

## MICROB-GE-3

### FOOD FERMENTATION AND PRESERVATION TECHNIQUES

**Marks: 100 (Theory = 50 marks  
Practicals = 50 marks)**

**Duration: Theory = 30 hours (2 credits)  
Practicals = 60 hours(2 credits)**

#### **Course objectives:**

The major objective of this paper is to develop clear understanding about the microorganisms important in food and various factors affecting their growth. The students will gain in depth knowledge about food fermentation, their benefits and the processes involved in production of fermented foods. The concept of probiotic, prebiotic and synbiotics will also be discussed. The course also deals with the principle and the techniques involved in processing and preservation of food substances. The students will also be trained and be given hands on training in various microbiological techniques involved in food fermentation and food preservation. The course on completion can open many career options.

**Pre-requisite:** Student should have studied Biology/ Biotechnology/ Biochemistry in 12th standard.

#### **Course learning outcomes:**

Upon successful completion of the course, the student:

CO1: Will be familiar with the microbes important in food, their morphological, cultural, and physiological characteristics, and factors influencing their growth

CO2: Will have got an overview of fermented foods and their health benefits. Also, will be acquainted with the microbes and their processes involved in production of fermented foods.

CO3: Will have learnt about the causes of food spoilage and be aware of different preservation techniques used to increase the shelf life of food products.

CO4: Will have gained hands on experience in isolating and characterizing microbes from food.

CO5: Will have become familiar with the principle of food fermentation by production of fermented foods in the laboratory.

CO6: Will have an insight into various microbiological and biochemical testing techniques used for assessing the efficacy of various food preservation techniques.

#### **Contents:**

##### **Theory:**

**30 hours**

**Unit 1: Microorganisms in Food Microbiology:** Introduction to microorganisms important in foods: morphological, cultural and physiological characteristics of moulds (*Aspergillus*, *Rhizopus*), yeast (*Saccharomyces*), and bacteria (*Lactobacillus*, *Acetobacter*), Factors affecting microbial growth in foods- intrinsic (pH, water activity, mechanical barriers and redox potential) and extrinsic (temperature, gaseous atmosphere). **6**

**Unit 2: Food Fermentation:** History, definition and benefits of fermented foods. Types of food

fermentations (acid-, yeast-, solid state-, oriental and indigenous fermented foods). Production and maintenance of microbial cultures involved in food fermentation, starter culture and its problems. Production of dairy (dahi, yoghurt, kefir, cheese) and non-dairy fermented foods (dosa, kanji, sauerkraut, tempeh, soy sauce), beverages (beer, wine) and concept of pre-, pro- and syn- biotics. **12**

**Unit 3: Principles of food preservation:** Definition and causes of food spoilage. Classification of food by ease of spoilage. General principles of food preservation. Preservation by low temperature: freezing & refrigeration. Preservation by high temperature: pasteurisation and canning. Preservation by moisture control: drying and dehydration. Preservation by radiation: Gamma, microwaves and UV rays. Preservation by added food preservatives: salt, sugar, benzoate, nitrite and nitrate, wood smoke, nisin. Preservation by developed preservatives, modified atmosphere packaging. **12**

**Practicals:** **60 hours**

**Unit 4: Isolation and characterisation of microbes important in food:** Isolation and microscopic examination of fungi from a spoiled bread. Isolation of lactic acid bacteria from curd using MRS medium and microscopic characterisation by Gram's staining. Effect of different temperatures/ salt concentration on microbial growth. **24**

**Unit 5: Food fermentation:** Preparation of kefir using kefir grains/ fermented cabbage (sauerkraut). Viability test for yeast using methylene blue. Survey on the availability and usage of various probiotic foods from market. **12**

**Unit 6: Food Preservation:** Effect of blanching on food preservation. Incubation test for cans/ tetrapack to determine sterility. 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. Assessment of efficiency of sterilisation of milk: principle and performance of Turbidity Test and evaluation of milk quality based on obtained results. **24**

### **Suggested Readings:**

1. Food processing and preservation by H. Naik and T. Amin. CRC Press. 2022.
2. Microbiology: A Laboratory Manual by J. Cappuccino and C.T. Welsh. 12<sup>th</sup> edition. Pearson Education, USA. 2020.
3. Microbiology and Technology of fermented foods by R. Hutkins. 2<sup>nd</sup> edition. Wiley Blackwell, UK. 2019.
4. Food Microbiology by W.C. Frazier, D.C. Westhoff, and N.M. Vanitha. 5<sup>th</sup> edition. TataMcGraw-Hill Publishing Company Ltd, India. 2017.
5. Handbook of fermented functional foods by F. Edward. 2<sup>nd</sup> Edition. CRC press, UK. 2016.
6. FSSAI Manual of methods of analysis of foods. Food safety and standards Authority of India, Ministry of Health and Family Welfare, Government of India, 2015.
7. Advances in Fermented Foods and Beverages by W. Holzapfel. 1<sup>st</sup> edition. Woodhead Publishing, USA. 2014.

8. Handbook of food and beverage fermentation technology by Y. Hui, L. Meunier-Goddik, J. Josephsen, W. Nip and P. Stanfield. 1<sup>st</sup> edition. CRC Press, UK. 2004.

**Facilitating the achievement of Course Learning Outcomes**

<b>S. No.</b>	<b>Course Learning Outcomes</b>	<b>Teaching and Learning Activity</b>	<b>Assessment Tasks</b>
1.	Will be familiar with the microbes important in food, their morphological, cultural, and physiological characteristics, and factors influencing their growth	Interactive sessions with power point presentations on the morphological, cultural, and physiological characteristics of microbes important in food	Assignment and quiz on the characteristics of microbes associated with food and factors influencing their growth
2.	Will have got an overview of fermented foods and their health benefits. Also, will be acquainted with the microbes and their processes involved in production of fermented foods	Classroom lectures and detailed discussion on the fermentation process through flow charts, power point presentations and relevant online videos	Students to collect samples of various fermented foods available commercially and do market survey on their consumption. Class test / Assignment on MFC and types of starter cultures
3.	Will have learnt about the causes of food spoilage and be aware of different preservation techniques used to increase the shelf life of food products.	Teaching of various preservation techniques through power point presentations and online videos	Class tests, Quiz and MCQs on the various preservation methods
4.	Will have gained hands on experience in isolating and characterizing microbes from food.	Media preparation and sterilization, isolation & identification of various microbes in food. Also understanding the importance of various physical- chemical factors on growth	Drawing well labelled diagrams of microscopic observations of isolated fungi and bacteria from food
5.	Will have become familiar with the principle of food fermentation by production of fermented foods in the laboratory.	Hands on training on the laboratory preparation of fermented foods and survey on the consumption pattern of fermented foods	Compilation of report on the survey done by the students to understand the availability and acceptance of fermented foods
6.	Will have an insight into various microbiological and biochemical testing techniques used for assessing the efficacy of various food preservation techniques.	Laboratory training in processing and preservation protocols for different food products	Viva voce, multiple choice questions and spotting

**\*Assessment tasks listed here are indicative and may vary**