DISCIPLINE SPECIFIC CORE COURSE – 6: Food and Dairy Microbiology

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
MICROB-DSC203: Food and Dairy Microbiology	4	3	0	1	Class XII pass with Biology/ Biotechnology/ Biochemistry	NIL

Learning Objectives

The Learning Objectives of this course are as follows:

- The main objective of this course is to familiarise students with the importance of microorganisms in food spoilage as well as in preparation of certain foods, and to acquaint the students with quality control and safety indices used in the food industry

Learning outcomes

The Learning Outcomes of this course are as follows:

- Student will be able to evaluate the factors governing microbial growth in foods and sources of food contamination.
- Student will be able to discuss the factors that govern spoilage of some common foods due to microbial activity.
- Student will be able to describe various physical and chemical methods used for food preservation.
- Student will be able to analyse the role of microorganisms in the production of fermented dairy and non-dairy food products. Will understand the health benefits of prebiotics, probiotics and synbiotics.
- Student will be able to discuss on the common food-borne diseases and preventive measures to be used, as well as methods for detection of food-borne pathogens.
- Student will be able to determine the importance of quality control in the food industry and describe various indices being used to measure quality and safety in the food industry.

SYLLABUS OF DSC-6

UNIT – I (3 Weeks)

Foods as a substrate for microorganisms: Natural microflora and contamination sources of foods. Factors impacting growth and survival of microbes in foods. Intrinsic : pH, moisture content, nutrient availability, Eh values, antimicrobial substances and biological structures. Extrinsic: temperature, relative humidity and gaseous storage. Spoilage of foods by microorganisms: Factors responsible for food spoilage. Non- perishable, -semi perishable and - highly perishable foods. Spoilage of vegetables, fruits, meat, eggs, milk, butter, bread, and canned foods

UNIT – II (3 Weeks)

Food preservation methods: Physical methods of food preservation: Temperature control (low: refrigeration, freezing; high: boiling, blanching, pasteurization, UHT, aseptic packaging). Canning: home and commercial. Dehydration: natural drying, artificial drying, freeze drying, smoking and tying of water molecules, reduced water activity products. Irradiation: radicidation, radurization, radappertization. Hydrostatic pressure, high voltage pulse, microwave processing. Chemicals used in food preservation: salt, sugar, organic acids, SO2, nitrites and nitrates, ethylene oxide, antibiotics and bacteriocins

UNIT – III (3 Weeks)

Fermented dairy and non-dairy foods: Starter cultures. Fermented foods: yogurt, acidophilus milk, kumiss, kefir, dahi, cheese, bread, dosa, kanji, sauerkraut, soy sauce, tempeh, and fermented meat (sausages). Concept, health benefits and limitations of prebiotics, probiotics and synbiotics. Selection criteria for probiotic. Probiotic foods available in the market.

UNIT – IV (4 Weeks)

Food intoxications, food infections and detection of food borne pathogens. Causative agents, foods involved, symptoms and preventive measures in food-borne diseases caused by Clostridium botulinum, Shigella (bacillary dysentery), Vibrio cholerae, Escherichia coli, Yersinia enterocolitica, Salmonella (food infection), Entamoeba histolytica. Mycotoxins: aflatoxins (Aspergillus). Detection of food-borne pathogens: culture-based as well as rapid detection methods

UNIT – V (2 Weeks)

Quality control in the Food Industry: Total Quality Management (TQM): concepts and approaches. Hazard Analysis of Critical Control Point (HACCP) for food safety: principles and limitations. Indices of food quality (IFQ): FSSAI standard, ISO certification.

Practical component

UNIT 1: (7.5 Weeks)

Microbial spoilage of food and fermented foods:

Isolation and identification of spoilage fungi from various spoiled vegetables/ fruits: collection of spoilt food samples, point inoculation on suitable media, preparation of temporary mounts, and microscopic observations. Isolation and identification of spoilage fungi from spoiled breads using similar methods. Comparison of the fungi identified in the two categories of foods. Fermented

foods: Production of fermented foods using starter cultures and normal microflora of food. Preparation of yogurt / dahi. Preparation of sauerkraut / kanji. Preparation of buttermilk and butter. Preparation of kefir using kefir grains. Student research study project: unusual fermented foods from India and around the world.

Unit 2: (7.5 Weeks)

Food Quality Control :

Methylene Blue Dye Reduction Test (MBRT) to assess the microbiological quality of raw versus pasteurized milk: principle of the method, performance of the test with various samples of milk, evaluation and grading of milk quality based on the results obtained. Evaluation of milk quality by assessing its bacterial load using the standard plate count with serial dilutions of the milk. Clot on boiling (COB) test of milk samples: principle, performance of the test with milk samples, and evaluation of milk quality based on results obtained. Alkaline phosphatase test to check efficiency of pasteurization of milk: principle, performance of the test with various pasteurized milk samples, evaluation of milk quality based on results obtained.

Essential/recommended readings

Theory:

1. Antimicrobials in Foods edited by P.M. Davidson, T.M. Taylor, and J.R.D. David. 4th edition. CRC Press, UK. 2020.
2. Food Microbiology by W.M. Foster. CBS Publishers & Distributors Pvt. Ltd. 2020
3. Food Microbiology by W.C. Frazier, D.C. Westhoff, and N.M. Vanitha. 5th edition. TataMcGraw-Hill Publishing Company Ltd, India. 2017.
4. Food Microbiology by M.R. Adams, M.O. Moss and P. McClure. 4th edition. Royal Society of Chemistry, UK. 2015.
5. Fundamental Food Microbiology by B. Ray and A. Bhunia. 5th edition. CRC Press. 2013.
6. Basic Food Microbiology by G.J Banwart. 2nd edition. CBS Publishers and Distributors, India. 2004.
7. Modern Food Microbiology by J.M. Jay, M.J. Loessner and D.A. Golden. 7th edition. Springer, Switzerland. 2005.
8. The Microbiological Safety and Quality of Foods. Vol. 1-2 by B.M. Lund, T.C. Baird-Parker,and G.W. Gould. ASPEN Publication, USA. 2000.

Practicals:

1. Analytical Food Microbiology: A Laboratory Manual by A.E. Yousef, J.G. Waite-Cusic and J.J. Perry. 2nd Edition. Wiley Publishers, UK. 2022.
2. Laboratory Manual of Food Microbiology by N. Garg, K.L. Garg and K.G. Mukerji. Dreamtech Press, India. 2021.
3. Microbiology: A Laboratory Manual by J. Cappuccino and C.T. Welsh. 12th edition. Pearson Education, USA. 2020.
4. Laboratory manual of Microbiology and Biotechnology by K.R. Aneja. 2nd edition. Scientific International Pvt. Ltd., Delhi. 2018.

Suggestive readings

Note: **Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.**