Choice Based Credit System

Scheme & Syllabus of

Master of Science in Food Technology

M.Sc. Food Technology

Batch 2024 onwards

By

Board of Study Food Science and Engineering

Department of Academics

I.K. Gujral Punjab Technical University

Vision:

To create competent professionals those, contribute towards the economic development of the nation by going in line with the policy of Government of India in the field of food processing food safety and security.

Mission:

- Development of human resources in the field of food science and technology to serve the cause of the nation
- Providing a strong theoretical and practical background across the food science discipline with an emphasis on developing sustainable resources to cater to food and nutrition-related challenges
- Development of human resources in the area of clinical nutrition and research to contribute effectively to making India healthy
- Create a favorable environment for innovation to translate theoretical knowledge into practical applications
- Inculcating professional ethical values, innovative research capabilities, and leadership abilities
- Holistic development of the youth through the process of self-evaluation and continuous improvement

Program Name:	Master of Science in Food Technology **Or** M.Sc. in Food Technology
Program Level	Postgraduate (PG) Program
Duration	2 years (4 Semesters)
Eligibility for Admission	Passing of Bachelor of Science / Applied Science in any subject/ B. Tech Food Technology / Biotechnology/ Sugar Technology/ Sugar and Alcohol Technology/ Fermentation Technology / Dairy Technology/ B.Voc. Food Science and Technology or any Allied Field/Agri-Food Technology/Food Processing/ Bachelor in Hotel Management and Catering Technology or any other examination recognized equivalent thereto with atleast 50% marks in aggregate
Year of Implementation	New Syllabus will be implemented from 2024 onwards.
Medium of Instruction	English

Program Education Objectives (PEOs):

POE1	**Technical Proficiency:** Students will demonstrate advanced knowledge and technical skills in food technology, encompassing food processing, preservation, and safety, enabling them to address complex challenges in the food industry.
POE2	**Research and Innovation:** Students will engage in cutting-edge research and innovation, contributing to the development of sustainable and efficient food technologies, while keeping abreast of emerging trends and scientific advancements.
POE3	**Professional Development**: Students will exhibit strong leadership, ethical practices, and effective communication skills, preparing them for successful careers in academia, industry, and regulatory bodies within the food sector.
POE4	**Global Competence:** Students will be equipped with a global perspective on food technology issues, understanding international standards, regulations, and market dynamics, allowing them to thrive in diverse and multicultural environments.
POE5	**Problem-Solving Excellence in Food Science and Technology:** Students will possess the capability to identify, formulate, and solve complex problems in food science and technology, ensuring innovative and effective solutions for industry challenges.

Program Outcomes (POs):

PO1	Students will demonstrate advanced knowledge and technical skills in food technology, focusing on food processing, preservation, and safety to tackle industry challenges.
PO2	Students will engage in cutting-edge research, developing sustainable and efficient food technologies, and staying updated with emerging scientific advancements.
PO3	Students will exhibit strong leadership, ethical practices, and effective communication, preparing for careers in academia, industry, and regulatory bodies.
PO4	Students will understand international food technology standards, regulations, and market dynamics, thriving in diverse and multicultural environments.
PO5	Students will have ability to identify, formulate, and solve food science and technology problems

Mapping of Program Outcomes with Program Education Objectives: -

POE / PO	POE1	POE2	POE3	POE4
PO1	**3**	**2**	**1**	**1**
PO2	**2**	**3**	**1**	**1**
PO3	**1**	**1**	**3**	**2**
PO4	**1**	**1**	**2**	**2**
PO5	**1**	**1**	**2**	**3**

Course Type Coding:

DSC	Discipline Core
DSE	Discipline Elective
QP-NOS	Qualification Pack - National Occupational Standards.
SEC-SB	Skill Enhancement Course- Skill Based
SEC-VB	Skill Enhancement Course- Value Based
AECC	Ability Enhancement Course
OE	Open Elective

Important Notes:

1. Theory courses will be of 04 hours and practical will be of 04 hours duration per week. For all lecture courses, one credit per lecture/week/semester will generally be adopted. One laboratory hour per week per semester will be assigned half credit.
2. No elective course will be run unless the number of students registered for the elective course is five or more.

Table of content

SEMESTER- I

Program Scheme & Syllabus

Semester I

Course Code	Course Title	Course Type	Load			Marks Distribution		Total	Credits
			L	T	P	Internal	External		
MSFT411-24	Principles of Food Science	DSC	4	0	0	40	60	100	4
MSFT412-24	Food Processing & Preservation	DSC	4	0	0	40	60	100	4
MSFT413-24	Food Analysis and Preservation (Lab)	DSC	0	0	4	30	20	50	2
MSFT414-24	Food Microbiology	DSC	4	0	0	40	60	100	4
MSFT415-24	Food Microbiology (Lab)	DSC	0	0	4	30	20	50	2
FIC/Q9005	Industrial Production Worker – Food Processing[#]	QP-NOS	4	0	0	40	60	100	4
SEC111-24	Digital Fluency	SEC-SB	4	0	0	40	60	100	4
SEC112-24	Digital Fluency (Lab)	SEC-SB	0	0	4	30	20	50	2
MSFT416-24	Industrial Visit and FoSTaC course	AECC	0	0	3	40[##]	--	40	3
	Total		**20**	**0**	**15**	330	360	690	29

[#] Students will learn the practical application of Industrial Production Worker – Food Processing skills in the food industry through industrial visits in first semester and summer training after their first year.

FoSTaC - Basic Manufacturing course must be completed from https://www.skillindiadigital.gov.in/home or any FSSAI recognized Training center

MSFT411-24: Principles of Food Science

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

Introduce students to the fundamentals of food science, including its historical development and composition, structure, and nutritional value of foods derived from plants and animals.

Course outcome: At the end of the course, the students will be able to

CO1	Explain the basics of food science and technology, and the status of the food industry in India and globally.
CO2	Analyze the functions and changes of nutrients during food processing and storage.
CO3	Describe the properties of water and its impact on food quality and spoilage.
CO4	Evaluate the composition, nutritional value, and processing techniques of plant-based foods.
CO5	Assess the composition, nutritional value, and processing effects on animal-based foods and understand the concept of healthy foods.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	3	2
CO2	3	3	2	2	3
CO3	2	2	1	1	3
CO4	3	2	2	2	3
CO5	3	2	2	2	3

Details of the Course Content - Principles of Food Science (MSFT411-24)

Unit	Contents	Contact Hours
I	**Introduction to Food Science and Fundamentals** **1. Introduction to Food Science, Food Technology, and Food Engineering:** Overview of food science, its importance, and interdisciplinary nature; Distinctions and interrelationships between food science, food technology, and food engineering **2. Status of the Food Industry in India and Abroad:** Current trends and statistics of the food industry in India; Comparison with global food industry trends; Key challenges and opportunities in the food industry **3. Nutrients and Functions of Food:** Carbohydrates, Proteins, Lipids, Vitamins, Minerals**:** Types, functions, dietary sources, importance in the diet, and Changes in nutrient composition during food processing and storage **4. Physical Properties of Water and Ice:** Chemical nature and structure of the water molecule; Physical properties of water and ice; Absorption phenomena and types of water solutions; Colligative properties of water; Distinction between free and bound water; Water activity and its role in food spoilage; Freezing and ice structure: Impact on food preservation and quality	12
II	**Food Dispersions and Plant-Based Foods** **1. Food Dispersions:** Introduction to food dispersions; Structure and classification of different types of food dispersions (e.g., solutions, suspensions, emulsions, gels); Stability factors and mechanisms affecting food dispersions **2. Cereals and Millets:** Definition, types, composition, nutritional value, structure (Wheat and rice), factors affecting and changes in major cereals and millets during processing (cooking and germination) **3. Pulses:** Definition, types, composition, nutritional value, factors affecting and changes in major pulses during processing (Soaking, Germination, Decortication, Cooking, Fermentation); Identification and implications of antinutritional factors in pulses	11
III	**Composition and Nutritive Value of Plant-Based Foods** 1. **Nuts & Oilseeds:** Definition, types, composition, and nutritional value of nuts and oilseeds; Processing techniques for oilseeds such as soybeans and coconut; Production and applications of protein isolates and texturized vegetable protein (TVP) 2. **Fruits & Vegetables:** Definition, classification, composition, and nutritional value of fruits and vegetables; Vegetable cookery: Techniques and nutritional implications; Changes in fruits and vegetables during maturation, ripening, storage, and cooking;	11

	Concept and mechanisms of enzymatic browning in fruits and vegetables 3. **Spices & Herbs:** Definition, classification, composition, and nutritional value of spices and herbs; Culinary and preservative uses of spices and herbs; Overview of essential oils and oleoresins: Extraction, properties, and applications.	
IV	**Composition and Nutritive Value of Animal-Based Foods and Health Foods** 1. **Eggs:** Structure, composition and nutritional value of eggs; Grading and quality assessment of egg; Changes in eggs during cooking and storage 2. **Meat & Fish:** Structure, types, composition and nutritional value of meat and fish; Different processing methods and their effects on meat and fish quality and nutritional value 3. **Dairy Products:** Definition, types, composition, nutritional value of milk; Overview of different types of market milk and milk products; Changes during milk processing such as pasteurization and homogenization; Storage and its effects on milk and milk products 4. **Health Foods:** Functional foods and nutraceuticals; definition, classification and their role in health; Organic foods: Definition and advantages; Genetically modified (GM) foods: Concept and Implications.	14

Recommended Books and Resources

1. Potter, N. N., & Hotchkiss, J. H. (1998). Food science (5th ed.). Springer.
2. DeMan, J. M. (2014). Principles of food chemistry (4th ed.). Springer.
3. Manay, N. S., & Shadaksharaswamy, M. (2009). Food facts and principles. New Age International.
4. Srilakshmi, B. (2016). Food science (4th ed.). New Age International.
5. Frazier, W. C., & Westhoff, D. C. (2008). Food microbiology (5th ed.). Tata McGraw-Hill Education.
6. Fellows, P. J. (2017). Food processing technology: Principles and practice (4th ed.). Woodhead Publishing.
7. De, S. (2015). Outlines of dairy technology (3rd ed.). Oxford University Press.
8. Vaclavik, V. A., & Christian, E. W. (2014). Essentials of food science (4th ed.). Springer.
9. Mudambi, S. R., & Rao, S. M. (2007). Food science. Oxford University Press
10. Singh, R. P., & Heldman, D. R. (2014). Food engineering: Fundamentals and applications (2nd ed.).
11. Sharma, D. (2018). The food industry in India: Challenges and opportunities.
12. Whitney, E. N., & Rolfes, S. R. (2018). Understanding nutrition (15th ed.).
13. McCain, V. B. (2010). Water in foods.
14. Walstra, P. (2003). Physical chemistry of foods.
15. Fennema, O. R. (Ed.). (1996). Food chemistry (3rd ed.).
16. deMan, J. M. (1999). Principles of food chemistry (3rd ed.). Springer.
17. Grumezescu, A. M., & Holban, A. M. (Eds.). (2019). Handbook of plant-based food and beverage technology.
18. Li, T. S. C. (2006). Vegetables and fruits: Nutritional and therapeutic values.
19. Walstra, P., Wouters, J. T. M., & Geurts, T. J. (2006). Dairy science and technology (2nd ed.).
20. Warriss, P. D. (2010). Meat science: An introductory text (2nd ed.).

21. Garg, M. L., & Berry Ottaway, P. (Eds.). (2011). Functional foods: Principles and technology.
22. Hui, Y. H. (Ed.). (2006). Handbook of food science, technology, and engineering (Vols. 1-4).
23. Brennan, J. G. (Ed.). (2006). Food processing handbook.
24. Hui, Y. H., Meunier-Goddik, L., Josephsen, J., Nip, W.-K., Stanfield, P. S., & Lam, A. S. T. (Eds.). (2004). Handbook of food and beverage fermentation technology.
25. Shortt, C., & O'Brien, J. (Eds.). (2004). Handbook of functional dairy products.
26. Shetty, K., Paliyath, G., Pometto, A., & Levin, R. E. (2008). Food biotechnology (2nd ed.). CRC Press.
27. Bagchi, D., Misra, L. K., Bagchi, M., & Kothari, S. C. (Eds.). (2014). Nutraceutical and functional food processing technology (2nd ed.). CRC Press.

MSFT412-24: Food Processing & Preservation

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

Equip students with comprehensive knowledge of historical and modern food preservation techniques, including thermal and non-thermal methods, microbial control, and emerging technologies, to enhance food safety, quality, and shelf life.

Course outcome: At the end of the course, the students will be able to

CO1	Understand the historical evolution and principles of food preservation, recognizing its importance in extending shelf life and ensuring food safety.
CO2	Classify various types of foods based on perishability and comprehend the factors influencing their shelf life.
CO3	Identify and explain different types of food spoilage and contaminants, and understand the role of microorganisms in food preservation.
CO4	Analyze and apply thermal and non-thermal preservation methods to maintain food quality and safety.
CO5	Evaluate emerging preservation technologies and their impact on food quality and microbial control.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	3	2
CO2	2	2	1	2	3
CO3	3	2	1	2	3
CO4	3	3	2	2	3
CO5	3	3	2	2	3

Details of the Course Content - Food Processing & Preservation (MSFT412-24)

Unit	Contents	Contact Hours
I	**Introduction to Food Preservation** **1. Food Preservation:** Historical Perspectives**:** Early methods of food preservation; Evolution of food preservation technologies; Principles of Food Preservation: Importance and objectives of food preservation. **2. Types of Foods and Shelf Life:** Classification of foods: Perishable foods, Semi-perishable foods, Shelf-stable foods; Definition of shelf life **3. Food Spoilage and Contaminants:** Concept and types of spoilage (biological, chemical, physical); Concept, sources and types of contaminants. **4. Food Microbiology:** Microorganisms associated with foods: bacteria, yeast, mold and their importance in the food industry; Classification and growth curve of microorganisms; Food infection and food intoxication.	11
II	**Thermal Preservation Methods** **1. Heat Processing:** Thermal Processing: Principles of thermal processing, Thermal resistance of microorganisms, Thermal Death Time and Lethality concept, Characterization of heat penetration data, Thermal process calculations; Commercial Heat Preservation Methods: Sterilization and commercial sterilization, Pasteurization and Blanching. Effect of thermal processing on food. Process of canning, Equipment and materials used, Safety and quality control in canning. **2. Microwave and Ohmic Heating:** Mechanisms and applications, Advantages and limitations. Effects of microwave and ohmic heating on food. **3. Drying and Dehydration:** Definition, Principles of drying, heat and mass transfer, factors affecting rate of drying, normal drying curve, Types of dryers; Impact on food quality. Psychrometric Charts: Introduction, Data Interpretation and Application. **4. Evaporation:** Definition and factors affecting evaporation, Types of evaporators used in the food industry	13
III	**Non-Thermal Preservation Methods** **1. Food Preservation by Low Temperature:** Introduction to refrigeration, cool storage, and freezing; Refrigeration: Mechanism and effects on microbial growth, Types of refrigeration systems; Freezing: Principles and equipment, Types of freezing (slow, fast, cryogenic), Freezing curve and quality changes during freezing and storage, Introduction to thawing and its effects on food. **2. Chemical Preservation:** Types of preservatives, GRAS (Generally Recognized As Safe) substances, Use of chemical preservatives, Safety and regulatory aspects. **3. Biological Preservation:** Fermentation definition, Principles and benefits, Types of fermented foods.	12

	4. Modified Atmosphere Packaging (MAP): Definition, Principles and techniques, Applications and advantages.	
IV	**Emerging Technologies** **1. Pulsed Electric Fields (PEF):** Principles and applications, Effects on microorganisms and food quality. **2. Irradiation:** Mechanisms and types (gamma rays, X-rays, electron beams), Safety and regulatory concerns. **3. High-Pressure Processing (HPP):** Principles and mechanisms, Impact on microorganisms and food quality, Applications and limitations **4. Cold plasma technology:** Principles and potential applications,	12

Recommended Books and Resources

1. Potter, N. N., & Hotchkiss, J. H. (1998). Food Science (5th ed.). Springer.
2. Desrosier, N. W., & Desrosier, J. N. (1987). The Technology of Food Preservation (4th ed.). AVI Publishing Company.
3. Fellows, P. (2009). Food Processing Technology: Principles and Practice (4th ed.). Woodhead Publishing.
4. Rahman, M. S. (2020). Handbook of Food Preservation (3rd ed.). CRC Press.
5. Hui, Y. H. (2006). Handbook of Food Science, Technology, and Engineering (Vol. 4). CRC Press.
6. Barbosa-Cánovas, G. V., & Juliano, P. (2008). Food Engineering: Thermal Processing Systems. Springer.
7. Singh, R. P., & Heldman, D. R. (2022). Introduction to Food Engineering (6th ed.). Academic Press.
8. Heldman, D. R., & Lund, D. B. (2006). Handbook of Food Engineering (2nd ed.). CRC Press.
9. Leistner, L., & Gorris, L. G. M. (1995). Food Preservation by Combined Processes. CRC Press.
10. Gould, G. W. (2000). New Methods of Food Preservation. Springer.
11. Zhang, H. Q., Barbosa-Cánovas, G. V., Balasubramaniam, V. M., Dunne, C. P., Farkas, D. F., & Yuan, J. T. C. (2011). Nonthermal Processing Technologies for Food. Wiley-Blackwell.
12. Hendrickx, M., & Knorr, D. (2001). Ultra High Pressure Treatments of Foods. Springer.
13. Barbosa-Cánovas, G. V., Tapia, M. S., & Cano, M. P. (2004). Novel Food Processing Technologies. CRC Press.
14. Rosenthal, I. (2010). Pulsed Electric Fields Technology for the Food Industry. Springer.
15. Heldman, D. R. (2023). Food Preservation Process Design. Springer.
16. Ghosh, D., & Kumar, A. (2024). Emerging Technologies in Food Preservation. Wiley-Blackwell.
17. Datta, A. K. (2023). Food Processing and Preservation. CRC Press.
18. Smith, J. P., & Hongshun, Y. (2022). Food Processing: Principles and Applications (3rd ed.). Wiley-Blackwell.

MSFT413-24: Food Analysis and Preservation (Lab)

Total marks: 50	**L**	**T**	**P**
	0	**0**	**4**

Course objective:

To equip students with practical skills and comprehensive knowledge in the analysis and preservation of food products, ensuring proficiency in laboratory techniques, safety protocols, and quality evaluation methods essential for preserving the food products in the food technology field.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate proficiency in using laboratory equipment and adhering to safety protocols in a food testing lab.
CO2	Apply fundamental techniques for food sampling, preparation, and proximate as well as physio-chemical analysis.
CO3	Perform microbial analysis, including total plate count, coliform, and E. coli detection, to ensure food safety and quality.
CO4	Evaluate the quality characteristics of various food products preserved by methods such as drying, freezing, blanching, pickling, and canning.
CO5	Compare and contrast conventional and modern food processing methods, and analyze their effects on the nutritional and microbial stability of food products.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	2	3
CO2	3	2	1	2	3
CO3	3	2	1	2	3
CO4	3	2	2	2	3
CO5	3	3	2	2	3

Details of the Course Content - Food Analysis and Preservation (Lab) (MSFT413-24)

Practical no.	Contents	Contact Hours
1*	Overview of the laboratory processes	1
2*	Introduction to the quality analysis process	1
3*	Attributes of an assistant lab technician -Food and Agricultural Commodities and laboratory ethics	1
4*	Prepare and Maintain Work Area and Equipment for Food Lab Testing (FIC/N7601)	1
5*	Prepare for Quality Analysis and Manage Housekeeping for Food Lab Activities (FIC/N7602)	1
6*	Food Safety, Hygiene and Sanitation for Food Lab Testing (FIC/N7605)	1
7*	Sampling and Quality Analysis for Food Lab Activities (FIC/N7603)	2
8*	Complete Documentation and Record Keeping Related to Performing Lab Activities (FIC/N7604)	2
9	Moisture and ash content determination in food samples (Gravimetric method).	2
10	Determination of pH in Various Foods Using pH Meter	2
11	Determination of protein content (Kjeldahl method).	2
12	Estimation of fat content (Soxhlet extraction method).	2
13	Determination of dietary fibre content in food samples.	2
14	Estimation of total carbohydrate content in food samples (Titrimetric or spectrophotometric method).	2
15	Identification and Classification of Cereals and Millets.	2
16	Quality Evaluation of Spices and Condiments.	2
17	Quality Characteristics of Foods Preserved by Drying/Dehydration.	2
18	Quality Characteristics of Frozen Foods.	2
19	Blanching of Vegetables and Its Effects.	2
20	Pickling Process and Quality Analysis.	2
21	Comparison of Conventional and Microwave Processing of Foods.	2
22	Preservation of Food by Canning and Cut-Out Analysis.	2

*Mandatory to teach from FIC/Q7601 manual

Recommended Books and Resources

1. FICSI. FIC/Q7601- Assistant Lab TechnicianFood and Agricultural Commodities.
2. Food Safety and Standards Authority of India (FSSAI). (n.d.). Manual of Methods of Analysis for Various Food Products. Retrieved from https://fssai.gov.in/cms/manuals-of-methods-of-analysis-for-various-food-products.php.
3. Food Analysis Laboratory Manual (In-house developed manual with specific methods).
4. American Public Health Association, American Water Works Association, & Water Environment Federation. (2017). Standard Methods for the Examination of Water and Wastewater (23rd ed.). Washington, DC: American Public Health Association.
5. Food Safety and Standards Authority of India (FSSAI). (2018). Manual on Food Safety Laboratory Practices. New Delhi, India: FSSAI.
6. International Organization for Standardization (ISO). (n.d.). ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories**.** Geneva, Switzerland: ISO.
7. AOAC International. (2019). Official Methods of Analysis of AOAC International (21st ed.). Gaithersburg, MD: AOAC International.
8. Prosky, L., Asp, N.-G., Schweizer, T. F., DeVries, J. W., & Furda, I. (1985). Determination of Insoluble, Soluble, and Total Dietary Fiber in Foods and Food Products: Interlaboratory Study. *Journal of the Association of Official Analytical Chemists*, *68*(4), 677-679.

9. American Spice Trade Association. (2000). ASTA Method of Analysis. Washington, DC: American Spice Trade Association.
10. Nielsen, S. S. (Ed.). (2010). *Food analysis* (4th ed.). Springer.
11. Sarker, D. K., & Nahar, N. (Eds.). (2016). *Handbook of food analysis* (3rd ed.). CRC Press.
12. BeMiller, J. N., & Whistler, R. L. (Eds.). (2009). *Carbohydrate chemistry for food scientists* (3rd ed.). AACC International.
13. Yanniotis, S., & Taoukis, P. (Eds.). (2013). *Food process monitoring and control* (1st ed.). Woodhead Publishing.
14. Wrolstad, R. E., Acree, T. E., Decker, E. A., Penner, M. H., Reid, D. S., Schwartz, S. J., Shoemaker, C. F., & Smith, D. M. (Eds.). (2019). *Handbook of food analytical chemistry* (1st ed.). Wiley.
15. Valero, D., & Valverde, J. M. (Eds.). (2012). *Postharvest biology and technology of horticultural crops: Principles and practices for quality maintenance* (1st ed.). Woodhead Publishing.
16. Nollet, L. M. L., & Toldrá, F. (Eds.). (2012). *Handbook of analysis of active compounds in functional foods* (1st ed.). CRC Press.
17. Smith, J. L., & Charter, E. R. (Eds.). (2012). *Food chemical safety* (1st ed.). Springer.
18. Velasco, V., & Meléndez-Martínez, A. J. (Eds.). (2010). *Handbook of food science, technology, and engineering* (4th ed.). CRC Press.
19. Nielsen, S. S. (Ed.). (2016). *Food analysis laboratory manual* (2nd ed.). Springer.

MSFT414-24: Food Microbiology

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

To comprehensively understand the role, significance, and classification of microorganisms in food, their growth, nutrition, and impact, along with advanced practices for preservation, microbial inactivation, factors affecting microbial proliferation, spoilage, fermentation, public health implications, and adherence to food safety standards.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate an understanding of the historical developments, classification systems, and differentiation between procaryotes and eucaryotes in microbiology.
CO2	Analyze the types of microorganisms associated with food and their impact on food contamination, spoilage, and safety during handling and processing.
CO3	Identify intrinsic and extrinsic factors affecting microbial growth and apply advanced preservation techniques to control food spoilage.
CO4	Evaluate the role and significance of fermentation in food microbiology, including the production of fermented foods and beverages.
CO5	Assess public health implications of foodborne illnesses, microbial toxins, and implement food safety standards such as HACCP and hurdle technology.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	2	2
CO2	3	2	1	2	3
CO3	3	2	1	2	3
CO4	3	2	2	2	3
CO5	3	2	2	2	3

Details of the Course Content - Food Microbiology (MSFT414-24)

Unit	Contents	Contact Hours
I	Introduction to microbiology: Historical developments, Classification – A brief account, basis of classification. Three and five kingdom classification, Procaryotes and Eucaryotes. Microbial growth and nutrition. Introduction to food microbiology: Classification of microbes, Types of micro-organism normally associated with food- mold, yeast, and bacteria. Contamination of foods- vegetables, cereals, pulses, oilseeds, milk and meat during handling and processing. Best Practices to Avoid Food Spoilage, Microbiological Hazards	12
II	Factors affecting microbial growth: Intrinsic and extrinsic factors, Biochemical changes caused by micro-organisms, deterioration of various types of food product. Microbiology of food preservation, heating process, irradiation, low temperature storage, chemical preservatives, high-pressure processing, control of water activity.	12
III	Fermented and microbial foods: Fermented milk and milk products, fermented fruits and vegetables, fermented meat and fish products, fermented beverages (beer, vinegar and wine), single cell protein.	12
IV	Food microbiology and public health: food poisoning and microbial toxins, types of food poisonings. Bacterial agents of food borne illness. Non-bacterial agents of food borne illness- poisonous algae, fungi and food borne viruses. Microbial standards for different foods. HACCP and food safety, hurdle technology and its applications. Microbiological Food Safety Standards and Regulations. Food Safety and Hygiene Audits	12

Recommended Books and Resources

1. Frazier, W. C., & Westhoff, D. C. (2015). Food Microbiology (5th ed.). Tata McGraw Hill Publication, New Delhi.
2. Adams, M. R., & Moss, M. O. (2016). Food Microbiology (4th ed.). Royal Society of Chemistry, Cambridge.
3. James, M. J., Loessner, M. J., & Golden, D. A. (2018). Modern Food Microbiology (8th ed.). Springer.
4. Stanier, R. Y. (2006). General Microbiology (5th ed.). MacMillan, Hampshire.
5. Creager, J. G., Black, J. G., & Davison, V. E. (1990). Microbiology: Principles & Applications. Prentice Hall, New Jersey.
6. Battcock, M., & Azam-Ali, S. (1998). Fermented Fruits and Vegetables: A Global Perspective. FAO Agricultural Services Bulletin No. 134.
7. Campbell-Platt, G. (2017). Fermented Foods of the World: A Dictionary and Guide. Butterworth-Heinemann.
8. Doyle, M. P., & Beuchat, L. R. (2019). Food Microbiology: Fundamentals and Frontiers (4th ed.). ASM Press.
9. Fellows, P. J. (2017). Food Processing Technology: Principles and Practice (4th ed.). Woodhead Publishing.
10. Forsythe, S. J. (2010). The Microbiology of Safe Food (2nd ed.). Wiley-Blackwell.
11. Leistner, L., & Gorris, L. G. M. (1995). Food Preservation by Hurdle Technology. Springer.
12. Madigan, M. T., & Martinko, J. M. (2018). Biology of Microorganisms (15th ed.). Pearson.
13. Madigan, M. T., Martinko, J. M., Bender, K. S., Buckley, D. H., & Stahl, D. A. (2018). Brock Biology of Microorganisms (15th ed.). Pearson.
14. Mead, P. S., Slutsker, L., Dietz, V., McCaig, L. F., Bresee, J. S., Shapiro, C., ... & Tauxe, R. V. (1999). Food-Related Illness and Death in the United States. Emerging Infectious Diseases, 5(5), 607-625.

15. Motarjemi, Y., & Adams, M. (2006). Emerging Foodborne Pathogens. CRC Press.
16. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2008). Microbiology (5th ed.). McGraw-Hill.
17. Ray, B., & Bhunia, A. (2013). Fundamental Food Microbiology (5th ed.). CRC Press.
18. Sperber, W. H., & Doyle, M. P. (2009). Compendium of the Microbiological Spoilage of Foods and Beverages. Springer.
19. Tortora, G. J., Funke, B. R., & Case, C. L. (2020). Microbiology: An Introduction (14th ed.). Pearson.

MSFT415-24: Food Microbiology (Lab)

Total marks: 50	**L**	**T**	**P**
	0	**0**	**4**

Course objective:

To equip students with the skills necessary to establish and sustain microbiological laboratories, encompassing the operation and maintenance of laboratory equipment, implementation of sterilization techniques, application of precise sampling methods, adherence to aseptic practices, maintenance of microbial cultures, and execution of comprehensive microbiological analyses for food and water quality assurance.

Course outcome: At the end of the course, the students will be able to

CO1	Gain proficiency in establishing and sustaining microbiological laboratories, including the operation and maintenance of essential lab equipment.
CO2	Develop the ability to maintain high standards of hygiene and sanitation within the work area to ensure a contamination-free environment.
CO3	Master the preparation of culture media, sterilization using autoclaves, and conducting aseptic sampling and inoculation procedures.
CO4	Acquire skills in various microbiological analysis techniques, including staining, dilution, bacterial isolation, and the testing of food and water samples.
CO5	Be capable of maintaining pure microbial cultures, accurately reporting test results, and conducting environmental monitoring in food processing units for quality assurance.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	2	3
CO2	3	2	2	2	3
CO3	3	2	1	2	3
CO4	3	2	2	2	3
CO5	3	2	2	2	3

Details of the Course Content - Food Microbiology (Lab) (MSFT415-24)

Practical no.	Contents	Contact Hours
1*	Prepare and Maintain Work Area and Lab Equipment (FIC/N7609) a. Setting up Microbiological Laboratory b. Working Principle, Operations and Maintenance of Tools, Equipment and Glassware c. Maintaining Hygiene and Sanitation at Work Area	3
2*	Culture Media Preparation	1
3*	Sterilization Using Autoclave	1
4*	Sampling for Microbiological Assay	1
5*	Preparation of the workspace (Laminar Air Flow Cabinet)	1
6*	Aseptic Sample Inoculation	1
7*	Pure Culture Maintenance	2
8*	Reporting Microbiological Test Results	2
9*	Environmental Monitoring in Food Processing Units	2
10*	Quality Assurance (QA) Programme for Food Microbiology Laboratory	2
11	Bright field microscopy and examination of living micro-organisms	2
12	Direct microscopic count of micro-organisms– use of Neubauer counting chamber	2
13	Staining techniques: a. Simple staining, b. Gram staining, c. Spore staining and d. Negative staining etc.,	4
14	Dilution technique.	2
15	Isolation of bacteria by a. Serial dilution (streak plate), b. Pour plating and spreading, c. Bacterial population count- standard plate count.	3
16	Microbiological analysis of food products- i. Bacterial count, ii.Yeast and mold count, iii.Coliform count, iv.Standard plate count of milk and direct microscopic count of milk, v.Reductase Test (MBRT).	4
17	Microbiological testing of water- I. Quantitative test, ii. Bacteriological quality testing (MPN).	2

*Mandatory to teach from FIC/Q7603 manual

Recommended Books and Resources

1. FICSI. FIC/Q7603- Food Microbiologist.
2. Food Safety and Standards Authority of India (FSSAI). (2021). Food Safety and Standards (Food Product Standards and Food Additives) Regulations. Retrieved from https://www.fssai.gov.in/
3. Bureau of Indian Standards (BIS). (2018). IS 5403: 1999 Methods for Yeast and Mould Count of Foodstuffs and Animal Feeds. Retrieved from https://www.bis.gov.in/
4. AGMARK. (2021). Agricultural Produce (Grading and Marking) Act, 1937. Retrieved from https://dmi.gov.in/gradesstandards.aspx

5. International Organization for Standardization (ISO). (2016). ISO 4833-1:2013 Microbiology of the food chain — Horizontal method for the enumeration of microorganisms — Part 1: Colony count at 30 degrees C by the pour plate technique. Retrieved from https://www.iso.org/
6. AOAC International. (2020). Official Methods of Analysis of AOAC INTERNATIONAL. Retrieved from https://www.aoac.org/official-methods-of-analysis-21st-edition-2019/
7. Vanderzant, C., & Splittstoesser, D. F. (1992). Compendium of methods for the microbiological examination of foods. American Public Health Association.
8. Adams, M. R., & Moss, M. O. (2008). Food Microbiology. Royal Society of Chemistry.
9. Jay, J. M., Loessner, M. J., & Golden, D. A. (2005). Modern Food Microbiology. Springer.
10. FSSAI. (2020). Manual of Methods of Analysis of Foods - Microbiological Testing. Retrieved from https://www.fssai.gov.in/
11. ISO. (2017). ISO 21528-2:2017 Microbiology of the food chain — Horizontal method for the detection and enumeration of Enterobacteriaceae — Part 2: Colony-count technique. Retrieved from https://www.iso.org/
12. Cappuccino, J. G., & Sherman, N. (2013). Microbiology: A Laboratory Manual. Pearson.
13. Willey, J. M., Sherwood, L., & Woolverton, C. J. (2017). Prescott's Microbiology. McGraw-Hill Education.
14. FSSAI. (2021). Hygiene and Sanitation Guidelines for Food Processing Units. Retrieved from https://www.fssai.gov.in/
15. European Food Safety Authority (EFSA). (2019). Microbiological Risk Assessment Guidance for Food Safety. Retrieved from https://www.efsa.europa.eu/
16. National Center for Biotechnology Information (NCBI). (2020). Methods of Microbial Analysis. Retrieved from https://www.ncbi.nlm.nih.gov/
17. Food and Agriculture Organization (FAO). (2021). Food Microbiology and Safety. Retrieved from https://www.fao.org/
18. Bacteriological Analytical Manual (BAM). (2021). US FDA’s Bacteriological Analytical Manual. Retrieved from https://www.fda.gov/
19. National Institute of Food and Agriculture (NIFA). (2020). Food Safety and Microbiology. Retrieved from https://nifa.usda.gov/
20. Merck Microbiology Manual. (2018). Microbiological Culture Media: Principles and Practice. Retrieved from https://www.merckgroup.com/
21. Society for Applied Microbiology (SfAM). (2020). Guidelines for Microbiological Quality Assurance in Food Laboratories. Retrieved from https://www.sfam.org.uk/
22. Royal Society of Biology. (2021). Microbiology Teaching Resources. Retrieved from https://www.rsb.org.uk/
23. National Institute of Standards and Technology (NIST). (2020). Microbiological Testing Standards. Retrieved from https://www.nist.gov/
24. ASM International. (2021). Microbial Testing Guidelines. Retrieved from https://www.asm.org/
25. WHO. (2021). Guidelines for the Safe Use of Wastewater, Excreta and Greywater in Agriculture. Retrieved from https://www.who.int/
26. FDA. (2020). Guidance for Industry: Microbiological Considerations for Food and Beverages. Retrieved from https://www.fda.gov/

FIC/Q9005: Industrial Production Worker – Food Processing

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

To equip students with comprehensive training aligned to the Qualification Pack for Industrial Production Worker - Food Processing (FIC/Q9005) and Food Product Handler (FIC/Q9010) at NSQF level 2, covering understanding of industry standards, proficiency in hygiene and safety, practical skills in machinery operation and maintenance, and knowledge of documentation and compliance practices.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate comprehensive knowledge of the food processing industry, including its organizational standards, norms, and regulatory requirements.
CO2	Exhibit proficiency in maintaining high standards of personal hygiene and workplace ethics as per food safety guidelines.
CO3	Possess practical skills in cleaning, sanitizing, and maintaining work areas and processing machinery to ensure optimal production conditions.
CO4	Competently operate and troubleshoot various processing machinery used in bakery, fruits and vegetable processing, milk and milk products, and meat processing industries.
CO5	Understand the importance of documentation and record-keeping in maintaining quality standards and regulatory compliance within food processing operations.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	3	3
CO2	3	2	3	2	3
CO3	3	2	2	2	3
CO4	3	2	2	2	3
CO5	3	2	2	3	3

Details of the Course Content -Industrial Production Worker – Food Processing (FIC/Q9005)

Unit	Contents	Contact Hours
I	**Introduction to the Training Program of Industrial Production Worker - Food Processing and (based on the Qualification Pack (QP) code FIC/Q9005) and Overview of Food Processing Industry (FIC/N9020):** Introduction to the training program; Food Processing and Technology: An overview, Classification of Food and Agro-Processing Industry **Organizational Standards and Norms (CSC/N1336):** Roles and Responsibilities Industrial Production Worker - Food Processing; Knowledge and understanding of the organization; Workplace ethics; Personal hygiene guidelines for food handlers; Food Safety and hygienic standards for workplace	12
II	**Prepare And Maintain Work Area And Processing Machineries For Production (FIC/N9020):** Cleaning and sanitation; Prepare and maintain the work area and processing machineries for the production process; Machine maintenance and troubleshooting; Waste management **The Production Process (FIC/N9020):** Operation of machineries and equipment's; Post Production cleaning and storage of tools	12
III	**The Production Process (FIC/N9020):** Manufacturing Process and Controls in Bakery industry, Fruits and Vegetable Processing industry, milk and milk products processing industry, meat processing industry **Documentation And Record Keeping (FIC/N9020):** Need of documentation and record keeping; Process of documenting records	12
IV	**Basic Health And Safety Practices At Food Processing Workplace FIC/N9002):** Workplace safety, Types of Safety and safety measures, Methods to build safety in daily operations, Emergency response and evacuation, Rescue techniques during emergency, Basic first aid methods , Methods of accident prevention, Managing the safety hazards in different industries	12

Recommended Books and Resources

1. Food Industry Capacity & Skill Initiative (FICSI). (2023). Industrial Production Worker – Food Processing. https://www.ficsi.in/upload/participant_handbook/PH_English_Industrial%20Production%20Worker_FICQ9005_V3.0.pdf
2. F Food Industry Capacity & Skill Initiative (FICSI). (2023). Food Product Handler PH V.10: English. https://www.ficsi.in/upload/participant_handbook/Food%20Product%20Handler%20PH%20V.10-%20English.pdf
3. Food Safety and Standards Authority of India. (2022). Food Safety and Standards (Licensing and Registration of Food Businesses) Regulations, 2011. Retrieved from https://www.fssai.gov.in

4. Bureau of Indian Standards. (2018). IS 14596: Food Hygiene - General Principles - Code of Practice. Retrieved from https://www.bis.gov.in
5. AGMARK. (2021). Agricultural Produce (Grading and Marking) Act, 1937. Retrieved from https://agmarknet.gov.in
6. International Organization for Standardization. (2018). ISO 22000:2018 - Food Safety Management Systems - Requirements for Any Organization in the Food Chain. Retrieved from https://www.iso.org
7. International Organization for Standardization. (2018). ISO 19011:2018 - Guidelines for Auditing Management Systems. Retrieved from https://www.iso.org
8. Food Safety and Standards Authority of India. (2022). Training Videos. Retrieved from https://www.fssai.gov.in/home/training/videos.html
9. Bureau of Indian Standards. (2022). BIS Standards. Retrieved from https://www.standards.bis.gov.in
10. International Organization for Standardization. (2022). ISO Standards. Retrieved from https://www.iso.org/standards.html
11. Food Processing Machinery Standards. (2022). Retrieved from https://www.nsf.org/knowledge-library/food-equipment-standards
12. National Qualifications Register. (2022). FIC/N9020: Monitor the food production on a mechanized production line for processed food items. Retrieved from https://www.nqr.gov.in/qualification-title/nqr-title/fic/n9020
13. National Qualifications Register. (2022). FIC/N9002: Use basic health and safety practices at a food processing workplace. Retrieved from https://www.nqr.gov.in/qualification-title/nqr-title/fic/n9002
14. National Qualifications Register. (2022). CSC/N1336: Work effectively with others. Retrieved from https://www.nqr.gov.in/qualification-title/nqr-title/csc/n1336
15. FICSI - Food SSC (2022). Overview of Food Processing Industry. Retrieved from https://youtu.be/wMu0EpUgCd4
16. FICSI - Food SSC. (2022). Industrial Production Worker. Retrieved from https://youtu.be/0tThA3DYX2c
17. FICSI - Food SSC. (2022). Introduction to Bread & Bakery Industry. Retrieved from https://youtu.be/mcpVs3CVNIw
18. FICSI - Food SSC. (2022). Overview of fruits and vegetable processing. Retrieved from https://youtu.be/hW10tq2fWfY
19. FICSI - Food SSC. (2022). Overview of Dairy Industry. Retrieved from https://youtu.be/4XuvGYvKGnE
20. FICSI - Food SSC. (2022). Overview of Meat and Poultry Industry. Retrieved from https://youtu.be/UZ7nMyVQWCU
21. FICSI - Food SSC. (2022). Documentation and record keeping in food processing unit. Retrieved from https://youtu.be/HesWbNFSQS4
22. FICSI - Food SSC. (2022). Introduction to entrepreneurship. Retrieved from https://youtu.be/BzeoC3mSDgg
23. FICSI - Food SSC. Traits of Entrepreneur. Retrieved from https://youtu.be/3uEqWH9oWls

SEC111-24: Digital Fluency

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

Equip students with comprehensive digital fluency, encompassing fundamental computer skills, effective digital communication and collaboration, office productivity tools, e-learning, digital content creation, e-commerce, cybersecurity, emerging technologies, and ethical considerations to proficiently navigate and leverage the digital landscape.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate a thorough understanding of digital fluency, including the use of essential digital tools and platforms.
CO2	Exhibit proficiency in basic computer skills, operating systems, and file management.
CO3	Apply effective digital communication techniques and utilize office productivity tools for various professional tasks.
CO4	Create and manage digital content, engage in e-commerce transactions securely, and understand cybersecurity measures.
CO5	Analyze and evaluate the impact of digital emerging technologies on the food industry and society, while adhering to ethical and legal standards in the digital world.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	2	2	3	2	2
CO2	2	2	3	2	2
CO3	2	2	3	2	2
CO4	3	2	3	2	3
CO5	3	3	2	3	3

Details of the Course Content - Digital Fluency (SEC111-24)

Unit	Contents	Contact Hours
I	**Introduction to Digital Fluency and Basic Computer Skills** 1. **Introduction to Digital Fluency:** Importance of digital fluency, Overview of digital tools and platforms 2. **Basic Computer Skills:** An Overview of the Computer, Block Diagram of the Computer, Evolution and Generations of Computers, Software and its types, Operating systems: types of operating systems: Windows, macOS, Linux; major functions of the operating systems; File management and organization.	10
II	**Digital Communication and Collaboration** **1. Digital Communication:** Email etiquette and management; Online communication tools: messaging apps, and video conferencing; Netiquette and digital footprint **2. Office Productivity Tools**: Creating and Editing: Word processing (Microsoft Word, Google Docs), Spreadsheets (Microsoft Excel, Google Sheets), Presentations (Microsoft PowerPoint, Google Slides), Google form: Creating and analysis of response; Google Drive- uploading and sharing of files and folders.	12
III	**E-learning, Digital Content Creation, E-commerce and Security Aspects** **1. E-learning:** Introduction to e-learning platforms such as Swayam and MOOC. **2. Digital Content Creation**: Basics of graphic design (Canva); Video creation and editing **3. E-Commence:** Basic Web Commerce Concept, E- payment methods: E-cash Payment System, Credit Payment System, Types of Electronic Payment Systems: Credit Card • Debit Card • Smart Card • E-Money • Electronic Fund Transfer (EFT). **4. Cyber Security and Online Privacy:** Threats and Prevention, Viruses and its types, Antivirus, HTTP vs HTTPS, Firewall, Cookies, Hackers and Crackers, Safe browsing practices, Protecting personal information online	14
IV	**Emerging Technologies and Ethical Issues** **Emerging Technologies:** Introduction to emerging technologies and their applications in the food industry- Artificial Intelligence, IoT, Cloud Computing, Machine learning, Big Data, Blockchain, ChatGPT; Impact of emerging technologies on society; Future trends in technology **Ethical and Legal Issues in the Digital World:** Understanding digital rights and responsibilities; Intellectual property and copyright issues; Ethical considerations in digital technology	12

Recommended Books and Resources

1. Fundamentals of computers - V. Rajaraman - Prentice- Hall of India.
2. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications
3. Digital Promise. Digital literacy. Retrieved from https://digitalpromise.org/initiative/digital-literacy/
4. Norton, P. (2018). Introduction to Computers. McGraw-Hill Education.
5. Shelly, G. B., & Vermaat, M. E. (2012). Discovering Computers: Fundamentals. Cengage Learning.
6. Coursera. Email Etiquette: Tips and Tricks for Professionals. Retrieved from https://www.coursera.org/learn/email-etiquette
7. Poatsy, M. A., & Mulbery, K. (2019). Exploring Microsoft Office 2019 Introductory. Pearson.
8. Microsoft Office Support. Retrieved from https://support.microsoft.com/en-us/office
9. LinkedIn Learning. Office 365 Essential Training. Retrieved from https://www.linkedin.com/learning/office-365-essentials
10. Bates, A. W. (2019). Teaching in a Digital Age: Guidelines for Designing Teaching and Learning. Tony Bates Associates Ltd.
11. SWAYAM. Retrieved from https://swayam.gov.in/ & https://www.aicte-india.org/bureaus/swayam
12. edX.Introduction to MOOCs. Retrieved from https://www.edx.org/
13. Canva Design School. Retrieved from https://www.canva.com/learn/
14. Adobe Creative Cloud. Video Production and Editing. Retrieved from https://www.adobe.com/creativecloud/video/discover.html
15. Laudon, K. C., & Traver, C. G. (2020). E-Commerce 2020: Business, Technology, Society. Pearson.
16. Coursera. Introduction to E-Commerce. Retrieved from https://www.coursera.org/learn/e-commerce
17. Stallings, W. (2020). Network Security Essentials: Applications and Standards. Pearson.
18. Cybersecurity & Infrastructure Security Agency (CISA). (n.d.). Retrieved from https://www.cisa.gov/
19. Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach. Pearson.
20. Coursera. Introduction to AI. Retrieved from https://www.coursera.org/learn/ai
21. Spinello, R. A., & Tavani, H. T. (2016). Cyberethics: Morality and Law in Cyberspace. Jones & Bartlett Learning.
22. Quinn, M. J. (2016). Ethics for the Information Age. Pearson.
23. edX. Cybersecurity and Privacy. Retrieved from https://www.edx.org/course/cybersecurity-and-privacy-in-the-iot.
24. Digital 101 Course offered by Future Skill Prime Platform https://learn.futureskillsprime.in/
25. Gmail Creating links:
26. https://clubrunner.blob.core.windows.net/00000000961/en-ca/files/homepage/how-to- create-a-gmail-account/HowtoCreateaGmailAccount.pdf
27. Google Forms: https://pdst.ie/sites/default/files/Google%20Drive_1.pdf
28. Google Meet: https://edvance.hawaii.hawaii.edu/wp-content/uploads/Google-Meet- Tutorial-Getting-Started-and-Recording-a-Lecture.pdf
29. Security Aspects - https://ncert.nic.in/textbook/pdf/lecs112.pdf
30. E-Commence: http://www.aagasc.edu.in/cs/msccs/ECommerce%20Unit%201.pdf
31. E- payment methods: http://www.dspmuranchi.ac.in/pdf/Blog/e%20business%20UnitIII,%20%202020.pdf

SEC112-24: Digital Fluency (Lab)

Total marks: 50	**L**	**T**	**P**
	0	**0**	**4**

Course objective:

To equip students with practical skills and comprehensive knowledge in the analysis and preservation of food products, ensuring proficiency in laboratory techniques, safety protocols, and quality evaluation methods essential for preserving the food products in the food technology field.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate proficiency in using laboratory equipment and adhering to safety protocols in a food testing lab.
CO2	Apply fundamental techniques for food sampling, preparation, and proximate as well as physio-chemical analysis.
CO3	Perform microbial analysis, including total plate count, coliform, and E. coli detection, to ensure food safety and quality.
CO4	Evaluate the quality characteristics of various food products preserved by methods such as drying, freezing, blanching, pickling, and canning.
CO5	Compare and contrast conventional and modern food processing methods, and analyze their effects on the nutritional and microbial stability of food products.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	2	3
CO2	3	2	1	2	3
CO3	3	2	1	2	3
CO4	3	2	1	2	3
CO5	3	3	2	2	3

Details of the Course Content - Digital Fluency- Lab (SEC112-24)

Practical no.	Contents	Contact Hours
1	Identifying the configuration and version of a computer system (PC), laptop, and a mobile phone.	3
2	Finding the background and foreground processes on Task manager.	2
3	Translating English into Punjabi/Hindi words in Google embedded with AI.	2
4	Use Google assistant on any android smartphone to dictate commands and to launch apps	2
5	Downloading your e-aadhar, mask e-aadhar and locked e-aadhar.	2
6	Creating resume in Word processor.	2
7	Creating powerpoint presentation for your department introduction and apply transitions and animations.	2
8	Create your marksheet in Microsoft Excel.	2
9	Simple computation using spread sheet.	2
10	Create an email-ID and sending and forwarding.	2
11	Attaching files and downloading files in email.	2
12	Creating a Google form and send it to Ten users.	2
13	Scheduling a virtual meet and invite peoples to join the Google meet/Zoom/skype.	2
14	Creating a hotspot from a mobile phone, and allowing others to use the hotspot.	2
15	Sign in and create account e-learning platforms such as Swayam and MOOC.	2
16	Creating an account on the railway reservation website, IRCTC, and finding trains and running status.	2
17	Demo of online order placing for books using Flipkart/Amazon, etc.	2
18	Install any antivirus app on your mobile and scan.	2
19	Demonstrate unsecured (HTTP) and secured (HTTPS) websites	2
20	Demonstrate setup of printer, scanner and projector with laptop or PC	2

Recommended Books and Resources

1. Fundamentals of computers - V. Rajaraman - Prentice- Hall of India.
2. Computer Fundamentals - P. K. Sinha Publisher: BPB Publications
3. Digital Promise. Digital literacy. Retrieved from https://digitalpromise.org/initiative/digital-literacy/
4. Norton, P. (2018). Introduction to Computers. McGraw-Hill Education.
5. Shelly, G. B., & Vermaat, M. E. (2012). Discovering Computers: Fundamentals. Cengage Learning.
6. Coursera. Email Etiquette: Tips and Tricks for Professionals. Retrieved from https://www.coursera.org/learn/email-etiquette
7. Poatsy, M. A., & Mulbery, K. (2019). Exploring Microsoft Office 2019 Introductory. Pearson.
8. Microsoft Office Support. Retrieved from https://support.microsoft.com/en-us/office
9. LinkedIn Learning. Office 365 Essential Training. Retrieved from https://www.linkedin.com/learning/office-365-essentials
10. Bates, A. W. (2019). Teaching in a Digital Age: Guidelines for Designing Teaching and Learning. Tony Bates Associates Ltd.

11. SWAYAM. Retrieved from https://swayam.gov.in/ & https://www.aicte-india.org/bureaus/swayam
12. edX.Introduction to MOOCs. Retrieved from https://www.edx.org/
13. Canva Design School. Retrieved from https://www.canva.com/learn/
14. Adobe Creative Cloud. Video Production and Editing. Retrieved from https://www.adobe.com/creativecloud/video/discover.html
15. Laudon, K. C., & Traver, C. G. (2020). E-Commerce 2020: Business, Technology, Society. Pearson.
16. Coursera. Introduction to E-Commerce. Retrieved from https://www.coursera.org/learn/e-commerce
17. Stallings, W. (2020). Network Security Essentials: Applications and Standards. Pearson.
18. Cybersecurity & Infrastructure Security Agency (CISA). (n.d.). Retrieved from https://www.cisa.gov/
19. Russell, S., & Norvig, P. (2020). Artificial Intelligence: A Modern Approach. Pearson.
20. Coursera. Introduction to AI. Retrieved from https://www.coursera.org/learn/ai
21. Spinello, R. A., & Tavani, H. T. (2016). Cyberethics: Morality and Law in Cyberspace. Jones & Bartlett Learning.
22. Quinn, M. J. (2016). Ethics for the Information Age. Pearson.
23. edX. Cybersecurity and Privacy. Retrieved from https://www.edx.org/course/cybersecurity-and-privacy-in-the-iot.
24. Digital 101 Course offered by Future Skill Prime Platform https://learn.futureskillsprime.in/
25. Gmail Creating links:
26. https://clubrunner.blob.core.windows.net/00000000961/en-ca/files/homepage/how-to- create-a-gmail-account/HowtoCreateaGmailAccount.pdf
27. Google Forms: https://pdst.ie/sites/default/files/Google%20Drive_1.pdf
28. Google Meet: https://edvance.hawaii.hawaii.edu/wp-content/uploads/Google-Meet- Tutorial-Getting-Started-and-Recording-a-Lecture.pdf
29. Security Aspects - https://ncert.nic.in/textbook/pdf/lecs112.pdf
30. E-Commence: http://www.aagasc.edu.in/cs/msccs/ECommerce%20Unit%201.pdf
31. E- payment methods: http://www.dspmuranchi.ac.in/pdf/Blog/e%20business%20UnitIII,%20%202020.pdf

MSFT416-24: Industrial Visit and FoSTaC Course

Total marks: 40	**L**	**T**	**P**
	0	**0**	**3**

Course objective:

To equip students with practical industry exposure and essential food safety knowledge through industrial visits, expert lectures, and completion of the FoSTaC - Basic Manufacturing course, fostering their competence in food manufacturing, processing, and packaging practices.

Course outcome: At the end of the course, the students will be able to

CO1	Students will gain practical knowledge of food industry operations and standards through firsthand industrial exposure and expert insights.
CO2	Students will develop a comprehensive understanding of fundamental food safety principles, including personal hygiene and food handling practices.
CO3	Students will be proficient in managing food operations and controls, ensuring adherence to safety and quality protocols.
CO4	Students will acquire skills in proper packaging and distribution methods to maintain food integrity and safety during the supply chain.
CO5	Students will be able to compile and present detailed reports on their industrial visit/expert lecturer and FoSTaC course experiences, demonstrating their applied knowledge and analytical skills.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	3	3
CO2	3	3	2	3	2
CO3	2	2	3	3	3
CO4	2	2	2	3	3
CO5	3	3	2	2	2

Details of the Course Content - Industrial Visit and FoSTaC Course (MSFT416-24)

Unit	Contents	Contact Hours
I	Students are required to visit a food industry or attend a guest lecture by a food industry expert. Subsequently, they must submit a report to the Head of the Department and Course Coordinator.	10
II	Students must complete the FoSTaC - Basic Manufacturing course. This course should be completed through https://www.skillindiadigital.gov.in/courses/detail/43c98220-675c-4284-b998-7bd3d413d724 or https://fostac.fssai.gov.in/index or any FSSAI-recognized training center.	

Recommended Books and Resources

1. https://www.skillindiadigital.gov.in/courses/detail/43c98220-675c-4284-b998-7bd3d413d724
2. https://fostac.fssai.gov.in/index

SEMESTER- II

Program Scheme & Syllabus

Semester II

Course Code	Course Title	Course Type	Load			Marks Distribution		Total	Credits
			L	T	P	Internal	External		
MSFT421-24	Food Chemistry and Biochemistry	DSC	4	0	0	40	60	100	4
MSFT422-24	Principles of Food Engineering	DSC	4	0	0	40	60	100	4
MSFT423-24	Dairy Technology	DSE	4	0	0	40	60	100	4
MSFT424-24	Dairy Technology (Lab)	DSE	0	0	4	30	20	50	2
M/FIC/Q7006	Food Packer	DSC/ QP-NOS	4	0	0	40	60	100	4
M/FIC/Q7001	Food Products Packaging Technician (Lab)	DSC/ QP-NOS	0	0	4	30	20	50	2
M/FIC/Q9001	Processed Food Entrepreneur	SEC-SB/ QP-NOS	4	0	0	40	60	100	4
MSFT424-24	Industrial Visit with Cold Storage Technician Course	AECC	0	0	3	40[#]	--	40	3
	Total		**20**	**0**	**11**	300	340	640	27

[#] Indutsrial Visit with Cold Storage Technician Course will have internal evaluation only. Cold Storage Technician course must be completed and certified from https://www.skillindiadigital.gov.in or https://elearning.ficsi.in/ or any FICSI recognized Training center

MSFT421-24: Food Chemistry and Food Biochemistry

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

To provide comprehensive knowledge of food chemistry and biochemistry, emphasizing the structural, functional, and metabolic roles of carbohydrates, proteins, lipids, vitamins, and minerals, along with their impact on food processing, nutrition, health, and associated deficiency diseases.

Course outcome: At the end of the course, the students will be able to

CO1	Analyze the structural and functional properties of carbohydrates, proteins, lipids, vitamins, and minerals, and their implications for food processing and nutrition.
CO2	Evaluate the role of enzymatic activities, food pigments, and additives in improving food quality and stability under various conditions.
CO3	Demonstrate understanding of the biochemical processes involved in fermentation and their applications in creating functional foods and probiotics.
CO4	Assess the impact of macro- and micronutrient deficiencies on human health and suggest dietary interventions to address these issues.
CO5	Explore advanced topics such as genetic engineering and omics technologies in food biochemistry to predict future trends in food science and technology.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	1	3
CO2	3	2	2	3	3
CO3	3	2	3	2	3
CO4	2	3	1	2	3
CO5	3	2	2	2	3

Details of the Course Content - Food Chemistry and Food Biochemistry (MSFT421-24)

Unit	Contents	Contact Hours
I	***Introduction to Food Chemistry and Biochemistry:*** Definition and scope of food chemistry and biochemistry.; Composition of food: Overview of carbohydrates, proteins, lipids, water, vitamins, and minerals.; Importance of food chemistry in food processing and preservation. Understanding relationship between food, nutrition and health. ***Carbohydrates in Foods:*** Structure and classification of carbohydrates. Monosaccharides, disaccharides, and polysaccharides. Functional properties of carbohydrates: Sweetness, viscosity, gelation, and water-binding. Carbohydrate metabolism and dietary fiber. Deficiency diseases caused by carbohydrate imbalances (e.g., ketosis). ***Proteins in Foods:*** Structure and classification of proteins. Amino acids: Essential and non-essential. - Functional properties of proteins: Solubility, gelation, emulsification, and foaming. Protein denaturation and enzymatic activity in food systems. Deficiency diseases caused by protein malnutrition (e.g., Kwashiorkor and Marasmus).	12
II	***Lipids in Foods:*** Structure and classification of lipids. Saturated, unsaturated, and trans fats. Functional properties of lipids: Emulsification, crystallization, and oxidation. Role of lipids in flavor and texture of foods. Diseases and health issues related to lipid imbalances (e.g., cardiovascular diseases, obesity). ***Vitamins and Minerals:*** Classification of vitamins: Water-soluble and fat-soluble. Functions, stability, and degradation of vitamins. Essential minerals in food: Macro and micro minerals. Bioavailability and factors affecting mineral absorption. Deficiency diseases due to vitamin and minerals imbalances (e.g., scurvy, beri-beri, Goitre, rickets, anemia, and osteoporosis).	11
III	***Enzymes in Foods:*** Nature and classification of enzymes. Mechanism of enzyme action. Enzyme activity in food processing: Proteases, amylases, lipases, and pectinases. Enzyme inhibition and its implications. ***Food Colors and Pigments:*** Natural pigments in food: Chlorophyll, carotenoids, anthocyanins, and betalains. Synthetic food colors and their regulations. Stability of food pigments under different conditions. Role of pigments in food quality and acceptability. ***Food Additives:*** Definition and classification of food additives. Preservatives, antioxidants, emulsifiers, and stabilizers. Safety and regulatory aspects of food additives. Role of additives in enhancing food quality and shelf life.	11
IV	***Food Flavors and Aromas:*** Chemical basis of food flavors. Natural and synthetic flavoring agents. Aroma compounds in food and their perception. Factors affecting flavor stability during processing and storage. ***Nutraceuticals and Functional Foods :*** Introduction to nutraceuticals and functional foods. Bioactive compounds in food: Polyphenols, phytosterols, and omega-3 fatty acids. Health benefits of functional foods. Regulatory aspects of nutraceuticals and functional foods. ***Food Biochemistry of Fermentation:*** Principles of fermentation and its applications in food. Role of microorganisms in fermentation. Biochemical changes during fermentation: Alcoholic, lactic acid, and acetic acid fermentation. Probiotics and their health benefits.	12

	Advanced Topics in Food Biochemistry: Recent advancements in food chemistry research. Impact of genetic engineering on food composition. Role of omics technologies in food biochemistry: Genomics, proteomics, and metabolomics. Future trends in food biochemistry.	

Recommended Books and Resources

1. Belitz, H.-D., Grosch, W., & Schieberle, P. (2009). Food Chemistry (4th ed.). Springer.
2. Damodaran, S., Parkin, K. L., & Fennema, O. R. (2017). Fennema's Food Chemistry (5th ed.). CRC Press.
3. Coultate, T. P. (2016). Food: The Chemistry of Its Components (6th ed.). Royal Society of Chemistry.
4. DeMan, J. M. (1999). Principles of Food Chemistry (3rd ed.). Springer.
5. Vaclavik, V. A., & Christian, E. W. (2014). Essentials of Food Science (4th ed.). Springer.
6. Nielsen, S. S. (Ed.). (2017). Food Analysis (5th ed.). Springer.
7. Hui, Y. H. (Ed.). (2006). Handbook of Food Science, Technology, and Engineering. CRC Press.
8. Yada, R. Y. (Ed.). (2004). Proteins in Food Processing. Woodhead Publishing.
9. Simpson, B. K., Aluko, R. E., & Aryee, A. N. (Eds.). (2019). Biochemistry of Foods (3rd ed.). Academic Press.
10. Shahidi, F., & Zhong, Y. (Eds.). (2018). Lipid Chemistry and Applications. Wiley.
11. Schaafsma, G., & Kok, F. J. (Eds.). (2006). Nutritional Biochemistry of the Vitamins. Cambridge University Press.
12. Campbell-Platt, G. (2017). Food Science and Technology (2nd ed.). Wiley-Blackwell.
13. Mann, J., & Truswell, S. (2017). Essentials of Human Nutrition (5th ed.). Oxford University Press.
14. Shils, M. E., Shike, M., Ross, A. C., Caballero, B., & Cousins, R. J. (Eds.). (2005). Modern Nutrition in Health and Disease (10th ed.). Lippincott Williams & Wilkins.
15. Whitney, E., & Rolfes, S. R. (2018). Understanding Nutrition (15th ed.). Cengage Learning.
16. Gibson, R. S. (2005). Principles of Nutritional Assessment (2nd ed.). Oxford University Press.
17. Allen, L., de Benoist, B., Dary, O., & Hurrell, R. (2006). Guidelines on Food Fortification with Micronutrients. World Health Organization (WHO).
18. MIT OpenCourseWare – Principles of Biochemical Engineering: https://ocw.mit.edu
19. NPTEL Online Courses – Food Chemistry and Biochemistry: https://nptel.ac.in

MSFT422-24: Principles of Food Engineering

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

To equip students with a comprehensive understanding of the fundamental engineering principles and their applications in food processing, covering material and energy balances, heat and mass transfer, fluid flow, rheology, mechanical operations, and process control for the efficient design and optimization of food systems.

Course outcome: At the end of the course, the students will be able to

CO1	Develop a comprehensive understanding of food engineering principles, including the physical, gravimetric, optical, and thermal properties of food, and their applications in processing.
CO2	Apply concepts of material and energy balances, heat transfer, and fluid dynamics to analyze and optimize food processing systems effectively.
CO3	Demonstrate proficiency in mass transfer operations, rheology, and textural analysis for designing efficient food preservation and extraction processes.
CO4	Utilize knowledge of mechanical operations, process control, and automation for the design and operation of food processing equipment.
CO5	Incorporate sustainability and energy efficiency principles into the design and operation of food engineering systems while adhering to hygiene and safety standards.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	2	2
CO2	2	3	2	3	3
CO3	1	1	1	2	1
CO4	1	1	1	1	2
CO5	3	3	3	2	3

Details of the Course Content - Principles of Food Engineering (MSFT422-24)

Unit	Contents	Contact Hours
I	**Introduction to Food Engineering:** Definition and scope of food engineering. Overview of food processing industries and challenges. Units and dimensions in food engineering. **Physical and Gravimetric Properties:** Size, Shape, Volume, Density, Porosity, Specific Surface Area, Mass, Moisture Content, Water Activity (aw), Bulk Density, Specific Gravity. Application of Physical and Gravimetric Properties **Optical Properties:** Color, Transparency/Opacity, Reflectivity, Refractive Index. Application of Optical Properties	10
II	**Material and Energy Balances in Food Processing:** Basic concepts of material balance. Material balance in food processing systems., Energy balance: concepts and calculations. Applications of energy balance in food processing. **Heat Transfer in Food Processing – Fundamentals:** Modes of heat transfer: conduction, convection, and radiation. Fourier's law and thermal conductivity. Heat transfer equations and applications in food processing. Thermal Properties of food and their significance: Thermal Conductivity, Thermal Diffusivity, Specific Heat Capacity, Latent Heat, Enthalpy. Heat Transfer Applications in Food Engineering: **Aerodynamic and Hydrodynamic Properties:** Terminal Velocity, Drag Coefficient, Fluidization Characteristics. Application of Aerodynamic and Hydrodynamic Properties	11
III	**Mass Transfer in Food Processing – Fundamentals:** Mass Transfer Properties (Diffusivity, Permeability, Sorption Isotherms), Principles of diffusion and mass transfer., Fick's law of diffusion and its applications., Mass transfer coefficients in food systems., Significance of mass transfer in drying, extraction, and absorption. Mass Transfer Applications in Food Engineering **Fluid Flow in Food Processing:** Properties of fluids and types of flow (laminar and turbulent). Fluid flow in pipes and channels: continuity equation and Bernoulli's principle. Pumps and pumping systems in food processing. **Rheological and Textural Properties**: Viscosity, Elasticity, Plasticity, Hardness, Cohesiveness, Adhesiveness, Chewiness. Rheological Properties: Viscosity, Elasticity, Plasticity, Flow Behavior: Newtonian and non-Newtonian characteristics. Rheology of food products and its engineering implications.	12
IV	**Mechanical Operations in Food Engineering:** Mechanical Properties: Strength, Stiffness, Fracture Toughness, Compression/Tension Properties, Shear Force. Size reduction: principles and equipment (grinders, crushers, mills). Mixing of food materials: types and applications. Separation processes: centrifugation, filtration, and sieving. Emulsification and homogenization techniques.	12

	Food Process Control and Instrumentation: Basics of process control and automation in food engineering. Measurement of temperature, pressure, and flow in food processing. Control systems: feedback and feedforward control. Computer applications in food engineering. **Food Processing Equipment Design:** Principles of equipment design for food processing. Materials used in food processing equipment. Sanitary design and hygiene requirements. Energy efficiency in equipment design.	

Recommended Books and Resources

1. Heldman, D. R., & Singh, R. P. (2018). *Introduction to Food Engineering* (5th ed.). Academic Press.
2. Fellows, P. J. (2017). *Food Processing Technology: Principles and Practice* (4th ed.). Woodhead Publishing.
3. Rao, M. A., Rizvi, S. S. H., Datta, A. K., & Ahmed, J. (2014). *Engineering Properties of Foods* (4th ed.). CRC Press.
4. Toledo, R. T., Singh, R. K., & Narlikar, S. M. (2018). *Fundamentals of Food Process Engineering* (4th ed.). Springer.
5. Cengel, Y. A., & Ghajar, A. J. (2021). *Heat and Mass Transfer: Fundamentals and Applications* (6th ed.). McGraw-Hill Education.
6. Barbosa-Cánovas, G. V., & Juliano, P. (2005). *Food Powders: Physical Properties, Processing, and Functionality.* CRC Press.
7. McCabe, W. L., Smith, J. C., & Harriott, P. (2020). *Unit Operations of Chemical Engineering* (7th ed.). McGraw-Hill Education.
8. Singh, R. P., & Heldman, D. R. (2009). *Introduction to Food Process Engineering.* Springer.
9. Chandrasekaran, M., & Ramanathan, G. (2018). *Processing and Impact on Active Components in Food.* Academic Press.
10. Brennan, J. G., & Grandison, A. S. (2011). *Food Processing Handbook* (2nd ed.). Wiley-VCH.
11. Ranganna, S. (1986). *Handbook of Analysis and Quality Control for Fruit and Vegetable Products* (2nd ed.). Tata McGraw-Hill Education.
12. NPTEL Online Courses: Food Engineering and Process Control nptel.ac.in.

MSFT423-24: Dairy Technology

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

To provide comprehensive knowledge of dairy technology, including milk composition, processing techniques, fermented and fat-rich dairy products, indigenous products, by-products, value-added dairy innovations, and adherence to standards and legislations, ensuring proficiency in sustainable and quality dairy production.

Course outcome: At the end of the course, the students will be able to

CO1	Understand the composition, properties, and processing techniques of milk and its derivatives, ensuring knowledge of quality assurance and safety.
CO2	Analyze and apply advanced methods for producing fermented dairy products, fat-rich products, and traditional dairy items.
CO3	Develop expertise in processing and utilizing dairy by-products and value-added products for sustainable dairy production.
CO4	Evaluate and implement technological interventions to improve shelf life, scalability, and compliance with dairy standards and legislations.
CO5	Gain practical insights into troubleshooting defects, optimizing production efficiency, and enhancing the nutritional and economic value of dairy products.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	1	3
CO2	2	3	1	2	3
CO3	2	3	1	1	3
CO4	3	2	2	**3**	3
CO5	3	3	1	2	3

Details of the Course Content - Dairy Technology (MSFT423-24)

Unit	Contents	Contact Hours
I	**Introduction to Dairy Technology:** Overview of the dairy industry: global and Indian perspectives, Importance of milk and dairy products in nutrition and economy, **Milk:** Definition, composition and nutritive value of milk and factors affecting it, Physicochemical properties of milk. Milk Lipids: Chemical and functional properties. Chemical reactions (hydrolysis, auto-oxidation), factors affecting oxidation, prevention methods, and measurement techniques. Milk Proteins: Types (caseins, whey proteins), micellar structure, protein precipitation mechanisms, functional roles in emulsification, foaming, and gelation. Milk Enzymes: Key enzymes (catalase, alkaline phosphatase, lipases, proteases) and their roles in milk processing, freshness indicators, and product quality. Coagulation of Milk: Enzymatic (rennet action) and acid-induced coagulation, casein aggregation, and gel formation in cheese and yogurt. **Milk Procurement and Quality Testing:** Clean milk production. Milk procurement systems, Milk collection and chilling centers, Quality and safety testing of raw milk: physical, chemical, and microbiological tests **Liquid Milk Products:** Standardization of milk: fat and SNF adjustment; fullcream, standard, Toned, double-toned, and skimmed milk, Flavoured milk, Reconstituted milk and recombined milk,; Fortification of milk: micronutrients and technologies. Adulteration of milk and its detection. Common preservative used in milk and their detection.	11
II	**Milk Processing Techniques:** Principles of milk processing, Various stages of processing such as Filtration, Clarification, Storage and processing of fluid milk i.e. Pasteurization, sterilization, UHT processing and aseptic packaging and homogenization: principles, types and applications. **Fermented Dairy Products:** **Cheese Technology:** Classification, Production Process, Characteristics, Health Benefits, Common cream defects, their causes, and remedies of various cheese (fresh, ripened, and processed), Microbiology and biochemistry of cheese ripening. **Yogurt and curd:** Definition, Types, Production Process, Characteristics, Health Benefits, Common cream defects, their causes, and remedies **Kumis, Kefir, acidophilus milk, and cultured buttermilk:** Definition, Production Process, Characteristics, Health Benefits, Common cream defects, their causes, and remedies	11
III	**Fat-Rich Dairy Products:** ***Cream:***Types of cream and their respective fat content, Composition and production methods of cream., Factors affecting the richness of cream during separation. Efficiency of cream separators and	12

	optimization techniques.Cream ripening for butter making:Natural ripening and ripening with starter cultures, Objectives and biochemical changes during cream ripening. Common cream defects, their causes, and remedies ***Butter:*** Types and composition of butter, Methods of butter preparation, Factors influencing cream churnability, Theories of churning, Butter grading, Common butter defects, their causes, and remedies. Butter standard and shelf life enhancement techniques. ***Ghee production:*** traditional and industrial methods, Common defects, their causes, and remedies Nutritional aspects and shelf-life enhancement of fat-rich products **Concentrated and Evaporated Milk Products:** Condensed milk and evaporated milk: processing, packaging and uses, Common condensed and evaporated defects, their causes, and remedies; **Dried Milk Products** (WMP, SMP): composition, nutritive value, process of manufacture, Common dry powder defects, their causes, and remedies, Instantization of milk powder. Infant milk food. **Ice Cream and Frozen Dairy products**- composition, nutritive value, process of manufacture, defects (their causes and prevention). Stabilizers and emulsifiers in frozen desserts	
IV	**Indigenous Dairy Products:** Production of khoa, paneer, chhana, shrikhand and traditional sweets (rasgulla, gulab jamun, peda and burfi**).** Technological interventions for scaling up production and shelf-life enhancement**,** Challenges in scaling up traditional dairy processes **By-Products and Value-Added Dairy Products:** Overview of Dairy By-Products- Definition, classification, Products Derived from Dairy By-Products, Challenges in processing and storage of by-products. and benefits of utilizing dairy by-products; Value-Added Dairy Products: Cream Powder, Sterilized Cream, Butter Powder, Butter Spread and Cheese Spread – Production and applications. **Standards and Legislations:** Milk and milk products standards and legislations – part III of Schedule 4 of Food Safety & Standards (Licensing & Registration of Food Businesses) Regulation, 2011, Dairy plant sanitation-hygiene in dairy industry, different types of cleansing and sanitizing agents, their applications, cleaning systems (cleaning in place, central cleaning system, self-contained cleaning system). Documentation and Record Keeping	12

Recommended Books and Resources

1. Walstra, P., Wouters, J. T., & Geurts, T. J. (2005). *Dairy Science and Technology*. CRC Press.
2. Tamime, A. Y., & Robinson, R. K. (2007). *Yoghurt: Science and Technology* (3rd ed.). Woodhead Publishing.
3. Chandan, R. C., Kilara, A., & Shah, N. P. (2015). *Dairy Processing and Quality Assurance* (2nd ed.). Wiley-Blackwell.

4. Fox, P. F., Guinee, T. P., Cogan, T. M., & McSweeney, P. L. (2017). *Fundamentals of Cheese Science* (2nd ed.). Springer.
5. Goff, H. D., & Hartel, R. W. (2013). *Ice Cream* (7th ed.). Springer.
6. Smith, G. (2021). *Milk Processing and Quality Management*. Wiley.
7. Tamime, A. Y. (2009). *Dairy Powders and Concentrated Products*. Wiley-Blackwell.
8. Aneja, R. P., Mathur, B. N., Chandan, R. C., & Banerjee, A. K. (2002). *Technology of Indian Milk Products*. Dairy India.
9. Khanal, A. R. (2020). *Technological Advances in Dairy Processing*. Springer.
10. Early, R. (2020). *The Technology of Dairy Products* (2nd ed.). Springer.
11. Handbook of Dairy Products. (2021). *Dairy Industry Handbook*. Elsevier.
12. International Dairy Federation (IDF) - https://www.fil-idf.org/
13. National Programme on Technology Enhanced Learning (NPTEL) - https://nptel.ac.in/
14. Codex Alimentarius - http://www.fao.org/fao-who-codexalimentarius/
15. Walstra, P., & Jenness, R. (2020). *Dairy Chemistry and Physics* (3rd ed.). Springer.
16. FICSI (2022). Butter and Ghee processing operator. FIC/Q2003
17. FICSI (2022). Ice Cream processing Technician. FIC/Q2004
18. FICSI (2020). Cottage Cheese Maker. FIC/Q2005
19. FSSAI (2011). Food Product Standards:Dairy Products And Analogueshttps://fssai.gov.in/upload/uploadfiles/files/2_%20Chapter%202_1%20%28Dairy%20products%20and%20analogues%29.pdf
20. FSSAI (2011). Table-2A Microbiological Standards for Milk and Milk Products –Process Hygiene Criteria. https://fssai.gov.in/upload/uploadfiles/files/Appendix%20B.pdf.
21. FSSAI (2011). Guidance document provides comprehensive instructions based on Part III of Schedule 4. https://fssai.gov.in/upload/uploadfiles/files/Guidance_Document_Milk_14_03_2019.pdf.
22. FSSAI (2011). Food Safety and Standards (Food Products Standards and Food Additives) Regulations, https://fssai.gov.in/upload/uploadfiles/files/Food_Additives_Regulations.pdf.
23. FSSAI (2018). National Milk Safety and Quality Survey. https://fssai.gov.in/upload/uploadfiles/files/Report_Milk_Survey_NMQS_18_10_2019.pdf.
24. FSSAI. Common Quick tests for detection of Food Adulterants at household. https://fssai.gov.in/upload/knowledge_hub/1878035b34b558a3b48DART%20Book.pdf.
25. Indian Council of Agricultural Research (ICAR) E-Learning Portal for Dairy Technology. Available at: https://ecourses.icar.gov.in

MSFT424-24: Dairy Technology (Lab)

Total marks: 50	**L**	**T**	**P**
	0	**0**	**4**

Course objective:

To develop proficiency in practical techniques for analyzing, processing, and ensuring the quality and safety of milk and milk products in alignment with FSSAI standards and global best practices.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate proficiency in sampling, analyzing, and evaluating the physicochemical properties and quality parameters of milk and milk products.
CO2	Identify and detect common adulterants and microbial contaminants in dairy products, ensuring compliance with food safety and regulatory standards.
CO3	Develop skills in the preparation and quality assessment of various dairy products, including butter, paneer, cheese, yogurt, and ice cream.
CO4	Evaluate the thermal processing efficiency and packaging techniques to ensure the safety, stability, and shelf life of milk and milk-based products.
CO5	Apply knowledge of dairy technology in implementing FSSAI standards and quality control measures for market milk and milk products.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	2	3
CO2	2	1	2	3	3
CO3	3	2	2	2	3
CO4	3	2	1	3	3
CO5	2	3	2	3	3

Details of the Course Content - Dairy Technology (Lab) (MSFT424-24)

Practical no.	Contents	Contact Hours
1	Sampling Techniques for Milk and Milk Products	1
2	Determination of Specific Gravity of Milk	1
3	Analysis of Milk Fat Content and Solid-Not-Fat (SNF)	1
4	COB and Alcohol test	1
5	Milk Acidity and pH Determination	1
6	Detection of Adulterants in Milk	1
7	Methylene Blue Reduction Test (MBRT)	1
8	Preparation of flavoured milk	1
9	Cream Separation and Fat Testing	1
10	Preparation and Quality Evaluation of butter quality	1
11	Alkaline phosphatase test to determine the adequacy of pasteurization.	1
12	Preparation and Quality Evaluation of Ghee	1
13	Preparation and Quality Evaluation of Paneer	1
14	Preparation and Quality Evaluation of Cheese	1
15	Preparation and Quality Evaluation of Yogurt	1
16	Detection of Microbial Contamination	1
17	Determination of the Freezing Point of Milk	1
18	Shelf Life Study of Milk Products	1
19	Preparation and Quality Evaluation of Ice Cream	1
20	Quality Control of Market Milk	1
21	Determination of Milk Proteins	1
22	Analysis of packaging materials, shelf-life impact, and FSSAI labeling requirements.	1

Recommended Books and Resources

1. Bureau of Indian Standards (BIS) Specifications for Milk and Milk Products. Available at: https://bis.gov.in
2. FSSAI Dairy Products Manual (2022). Available at: https://fssai.gov.in
3. International Organization for Standardization (ISO) Guidelines for Milk and Dairy Products. Available at: https://iso.org
4. Association of Official Analytical Chemists (AOAC) Official Methods of Analysis. Available at: https://aoac.org
5. Handbook of Dairy Foods Analysis by Leo M.L. Nollet and Fidel Toldra.
6. Indian Council of Agricultural Research (ICAR) E-Learning Portal for Dairy Technology. Available at: https://ecourses.icar.gov.in
7. National Dairy Development Board (NDDB) Resources. Available at: https://nddb.coop
8. Khan Academy videos on Dairy Technology. Available at: https://khanacademy.org
9. YouTube Channels: NPTEL Dairy Technology Lectures by IITs and Infinity Richa (for competitive exam preparation).
10. Codex Alimentarius Standards for Milk and Milk Products. Available at: https://codexalimentarius.org
11. Practical Dairy Technology by Eiri Board of Consultants and Engineers.
12. "Outlines of Dairy Technology" by Sukumar De.
13. "Modern Dairy Technology" by Robinson, R.K.
14. Dairy Processing and Quality Assurance by Ramesh C. Chandan.

M/FIC/Q7006: Food Packer

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

To equip learners with comprehensive knowledge and practical skills in food packaging technologies, materials, machinery, safety standards, and regulatory compliance, ensuring effective packaging solutions that preserve food quality, enhance shelf life, and meet industry standards.

Course outcome: At the end of the course, the students will be able to

CO1	Students will understand the fundamentals of food packaging, including materials, types, and their properties, enabling them to make informed decisions on packaging solutions.
CO2	Learners will gain knowledge of advanced packaging technologies such as aseptic, active, intelligent packaging, and the application of edible films and coatings.
CO3	Students will develop hands-on expertise in operating and troubleshooting various packaging machines and systems used in the food industry.
CO4	Learners will demonstrate an understanding of safety considerations, environmental requirements, and waste management practices in food packaging operations.
CO5	Students will be proficient in adhering to quality standards and regulatory compliance under the Food Safety and Standards Act, for diverse food products.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	2	2
CO2	2	3	2	2	3
CO3	3	2	2	1	3
CO4	2	1	2	**3**	2
CO5	3	1	2	3	3

Details of the Course Content - Food Packer (M/FIC/Q7006)

Unit	Contents	Contact Hours
I	**Introduction to Food Packaging**: Definition, factors influencing the evolution and selection of food packaging, and functions of food packaging. Overview of the packaging industry. **Food Packaging Types**: Overview of various sectors in food processing and the packaging materials used. Properties of Packaging Materials: Migration aspects of packaging materials. **Paper and Paper-Based Packaging Materials**: Types, properties, testing methods, defects, and applications. **Plastic Packaging Materials**: Types, properties, and testing methods. Processing and conversion of thermoplastic polymers. Laminates in Packaging: Definition, composition (multi-layer structures combining plastic, paper, aluminum, etc.), properties, manufacturing processes, testing methods, and applications in flexible packaging.	10
II	**Metal Packaging**: Processes for container manufacturing (end-making, two-piece and three-piece can manufacture), coatings, functional properties, defects, application and quality control tests. **Aseptic Packaging**: Materials Used and application, sterilization of packaging materials. **Glass Packaging**: Composition, manufacturing process, closures, properties (mechanical, thermal, optical), applications, defects, and quality control tests. **Active and Intelligent Packaging**: Definition, scope, types, principles, and applications. **Edible Films and Coatings**: Materials Used, Properties, application.	11
III	**Food Packaging Line**: Characteristics and subsystems of packaging machines. **Types of Packaging Machines and Their Operating Parameters**: Blister packs, skin packs, and vacuum packaging machines. Aseptic packaging systems, shrink packaging, stretch wrapping. Bottle capping equipment, closures and closing operations. Seaming and sealing machines, wrapping and bagging equipment. Form-fill-seal machines, cartoning machines, filling machines for liquids, dry, and powdered products. Box, case, and tray forming. **Operating Parameters and Fault Diagnosis**: Identification of equipment faults and parameters required to correct them.	12
IV	**Safety Considerations**: Types of food safety problems associated with packaging. Environmental requirements for specific food packaging and waste management (waste reduction, recycling). Personal hygiene and	12

	sanitation guidelines. Cleaning and documentation of packaging machines after use. Use of personal protective equipment (PPE) in packaging operations. **Quality Criteria for Packaging**: Need for quality assurance in packaging. Significance of different quality tests for packaging materials. Integrity testing of packaging items and identification of discrepancies or non-standard outputs. Food packaging system along with packing specification. **Regulatory Compliance**: Food Safety and Standards Act, 2011 - Packaging and Labeling regulations specific to food items such as: Milk and milk products. Fruits and vegetable products. Fats, oils, and fat emulsions. Sweets, confectionery, meat, and poultry products. Fish, seafood, honey, spices, condiments, beverages, salt, and related products. Handling of food and related materials, along with housekeeping practices.	

Recommended Books and Resources

1. Ahvenainen, R. (2003). Novel Food Packaging Techniques. CRC Press.
2. Coles, R., McDowell, D., & Kirwan, M. J. (Eds.). (2003). Food Packaging Technology. Wiley-Blackwell.
3. Robertson, G. L. (2016). Food Packaging: Principles and Practice (3rd ed.). CRC Press.
4. Kirwan, M. J. (2011). Handbook of Paper and Paperboard Packaging Technology (2nd ed.). Wiley-Blackwell.
5. Han, J. H. (2013). Innovations in Food Packaging (2nd ed.). Academic Press.
6. Emblem, A., & Emblem, H. (Eds.). (2012). Packaging Technology: Fundamentals, Materials and Processes. Woodhead Publishing.
7. Soroka, W. (2009). Fundamentals of Packaging Technology (4th ed.). IoPP.
8. Yam, K. L. (2009). The Wiley Encyclopedia of Packaging Technology (3rd ed.). Wiley.
9. Lee, D. S., Yam, K. L., & Piergiovanni, L. (2008). Food Packaging Science and Technology. CRC Press.
10. Mahalik, N. P. (2014). Automation in Packaging and Food Processing. CRC Press.
11. Singh, S. P., & Singh, J. (2011). Packaging Materials and Systems for Food Products. Wiley-Blackwell.
12. Food Safety and Standards Authority of India (FSSAI). (2011). Packaging and Labeling Regulations. Accessible at www.fssai.gov.in.
13. YouTube Channel: Institute of Packaging Professionals (IoPP).: Video lectures on packaging technologies and industry practices.
14. Website: www.packagingdigest.com: Industry updates and innovations in food packaging.
15. Website: www.foodpackagingforum.org: Scientific insights into food packaging materials and safety regulations.
16. Food Packaging Developer, FIC/Q9302 (2022). Accesible at https://www.ficsi.in/upload/participant_handbook/Food%20Packaging%20Developer%20PHB%20English_Final.pdf
17. Food Packer, FIC/Q7006 (2023). Accesible at https://www.ficsi.in/upload/participant_handbook/Food%20Packer%20PH%20V1.0%20english.pdf
18. Food Products Packaging Technician, FIC/Q7001 (2016). Accesible at https://www.ficsi.in/upload/practical_guides/3f7942240cacd95c45a0c93b01d118c1.pdf

M/FIC/Q7001: Food Products Packaging Technician (Lab)

Total marks: 50	**L**	**T**	**P**
	0	**0**	**4**

Course objective:

To equip learners with the technical knowledge and practical skills required for effective food packaging operations, including material identification, quality testing, machinery operation, documentation, regulatory compliance, and shelf-life estimation of packaged foods.

Course outcome: At the end of the course, the students will be able to

CO1	Students will demonstrate the ability to clean, maintain, and operate packaging machinery and work areas to ensure efficiency and hygiene.
CO2	Learners will acquire skills in planning and calculating packaging materials, machinery, and manpower requirements for optimal production output.
CO3	Students will gain proficiency in testing and identifying various packaging materials, understanding packaging regulations, and addressing packaging defects.
CO4	Learners will perform quality tests on diverse packaging materials such as paper, plastic, metal, glass, and composites, ensuring compliance with industry standards.
CO5	Students will effectively document packaging processes, maintain records of packed products, and estimate shelf life using sorption isotherm curves for different packaged foods.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	2	3
CO2	2	3	2	2	3
CO3	3	2	3	3	3
CO4	3	2	1	3	3
CO5	3	1	2	2	3

Details of the Course Content - Food Products Packaging Technician (Lab) (M/FIC/Q7001)

Practical no.	Contents	Contact Hours
1	Demonstrate the appropriate method for cleaning and maintaining the work area and process machineries	1
2	Demonstrate how to plan and calculate packaging materials, machineries and Manpower required for getting desired quantity of finished product	1
3	Carry out the process of post-production cleaning and regular maintenance work	1
4	Demonstrate the process of maintaining documentation for packaging materials	1
5	Demonstrate the Records of Packed Products	1
6	Identification and testing of packaging materials used for different foods	1
7	Identify different types of food packaging and packing material with their Packaging Regulation	1
8	Sampling Plan and Condition of Test Specimen	1
9	Quality Tests for paper and paper boards	1
10	Quality Tests for Plastic Films and Laminates	1
11	Quality Tests for Aluminium Foils	1
12	Quality Tests for Glass Containers	1
13	Classification of Packaging defects	1
14	Quality Tests for Metal Containers	1
15	Quality Tests for Plastic Containers	1
16	Quality Tests for Kraft Liner, Fluting Media	1
17	Quality Tests for Corrugated Board, Folding Cartons, Lined Carton, Liners, Aseptic Cartons	1
18	Performance Tests of Corrugated Fibre Board Boxes	1
19	Quality Tests for Thermoformed Containers	1
20	Peel Test on Lid or Sealing Material	1
21	Peel Test of Adhesive Tapes	1
22	Tack Loop Test for Testing the Adhesive Strength of Adhesive Tape	1
23	Unscrewing Lids/Torsion Testing	1
24	Preparation sorption isotherm curve and estimation of shelf life various packaged foods	1

Recommended Books and Resources

1. Food Products Packaging Technician, FIC/Q7001 (2016). Accesible at https://www.ficsi.in/upload/practical_guides/3f7942240cacd95c45a0c93b01d118c1.pdf
2. Food Packaging Developer, FIC/Q9302 (2022). Accesible at https://www.ficsi.in/upload/participant_handbook/Food%20Packaging%20Developer%20PHB%20English_Final.pdf
3. Food Packer, FIC/Q7006 (2023). Accesible at https://www.ficsi.in/upload/participant_handbook/Food%20Packer%20PH%20V1.0%20english.pdf
4. Food Safety and Standards Authority of India (FSSAI). (2011). Packaging and Labeling Regulations. Accessible at www.fssai.gov.in.
5. Robertson, G. L. (2016). Food Packaging: Principles and Practice (3rd ed.). CRC Press.
6. Kirwan, M. J. (2011). Handbook of Paper and Paperboard Packaging Technology (2nd ed.). Wiley-Blackwell.

7. Emblem, A., & Emblem, H. (Eds.). (2012). Packaging Technology: Fundamentals, Materials and Processes. Woodhead Publishing.
8. Soroka, W. (2009). Fundamentals of Packaging Technology (4th ed.). IoPP.
9. Yam, K. L. (2009). The Wiley Encyclopedia of Packaging Technology (3rd ed.). Wiley.
10. YouTube Channel: Institute of Packaging Professionals (IoPP).: Video lectures on packaging technologies and industry practices.
11. Website: www.packagingdigest.com: Industry updates and innovations in food packaging.
12. Website: www.foodpackagingforum.org: Scientific insights into food packaging materials and safety regulations.
13. Bureau of Indian Standards (BIS): IS 8312: Specification for Food Packaging Materials
14. Indian Standards for Paper Testing - IS 1060 (Part 1 to 3): Testing of Paper and Paperboard.
15. Handbook of Packaging Technology by A. Emblem and H. Emblem, Woodhead Publishing.
16. Food Packaging: Principles and Practice by Gordon L. Robertson, CRC Press.
17. YouTube Channel: Institute of Packaging Professionals (IoPP) - Video tutorials on packaging machinery operation and testing.
18. Testing and Quality Assurance in Packaging - ASTM D4169 for Performance Testing of Shipping Containers.
19. Plastic Films and Laminates Testing - ASTM D882: Standard Test Method for Tensile Properties of Thin Plastic Films.
20. Handbook of Corrugated Fibreboard by McKinlay, American Forest & Paper Association.
21. Metal Containers Testing Standards - IS 14002: Testing of Tin and Steel Containers.
22. Peel Testing and Adhesive Strength Analysis - ASTM D3330: Standard Test Method for Peel Adhesion.
23. Practical Guide to Packaging Materials by Deborah L. Dull.
24. Sorption Isotherm and Shelf-Life Estimation - CRC Handbook of Food Science and Technology.
25. Singh, S. P., & Singh, J. (2011). Packaging Materials and Systems for Food Products. Wiley-Blackwell.

M/FIC/Q9001: Processed Food Entrepreneur

Total marks: 100	**L**	**T**	**P**
	4	**0**	**0**

Course objective:

To equip learners with comprehensive knowledge and skills in entrepreneurship, business planning, and operational management specific to the processed food industry, enabling them to establish and manage sustainable food processing enterprises with an emphasis on innovation, regulatory compliance, and market competitiveness.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate a clear understanding of entrepreneurship concepts, roles, and opportunities, particularly in the processed food industry, while integrating innovation and sustainability into business practices.
CO2	Develop and evaluate business plans, conduct feasibility studies, and design strategies for product selection, costing, branding, and packaging tailored to market needs.
CO3	Gain proficiency in planning and establishing food processing units, including site selection, financing, documentation, and adherence to regulatory requirements.
CO4	Execute operational processes in food processing, including plant design, recruitment, production, quality assurance, and food safety practices, ensuring compliance with industry standards.
CO5	Apply effective marketing, sales, distribution, and sanitization strategies to manage and grow food processing enterprises, fostering competitiveness and sustainability in the marketplace.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	2	2	2
CO2	3	3	2	3	3
CO3	3	2	2	3	3
CO4	3	2	3	2	3
CO5	2	3	3	3	3

Details of the Course Content - Processed Food Entrepreneur (M/FIC/Q9001)

Unit	Contents	Contact Hours
I	**Introduction to Entrepreneurship** **Concepts of Entrepreneurship**: Definition, characteristics, and types of entrepreneurship. Innovation and sustainability in food businesses **Business Opportunities in Entrepreneurship**: Identification and evaluation of business ideas in the food industry. **Entrepreneur vs. Entrepreneurship**: Roles, characteristics, and significance. **Overview of the "Processed Food Entrepreneur" Role**: Responsibilities, challenges, and opportunities in the field. Overview of Processed Food Industry. Case studies of successful entrepreneurs. **Skills for Success**: Professional skills, IT skills for business, Core skills in food entrepreneurship **Evaluate and Develop Entrepreneurship Skills**: Identifying business opportunities, Conducting a market study, Preparing a business plan, Managing an enterprise, Utilizing online banking and digital tools for business operations.	11
II	**Selection of Product and Business Planning** **Business Planning**: Definition and importance of a business plan, Key components of a business plan, Understanding risks in small businesses, Steps to establish a business **Business Idea Generation and Validation:** Process for selecting the right product, Identifying market gaps and consumer needs Feasibility study for the product, Market research and analysis, Product development and testing methodologies **Costing, Branding, and Packaging**: Principles of product costing, Developing a branding strategy, Selecting appropriate packaging materials and designs	11
III	**Preparing for the Start-Up of a Food Processing Unit** **Site Selection for the Food Processing Unit**: Criteria for selecting a suitable site, Regulatory and logistical considerations **Finance Management**: Methods for arranging finance, Financial institutions offering loans, Requirements and procedures for securing loans, Types of loans available for food entrepreneurs	12

	Entrepreneur's Memorandum: Filing procedures for the Entrepreneur's Memorandum, Importance of the memorandum for business registration **Documentation and Record Keeping**: Maintaining accurate documentation for regulatory compliance and record-keeping best practices for food processing units.	
IV	**Starting a Food Processing Unit** **Food Processing Unit Design and Construction**: Designing food processing plants, Layout planning and optimization, Construction requirements for food safety compliance **Setting Up a Food Processing Unit**: Recruitment and training of manpower, Production processes and machinery selection, Obtaining necessary registrations and licenses, Labelling and packaging regulations for food products **Food Production and Testing**:Verifying raw materials, Conducting trial production runs, Food nutrition analysis and laboratory testing, Food Product Production, Food Product Inspection **Marketing and Sales**: Developing marketing strategies for food products, Setting up distribution channels, Managing logistics for efficient food distribution **Cleaning and Sanitization**: Implementing cleaning and sanitization processes, Sterilization and hygiene maintenance in food processing facilities.	12

Recommended Books and Resources

1. Acharya, S. S., & Agarwal, N. L. (1987). *Agricultural Marketing in India*. Oxford & IBH Publishing Co., New Delhi.
2. Chandra, P. (1996). *Projects: Planning, Analysis, Selection, Implementation and Review*. Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. David, D., & Erickson, S. (1987). *Principles of Agri-Business Management*. McGraw Hill Book Co., New Delhi.
4. Desai, V. (2011). *The Dynamics of Entrepreneurial Development and Management*. Himalaya Publishing House Pvt. Ltd., Mumbai.
5. Desai, V. (2012). *Fundamentals of Entrepreneurship and Small Business Management*. Himalaya Publishing House Pvt. Ltd., Mumbai.
6. Fellows, P., & Axtell, B. (2012). *Setting up and Running a Small Food Business: A Guide for Food Entrepreneurs*. CTA.
7. Goyal, M., & Parkash, J. (2011). *Entrepreneurship Development*. Kalyani Publishers.
8. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2020). *Entrepreneurship*. McGraw Hill.
9. Holt, D. H. (2002). *Entrepreneurship – A New Venture Creation*. Prentice Hall of India, New Delhi.
10. Kotler, P., Keller, K. L., & Chernev, A. (2021). *Marketing Management*. Pearson.
11. Osterwalder, A., & Pigneur, Y. (2010). *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. Wiley.

12. Processed Food Entrepreneur - FIC/Q9001(2022). Accesible at https://www.ficsi.in/upload/participant_handbook/PH_English_Processed%20Food%20Entrepreneur_FICQ9001_Ver3.0.pdf.
13. Sivakumar, A. I. (2014). *Introduction to Food Manufacturing Engineering*. CRC Press.

MSFT425-24: Industrial Visit with Cold Storage Technician Course

Total marks: 40	**L**	**T**	**P**
	0	**0**	**3**

Course objective:

To provide students with practical exposure to food industry operations and/or cold storage technologies through industrial visits or expert interactions and completion of the FICSI - Cold Storage Technician Course, fostering technical skills in cold storage systems, equipment maintenance, temperature control, and industry standards compliance.

Course outcome: At the end of the course, the students will be able to

CO1	Demonstrate an understanding of food industry operations and cold storage technologies through hands-on exposure and expert-led interactions.
CO2	Develop technical proficiency in the maintenance and operation of cold storage systems, including temperature control and equipment management.
CO3	Acquire knowledge of industry standards, safety protocols, and best practices for cold chain management in the food sector.
CO4	Enhance report-writing and analytical skills by documenting and presenting findings from industrial visits or expert lectures.
CO5	Obtain FICSI certification as a Cold Storage Technician, ensuring industry-recognized competence and readiness for professional roles.

Mapping of Course Outcomes with Program Outcomes: Formulation of Course Outcomes-Program Outcomes matrix with correlation values as 1 (Low), 2 (Medium), 3 (High)

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	2	1	1	2
CO2	3	2	2	1	3
CO3	3	1	2	2	3
CO4	2	1	3	2	2
CO5	3	1	3	2	3

Details of the Course Content - Industrial Visit with Cold Storage Technician Course (MSFT425-24)

Unit	Contents	Contact Hours
I	Students are required to visit any food industry or attend a guest lecture by a food industry expert. Subsequently, they must submit a report to the Head of the Department and Course Coordinator.	12
II	Cold Storage Technician course must be completed and certified from https://www.skillindiadigital.gov.in or https://elearning.ficsi.in/ or any FICSI recognized Training center	

Recommended Books and Resources

1. https://elearning.ficsi.in
2. https://www.skillindiadigital.gov.in