5.6 Cosmetic products using algal metabolites. (K1,K2)

**TEXT BOOKS:**

1. Pandey. H (2009),“ Herbal beauty products with formulations and processes”. Himalaya publishers.
2. Simon.Y.Mills(2000) , “ The essential book of herbal medicine”. 2<sup>nd</sup> edition . Elsevier.
3. Eliot Cowan (1996). “Plant spirit medicine: The healing power of plants”. CRC press. United states.

**REFERENCE BOOKS:**

1. Sagrin C.B.( 2011). Cosmetic Science and technology. 1<sup>st</sup> edition. Wiley & Sons. United states.
2. Marc Paye, Andre. O. Barel.(2000). Handbook of Cosmetic Science and technology . CRC press, Unites states.
3. Surabhi Joshi, Roshani Kumari and Vivek N. Upasani. (2003). Applications of Algae in Cosmetics: An Overview. S. Chand and Company Ltd., New Delhi.

**OER:****DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>



**ALLIED MICROBIOLOGY**  
**( B.Sc Biochemistry- Semester III)**  
**UAMBA20 – ALLIED III: MICROBIOLOGY –I**

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
<b>SEM: III</b>	UAMBA20	Allied III: Microbiology-I	Theory	Allied	4	4	100

**Course Objective:**

To make the students know about the third major component of the biotic system and provide a detailed insight on the study of microbes.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Discuss history, recent developments and microscopy.

**CO2:** Utilize techniques of sterilization, pure culture and staining.

**CO3:** Outline classification and anatomy of bacteria.

**CO4:** Compare structural characteristics of algae, fungi and protozoa.

**CO5:** Demonstrate measurement of microbial growth and explain classification of antibiotics with its mode of action.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	H	M	H	L	L	M
<b>CO2</b>	H	H	H	L	L	M
<b>CO3</b>	H	L	H	H	L	M
<b>CO4</b>	H	L	M	H	M	M
<b>CO5</b>	H	M	M	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO1</b>	H	M	H	L	L	M
<b>CO2</b>	H	H	H	L	L	M
<b>CO3</b>	H	L	H	H	L	M
<b>CO4</b>	H	L	M	H	M	M
<b>CO5</b>	H	M	M	M	L	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

## **COURSE SYLLABUS**

### **UNIT I: History of Microbiology and Microscopy. (12 hours)**

- 1.1 Definition and scope of Microbiology-History and recent Developments, Spontaneous generation and Biogenesis. (K1,K2)
- 1.2 Contribution of Louis Pasteur, Antony Van Leuwenhoek, Joseph Lister, Robert Koch. (K1,K2)
- 1.3 Edward Jenner, Emil Christian Hansen, Hans Christian Gram, Alexander Fleming. (K1,K2)
- 1.4 Microscopy – Bright field Microscopy, Dark field Microscopy. (K1,K2, K3)
- 1.5 Phase contrast Microscope and Fluorescence Microscope. (K1,K2)
- 1.6 Electron Microscopy – TEM & SEM. (K1,K2)

### **UNIT II: Basic techniques in Microbiology. (12 hours)**

- 2.1 Sterilization of glass wares. (K1, K2, K3)
- 2.2 Culture media and its types. (K1, K2, K3)
- 2.3 Preparation of basal media. (K1, K2, K3)
- 2.4 Pure culture techniques – spread plate, pour plate and streak plate techniques.(K1,K2, K3)
- 2.5 Serial dilution and Standard plate count methods. (K1,K2, K3)
- 2.6 Staining techniques – simple and differential (Grams staining and Acid fast staining). (K1,K2, K3)

### **UNIT III: Binomial nomenclature and Anatomy of bacteria. (12 hours)**

- 3.1 Brief outline on bacterial classification- Binomial Nomenclature of Microbes. (K1,K2)
- 3.2 Morphology of bacteria - size, shape and arrangement of bacteria. (K1,K2)
- 3.3 Anatomy of Bacteria – Cell wall (Gram positive and Gram negative). (K1,K2)
- 3.4 Cytoplasmic membrane. (K1,K2)
- 3.5 Flagella –structure and arrangement, capsule, pili .(K1,K2)
- 3.6 Spore and sporulation. (K1,K2)

### **UNIT IV: Structural characteristics of algae, fungi and protozoa. (12 hours)**

- 4.1 Structural characteristics of Microalgae- An overview. (K1,K2)
- 4.2 *Oscillatoria, Volvox, Chlorella*. (K1,K2,K3)
- 4.3 Structural characteristics of fungi – An overview. (K1,K2)
- 4.4 Yeast- *Saccharomyces* and its reproduction. (K1,K2)
- 4.5 Molds - *Aspergillus, Penicillium, Rhizopus, Mucor*. (K1,K2, K3)
- 4.6 Protozoa (*Entamoeba* and *Plasmodium*). (K1,K2, K3)

### **UNIT V: Growth of Microorganism and their control. (12 hours)**

- 5.1 Measurement of microbial growth (turbidity, biomass, cell count). (K1,K2, K3)
- 5.2 Growth curve. (K1,K2, K3)

- 5.3 Preservation of culture (Lyophilization, Liquid N<sub>2</sub>). (K1,K2)
- 5.4 Antibiotics – Definition, classification and mode of action. (K1,K2)
- 5.5 Antibiotics inhibiting cell wall and cell membrane synthesis. (K1,K2)
- 5.6 Antibiotics inhibiting nucleic acid and protein synthesis. (K1,K2)

**TEXT BOOKS:**

1. Pelczar T.R, Chan M.J and Kreig N.R (2006). Microbiology.6<sup>th</sup> edition, Tata McGraw-Hill INC., New York.
2. Ananthanarayanan R and Jayaram Paniker, C.K. (2009).Text book of Microbiology.8<sup>th</sup> edition. Orient Longman, Hyderabad

**REFERENCE BOOKS:**

1. Lansing M. Prescott, John P. Harley., Donald A. Klein (2011) .Microbiology.8<sup>th</sup> edition. McGraw Hill Inc., New York.
2. Michael T. Madigan., John M. Martinko (2006) Brock Biology of Microorganisms. 11<sup>th</sup> edition, Pearson Prentice Hall publishers, United States.

**OER:**

E-books

1. [www.gutenberg.org](http://www.gutenberg.org)
2. [www.free-ebooks.net](http://www.free-ebooks.net)
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com)

Video lessons

1. [www.learnerstv.com](http://www.learnerstv.com)
2. [www.webcast.berkeley.edu](http://www.webcast.berkeley.edu)
3. [www.cosmolearning.org](http://www.cosmolearning.org)

**ALLIED MICROBIOLOGY**  
**( B.Sc Biochemistry- Semester IV)**  
**UAMBB20- ALLIED IV: MICROBIOLOGY – II**

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
<b>SEM: IV</b>	UAMBB20	Allied IV: Microbiology-II	Theory	Allied	4	4	100

**Course Objective:** To make the students know about the third major component of the biotic system and provide a detailed insight on the significance microbes in different environments.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Discuss the role of microorganisms in soil and biogeochemical cycles.

**CO2:** Disseminate knowledge on the potability of water, purification of municipal water supplies and sewage treatment process

**CO3:** Communicate sources of airborne pathogens and the diseases caused.

**CO4:** Explain Food borne diseases and outline on the contamination, spoilage and preservation of food.

**CO5:** Compile on different types of fermentation and fermented microbial product.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	H	M	H	H	L	M
<b>CO2</b>	H	H	H	M	L	M
<b>CO3</b>	H	H	H	L	L	M
<b>CO4</b>	H	H	H	L	L	M
<b>CO5</b>	H	H	H	L	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO1</b>	H	M	H	H	L	M
<b>CO2</b>	H	H	H	M	L	M
<b>CO3</b>	H	H	H	L	L	M
<b>CO4</b>	H	H	H	L	L	M
<b>CO5</b>	H	H	H	L	L	H

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

## **COURSE SYLLABUS**

### **UNIT I: Microbiology of soil and Biogeochemical cycle. (12 hours)**

- 1.1 Microbiology of soil - Microbes in soil. (K1,K2)
- 1.2 Rhizosphere, rhizoplane and phylloplane. (K1,K2)
- 1.3 Nitrogen fixation (symbiotic and non-symbiotic) - nitrifying and denitrifying bacteria. (K1,K2)
- 1.4 Biogeochemical cycle – Carbon cycle, Nitrogen cycle. (K1,K2)
- 1.5 Sulphur cycle and phosphorus cycle. (K1,K2)
- 1.6 Phosphate solubilizers and sulphur bacteria -Bacterial Biofertilizers. (K1,K2)

### **UNIT II: Microbiology of water. (12 hours)**

- 2.1 Microbiology of water – types of water – potable water. (K1,K2)
- 2.2 Municipal water purification. (K1,K2)
- 2.3 Sewage treatment process – An overview. (K1,K2)
- 2.4 Primary, Secondary and tertiary treatment process. (K1,K2)
- 2.5 Sewage disinfection and disposal. (K1,K2)
- 2.6 Water borne diseases. (K1,K2)

### **UNIT III: Aero Microbiology. (12 hours)**

- 3.1 Microbiology of air- An overview. (K1,K2)
- 3.2 Indoor and outdoor microflora. (K1,K2)
- 3.3 Distribution and source of airborne organisms – Droplet, Droplet nuclei and Infectious dust. (K1,K2)
- 3.4 Assessment of air quality. (K1,K2, K3)
- 3.5 Air sanitation. (K1,K2, K3)
- 3.6 Airborne diseases. (K1,K2)

### **UNIT IV: Food Microbiology (12 hours)**

- 4.1 Food Microbiology – An introduction. (K1,K2)
- 4.2 Food preservation techniques- asepsis, high temperature and low temperature. (K1,K2,K3)
- 4.3 Food preservation techniques – drying, radiation and food additives. (K1,K2, K3)
- 4.4 Microbial spoilage of food - vegetables and fruits, cereal and cereal products. (K1,K2)
- 4.5 Microbial spoilage of food – meat and meat products, milk and milk products. (K1,K2)
- 4.6 Food borne diseases. (K1,K2)

### **UNIT V: Fermentation and Industrial production. (12 hours)**

- 5.1 Fermentation- types of fermentation. (K1,K2)
- 5.2 Fermentor- structure and types. (K1,K2)
- 5.3 Industrial production – Antibiotic (Penicillin). (K1,K2)

- 5.4 Industrial production - alcohol (Ethanol). (K1,K2)
- 5.5 Industrial production - organic acid (acetic acid). (K1,K2)
- 5.6 Industrial production - Vitamin (B12). (K1,K2)

**TEXT BOOKS:**

1. Frazier W.C. and West Hoff D.C (2008). Food Microbiology. 4<sup>th</sup> edition. Mc Graw Hill, New York.
2. Joseph C. Daniel (1999). Environmental aspects of Microbiology. 1<sup>st</sup> edition, Bright Sun publications, Chennai.
3. Subba Rao NS (2004). Soil Microbiology. 4<sup>th</sup> edition, Oxford and BH Publishing Co.Pvt. Ltd., New Delhi.

**REFERENCE BOOKS:**

1. Vijaya Ramesh K (2004). Environmental Microbiology. 1<sup>st</sup> edition, MJP publishers. Chennai
2. Casida, J.E (1986), Industrial Microbiology. 1<sup>st</sup> edition. Wiley Eastern publishers. UK
3. Patel A.H (2001). Industrial Microbiology. 3<sup>rd</sup> edition. Mac Millan India ltd, Chennai.

**OER:**

E-books

1. [www.gutenberg.org](http://www.gutenberg.org)
2. [www.free-ebooks.net](http://www.free-ebooks.net)
3. [www.e-booksdirectory.com](http://www.e-booksdirectory.com)

Video lessons

1. [www.learnerstv.com](http://www.learnerstv.com)
2. [www.webcast.berkeley.edu](http://www.webcast.berkeley.edu)
3. [www.cosmolearning.org](http://www.cosmolearning.org)

**ALLIED PRACTICAL**  
**UAMBC20 - ALLIED PRACTICAL: MICROBIOLOGY**

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
<b>SEM:</b> IV	UAMBC20	Allied Practical: Microbiology	Practical	Allied	2	2	100

**Course Objective:**

To provide hands on training in basic and applied Microbiological techniques.

**Course Outcomes (CO):**

At the end of the course, the learners will be able to;

**CO1:** Perform cleaning & sterilization of glasswares.

**CO2:** Analyze the concept of simple and differential staining method and Prepare basal media for the cultivation of bacteria.

**CO3:** Assess and enumerate microorganisms present in different environment.

**CO4:** Examine the quality of milk sample.

**CO5:** Demonstrate the morphology of algae and fungi.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
<b>CO1</b>	H	L	H	L	L	M
<b>CO2</b>	H	H	H	L	L	M
<b>CO3</b>	H	H	H	H	L	M
<b>CO4</b>	H	M	H	L	L	M
<b>CO5</b>	H	L	H	H	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
<b>CO1</b>	H	L	H	L	L	M
<b>CO2</b>	H	H	H	L	L	M
<b>CO3</b>	H	H	H	H	L	M
<b>CO4</b>	H	M	H	L	L	M
<b>CO5</b>	H	L	H	H	L	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

## **COURSE SYLLABUS**

1. Cleaning of glasswares.
2. Sterilization of Glassware and culture media.
3. Microscopy- Bright field compound Microscope.
4. Preparation of bacterial smear and simple staining.
5. Grams staining Technique.
6. Hanging drop method for testing motility of bacteria.
7. Preparation of culture media – Nutrient agar, Nutrient broth, Agar slant.
8. Enumeration of microorganism in air by open plate count method.
9. Enumeration of bacteria from soil and water samples by standard plant count method.
10. Assessment of quality of milk by MBRT test.
11. Morphology of Fungi- Lacto phenol cotton blue wet mount preparation.
12. Observation of pond water for the presence of microorganism.

## **REFERENCE BOOKS:**

1. Dubey RC and Maheswari DK (2004). Practical Microbiology 1<sup>st</sup> edition, S.Chand & Company Ltd., New Delhi.
2. Kannan N (2003). Handbook of Laboratory Culture Media, Reagents, Stains and Buffers. Panima Publishing Corporation, New Delhi.
3. Rajan S and Selvi Christy (2011). Experimental procedures in life sciences. Anjana Book House publishers and distributors, Chennai
4. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. 6<sup>th</sup> edition, Published by Pearson Education.

## **OER:**

## **VIRTUAL LABS/ INTERACTIVE SIMULATIONS:**

1. [www.vlab.co.in](http://www.vlab.co.in)
2. [www.aview.in/aview](http://www.aview.in/aview)
3. [www.pbs.org](http://www.pbs.org)
4. [www.micro.magnet.fsu.edu/primer/java/scienceopticsu](http://www.micro.magnet.fsu.edu/primer/java/scienceopticsu)



## NON-MAJOR ELECTIVE

(For B.Sc /B.C.A/B.Com/B.B.A- Semester V and Semester VI)

### UGMBA20 – NON MAJOR ELECTIVE: FOOD MICROBIOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V & VI	UGMBA20	Food Microbiology	Theory	Non Major Elective	3	2	100

#### Course Objective:

To provide in depth knowledge on the significance microorganisms associated with food.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Outline the scope of food microbiology

**CO2:** Acquire knowledge on the role of microorganisms in food.

**CO3:** Prepare fermented dairy products and formulate the traditional Indian fermented products.

**CO4:** Communicate the significance of food borne diseases in association with public health.

**CO5:** Explain about the genetically modified plants which are commercially available and their applications.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	L	L	H
CO2	H	M	H	M	L	M
CO3	H	H	H	L	M	H
CO4	H	L	H	L	L	M
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	H	L	L	H
CO2	H	M	H	M	L	M
CO3	H	H	H	L	M	H
CO4	H	L	H	L	L	M
CO5	H	L	H	L	L	M

H – HIGH (3), M – MODERATE (2), L – LOW (1)

## **COURSE SYLLABUS**

### **UNIT I: Food Microbiology and its scope. (9 hours)**

- 1.1 Food Microbiology- Definition, Scope of Food Microbiology. (K1,K2)
- 1.2 Importance of microbes in food Microbiology - Bacteria. (K1,K2)
- 1.3 Importance of microbes in food Microbiology – Yeast. (K1,K2)
- 1.4 Importance of microbes in food Microbiology – Mold. (K1,K2)
- 1.5 Probiotics- its health benefits. (K1,K2)
- 1.6 Single cell proteins - its health benefits. (K1,K2)

### **UNIT II: Fermented dairy products. (9 hours)**

- 2.1 Fermented dairy products: Yogurt and Dahi. (K1,K2)
- 2.2 Acidophilus milk. (K1,K2)
- 2.3 Koumiss. (K1,K2)
- 2.4 Kefir. (K1,K2)
- 2.5 Cheese- their production. (K1,K2)
- 2.6 Therapeutic values of Fermented milk. (K1,K2)

### **UNIT III: Traditional Indian fermented foods. (9 hours)**

- 3.1 Traditional Indian fermented foods - Idli / dosa. (K1,K2,K3)
- 3.2 Papad, bread. (K1,K2)
- 3.3 Soy sauce. (K1,K2)
- 3.4 Sauerkraut, pickle. (K1,K2, K3)
- 3.5 Edible mushroom – their health benefits. (K1,K2)
- 3.6 Mushroom recipies – indian and western. (K1,K2, K3)

### **UNIT IV: Food borne illness. (9 hours)**

- 4.1 Food-borne illness- An introduction. (K1,K2)
- 4.2 Food intoxication (Staphylococcus and Clostridium). (K1,K2)
- 4.3 Food infection- Bacterial. (K1,K2)
- 4.4 Food infection – Viral. (K1,K2)
- 4.5 Food infection - Parasitic. (K1,K2)
- 4.6 Prevention and control measures. (K1,K2, K3)

### **UNIT V: Genetically modified foods. (9 hours)**

- 5.1 Genetically modified foods: Indian BT egg plant. (K1,K2)
- 5.2 Golden Rice. (K1,K2)
- 5.3 Purple tomato - tearless onion. (K1,K2)
- 5.4 Rainbow cauliflower. (K1,K2)
- 5.5 Methionine enriched oil. (K1,K2)
- 5.6 Calgene FLAVR SAVR tomato. (K1,K2)

**TEXT BOOKS:**

1. Frazier W.C. and West Hoff D.C (2008). Food Microbiology. 4<sup>th</sup> edition. Mc Graw Hill, New York.
2. Ronnie Cummins and Ben Lilliston (2009). Genetically Engineered Food. 2<sup>nd</sup> edition, Hachette publishers, UK.

**REFERENCE BOOKS:**

1. Adam. M.R and Moss M.O (2004). Food Microbiology. 2<sup>nd</sup> edition. New international pvt. Ltd., publishers.
2. Vijaya Ramesh K (2007). Food Microbiology. 1<sup>st</sup> edition, MJP Publishers, Chennai.
3. Robinson R.K,( 1990). Dairy Microbiology.1<sup>st</sup> edition, Elseveir Applied science, London.
4. James M Jay (2003). Modern Food Microbiology. 4<sup>th</sup> edition, CBS Publishers, New Delhi.
5. Shu-Ting Chang, Philip G.Miles and Chang S. T (2004).Mushrooms: Cultivation, nutritional value, medicinal effect and environmental impact, 2<sup>nd</sup> edition, CRC press. United States.
6. Knut J. Heller (2006).Genetically Engineered Food: Methods and Detection.1<sup>st</sup> edition, John Wiley & Sons, United States.

**OER:****DIGITAL LIBRARIES:**

1. <http://www.loc.gov/>
2. <http://library.clark.edu/>
3. <http://www.dli.ernet.in/>
4. <http://www.loc.gov/education/>

## NON-MAJOR ELECTIVE

(For B.Sc /B.C.A/B.Com/B.B.A- Semester V and Semester VI)

### UGMBB20 – NON MAJOR ELECTIVE: WASTE WATER MICROBIOLOGY

Year III	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V & VI	UGMBB20	Waste water Microbiology	Theory	Non Major Elective	3	2	100

#### Course Objective:

To provide in depth knowledge on the significance of waste water and on waste water and its treatment cum recycling methods.

#### Course Outcomes (CO):

At the end of the course, the learners will be able to;

**CO1:** Use the available technologies for physical, chemical and biological treatment of municipal water.

**CO2:** Demonstrate the microbiological analysis of potable water and brief out water borne diseases.

**CO3:** Outline bioremediation of pesticides, heavy metals and oil spills.

**CO4:** Explain the sewage treatment process.

**CO5:** Utilization of solid and liquid waste.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	H	L	L	H
CO2	H	M	H	M	L	M
CO3	H	H	H	L	M	H
CO4	H	L	H	L	L	M
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	M	H	L	M	M
CO3	H	M	H	L	H	H
CO4	H	H	H	L	M	H
CO5	H	M	H	L	M	M

**H – HIGH (3), M – MODERATE (2), L – LOW (1)**

## **COURSE SYLLABUS**

### **UNIT I: Microbiology of water and treatment of municipal water supplies. ( 9 hours)**

- 1.1 Microbiology of water. (K1,K2)
- 1.2 Types of water. (K1,K2)
- 1.3 Potability of water. (K1,K2)
- 1.4 Sources of drinking water. (K1,K2)
- 1.5 Treatment method of municipal water supplies – Sedimentation and filtration. (K1,K2)
- 1.6 Disinfection of water- chlorination. (K1,K2)

### **UNIT II: Detection of potability of water and water borne diseases. ( 9 hours)**

- 2.1 Indicators of faecal contamination. (K1, K2)
- 2.2 Methods to detect potability of water samples: Standard qualitative procedure: Most Probable Number test. (K1,K2, K3)
- 2.3 Membrane filtration technique. (K1,K2, K3)
- 2.4 Water-borne diseases- An overview. (K1,K2)
- 2.5 Bacterial, viral and Protozoal water borne diseases- their etiological agents and clinical symptoms. (K1,K2)
- 2.6 Prevention and control measures. (K1,K2, K3)

### **UNIT III: Water pollution. ( 9 hours)**

- 3.1 Water Pollution – Definition, sources of water pollution. (K1, K2)
- 3.2 Pollution of water bodies by heavy metals. (K1, K2)
- 3.3 Removal of heavy metals by biosorption. (K1, K2)
- 3.4 Removal of pesticides. (K1, K2)
- 3.5 Marine oil spill pollution. (K1, K2)
- 3.6 Removal of oil spills by using microorganisms. (K1, K2)

### **UNIT IV: Sewage treatment process. ( 9 hours)**

- 4.1 Characteristics of sewage and objectives in sewage treatment. (K1, K2)
- 4.2 Biological treatment of sewage: preliminary treatment. (K1, K2)
- 4.3 Secondary treatment - activated sludge process. (K1, K2)
- 4.3 Trickling filters. (K1, K2)
- 4.4 Anaerobic sludge digestion. (K1, K2)
- 4.5 Household waste water treatment. (K1, K2, K3)

**UNIT V: Utilization of solid and liquid waste. ( 9 hours)**

- 5.1 Utilization of solid and liquid waste: Industrial re-use of effluents. (K1, K2)
- 5.2 Municipal reuse of effluent. (K1, K2)
- 5.3 Agricultural reuse of effluent (crop irrigation). (K1, K2)
- 5.4 SCP production. (K1, K2)
- 5.5 Composting (fertilizer). (K1, K2)
- 5.6 Aquaculture. (K1, K2)

**TEXT BOOKS:**

1. Vijaya Ramesh K (2004). Environmental Microbiology. 1<sup>st</sup> edition, MJP publishers. Chennai.
2. Atlas R.M. and Bartha R (1992). Microbial Ecology, Fundamental and Application, 3<sup>rd</sup> Edition, Benjamin and Cummings. United States.

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1. Joseph C. Daniel (1999). Environmental aspects of Microbiology. 1<sup>st</sup> edition, Bright Sun publications, Chennai.
2. Murugesan A.G and Rajakumari C (2005). Environmental Science and Biotechnology. 1<sup>st</sup> edition, MJP Publishers, Chennai.

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