DEPARTMENT OF MICROBIOLOGY				*CLASS: II B.Sc. Biotechnology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
III	Allied	20U3RAC1	Basic Microbiology	4	4	25	75	100

Nature of Course				
Knowledge and skill	✓		Employability oriented	
Skill oriented			Entrepreneurship oriented	

Course Objectives:

1. To impart basic knowledge on history of microbiology
2. To learn and relate the structural variation among the micro-organisms.
3. To emphasize the significance of beneficial microbes
4. To enable the students to explore the methods for the control of pathogenic microbes.
5. To understand various aspects of classical Microbiology and fundamental concepts in practical microbiological techniques that forms the basis for any biotechnology application.

Course Learning Outcomes:

On successful completion of the programme, the students will be able to

1. Explain the fundamental concepts; describe the history and development of microbiology.
2. Apply various staining techniques to differentiate and identify the microorganisms.
3. Identify the basic growth requirements of bacteria and demonstrate the practical skills in isolation, cultivation and preservation of microorganisms.
4. Apply suitable methodologies to control the growth of microbes by various sterilization techniques and by the use of other chemical agents
5. Compare and contrast the structural organization and economic importance of fungi, algae, viruses and protozoa.

Unit	Description	Hours	K-level	CLO
I	**Unit I: Introduction and History of Microbiology** Discovery of microorganisms- Contributions of Leeuwenhoek, Louis Pasteur, Edward Jenner, Robert Koch, Elie Metchnikoff and Fleming.Classification based on Carl Woese (The three domains) and Robert H. Whittaker (Five Kingdom system).	12 hrs	Up to K2	1
II	**Unit - II: Structural organization and Staining of Microbes** Types of bacteria based on morphology and flagella. Ultrastructure of bacteria (eg.*E. coli*)- cell wall, cell membrane, flagella, fimbriae, capsule, pili, endospore and cysts. Staining techniques – Simple, differential and special staining; Fungal staining. Microscopy – parts, principle and working mechanism of Bright field and Dark field microscope.	12 hrs	Up to K3	2

III	**Unit - III: Growth and Culturing Techniques** Nutritional requirements –factors affecting growth - determination of growth, growth curve - media and its types (natural, synthetic, selective, differential and enrichment media). Culture techniques – pure culture methods (direct plating, serial dilution technique, streak plate, spread plate, pour plate, stab culture, slant culture), anaerobic culture - preservation of cultures.	12 hrs	Up to K3	3
IV	**Unit - IV: Control of microbes** Sterilization, disinfection, sanitization, antisepsis. Physical methods- dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Tyndallisation, Pasteurization. Chemical methods-Mode of action and uses of: halogen and halogen compounds, compounds of heavy metals, phenols and its derivatives, alcohol, detergents. Chemosterilant gases (formaldehyde, ethylene oxide, beta propiolactone).	12 hrs	Up to K3	4
V	**Unit - V: Types of Microbes and their Economic Importance** General characteristics, morphology, ultra structure and economic importance of Algae – *Chlamydomonas* and *Anabaena.* Fungi- *Aspergillus niger*and *Saccharomyces cerevisiae.* Virus- HIV and T4 bacteriophage, Virions and Prions. Protozoa- *Amoeba*, *Plasmodium*.	12 hrs	Up to K4	5

Total 60 Hours

Books for Study

1. Dubey, R.C. and Maheswari, D.K. (2005). A text book of Microbiology. Revised Multicolour Edition. S. Chand & Company Limited, New Delhi.
2. Pelczar, T.R., Chan, E.C.S. and Kreig, N.R. (2006). Microbiology. 5th Edition. Tata McGraw – Hill, New Delhi.

Books for Reference

1. Prescott, L.M., Harley, J.P. and Klein, D.A. (2005). Microbiology. 6th Edition. Tata McGraw – Hill, New Delhi.
2. Moat, A.G. and Foster, J.W. (2002). Microbial Physiology. 3rd Edition. John Wiley & Sons, New York.
3. Boyd, R.F. (1984). General Microbiology. Times Mirror / Mosby College Publishers, UK.
4. Purohit, S.S. (2005). Microbiology – Fundamentals and Applications. Student Edition Publishers, Jodhpur.
5. Schlegel, H.G. (1993).General Microbiology. 7th Edition. Cambridge University Press, UK.

Web Resources

1. https://microbiologyinfo.com/category/basic-microbiology/
2. https://www.britannica.com/science/microbiology
3. https://www.youtube.com/watch?v=oEvUbWPWVqw
4. https://www.youtube.com/watch?v=gKA_VLC4-jQ&list=PLzju0_wImbUfJsCfSHyeB1iZ95PsTp85v

Rationale for nature of the course

Microorganisms play indispensable role in the field of biotechnology as they act as a main carrier for all biotechnological techniques. For any biotechnological application, understanding theoretical and practical aspects in microbiology becomes essential. It helps to realize the significance of beneficial microbes in various life processes.

Activities having direct bearing on skill development/ employability/entrepreneurship

Applying technical skills to differentiate and identify microorganisms

Exploring theoretical and practical aspects for isolation, cultivation, preservation and control of microorganisms

Imparting knowledge on economic importance of various microorganisms

Pedagogy

Chalk and talk, PPT, Group discussion, Seminar, Screening of educational videos and quiz

Course Learning Outcomes (CLO)

On completion of this course the students will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO-1	Explain the fundamental concepts; describe the history and development of microbiology.	Up to K2
CLO-2	Apply various staining techniques to differentiate and identify the microorganisms.	Up to K3
CLO-3	Identify the basic growth requirements of bacteria and demonstrate the practical skills in isolation, cultivation and preservation of microorganisms.	Up to K3
CLO-4	Apply suitable methodologies to control the growth of microbes by various sterilization techniques and by the use of other chemical agents	Up to K3
CLO-5	Compare and contrast the structural organization and economic importance of fungi, algae, viruses and protozoa.	Up to K4

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Mapping of Course Learning Outcome with Programme Specific Outcome

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	1	1	1	1	1
CLO2	3	2	1	3	3
CLO3	3	3	2	3	3
CLO4	3	3	2	3	3
CLO5	3	3	2	3	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

Mapping of Course Outcome with Programme Outcome

	PO1	PO2	PO3	PO4	PO5
CLO1	3	1	1	1	1
CLO2	3	2	1	2	3
CLO3	3	3	3	3	3
CLO4	3	3	2	3	2
CLO5	3	3	2	3	1

Advance application – 3, Intermediate level – 2, Basic level – 1.

Learning Outcome Based Education & Assessment (LOBE) - Blue Print
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

S. No.	CLOs	K-Level	Section A		Section B		Section C (Either / or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K-Level	No. of Questions	K-Level		
1.	CLO 1	Up to K 2	2	K1 & K2	1	K1	2 (K1&K1)	1(K2)
2.	CLO 2	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
3.	CLO 3	Up to K 3	2	K1 & K2	1	K1	2 (K2&K2)	1(K3)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
No. of Questions to be asked			10		5		10	5
No. of Questions to be answered			10		5		5	3
Marks for each Question			1		2		5	10
Total Marks for each Section			10		10		25	30

K1 –Remembering and recalling facts with specific answers

K2 – Basic understanding of facts and stating main ideas with general answers

K3 – Application oriented – Solving Problems

K4 – Examining, analyzing, presentation and make interferences with evidences

Distribution of Section-wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Introduction and History of Microbiology	Introduction, History of Microbiology, Discovery of microorganisms		2	Chalk and talk
	Contributions of Leeuwenhoek, Louis Pasteur, Edward Jenner , Robert Koch, Elie Metchnikoff and Fleming		6	Screening of educational videos
	Classification based on Carl Woese (The three domains) and Robert H. Whittaker (Five Kingdom system)		4	Chalk and talk
II Structural organization and Staining of Microbes	Bacteria, types of bacteria based on morphology and flagella		2	PPT
	Ultrastructure of bacteria (eg.*E.coli*)- cell wall, cell membrane, flagella, fimbriae, capsule, pili, endospore and cysts		3	Screening of educational videos
	Staining techniques – Simple, differential and special staining; Fungal staining		4	Screening of educational videos
	Microscopy – parts, principle and working mechanism of simple and compound microscope		3	PPT
III Growth and Culturing Techniques	Growth of bacteria– nutritional requirements –factors affecting growth - determination of growth, growth curve		3	Chalk and talk
	Media and its types (natural, synthetic, selective, differential and enrichment media)		3	Quiz
	Culture techniques –pure culture methods (direct plating, serial dilution technique, streak plate, spread plate, pour plate, stab culture, slant culture)		4	Screening of educational videos
	Anaerobic culture, preservation of cultures		2	
IV Control of microbes	Sterilization, Disinfection, sanitization, antisepsis.		3	PPT
	Physical methods- dry heat, moist heat, UV light, ionizing radiation, filtration, HEPA filter, Tyndallisation, Pasteurization.		4	Chalk and talk
	Chemical methods-Mode of action and uses of: halogen and halogen compounds, compounds of heavy metals, phenols and its derivatives, alcohol, detergents. Chemosterilant gases (formaldehyde, ethylene oxide, beta propiolactone)		5	Chalk and talk

V Types of Microbes and their Economic Importance	General characteristics, morphology, ultra structure and economic importance of Algae – *Chlamydomonas* & *Anabaena*		3	Seminar, Group discussion
	General characteristics, morphology, ultra structure and economic importance of Fungi- *Aspergillus niger*and *Saccharomyces cerevisiae.*		3	Seminar, Group discussion
	General characteristics, morphology, ultra structure and economic importance of Virus- HIV and T4 bacteriophage, Brief study on Virions and Prions		3	Seminar, Group discussion
	General characteristics, morphology, ultra structure and economic importance of Protozoa- *Amoeba, Plasmodium*		3	Seminar, Group discussion
Total			**60 Hrs**	

Course designers : 1. Dr. P. Kiruthika Lakshmi