

**Subject Code: 02MB0531**

**Subject Name: Food and Dairy Microbiology**

**M.Sc. Microbiology Semester- III**

**OBJECTIVE:** Students are expected to have the advanced learning regarding applications of microbiology and biotechnology at commercial level. The course discusses application of microbiology in the field of dairy and food industry.

**Credits Earned:** 6 Credits

**COURSE OUTCOMES:** By the end of this course students should be able to:

- 1) Describe and comprehend the fundamental concepts of applied biotechnology.
- 2) Analyse primary literature articles in the field of applied microbiology to develop critical thinking skills and develop essential writing and verbal communication skills through essays and oral presentations that target the field of applied biotechnology.
- 3) To learn about the functioning of dairy industry.
- 4) To learn about the preparation, processing and storage of food items.

**Teaching Scheme:**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Marks	Practical	Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Practical (PR)	
4	0	3	6	50	30	20	25	25	150

**Pre-Requisite of Course:** Basic understanding of microbiology.

**Contents:**

Unit	Topics	Contact Hours
1	<p><b>Microbiology of milk and milk products:</b>            Definition and Composition of milk, Types of Milk (skimmed, toned and homogenized), Factors affecting quality and quantity of milk, Nutritive value of milk, Physical and Chemical properties of milk. <b>Microbiology of milk:</b> Common micro-organisms found in milk, Fermentation and spoilage of milk, Milk borne diseases. <b>Milk preservation and storage:</b> Methods of Pasteurization – LTH, HTST, UHT, storage specifications after pasteurization, phosphatase test and its significance. <b>Microbial analysis of milk:</b> Dye reduction test (using methylene blue and resazurin), total microbial count, Brucella ring test and tests for mastitis, Somatic cell count. <b>Milk products:</b> Starter cultures, Buttermilk, yoghurt, cheese, and other dairy products like milk powder, ice creams etc.</p>	14
2	<p><b>Food spoilage and food borne infections:</b>            Classification of Food: Perishable, Semi-perishable, stable, Health food, ethnic food, organic food, functional food, Nutraceuticals, fabricated foods, Convenience foods, GM foods, space foods. Microbial flora of food products: Molds, yeasts, and bacteria, Intrinsic and extrinsic factors affecting microbial growth in food. Food spoilage: factors responsible for food spoilage, microorganisms involved in food spoilage. Spoilage of meat and poultry products, bread, fruits and vegetables, eggs, sea foods, canned foods etc. Food infection and food poisoning by <i>Staphylococcus aureus</i>, <i>Clostridium botulinum</i>, <i>Aspergillus flavus</i>, <i>Salmonella typhimurium</i>, <i>Bacillus</i>, <i>Vibrio parahemolyticus</i>, <i>Listeria</i>, <i>Escherichia coli</i>, <i>Shigella</i>, <i>Campylobacter</i>, <i>Brucella</i>, <i>Yersinia</i> etc. Foodborne outbreaks – laboratory testing procedures.</p>	17
3	<p><b>Food preservation:</b>            Principles of food preservation. Thermal destruction - use of low temperature and high temperature, Determination of TDP, TDT, D, F, and Z values. Physical methods: Canning, chilling, freezing, dehydration, control of water activity, ultrafiltration, sterilization, radiations. Chemical methods: use of chemicals, antibiotics, preservatives. Food additives: definition, uses, functions of acid, base, buffer systems, salts and chelating/sequestering agents. Low calorie and non nutritive sweeteners. Antioxidants, emulsifying and stabilizing agents, anti-caking agents, thickeners, firming agents. Anti microbial agents / Class I and Class II preservatives as per PFA Act. Colorants, Flavoring agents and related substances, clarifying agents and other additives. Food packaging: types of antimicrobial packaging, introduction to Tetra pack technology.</p>	16

4	<b>Food products produced using microorganisms:</b> Traditional fermented foods (pickles, Kimchi, sauerkraut, soya sauce etc.), Microbial cells as food (SCP), Production of alcoholic beverages – beer and wine; vinegar fermentation, steroid conversions, industrial enzyme production – amylase, protease, lipase, cellulose; amino acid production, Bakery products, genetically modified foods, mushroom cultivation; Probiotics: Evaluation, role and production.	13
	<b>Total</b>	60

**References:**

- 1) Adams MR and Moss MO (1995), Food Microbiology. Royal Society of Chemistry Publication, Cambridge.
- 2) Banwart G. J. (1989). Basic Food microbiology, 2nd Edn. Chapman and Hall. International Thompson Publishing.
- 3) Clarence Henry Eckles, Willes Barnes Combs, Harold Macy (1943). Milk and milk products, 4th Ed. McGraw-Hill book Company, Incorporated.
- 4) James M. Jay, Martin J. Loessner, David A. Golden (2005). Modern food microbiology, 7<sup>th</sup> Edn. Springer Science & Business.
- 5) Sukumar. De (2001). Outlines of Dairy Technology. 1st Ed. Oxford University Press Delhi.
- 6) William C. Frazier, Dennis C. Westhoff, N. M. Vanitha (2013). Food Microbiology, 5thEdn.McGraw-Hill Education (India).
- 7) Prajapati JB (1995) Fundamentals of Dairy Microbiology. Nadiad Akta Prakashan.
- 8) Stanbury PF, Whitekar A and Hall SJ (1995) Principles of Fermentation Technology, 2<sup>nd</sup> edition. Pergamon Press.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Instructional Method:**

- j. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board may also use any of tools such as demonstration, role play, Quiz, brainstorming, etc.
- k. The internal evaluation will be done on the basis of continuous evaluation of students in the class-room in the form of attendance, assignments, verbal interactions etc.
- l. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

**Practicals:**

- 1) Isolation and identification of *Xanthomonas* spp. from infected sample
- 2) Production of ethanol from wheat flour / grapes etc.
- 3) Determination of moisture content in food sample
- 4) Estimation of ascorbic acid in beverage/juices
- 5) Determination of microbiological quality (TPC/SPC) of any food sample: pasteurized and sterilized/ flavoured milk/cheese/butter/veg/fruit/bread/meat samples.
- 6) Quality assurance tests: Antibiotic and growth factor assay (agar gel diffusion technique) / MIC and MBC of Antibacterial compounds
- 7) To analyse the quality of milk and dairy products by following methods
  - a. Phosphatase test
  - b. MBRT test
  - c. Test for mastitis
  - d. Milk fat estimation
  - e. Standard Plate Count (for milk / milk product e.g. milk powder)
  - f. Direct Microscopic count
  - g. Somatic cell count
- 8) Pyrogen Testing
- 9) Sterility testing of non-biocidal injectables
- 10) Sauerkraut production