**Semester I**

**Assessment and Grading:**

Assessment in this course will be multifaceted and may include the following components:

**Examinations:** Regular quizzes, mid-term exams, and a comprehensive final exam will assess your understanding of course materials.

**Assignments:** Homework assignments, research papers, or case studies will be assigned to reinforce theoretical knowledge and analytical skills.

**Class Participation:** Active engagement in class discussions, presentations, and group activities will be considered in the evaluation.

**Grading Criteria** (Note: These percentages are subject to adjustment based on the course structure):

Examinations: 80%

Class Participation: 5%

Assignments: 10%

Attendance: 5%

**Feedback and Assessment Criteria:**

- Constructive feedback will be provided on assignments and exams to help you understand your performance and areas for improvement.
- Clear assessment criteria, rubrics, and expectations will be provided at the beginning of the course to guide your work.
- Please feel free to seek clarification on grading and assessment-related questions throughout the course.
- Students with special needs may contact the concerned teacher before hand.

**FT23101CR**

**Food Microbiology and Biotechnology (4+0+0)**

**Course Description:**

The course "Food Microbiology and Biotechnology" at the master's level in Food Science and Technology is a comprehensive exploration of the intricate relationship between microorganisms and the food we consume. This course delves into the multifaceted world of food microbiology, where students will uncover the vital roles microorganisms play in food production, preservation, and biotechnological innovation. Throughout the course, students will engage in theoretical learning, practical laboratory work, and critical discussions to develop a profound understanding of the complex interplay between microbes and food.

**Unit I**

- Brief history of Food Microbiology. Microbial Growth Curve.
- Factors affecting microbial growth: intrinsic and extrinsic factors.
- Types of microbes associated with foods & their characteristics: Bacteria, yeast, Fungi.
- Biochemical changes caused by microorganisms: Degradation of different food components.

**Learning Outcomes:**

By the end of this unit, students should be able to:

- Describe the historical development of food microbiology and its significance in the food industry.
- Explain the microbial growth curve and its relevance to food processing and preservation.
- Identify intrinsic and extrinsic factors influencing microbial growth in food.
- Classify various types of microbes commonly associated with foods and describe their characteristics.
- Analyse the biochemical changes caused by microorganisms, focusing on the degradation of different food components.

**Unit II**

- Microorganisms associated with spoilage of milk, cereal, meat, fruit and vegetables & their products. Spoilage of canned products.

- Detection of Food spoilage using biosensors.
- Food borne diseases: Listeriosis, Salmonellosis, Shigellosis, Yersiniosis, Diseases caused by *Clostridium perfringens*, *Bacillus cereus*, *Escherichia coli*.
- Food intoxication: Staphylococcal intoxication, Botulism,
- Toxicants from molds: Aflatoxins, ochratoxins, patulin, Luteoskyrin, Pencillic acid.

**Learning Outcomes:**

By the end of this unit, students should be able to:

- Identify microorganisms responsible for the spoilage of various food products and describe their characteristics.
- Evaluate methods for detecting food spoilage using biosensors.
- Analyse the major foodborne diseases and their causative agents.
- Discuss food intoxications caused by specific bacteria and toxins.
- Recognize the toxins produced by molds and their implications for food safety.

**Unit III**

- Introduction to Genetic Engineering, Recombinant DNA Technology, Vectors, Ti Plasmid
- SCP: Sources, substrate requirement, Production,
- GM crops: Bt Corn, Bt Brinjal & Golden Rice.
- Antisense RNA & Gene silencing
- Genetic manipulation of industrially important yeast and Lactic Acid Bacteria.

**Learning Outcomes:**

By the end of this unit, students should be able to:

- Explain the principles of genetic engineering and recombinant DNA technology.
- Understand the role of vectors and Ti plasmids in genetic modification.
- Analyze the production of Single Cell Protein (SCP) and its applications.
- Evaluate genetically modified (GM) crops, including Bt Corn, Bt Brinjal, and Golden Rice.
- Describe the concepts of antisense RNA and gene silencing in biotechnology.

- Discuss the genetic manipulation of industrially important yeast and Lactic Acid Bacteria (LAB).

**Unit IV**

- Fermentation- types of fermentation, Fermenters
- Waste utilization in industrial microbiology
- Biocolor: Technology of production, sources (Microbial & plant) and applications
- Bio-preservatives – types and applications
- Enzyme immobilization- methods and advantages. Industrial application of enzymes.

**Learning Outcomes:**

By the end of this unit, students should be able to:

- Define fermentation and categorize different types of fermentation processes.
- Explain the principles of waste utilization in industrial microbiology.
- Describe the technology of Biocolor production, sources (microbial & plant), and its applications.
- Classify various types of bio-preservatives and discuss their applications in food preservation.

**References:**


1. Frazier, W.C. (2014). Food Microbiology. McGraw Hill Education (India) Private Ltd.
2. Jay, J. (2012). Modern Food Microbiology. Springer Science & Business Media.
3. George J. Banwart. (2012). Basic Food Microbiology. Springer Science & Business Media, 2012
4. Pommerville, J.C. Alcoms. (2021). Fundamentals of microbiology. Jones & Bartlett Learning
5. Stainier. (1979). Introduction to Microbiology. Prentice-Hall
6. Ray, B., & Bhunia, A. (2013). Fundamentals of Food microbiology. CRC Press, 2013
7. Pelczar, Smith & Chan. (2009). Microbiology. Tata McGraw-Hill Education
8. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Banglore, India

9. Byong H. Lee. (2015). Fundamentals of Food Biotechnology. JohnWiley & Sons, Ltd
10. Buchanan, Jones, G. (2007). Biochemistry and molecular biology of plants. I.K. International Pvt. Ltd.
11. Adrian, S., Nigel W. S., Mark, R.F. (2008). Plant Biotechnology: The genetic manupilation of plants. Second Edition, Oxford University Press.

**FT23102CR**

**Food Chemistry (4+0+0)**

**Course description**

The "Food Chemistry" course at masters' level provides an in-depth exploration of the fundamental principles and concepts underlying the chemistry of food. It examines the chemical properties and interactions of key food components, including water, carbohydrates, proteins, lipids, and food additives. Through theoretical and practical approaches, students will gain a comprehensive understanding of how these chemical elements influence the composition, quality, safety, and sensory attributes of food products. This course serves as a foundation for advanced studies in food science and technology and equips students with the knowledge and skills necessary to analyze and manipulate food chemistry in the food industry.

**UNIT I**

- Water- solute interactions.
- Carbohydrates- Classification, Structure and functional properties of mono, oligo & poly-saccharides.
- Non- Enzymatic browning (NEB): Chemistry and factors affecting NEB.
- Polysaccharide solubility, viscosity and stability.
- Starch structure. Gelatinization and pasting properties.
- Industrially important polysaccharides like cellulose, pectic substances, Guar gum, locust bean gum, Xanthan gum, Carrageenans, & beta- glucan.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Describe the role of water-solute interactions in food systems.
- Classify carbohydrates and explain the structural and functional properties of mono, oligo, and poly-saccharides.
- Analyse the chemistry of Non-Enzymatic Browning (NEB) reactions and identify factors affecting NEB.
- Evaluate polysaccharide solubility, viscosity, and stability, with a focus on starch structure and gelatinization properties.

- Recognize the industrial importance of polysaccharides like cellulose, pectic substances, gums (e.g., Guar gum, Xanthan gum), carrageenans, and beta-glucan.

**UNIT II**

- Amino acid- Classification, structure and properties.
- Proteins: Classification, structure and forces involved in stability of protein structure.
- Protein denaturation, thermodynamics of denaturation and denaturing agents.
- Functional properties including hydration, solubility and interfacial properties.
- Nutritional properties of proteins: protein quality, digestibility, evaluation of protein nutritive value.

**Learning Outcomes (CLO):**

By the end of this unit, students should be able to:

- Classify amino acids and describe their structure and properties.
- Categorize proteins, explain their structure, and identify the forces involved in stabilizing protein structures.
- Analyze protein denaturation, understand the thermodynamics of denaturation, and discuss denaturing agents.
- Evaluate the functional properties of proteins, including hydration, solubility, and interfacial properties.
- Assess the nutritional properties of proteins, including protein quality, digestibility, and methods for evaluating protein nutritive value.

**UNIT III**

- Lipids: Classification, and nomenclature of saturated and unsaturated fatty acids.
- Physical properties of triacylglycerols - rheological, density, thermal and optical properties. Physicochemical transition of lipids – supercooling, nucleation, crystal growth, post crystallization events. Polymorphism in lipids.
- Isolation, purification and modification of lipids.
- Mechanism of oxidative rancidity and role of Prooxidants and antioxidants in lipid oxidation.

- Food lipids and health: Trans- fatty acids, omega fatty acids

**Learning Outcomes:**

By the end of this unit, students should be able to:

- Classify lipids and understand the nomenclature of saturated and unsaturated fatty acids.
- Analyze the physical properties of triacylglycerols, including rheological, density, thermal, and optical properties.
- Explain the physicochemical transitions of lipids, including supercooling, nucleation, crystal growth, and post-crystallization events.
- Describe the isolation, purification, and modification of lipids in food systems.
- Investigate the mechanisms of oxidative rancidity and the roles of prooxidants and antioxidants in lipid oxidation.
- Assess the impact of food lipids on health, including trans-fatty acids and omega fatty acids.

**UNIT IV**

- Food Additives: Definition, classification and safety aspects.
- Commonly used food additives like antioxidants, antimicrobials, colorants and artificial sweeteners
- Food Flavors: Molecular mechanism of flavor perception. Taste substances and nonspecific saporous sensations: Sweet, bitter, sour, salty, astringency, Kokumi, pungency, and cooling.
- Flavoring substances associated with fruits and vegetables, milk, spices and processed products.
- Encapsulation, retention and controlled release of flavor and aroma compounds.

**Learning Outcomes:**

By the end of this unit, students should be able to:

- Define food additives, classify them, and discuss safety aspects.
- Identify commonly used food additives, such as antioxidants, antimicrobials, colorants, and artificial sweeteners.

- Explain the molecular mechanism of flavor perception and describe taste substances and nonspecific saporous sensations.
- Recognize flavoring substances associated with fruits and vegetables, milk, spices, and processed products.
- Understand the principles of encapsulation, retention, and controlled release of flavor and aroma compounds in food systems.

**References:**


1. Owen R. Fennema. (2007). Food Chemistry. CRC Press
2. Meyer. (1960). Food Chemistry. Reinhold Publishing Corporation.
3. Wong. (2018). Mechanism & Theory in Food Chemistry. Springer International Publishing
4. Belitz, H. D. (2009). Food Chemistry. Springer Science & Business Media
5. John M. deMan. (2018). Principles of Food Chemistry. Springer International Publishing
6. Joshi, V. K. and Sing., R.K. (2012). Food Biotechnology principles & Practices. I. K. International Publishing House Pvt. Ltd., New Delhi, Banglore, India
7. Andrew J Taylor. (2010). Food Flavor Technology. Wiley Blackwell Publishing Ltd
8. Branen, A.L., Davidson, P.M., and Salminen, S. (2001). Food Additives. CRC Press

**FT23103CR**

**Food Processing Technology (4+0+0)**

**Course Description:**

The "Food Processing Technology" course at the master's level delves into advanced principles and practices in food preservation and processing. This comprehensive course explores various technologies and methods used in the food industry to extend shelf life, enhance food quality, and ensure food safety. Students will gain insights into traditional and cutting-edge food processing techniques, as well as their applications and significance in the modern food manufacturing landscape.

**UNIT I**

- Principles of Food Preservation
- Food Dehydration: Drying curves, factors affecting food dehydration, effect of dehydration on food quality. Types of driers.
- Evaporation: Single and multiple effect evaporators, Types of evaporators.
- Significance of water activity in shelf stability of foods. Intermediate moisture foods.
- Thermal processing: blanching, pasteurization, sterilization. Aseptic processing.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Understand principles of food preservation and their significance.
- Analyze drying curves and factors affecting food dehydration.
- Examine the impact of dehydration on food quality.
- Differentiate between types of driers used in food processing.
- Grasp the significance of water activity in determining shelf stability.
- Describe intermediate moisture foods.
- Master thermal processing techniques like blanching, pasteurization, sterilization, and aseptic processing.

**UNIT II**

- Food Irradiation– Principle, mechanism and applications in foods. Safety concerns.

- Refrigeration and freezing: Principle of refrigeration, freezing curve. Types of freezers, Freezing and chilling injuries.
- Membrane processing–types of membranes, equipments, applications in foods, Advantages.
- Minimally processed foods– Preservation and packaging of minimally processed foods.
- Chemical preservatives.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Explain principles and mechanisms of food irradiation.
- Assess applications of food irradiation and associated safety concerns.
- Describe principles of refrigeration, freezing curves, and types of freezers.
- Evaluate potential freezing and chilling injuries in food products.
- Understand membrane processing techniques, types of membranes, and equipment.
- Discuss advantages of membrane processing in food production.
- Analyze preservation and packaging methods for minimally processed foods.
- Understand the use and role of chemical preservatives in food processing.

**UNIT III**

- High Pressure Processing of Foods: Concept of high-pressure processing, effects of pressure on microorganisms and its application in food processing.
- Ultrasonic in Food Processing: Properties and generation of ultrasonic, Cavitation, Ultrasonics as a processing technique.
- Cold plasma for Food Processing – Principle and generation of cold plasma. Application of cold plasma Technology.
- Pulse electric field - Principle, PEF system, Mechanism of microbial inactivation, Factors effecting pulse electric field efficiency. Applications of PEF.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Investigate the concept and applications of high-pressure processing of foods.
- Understand properties and generation of ultrasonic waves and their applications.
- Explain principles and generation of cold plasma for food processing.
- Describe pulse electric field (PEF) principles, components, and applications.

**Unit IV**

- Ohmic heating – principles and applications.
- Microwave processing–mechanism, equipment and applications.
- Supercritical Fluid Extraction: Properties of super critical fluids, Principle and applications in Food Processing.
- Micronization in food processing- techniques and benefits

**Learning outcomes:**

By the end of this unit, students should be able to:

- Grasp the principles and applications of ohmic heating.
- Analyze the mechanism, equipment, and applications of microwave processing.
- Understand properties of supercritical fluids and their applications in food processing.
- Explore micronization techniques and their benefits in food processing.

**References:**

1. P. Fellows. (2022). Food Processing Technology. Woodhead Publishing
2. Desrosier. The Technology of Food Preservation. AVI Publishing Company, 1959
3. Potter, N.N. (2013). Food Science. Springer Science & Business Media
4. Introduction to Food Science and Technology by Stewart. Elsevier 2012
5. Handbook of Food Preservation by M. Shafiur Rahman. CRC Press 2020
6. Novel Food Processing Technologies by Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. CRC Press 2004

**FT23104CR**

**Food Packaging (3+0+1)**

**Unit I**

- Definition and functions of packaging.
- Types of packaging used in foods-chemistry and applications.
- Properties of packaging materials - Barrier properties - gas transmission rate (GTR) and water vapour transmission rate (WVTR); Mechanical properties. Migration
- Metals: Tinplate containers, tinning process, Low tin steels, tin free steel (TFS). Can-manufacturing, types and lacquering.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Define packaging and its functions in the context of the food industry.
- Describe different types of packaging materials used in the food industry.
- Analyze the chemistry of packaging materials and their applications.
- Understand the properties of packaging materials, including barrier properties, gas transmission rate (GTR), water vapor transmission rate (WVTR), and mechanical properties.
- Examine migration issues related to packaging materials.
- Explore metals used in food packaging, such as tinplate, tinning processes, low tin steels, and tin-free steel (TFS).
- Understand can manufacturing processes, types of cans, and lacquering techniques.

**Unit II**

- Glass and paper packaging.
- Plastics: Polymer processing methods.
- Innovative technologies in food packaging: active packaging & intelligent packaging.
- Biodegradable and Edible packaging. Concept of green plastics and nanosensors.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Explain modified and controlled atmospheric packaging principles, designs, and applications.
- Utilize shelf-life assessment and prediction methodologies for food products.
- Identify specific packaging requirements for dairy, cereal, meat, spices, fruits, and vegetables.
- Understand food packaging regulations and labeling practices.

**Unit III**

- Modified and controlled atmospheric packaging: Design and application.
- Shelf –life assessment and prediction methodologies.
- Packaging requirements- Dairy, cereal, meat, spices, fruit & vegetable.
- Food packaging- regulations and labeling.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Explain modified and controlled atmospheric packaging principles, designs, and applications.
- Utilize shelf-life assessment and prediction methodologies for food products.
- Identify specific packaging requirements for dairy, cereal, meat, spices, fruits, and vegetables.
- Understand food packaging regulations and labeling practices.

**Unit IV (Practical)**

1. Identification of films
2. Determination of WVTR and OTR of packages
3. Determination of shelf life of packaged foods
4. Porosity of tinplate
5. Shrink and vacuum packaging of different foods.

**Learning outcome:**

By the end of this unit, students should be able to:

- Identify different packaging films used in the food industry.

- Determine water vapor transmission rates (WVTR) and oxygen transmission rates (OTR) of food packages.
- Evaluate the shelf life of packaged food products.
- Assess the porosity of tinplate materials.
- Gain practical experience in shrink and vacuum packaging techniques for various food products.

**References:**


1. Food Packaging Principles by Gorden Robertson. CRC Press 2005
2. Handbook of Food Packaging by Paine and Paine. (2012). Springer Science & Business Media
3. Food Packaging- Science & Technology by Lee. (2008). Taylor & Francis
4. Innovations in Food Packaging by Jung M. Han. (2014). Academic Press
5. Principles of Food Packaging by Saccharow and Griffin. AVI Publishing Company, 1980
6. Innovations in Food Packaging by Jung H. Han. Elsevier, 2005

**FT23101DCE**

**Food Engineering (3+0+1)**

**Unit I**

- Material and energy balance: Basic principles, total mass and energy balance, numerical problems based on dilution, concentration, dehydration, and energy balance.
- Modes of heat transfer- conduction, convection and radiation.
- Thermal process calculations- D value, Z value, F value for canned foods.
- Heat Exchangers: Design, types and applications.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Apply the principles of material and energy balance in food engineering.
- Solve numerical problems related to dilution, concentration, dehydration, and energy balance.
- Understand the modes of heat transfer, including conduction, convection, and radiation.
- Perform thermal process calculations, including D value, Z value, and F value for canned foods.
- Describe the design, types, and applications of heat exchangers.

**Unit II**

- Types of evaporators- Design of Single effect and multiple effect evaporators.
- Refrigeration– Principle, refrigeration cycle, Thermodynamics of refrigeration
- Psychometric charts and their application.
- Rheological studies: Viscosity, Newtonian and non-Newtonian fluids, Storage and loss Modulus and its applications in foods. Concept of Farinograph, Amylograph, Rheometer, and texture analyzer.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Differentiate between various types of evaporators and design single effect and multiple effect evaporators.

- Explain the principles of refrigeration, the refrigeration cycle, and the thermodynamics of refrigeration.
- Utilize psychometric charts for food engineering applications.
- Analyze rheological properties, including viscosity, Newtonian and non-Newtonian fluids, and storage and loss modulus.
- Understand the concepts and applications of Farinograph, Amylograph, Rheometer, and texture analyzer.

**Unit III**

- Size reduction – Elastic stress limit, yield point, Kicks law, Rittengers law, Bonds law.
- Equipment for fibrous, dry and liquid foods.
- Mixing – Theory of solids mixing, theory of liquids mixing, equipment for low, medium and high viscosity foods.
- Separation Processes: Sedimentation, Filtration, Centrifugal Separation.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Evaluate size reduction processes using concepts such as elastic stress limit, yield point, Kicks law, Rittengers law, and Bonds law.
- Identify equipment suitable for processing fibrous, dry, and liquid foods.
- Describe the theory of solids mixing and the theory of liquids mixing.
- Select appropriate equipment for low, medium, and high viscosity foods.
- Understand separation processes, including sedimentation, filtration, and centrifugal separation.

**Unit IV**

- To study drying rate characteristics of different food materials.
- Determination of freezing curve and freezing time of selected food material.
- Demonstration of steam distillation.
- To study particle size by using sieve analysis.

**Learning outcomes:**

By the end of this unit, students should be able to:

- Study the drying rate characteristics of different food materials.
- Determine freezing curves and freezing times for selected food materials.
- Perform steam distillation demonstrations.
- Conduct particle size analysis using sieve analysis techniques.

**References:**


1. Introduction to Food Engineering by R.P. Singh and D.R. Heldman. Academic Press, 2013
2. Fundamentals of Food Process Engineering by R.T. Toledo. Springer Science & Business Media, 2007
3. Industrial Engineering and Management by O. P. Khanna. Dhanpat Rai, 1980
4. Food Processing Technology by P. Fellows. (2022). Woodhead Publishing

**FT23102DCE**

**Experiments in Food Chemistry (Practical) (0+0+2)**

1. Preparation and standardization of solution.
2. Proximate analysis of foods.
3. Qualitative tests for Carbohydrates
4. Protein separation and characterization using SDS-PAGE electrophoresis
5. Smoke, Flash and Fire points of oils and fats
6. Determination of free fatty acids
7. Peroxide value and TBA for measuring lipid oxidation
8. Estimation of Total phenolic content
9. Pasting properties of starches using RVA.
10. Sensory methods for measuring food attributes- Difference tests and Rating tests.
11. Determination of adulterants in milk, ghee, edible oil, chillies, honey.

**References**


1. Handbook of Analysis and Quality Control for Fruit and Vegetable products by Ranganna. Tata McGraw-Hill, 1986
2. Food Analysis by S. Suzanne Nielsen. (2017). Springer Science & Business Media
3. Chemical Analysis of Foods and Food Products by Jacobs, Morris B. (1939). New York,: D. Van Nostrand company, inc.
4. Physical Properties of Food by R.Jowitt & Fescher. (1983)
5. Sensory Evaluation Practices by Stone. (2012). Elsevier Science

**FT23103DCE**

**Experiments in Microbiology (Practical) (0+0+2)**

1. Microscopy.
2. Techniques of inoculation.
3. Staining techniques-gram staining, Positive staining, Negative staining.
4. Enumeration of micro-organisms– TPC, Yeast and mould count, ANPC.
5. PCR
6. Production of biocolors
7. Identification of bacteria on the basis of:
    a. Cultural characteristics
    b. Morphological characteristics
    c. Biochemical characteristics -Indole Test/ MVIC test, Starch-hydrolysis, Oxidase Test, TSI test, Coagulase test, Catalase test

**References**


1. Textbook of Practical Microbiology by Subhash Chandra Parija. Elsevier 2016
2. Laboratory Manual in Microbiology by Gunasekaran. (2007). New Age International (P) Limited
3. Bergey's Manual of Systematic Bacteriology. (2012). Springer New York.

**FT23001GE**

**INTRODUCTORY LIPID TECHNOLOGY (2+0+0)**

**UNIT 1**

- Lipids-classification and sources
- Nomenclature of saturated and unsaturated fatty acids
- Physicochemical properties of Lipids.
- Extraction and rendering of lipids- Physical and chemical refining
- Hydrogenation, interesterfication and Winterization of oils

**UNIT II**

- Chemistry of frying of oils- physical and chemical changes. Decomposition products
- Mechanism of Lipid oxidation
- Factors affecting lipid oxidation
- Role of prooxidants and antioxidants
- Fat replacements

**References**


1. Food Lipids: Chemistry, nutrition and biotechnology by Casimer C. Akoh and David B. Min (2017). CRC Press
2. Fats and oils by Richard D-O' Brien. (2008). CRC Press
3. Food Chemistry, Third Edition. Hong Kong: Taylor & Francis, 1996.
4. Bailey's Industrial Oil and Fat Products, 7 Volume Set. United Kingdom: Wiley, 2020.

**FT23002OE**

**ELEMENTARY FOOD PROCESSING (2+0+0)**

**Unit – I**

- Status of Indian food industry– Exports scenario of fruits, vegetables, spices, and their processed products; Driving forces for food industry and constraints
- Causes of food spoilage.
- Thermal Processing – Canning, Sterilization, Pasteurization, Asceptic processing.
- Preservation by low temperature- Refrigeration and Freezing

**Unit–II**

- Concept of water activity; Intermediate moisture foods.
- Fermentation– Types, nutritional importance of fermented foods.
- Hurdle Technology
- Controlled atmospheric storage – Principle, design considerations, effects of CA storage on food quality.

**References:**

1. Fellows, P.J. Food Processing Technology: Principles and Practice. United Kingdom: Elsevier Science, 2009.

2. Desrosier, J. N.. Technology of Food Preservation. India: CAB Publishers., 1998.

3. Potter, Norman N. Food Science. United States: Avi Publishing Company, 1973.

4. Stewart, George. Introduction to Food Science and Technology. United States: Elsevier Science, 2012.