

Food Microbiology and Biotechnology

Course Code	Title of Course	Credit Hours
HND-118	Food Microbiology and Biotechnology	3(2-1)

Learning objectives:

Students will be able to:

- Understand the role of food Microorganisms in ensuring food security.
- Gain knowledge about the food constituents, food classification, presence of microbial agents and spoilage agents.
- Comprehend the role of various food processing and preservation methods in shelf-life extension and availability of food around the year.
- Biotechnology, its important areas in food and nutrition.
- How the major components of food and functional foods can be produced using microorganisms.
- Food bio-preservatives and the importance of fermentation and starter cultures.
- Genetically modified foods, plants and microbes, how they can be produced and what is their role in food and nutrition.

Course contents:

Theory

Food microbiology: introduction and scope; Important microbial genera in foods gut microbiota and nutrition, cross-talk between gut microbiota, host, and nutrient metabolism, bacteria, mold, yeast, and yeast-like fungi, viruses, general, morphological, cultural, and physiological characteristics; Factors affecting the growth and survival of microorganisms in food: intrinsic, extrinsic and implicit; Contamination and spoilage of perishable, semi-perishable, and stable foods, sources, transmission, microorganisms; Food microbiology and public health: food-borne infections: intoxications, Microbiological risk assessment; Microbiology in food sanitation, food sanitizers and pathogen reduction: a case study, Food fermentation: Probiotics in human health, Introduction and history of food biotechnology, Fermented food and its diversity, Food fermentation, their diversity and use in subcontinent; Starter culture use and types for fermentation; Food Bio-preservation, Bacteriocins as food

preservative: Niacin and its mode of action, Single cell oils, their production, oligeneous microbes and their criteria; SCO safety and application; Microbial exopolysaccharides and their importance; Single cell proteins, their production and application; Food flavors and role of biotechnology in their production; Natural Vs synthetic flavours; Food application of algae; Food application and Nutritional value of edible fungi- spirulina; Metabolic Engineering: introduction, aim, and steps, Metabolic engineering and LAB and its use in dairy products, functional food and biotechnology.

Practical:

Isolation, identification, and characterization of microorganisms: morphology, biochemical; Enumeration of microorganisms in food and water samples (total count, viable count, MPN); Examination of foods for pathogenic organisms (*Escherichia coli*, *Coliform*, *Salmonella*, and *Listeria monocytogenes*); Introduction to prebiotics and probiotics, their criteria and applications, *Lactobacilli* and their selective media for growth, Intro to beta galactosidase and transgalactosylation; Bioconversion of lactose using beta-galactosidase to produce prebiotic galacto-oligosaccharides and discussion for factors affecting lactose intolerance and concept of lactose free functional dairy products; Production of dairy products (milk, yogurt) with reduced lactose and improved GOS; Preparation of fermented and probiotic-enriched food products.

Suggested Readings Textbook:

1. Adams, M.R., M.O. Moss and P. McClure. 2024. Food Microbiology, 5th ed. Royal Society of Chemistry, Cambridge, UK.
2. Stahl U., Donalies U. E. B., and Nevoigt E. 2008. Food Biotechnology. Advances in Biochemical Engineering /Biotechnology. Springer-Verlag Berlin Heidelberg.

Reference Books:

1. Brown, M. and M. Stringer. 2002. Microbiological risk assessment in food processing. Woodhead Publishing Ltd. Cambridge, UK.
2. Frazier, W.C., D.C. Westhoff and K.N. Vanitha. 2013. Food Microbiology, 5thed. McGraw-Hill Book Co., New York, USA.
3. Shetty K., Paliyath G., Pometto, Levin, R. E. 2006. Food Biotechnology. 2nd edition. Taylor and Francis Group, LLC.