DEPARTMENT OF MICROBIOLOGY				*CLASS: II B.Sc. Microbiology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
IV	NME - II	20U4RNM2	Microbes in Human welfare	2	2	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 identify the principles of industrially important microorganisms and the process of production of industrially important products
3. To know the biopharmaceuticals and their production
4. To study beneficial microbes in soil and control of plant diseases
5. To emphasize the significance of microbes in sewage treatment

Course Learning Outcome:

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. Describe the microorganisms of industrial importance and industrial production of products
3. Define the production of biopharmaceuticals and antibiotics
4. Discuss beneficial microbes in soil and control plant diseases
5. Identify the microbes in sewage treatment and environment

Unit	Description	Hours	K-level	CLO
I	**Unit I - History and Scope 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).	6 hrs	Up to K2	1
II	**Unit II – Microbes in Food, medicine and Industrial products** Microbes in Dairy and fermented beverages - *Saccharomyces, Lactobacillus, Agaricus, Spirulina*. Industrial production of alcohol.	6 hrs	Up to K2	2

III	**Unit III – Microbes in Pharma field** Industrial production of Insulin. Antibiotics- Industrial production of Penicillin. Immunization- Vaccines, immunization schedule for children, role of vaccines for Small pox, Rabies and Polio.	6 hrs	Up to K2	3
IV	**Unit IV – Microbes in Agriculture** Soil microflora, Rhizosphere, organic manure. Bio control agents- Biofertilizers (Bacteria-Rhizobium, Fungi-Trichoderma, Blue green algae- NOSTOC, Actinomyctes-Frankia), Bioinsecticides- *Bacillus thuringiensis*.	6 hrs	Up to K2	4
V	**Unit V – Microbes in sewage treatment** Introduction of sewage, Trickling filter, activated sludge, oxidation pond, oxidation ditch. Microbes in production of biogas.	6 hrs	Up to K2	5
		Total	**30 Hours**	

Books for Study:

1. Dubey, R.C. and Maheswari, D.K. (2005). A text book of Microbiology. Revised Multicolour Edition. Published by 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, M. (2005). Microbiology. 6th Edition. Tata McGraw – Hill. New Delhi.
2. Albert Moat, G. and John Foster, W. (2004). Microbial Physiology. 4th Edition. John Wiley & Sons. New York.
3. Robert Boyd , F. (1984). General Microbiology. Times Mirror / Mosby College Publishers. UK.
4. Purohit, S.S. (2005). Microbiology – Fundamentals and Applications. Reprinted & Published by Student Edition. Behind Nasrani Cinema, Chopasani Road, Jodhpur.
5. Schlegel, H.G. (1993). General Microbiolog. Seventh edition. Cambridge University Press. UK.

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.Introductiontomicrobiology.youtube.com

Rationale for Nature of the course

Microorganisms are the major component of biological system and they are present everywhere-soil, water, air, inside our bodies and of animals and plants. The microorganisms infect the living organisms and cause serious diseases in plants, animals and humans and hence can be harmful to man both directly and indirectly. But some of them are also very useful to human beings. These

microorganisms help in the preparation of medicines, in food industry, in brewery, baking, agriculture, household and health products.

Activities having direct impact on Skill development/Employability / Entrepreneurship

- Employing microorganisms for production of biogas in rural areas.
- Identifying essential microbes for producing food and health products.
- Exploring research related to biocontrol agents.

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
CLO-1	Explain the fundamental concepts; describe the history and development of microbiology.	Up to K2
CLO-2	Describe the microorganisms of industrial importance and industrial production of products.	Up to K2
CLO-3	Define the production of biopharmaceuticals and antibiotics	Up to K2
CLO-4	Discuss beneficial microbes in soil and control plant diseases	Up to K2
CLO-5	Identify the microbes in sewage treatment and environment	Up to K2

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

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

Mapping of Course Outcome with Programme Outcome

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

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

LESSON PLAN

UNITS	DESCRIPTION	STAFF	HOURS	MODE
I History and scope of Microbiology	a) Introduction, History of Microbiology, Discovery of microorganisms		2	Chalk and talk
	b) Contributions of Leeuwenhoek, Louis Pasteur, Edward Jenner , Robert Koch, Elie Metchnikoff and Fleming		2	Screening of educational videos
	c) Classification based on Carl Woese (The three domains) and Robert H. Whittaker (Five Kingdom system)		2	Chalk and talk
II Microbes in Food and Industrial products	a) Study of *Saccharomyces* nutritional requirement and commercial application in fermented beverages.		2	PPT
	b) Probiotic properties, diversity and beneficial activity of *Lactobacillus* in food and feed.		1	Screening of educational videos
	c) Isolation, cell structure, metabolism, nutritional status, chemical composition, utilization of *Spirulina* and *Agaricus* as food source.		2	Screening of educational videos
	d) Microbes used in ethanol fermentation		1	PPT
III Microbes in Pharma field	a) History, raw material, manufacturing processes and quality control of Insulin.		2	Chalk and talk
	b) Penicillin: Discovery and its commercial production.		1	PPT
	c) Introduction to vaccines and WHO recommendations for routine immunization schedule for children.		2	Screening of educational videos
	d) Role of vaccines for small pox, rabies and		1	

IV Microbes in Agriculture	a) Mode of action of microbial biological control agents against plant diseases: Relevance beyond efficacy.		2	PPT
	b) Recent advances and future prospects of biofertilizers.		2	Chalk and talk
	c) Role of microorganisms in soil health and uses of organic manure.		2	Chalk and talk
V Microbes in sewage treatment	a) Study of physical and biological environment processes for sewage treatment.		3	PPT
	b) Biogas Production from Organic Waste: Recent Progress and Perspectives.		3	Chalk and talk, seminar.
		Total	**30 Hrs**	

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

CLOs	**K- Level**	**Section A**		**Section B**		**Section C**	
		Short Answers		**(Either/or Choice)**		**(Open Choice)**	
		No. of Questions	**K- Level**	**No. of Questions**	**K- Level**	**No. of Questions**	**K- Level**
CLO x	Up to K2	1	K1	1	K2/K2	1	K1
CLO y	Up to K2	2	K1	1	K2/K2	2	K1
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		**6**		**14**		**20**	

- *CLO5 will be allotted for individual Assignment which carries five marks as part of CIA component.*

Distribution of Section-wise Marks with K Levels (CIA I & II)

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	6	-	30	-	**36**	56.25	**100**
K2	-	28	-	-	**28**	43.75	
K3	-	-	-	-	**-**	-	**-**
K4	-	-	-	-	**-**	-	**-**
Total Marks	**6**	**14**	**30**	**-**	**64**	**100.00**	**100%**

Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Units	**CLOs**	**K-Level**	**Section – A**		**Section – B**		**Section – C**	
			Short Answers		**(Either / or Choice)**		**(Open Choice)**	
			No. of Questions	**K-Level**	**No. of Questions**	**K-Level**	**No. of Questions**	**K-Level**
1	CLO 1	Up to K2	1	K1	1	K2/K2	1	K1
2	CLO 2	Up to K2	1	K1	1	K2/K2	1	K1
3	CLO 3	Up to K2	1	K1	1	K2/K2	1	K1
4	CLO 4	Up to K2	1	K1	1	K2/K2	1	K1
5	CLO 5	Up to K2	1	K1	1	K2/K2	1	K1
No. of Questions to be asked			5		5		5	
No. of Questions to be answered			5		5		3	
Marks for each question			2		7		10	
Total Marks for each section			**10**		**35**		**30**	

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Section D (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-	50	-	60	46.15	100
K2	-	70	-	-	70	53.85	
K3	-	-	-	-	-	-	-
K4	-	-	-	-	-	-	-
Total Marks	**10**	**35**	**50**	**-**	**130**	**100.00**	**100**

Course designers

1. **Dr.S.Sree Gayathri**