DEPARTMENT OF MICROBIOLOGY				*CLASS: I M.Sc. Microbiology*				
Sem	**Course Type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
II	NME-2	21P2RNM2	Food and Dairy Microbiology	2	2	25	75	100

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

Course Objectives

1. To understand the significance of microorganisms in food and the factors affecting microbial growth
2. To explain the sources and components of food and their preservation techniques.
3. To illustrate the spoilage mechanisms in foods and identify control methods of deterioration and spoilage
4. To describe the effects of fermentation in food production and it influence on quality and status of the food product.
5. To understand food-borne diseases and food quality control

Course Learning Outcomes

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

1. Outline the role of microorganisms in the production of food and factors influencing their growth and survival.
2. Discuss about various principles involved in food preservation techniques.
3. Classify and describe the characteristics of important pathogens and spoilage microorganisms in foods.
4. Summarize the production and recovery processes of various fermented foods.
5. Discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food sanitation.

Unit	Description	Hours	K- level	CLO
I	**Unit – I Food as a substrate for microbes** Food as a substrate for microorganisms – microorganisms in food: molds, yeast and bacteria – factors affecting the growth of microorganisms in food.	6 hrs	Up to K2	1
II	**Unit – II Food spoilage** Spoilage of food - vegetables, eggs, milk and milk products, meat and meat products, sea foods (fish) and canned foods.	6 hrs	Up to K2	2

III	**Unit – III Food-borne diseases and food sanitation** Food borne infections and intoxications – bacterial and non-bacterial – investigation of food borne diseases – microbiology in food sanitation. Quality control of food.	6 hrs	Up to K2	3
IV	**Unit – IV Food preservation** Principles of food preservation – general principles and application methods – asepsis, removal of microorganisms-anaerobic conditions, high temperature, low temperature, drying and food additives.	6 hrs	Up to K2	4
V	**Unit – V Fermented food products** Fermented foods - pickled cucumber, sauerkraut – bread, cheese, vinegar, fermented dairy products. Spoilage of fermented dairy products.	6 hrs	Up to K2	5

Total 30 Hours

Books for Study:

1. Frazier, W.C. and Westhoff, D.C. (2008). Food Microbiology, 4th Edition. McGraw Hill Publishing Co., New Delhi.
2. Bamforth, C.W. (2005). Food, fermentation and Microorganisms. 1st Edition. Black well Science, USA.

Books for Reference:

1. Doyle, M.P., Buchanana, R.L. (2013). Food microbiology- Fundamentals and frontiers. 4th Edition. ASM Press, USA.
2. James, J.M., Martin, L. J., David, G. A. (2005). Modern Food Microbiology. 7th Edition. Springer Publishers, New York.
3. Robinson, R.L. (2012). Dairy Microbiology. Milk and milk products. 3rd Edition. Willey Publishers, USA.

Web Resources:

1. https://www.sciencedirect.com/food-microbiology
2. https://www.omicsonline.org/scholarly/food-microbiology
3. https://www.youtube.com/watch?v=raZlcOCdrlw
4. https://www.youtube.com/watch?v=6o6wPyqPjsA

Rationale for nature of the course

Microorganisms play a vital role in foods spoilage and also fined the maximum exploitation in the production of food and food products. The course includes various factors involved in microbial growth in food. Moreover, incidence of microorganisms in food represents a major challenge for public health due to their ability to cause food poisoning. Food preservation aims at inactivating and controlling the growth of spoilage and pathogenic microorganisms, insuring shelf-stable and healthy foods.

Activities having direct bearing on skill development/ employability/entrepreneurship

Determination of food quality
Production and recovery of various fermented foods
Microbiological analysis of food sanitation

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	Outline the role of microorganisms in the production of food and factors influencing their growth and survival.	Up to K2
CLO-2	Discuss about various principles involved in food preservation techniques.	Up to K2
CLO-3	Classify and describe the characteristics of important pathogens and spoilage microorganisms in foods.	Up to K2
CLO-4	Summarize the production and recovery processes of various fermented foods.	Up to K2
CLO-5	Discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food sanitation.	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	1	1
CLO2	2	3	3	2	2
CLO3	1	1	2	1	1
CLO4	1	2	1	1	2
CLO5	1	1	1	2	1

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

Mapping of Course Outcome with Programme Outcome

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

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

LESSON PLAN

Units	Description	Staff	Hours	Mode
I Food as a substrate for microbes	a) Food as a substrate for microbial growth		2	Chalk and Talk
	b) Microbes and their importance in maintenance of food.		2	PPT
	c) Intrinsic and extrinsic factors that affect growth and survival of microbes in foods		2	PPT
II Food spoilage	a) Natural flora and source of contamination of foods in general.		1	PPT
	b) Principles, Spoilage of vegetables, fruits.		1	Chalk and Talk
	c) Spoilage in milk products and bread.		2	Lecture
	d) Spoilage in meat and sea foods.		1	PPT
	e) Spoilage in canned foods.		1	Chalk and Talk
III Food-borne diseases and food sanitation	a) Food borne infections and intoxications – bacterial and non-bacterial		2	PPT
	b) Investigation of food borne disease		2	Lecture
	c) Microbiology in food sanitation and control (HACCP)		2	Chalk and Talk
IV Food preservation	a) Principles and factors influencing food preservation.		1	Chalk and talk
	b) Physical methods - high temperature, low temperature, irradiation, aseptic packaging.		2	PPT

	c) Chemical methods - salt, sugar, benzoates, citric acid, ethylene oxide, nitrate and nitrite.		2	Chalk and Talk
	d) Food additives		1	Lecture
V Fermented food products	a) Fermented foods-Vegetables (sauerkraut)		2	Chalk and talk
	b) Fermented dairy products- yogurt, acidophilus milk, kumiss, kefir, dahi and cheese.		2	PPT
	c) Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.		1	Chalk and Talk
	d) Spoilage of fermented foods.		1	PPT
Total			**30 Hours**	

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. N.Panneer Selvam