DEPARTMENT OF MICROBIOLOGY				*CLASS: II B.Sc. Biotechnology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
IV	Allied	20U4RAC2	Applied Microbiology	4	4	25	75	100

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

Course Objectives:

1. To understand the concept of microbial contamination and spoilage of foods and their preservation and microbiological production of foods.
2. To study beneficial microbes in soil and control of plant diseases.
3. To analyze the microbes in environment and water contamination.
4. To know the biopharmaceuticals and their production.
5. To identify the principles of industrially important microorganisms and the process of production of industrially important products.

Course Learning Outcomes:

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

1. Comprehend the concept of microbial contamination and spoilage of foods and their preservation and microbiological production of foods.
2. Discuss beneficial microbes in soil and control plant diseases.
3. Analyze the microbes in environment and water contamination.
4. Distinguish the production of biopharmaceuticals and antibiotics.
5. Categorize the microorganisms of industrial importance and industrial production of products.

Unit	Description	Hours	K-level	CLO
I	**Unit - I: Food Microbiology** Microorganisms of food spoilage and their sources. Contamination and Spoilage of different foods - fruits, vegetables, milk, meat, fish and canned foods. General account of food preservation. Microbiological production of fermented foods – bread, cheese, yogurt. Microorganisms as food – SCP.	12Hrs	Up to K2	1
II	**Unit - II: Soil and Agricultural Microbiology** Soil microflora. Plant growth-promoting microorganisms. Biofertilizers –*Rhizobium*,*Azolla* and Mycorrhizae. Bacterial and fungal diseases of Plants – bacterial blight of rice, citrus canker, leaf spot of rice and rust of sorghum. Biopesticides – *Bacillus thuringiensis*, Nuclear polyhedrosis virus (NPV), *Trichoderma*.	12Hrs	Up to K3	2

III	**Unit - III: Environmental Microbiology** Microbial interactions – mutualism, commensalism, antagonism, competition, parasitism, predation. Microbiology of potable and polluted waters. *E. coli* and *Streptococcus faecalis* as indicators of water pollution. Biogeochemical cycles-Nitrogen, Phosphorous and Sulphur.	12Hrs	Up to K4	3
IV	**Unit - IV: Pharmaceutical Microbiology** Microbial drugs and edible vaccines. Biopharmaceuticals- source and production methods - cytokines, haemopoetic growth factors, hormones and therapeutic enzymes. Industrial production of antibiotics (penicillin).	12Hrs	Up to K3	4
V	**Unit - V: Industrial Microbiology** Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes. Screening and isolation of industrially-important microorganisms. Industrial production of alcohols (ethyl alcohol), beverages (beer and wine), enzymes (amylases), and organic acids (citric acid).	12Hrs	Up to K3	5

Total 60 Hrs.

Books for Study

1. Frazier, W.C. and Westhoff, D.C. (1988). Food Microbiology, Mc Graw Hill, New York.
2. Rangaswami, G. and Bhagyaraj, D.J. (2001). Agricultural Microbiology, 2nd Edition, Prentice Hall of India, New Delhi.
3. Subba Rao, N.S. (1999). Soil Microorganisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Patel, A.H. (1984). Industrial Microbiology. Mac Milan India Ltd., Hyderabad.
5. Vijaya Ramesh. K (2004). Environmental Microbiology. 1st Edition, MJP Publishers, Chennai

Books for Reference

1. Jay, J.M. (1996). Modern Food Microbiology. Chapman and Hall, New York.
2. Ray, B. (1996). Fundamentals of Food Microbiology.CRC Press, USA.
3. Adams, M.R. and Moss, M.O. (1996). Food Microbiology. New Age International (P) Ltd, New Delhi.
4. Atlas, R.M. and Bartha, R. (1998). Microbial Ecology - Fundamentals and Applications. Addison Wesley Longman, Inc., USA
5. Banwart, G.J. (1987). Basic Food Microbiology. CBS Publishers and Distributors, New Delhi.
6. Cassida, L.E. (1968). Industrial Microbiology. Wiley Eastern Ltd. & New Age International Ltd., New Delhi.
7. Reed, G. (Ed.) (1987). Prescott & Dunn's Industrial Microbiology. 4th Edition. CBS Publishers & Distributors, New Delhi.

Web Resources

1. https://www.periobasics.com/basic-microbiology.
2. https://www.microbiologynutsandbolts.co.basic-concepts.
3. https://www.microbiologyinfo.com/category/basic-microbiology
4. https://www. Microbiology - Overview -youtube.com
5. https://www. Introduction to microbiology. youtube.com

Rationale for nature of the course

This course provides special emphasis on the application of knowledge about microorganisms in various life processes. Significant role of microorganisms in various sectors like industries, agriculture, medicine, environment etc. attracted the biotechnologist to manipulate the microorganisms and to generate products of commercial importance.

Activities having direct bearing on skill development/ employability/entrepreneurship

- Applying potential microorganisms in food and dairy industries
- Exploring the role of microorganisms in bioremediation, ecological recycling
- Appraise the significance of microorganisms in pharmaceutical and agricultural sectors

Pedagogy

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

Course Learning Outcomes (CLO)

On the completion of the course the student will be able to

CLOs	Course Learning Outcome	Knowledge Level
CLO1	Comprehend the concept of microbial contamination and spoilage of foods and their preservation and microbiological production of foods.	Up to K2
CLO2	Discuss beneficial microbes in soil and control plant diseases.	Up to K3
CLO3	Analyze the microbes in environment and water contamination.	Up to K4
CLO4	Distinguish the production of biopharmaceuticals and antibiotics.	Up to K3
CLO5	Categorize the microorganisms of industrial importance and industrial production of products.	Up to K3

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	2	1	1	1	2
CLO2	1	2	1	1	2
CLO3	2	1	1	2	1
CLO4	1	2	1	1	2
CLO5	2	1	2	3	2

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

Mapping of Course Outcome with Programme Outcome

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

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	K1	2 (K2&K2)	1(K3)
3.	CLO 3	Up to K 4	2	K1 & K2	1	K2	2 (K4&K4)	1(K4)
4.	CLO 4	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
5.	CLO 5	Up to K 3	2	K1 & K2	1	K2	2 (K3&K3)	1(K3)
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 Food Microbiology	a) Microorganisms of food spoilage and their sources.		1	Chalk and Talk
	b) Contamination and Spoilage of fruits,		1	
	c) Contamination and Spoilage of vegetables,		1	
	d) Contamination and Spoilage of milk,		2	
	e) Contamination and Spoilage of meat,		1	
	f) Contamination and Spoilage of fish		1	
	g) Contamination and Spoilage of canned foods.		1	
	h) General account of food preservation.		1	
	i) Microbiological production of fermented foods – bread, cheese, yogurt.		2	
	j) Microorganisms as food – SCP.		1	
II Soil and Agricultural Microbiology	a) Soil microflora.		1	Chalk and Talk
	b) Plant growth-promoting microorganisms.		1	
	c) Biofertilizers –*Rhizobium*		2	
	d) *Azolla*		1	
	e) Mycorrhizae		2	
	f) Bacterial diseases of Plants – bacterial blight of rice and citrus canker		1	
	g) Fungal diseases of Plants –leaf spot of rice and rust of sorghum		1	
	h) Biopesticides – *Bacillus thuringiensis*		2	
	i) Nuclear polyhedrosis virus (NPV) and *Trichoderma*.		1	
III Environmental Microbiology	a) Microbial interactions – mutualism, commensalism,		2	Chalk and Talk & PPT
	b) Antagonism, competition, parasitism, predation.		2	
	c) Microbiology of potable and polluted waters.		2	
	d) *E. coli* and *Streptococcus faecalis* as indicators of water pollution.		2	
	e) Biogeochemical cycles-Nitrogen,		2	
	f) Phosphorous and sulphur cycles.		2	
IV Pharmaceutical Microbiology	a) Microbial drugs and edible vaccines.		2	PPT & Chalk and Talk
	b) Biopharmaceuticals- source and production method of cytokines		2	
	c) Source and production method of haemopoetic		2	
	d) Source and production method of hormones		2	
	e) Source and production method of therapeutic		2	
	f) Industrial production of antibiotics (penicillin).		2	
V Industrial Microbiology	a) Microorganisms of industrial importance – yeasts, moulds, bacteria, actinomycetes. Screening and isolation of industrially-important microorganisms.		3	PPT
	b) Industrial production of alcohols (ethyl alcohol)		3	
	c) Industrial production of beverages (beer and wine)		2	
	d) Industrial production of enzymes (amylases)		2	
	e) Industrial production of organic acids (citric acid).		2	
		Total	**60 Hrs**	

Course designer : 1. Mr. P. Sasikumar