

YEAR – III	FOOD AND DAIRY MICROBIOLOGY (For the students who are admitted in the year 2019 – 2020 and onwards)	19MB509
SEMESTER - V		HRS/WK - 5
CORE - 9		CREDITS - 4

Objective: To make the students understand the importance of microbes in food and dairy industry.

Course Outcomes: `

Upon successful completion of the course, the student:

CO 1: will be able to describe the importance of microorganisms in food and methods used for food preservation.

CO 2: will be able to identify the source of contamination and spoilage causing microorganisms in different foods

CO 3: will be able to understand the role of microorganisms in food fermentation.

CO 4: will be able to apply the knowledge in dairy product production and develop the skill for testing milk sample.

CO 5: will be able to understand food borne diseases and detect the pathogens in different food samples.

SEMESTER: V	COURSE CODE: 19MB509					COURSE TITLE: FOOD AND DAIRY MICROBIOLOGY			HOURS: 5	CREDITS: 4
COURSE OUTCOMES	PROGRAMME OUTCOMES (PO)					PROGRAMME SPECIFIC OUTCOMES (PSO)			MEAN SCORE OF COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3		
CO1	3.5	3.5	4	4.5	4	4	4	5	4.6	
CO2	3	3	3.5	3.5	3	3	4	4.5	3.4	
CO3	2.5	3	3	4	4	3	4.5	4.5	3.5	
CO4	4	2.5	3	3.5	3.5	3.5	3.5	4	3.4	
CO5	3	2.5	3.5	4	4	3.5	4	4.5	3.6	
Mean Overall Score									3.7	

Result: The score of this course is 3.7 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit – 1

(15 hrs)

Food as a substrate for microorganisms - Microorganisms important in food microbiology - Principles of food preservation - asepsis - removal of microorganisms - high temperature - low temperature-drying- food additives - radiation

Unit – 2 (15 hrs)
Contamination, spoilage and preservation of - vegetables and fruits, meat and meat products, fish and sea food, poultry products, canned food.

Unit – 3 (15 hrs)
Food fermentations – bread, malted beverages, idly, fermented vegetables, pickles, Oriental fermented foods- Probiotics: definition, types of microorganisms and health benefits

Unit – 4 (15 hrs)
Milk and milk products - fermented dairy products - butter, cheese, yogurt, acidophilus milk; Spoilage and defects of fermented dairy products; Milk-borne diseases; Microbiological analysis of milk – dye reduction test, total bacterial count; Applications of microbial enzymes in dairy industry (Proteases and Lipases).

Unit – 5 (15 hrs)
Food-borne infections and intoxications - bacterial, non-bacterial - laboratory methods for detection of food borne pathogens (cultural and rapid method) - Food plant sanitation - quality control - HACCP.

Text Books

- Food Microbiology. 2013 (5th Edition). William C. Frazier, Dennis C. Westhoff, K. N. Vanitha. McGraw-Hill Education, India.
- Modern Food Microbiology. 2007 (2nd Edition). James, M.J. CBS Publisher, New Delhi

Reference Books

- Food Microbiology. 2016 (1st Edition). Foster, W. M. CBS Publishers and Distributors Pvt. Ltd, New Delhi.
- Food Microbiology. 2015 (4th Edition). Adams, M.R., Moss, M.O and McClure, P. J. RSC Publication, CPI Group (UK) Ltd, Croydon, UK.
- Modern Food Microbiology. 2005 (7th Edition). James M. Jay, Martin J. Loessner, David A. Golden. Springer Science & Business.
- Food Microbiology -Fundamentals and Frontiers. 2001 (2nd Edition). Doyle, M. P., L. R. Beuchat and T. J. Montville. ASM Press. Washington, D.C.
- Dairy Microbiology Hand Book. 2002 (3rd Edition). Richard K. Robinson. John Wiley & Sons, New York, US.

YEAR – III	FOOD SAFETY (For the students who are admitted in the year 2019 – 2020 and onwards)	19SMB51C
SEMESTER - V		SELF STUDY COURSE
ELECTIVE		CREDITS – 2

Objective: To make the students understand basics and importance of food safety in food industry.

Course Outcomes:

Upon successful completion of the course, the student:

CO 1: acquires knowledge of Food safety

CO 2: understands the problem of Food Adulteration

CO 3: becomes familiar with Food safety operations

CO 4: describes Food Quality Indicators in foods

CO 5: gains knowledge of Food safety management

SEMESTER: V	COURSE CODE: 19SMB51C					COURSE TITLE: FOOD SAFETY			HOURS: -	CREDITS : 2
COURSE OUTCOME S	PROGRAMME OUTCOMES (PO)					PROGRAMME SPECIFIC OUTCOMES (PSO)			MEAN SCORE OF Cos	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3		
CO1	3.5	4	4	3.5	3.5	4	4	3.5	3.75	
CO2	3.5	4	3.5	4	4	3.5	4	3.5	3.75	
CO3	4	4	3.5	3.5	3.5	4	4	3.5	3.75	
CO4	3.5	4	4	3	3.5	4	3.5	3.5	3.62	
CO5	4	3.5	4	3.5	3.5	4	4	3.5	3.75	
Mean Overall Score									3.72	

Result: The score of this course is 3.72 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit I
hrs)

(6

Introduction to Food- Carbohydrates, Protein, Fat, Fibre, Vitamins, Minerals- Effect of food processing on food nutrition- Introduction to Food safety – Factors affecting food safety

(Physical, Chemical and Microbial) – Safe Food – Definition – Importance of safe food – Personal Hygiene.

Unit II (6 hrs)

Food Adulteration – Definition – common adulterants- simple methods for detection of adulterants – Food additives- classification of food additives – Functional role of food additives – safety issues of food additives- Food Packaging and Labelling.

Unit III (6 hrs)

Food Processing & issues: Minimal processing Technologies, Hurdle Technology – Food preservation techniques - Pickling, drying, smoking, curing, canning, bottling, Jellying, modified atmosphere, pasteurization- Issues in food Processing – organic food, GM food, Irradiated food, Freeze dried food, Functional foods.

Unit IV (6 hrs)

Food Surveillance & Risk analysis: Food alerts - Recent food alert, Rapid Alert system for food - Traceability – objectives of traceability, steps for application of traceability - Food Product Recall – Role of Government agencies, Recall classification - Risk assessment.

Unit V (6 hrs)

Food safety management: Good Hygienic Practices (GHP) – Good Manufacturing Practices (GMP)- Food plant sanitation- Hazard Analysis Critical Control Point- Key elements and use of ISO 22000 – Quality management system- ISO 9001- Documentation structure of ISO 9001: 2008, Codex Alimentarius commission (CODEX).

Textbooks

- The training manual for Food Safety Regulators. Vol.I- Food Safety regulations and food safety management. 2010. Food safety and Standards Authority of India. New Delhi.
- The training manual for Food Safety Regulators. Vol.II- Food Safety regulations and food safety management. 2010. Food safety and Standards Authority of India. New Delhi.

Reference books

- Food Analysis: Theory and Practice. 2008. Pomeraz, Y. and McLoari, C.E. CBS publishers and Distributor, New Delhi.
- Guide to Quality Management Systems for the Food Industry. 2006. Early, R. Blackie, Academic and Professional, London.
- Manuals of Food Quality Control. 2-Additives Contaminants Techniques. 2006. FAO.

YEAR – III	BIOTECHNOLOGY (For the students who are admitted in the year 2019 – 2020 and onwards)	19MB616
SEMESTER - VI		HRS/WK - 5
CORE - 16		CREDITS - 4

Objective: To make the students understand the basic principles and techniques involved in gene technology

Course Outcomes:

Upon successful completion of the course, the student:

CO1: Understands the basics of recombinant DNA technology and cloning vectors.

CO2: Gains knowledge about the DNA and its amplification.

CO3: Acquires knowledge about enzymes and biofuels.

CO4: Understands the usage of plants and exploitation of them through genetic modification

CO5: Understands the usage of animals and exploitation of them through genetic modification, patenting and intellectual property rights.

SEMESTER : VI	COURSE CODE: 19MB616					COURSE TITLE: BIOTECHNOLOG Y			HOURS : 5	CREDITS : 4
COURSE OUTCOME S	PROGRAMME OUTCOMES (PO)					PROGRAMME SPECIFIC OUTCOMES (PSO)			MEAN SCORE OF COs	
	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3		
CO1	3	4	4	4	3.5	3	3.5	4	3.62	
CO2	3	4	4	4	4	3	4	3.5	3.68	
CO3	4	3	3.5	3	3	4	3.5	3	3.37	
CO4	3.5	4	4	4	4	3	4	4	3.81	
CO5	3	4	4	4	4	4	4	4	3.87	
Mean Overall Score									3.67	

Result: The score of this course is 3.67 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit - 1

(15 Hrs)

Definition and history – Recombinant DNA technology – Restriction endonucleases- Cloning vectors – pBR322, Cosmids - M13 phage vector and its applications – DNA ligation.

Unit - 2

(15 Hrs)

Chemical synthesis of DNA - DNA sequencing – Hybridisation techniques - Southern and Northern blotting techniques – Colony hybridization - PCR – Genomic library.

Unit - 3 **(15 Hrs)**

Enzyme technology – Enzyme immobilisation, products, Applications - Biofuel –Hydrogen gas as fuel from Microorganisms – Biodiesel.

Unit - 4 **(15 Hrs)**

Genetic engineering of plants – Electroporation – Gene gun –Particle bombardment- Ti plasmid vectors –Cauliflower mosaic virus as cloning vector - Applications- Transgenic plants –Insect resistant, Virus resistant plants, genetically modified foods.

Unit - 5 **(15 Hrs)**

Transgenic animals –Retroviral vector method , DNA microinjection method –Applications of r DNA technology – Recombinant products –insulin, tPA, Interferons – Gene therapy – **Patents – IPR.**

Text Books

- Elements of Biotechnology. 1996. Gupta, P.K. Rastogi and Company, Meerut.
- Basic Biotechnology. 2001 (2nd edition). Ratledge C. and B. Kristiansen. Cambridge University press, United Kingdom.

Reference Books

- Principles of Gene Manipulation. 1994 (5th Edition).Old, R.W. and S.B.Primrose. Blackwell Science, Oxford.
- Molecular Biotechnology - Principles and Applications of Recombinant DNA technology. 2010 (4th Edition). Glick, B. R., Pasternack J.J. and Patten C.L.ASM Press.
- Genetics- A Molecular Approach. 2004. Brown, T.A. Chapman Hall, London.
- Biotechnology Expanding Horizons. 2021. Singh, B.D. Kalyani Publishers, Ludhiana.

III B.Sc. ZOOLOGY	BIOFERTILIZER TECHNOLOGY For the students admitted from the year 2018-19 onwards	20EZ513A
SEMESTER - V		HRS/WK - 4
ELECTIVE		CREDIT - 2

Objective: To enable the students learn the importance of biofertilizers and their production

- To enlighten the students with the knowledge of microbial inoculants
- To highlight the role of microorganisms in soil fertility and plant growth promotion
- To understand the process of isolation, production, formulation, method of application and quality control of bio-fertilizers

Course Outcomes:

Upon successful completion of the course, the student:

CO 1: will be able to appreciate the role of soil microorganisms

CO 2: will be able to describe various nitrogen fixing organisms

CO 3: will be able to explain different nutrient solubilizing bacteria

CO 4: will be able to gain knowledge on production of biofertilizers

CO 5: will be able to elaborate on the formulation of biofertilizers

SEMESTER: R: V	COURSE CODE: 20EZ513A					TITLE OF THE PAPER: BIOFERTILIZER TECHNOLOGY			HOURS : 4	CREDIT S: 2
	PROGRAMME OUTCOMES (PO)					PROGRAMME SPECIFIC OUTCOMES (PSO)			MEAN SCORE OF COs	
COURSE OUTCOMES	PO 1	PO 2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3		
CO1	3	2	5	5	4	4	4	5	4.0	
CO2	2	2	5	5	3	3	5	5	3.7	
CO3	2	2	4	5	4	3	5	5	3.7	
CO4	4	2	4	4	4	3	4	4	3.6	
CO5	4	2	4	4	4	3	5	5	3.8	
Mean Overall Score									3.7	

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	$0 \leq \text{rating} \leq 1$	$1.1 \leq \text{rating} \leq 2$	$2.1 \leq \text{rating} \leq 3$	$3.1 \leq \text{rating} \leq 4$	$4.1 \leq \text{rating} \leq 5$
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit – 1

(12 Hrs)

SOIL MICROORGANISMS AND PLANTS: Important groups of soil microorganisms - Bacteria, Fungi, Algae, Protozoa, and Viruses - Microbial interactions in soil- positive and negative interactions - Rhizosphere – Phyllosphere -Spermosphere - R:S ratio; Biofertilizers – definition, types, importance of biofertilizers in agriculture; Plant Growth Promoting Rhizobacteria (PGPR) and their products - Cytokinin, Gibberellic acid, IAA, HCN and Siderophore.

Unit – 2 (12 Hrs)

NITROGEN FIXERS: Biological nitrogen fixation (BNF) - mechanism of BNF - Symbiotic nitrogen fixation - legume symbiosis- Rhizobium- characters and classification, nodulation- Free living nitrogen fixation - BGA, Azolla, Azospirillum, Azotobacter, Glucanoacetobacter and Frankia.

Unit – 3 (12 Hrs)

NUTRIENT SOLUBILIZERS AND MOBILIZERS: Solubilization of insoluble P, K, Zn and Si; Important solubilizing bacteria and fungi - Mycorrhizal bioinoculants – classification - Ectomycorrhizae – Endomycorrhizae -VAM- Taxonomy of mycorrhizae – role of mycorrhizae.

Unit – 4 (12 Hrs)

PRODUCTION TECHNOLOGY: Isolation and mass multiplication of Nitrogen fixers (*Rhizobium*), P, K, Zn and Si solubilizing organisms (*Pseudomonas*), BGA, *Azollae*and Mycorrhizae - Carrier materials – selection, sterilization and preparation of carrier materials – fermenters.

Unit – 5 (12 Hrs)

FORMULATION OF BIOFERTILIZERS: Carrier based, gel based and liquid based biofertilizers - **Quality control of different formulations** – Problems and constraints in production- Methods of application and recommendations

Text Books

- Soil Microbiology.199 (4th Edition). Subba Rao N.S. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India
- Agricultural Microbiology. 2002(2nd Edition).Bagyaraj D.J. and G. Rangasamy. Prentice Hall, New Delhi, India

Reference Books

- Microbes as Bio-fertilizers and their production Technology. 2015. Borkar S.G. Wood Head Publishers, New Delhi.
- Biofertilizers: Commercial production Technology and quality control. 2017. Hyma P. Random publishers, New Delhi
- Biofertilizer Manual. 2006. FNCA (Forum for Nuclear Cooperation in Asia) Biofertilizer Project Group. Published by Japan Atomic Industrial Forum.

II B.Sc. CHEMISTRY	FOOD PROCESSING TECHNOLOGY (For those students admitted in the year 2020 – 21 and onwards)	NMEFT401
SEMESTER - IV		HRS/WK - 3
NME		CREDITS - 2

Objective: To make the students understand food processing and preservation methods

Course Outcomes:

Upon successful completion of the course, the student:

CO1: could understand the principles of food preservation and processing

CO2: could obtain knowledge about preservation of food at various temperatures

CO3: could acquire knowledge about food preservation by radiation

CO4: could comprehend government regulations and policies on food control

CO5: could gain knowledge about processed foods

SEMESTER : III	COURSE CODE: 20A0FT301					TITLE OF THE PAPER: FOOD PROCESSING TECHNOLOGY			HOURS : 3	CREDITS : 2
	PROGRAMME OUTCOMES (PO)					PROGRAMME SPECIFIC OUTCOMES (PSO)			MEAN SCORE OF COs	
COURSE OUTCOME S	PO1	PO2	PO3	PO4	PO5	PSO 1	PSO 2	PSO 3		
CO1	4	3	4	4	3	4	3	3	3.50	
CO2	3	3	4	4	3	4	4	4	3.62	
CO3	4	4	3	4	3	4	4	3	3.62	
CO4	3	4	3	4	3	3	2	3	3.12	
CO5	3	4	4	4	3	4	4	4	3.75	
Mean Overall Score									3.5	

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit-1

(9 Hrs)

Principles of preservation and processing of foods; classification of foods by ease of spoilage;

principles of food preservation, methods of food preservation – asepsis, removal of microorganisms, maintenance of anaerobic conditions.

Unit-2 (9 Hrs)

Preservation of food by use of high and low temperature - Factors affecting heat resistance (Thermal death time); heat penetration, heat treatments employed in processing foods, canned foods; low temperature storage, chilling and freezing, freezing of foods and its consequences.

Unit-3 (9 Hrs)

Preservation of foods by drying - Methods of drying, treatments of foods before drying, procedures after drying, intermediate moisture foods; Preservation of foods by additives - antimicrobial preservatives, added preservatives, developed preservatives; Preservation of foods by radiation - Ultra violet radiation, ionizing radiations, gamma rays and cathode rays; microwave processing.

Unit-4 (9 Hrs)

Food Adulteration; Food sanitation - Microbiology of the food product, good manufacturing practices, Hazard Analysis Critical Control Points, health of employees; Food control – enforcement and control agencies – international agencies (FAO, WHO, FDA & ISO); national agencies (Agmark, ISI, BIS).

Unit-5 (9 Hrs)

Processed foods – Jam, canned fruit juices, pickles, Bread, Seafoods, Dairy products - Market milk, Special milk, Cream, Butter, Ice Cream, Cheese, Dried milk products; Packaging of milk and milk products.

Text Book:

- Food Microbiology. 5th Edition, 2013. William C. Frazier, Dennis C. Westhoff, N. M. Vanitha. McGraw-Hill Education (India).
- Food Microbiology, 4th Edition, 2015. Adams, M.R., Moss, M.O and McClure, P. J. RSC Publication, CPI Group (UK) Ltd., Croydon, UK.

Reference Books:

- Outlines of Dairy Technology. 1991. Sukumar De. Oxford University Press.
- A First Course in Food Analysis. 1999. A.Y. Sathe. New Age International (P) Limited, Publishers, New Delhi.
- The Microbiological Safety and Quality of Food. 2000. Barbara M. Lund, Baird-Parker, Gould G.W. An Aspen publication, Maryland, U.S.A.