Choice Based Credit System

Scheme & Syllabus of

Bachelor of Science (Hons) in Food Technology

B.Sc. (Hons)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:	Bachelor of Science (Hons) in Food Technology **Or** B.Sc. (Hons) in Food Technology
Program Level	Undergraduate (UG) Programme
Duration	4 years (8 Semesters)
Eligibility for Admission	Passing of 10+2 examination (Science) or 10+2 arts with Food Preservation / Food Science and Technology Vocational subject of the recognized board (Punjab School Education Board / C.B.S.E. / I.C.S.E) with 40% marks or any other equivalent examination.
Year of Implementation	New Syllabus will be implemented from 2024 onwards.
Medium of Instruction	English

Program Education Objectives:

1. To make the students competent in developing future foods by utilizing technologies such as dehydration, freezing, irradiation, fermentations, applications of enzymes in food processing, food product development, nutraceuticals, and nutritional and functional foods.

2. To keep students abreast with the rapid developments reported within technology and biological science that are creating completely new ways of developing various processed foods.

3. To impart an understanding of modern food processing and profound knowledge of technology associated with the development of healthy and safe foods.

4. To motivate and enable students of B.Sc. Food Technology to opt for higher levels of learning viz. post-graduate program, and doctoral programs by research in this interdisciplinary field with the view of developing highly skilled professionals to work in Industry and academia.

Program Outcomes:

PO1	To impart knowledge of various areas related to Food Science and Technology
PO2	To enable the students to understand food composition and its physicochemical, nutritional, microbiological, and sensory aspects
PO3	To familiarize the students with the processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products
PO4	To emphasize the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering, and packaging in the food industry.
PO5	To impart an understanding of modern food processing and profound knowledge of technology associated with the development of healthy and safe foods**.**

Mapping of Program Outcomes with Program Education Objectives: -

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

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		
BSFT111-24	Foundations of Food Science	DSC	4	0	0	40	60	100	4
BSFT112-24	Technology of Food Preservation	DSC	4	0	0	40	60	100	4
BSFT113-24	Food Analysis and Preservation (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
HVPE101-18	Human Values, De-addiction, and Traffic Rules	AECC	3	0	0	40	60	100	3
HVPE102-18	Human Values, De-addiction and Traffic Rules (Lab/Seminar)	AECC	0	0	1	25[##]	--	25	1
BTHU103-18	English	AECC	1	0	0	40	60	100	1
BTHU104-18	English (Lab)	AECC	0	0	2	30	20	50	1
BSFT114-24	Industrial Visit with FoSTaC Course	AECC	0	0	3	40	--	40	3
BMPD102-18	Mentoring and Professional Development	SEC-VB	0	0	1	25[##]	--	25	1
	Total		**20**	**0**	**15**	420	420	840	30

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

[##]The Human Values, De-addiction and Traffic Rules (Lab/ Seminar), and Mentoring and Professional Development course will have internal evaluation only.

BSFT111-24: Foundations 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	1	3
CO2	1	3	3	1	2
CO3	1	3	1	3	1
CO4	1	3	3	1	2
CO5	3	3	3	3	3

Details of the Course Content - Foundations of Food Science (BSFT111-24)

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.

BSFT112-24: Technology of Food 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	1	1	2	3
CO2	2	3	2	2	2
CO3	**3**	3	2	3	2
CO4	3	2	3	3	3
CO5	2	1	2	2	3

Details of the Course Content - Technology of Food Preservation (BSFT112-24)

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.

BSFT113-24: 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	2	1	1	3	1
CO2	3	3	2	2	2
CO3	2	3	1	3	2
CO4	2	2	3	2	2
CO5	2	2	2	2	3

Details of the Course Content - Food Analysis and Preservation (Lab) (BSFT113-24)

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 and Effect of pH on Microbial Stability of Foods.	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.

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	2
CO2	2	1	1	3	2
CO3	2	2	2	3	3
CO4	2	2	3	3	3
CO5	2	2	1	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. F 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
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7. International Organization for Standardization. (2018). ISO 19011:2018 - Guidelines for Auditing Management Systems. Retrieved from https://www.iso.org
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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
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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
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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	3	1	1	2	2
CO2	3	2	2	3	3
CO3	2	1	1	3	2
CO4	3	2	2	3	3
CO5	3	3	3	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; Role of Phyton, Pandas, Numpy, matplotlib in machine learning. 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	2	1	1	3	1
CO2	3	3	2	2	2
CO3	2	3	1	3	2
CO4	2	2	3	2	2
CO5	2	2	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 Punjabi/Hindi words into English 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

HVPE101-18: HUMAN VALUES, DE-ADDICTION AND TRAFFIC RULES

Total marks: 100	**L**	**T**	**P**
	3	**0**	**0**

Course objective:

To equip students with comprehensive communication skills, including theory, types, and modes of communication, proficiency in verbal and non-verbal language, enhanced reading and interpretation abilities, and effective writing techniques, preparing them for diverse personal, social, and professional contexts.

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

CO1	Students will develop a comprehensive understanding of the theory, types, and modes of communication, enabling effective verbal and non-verbal interactions across various contexts.
CO2	Students will gain proficiency in spoken and written communication, encompassing personal, social, and business scenarios, and learn strategies to overcome communication barriers.
CO3	Students will master close reading, comprehension, summary paraphrasing, and analysis, fostering critical thinking and interpretive abilities through diverse texts, including translations between Hindi/Punjabi and English.
CO4	Students will acquire essential writing skills for documenting, report writing, note-making, and letter writing, enhancing their ability to produce clear and structured written communication.
CO5	Students will develop effective intra-personal, inter-personal, and group communication skills, preparing them for collaborative and professional environments.

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	1	1	1	1	2
CO2	1	2	1	2	3
CO3	2	2	1	2	3
CO4	2	1	2	3	3
CO5	2	1	1	2	3

Details of the Course Content - Human Values, De-Addiction And Traffic Rules (HVPE101-18)

Unit	Contents	Contact Hours
I	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** 1. Understanding the need, basic guidelines, content and process for Value Education 2. Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels	6
II	**Understanding Harmony in the Human Being - Harmony in Myself!** 1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 2. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha 3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 4. Understanding the characteristics and activities of 'I' and harmony in 'I' 5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail 6. Programs to ensure Sanyam and Swasthya- Practice Exercises and Case Studies will be taken up in Practice Sessions.	6
III	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** 1. Understanding harmony in the Family- the basic unit of human interaction 2. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship 3. Understanding the meaning of Vishwas; Difference between intention and competence 4. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship 5. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals	6

	6. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!- Practice Exercises and Case Studies will be taken up in Practice Sessions.	
IV	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** 1. Understanding the harmony in the Nature 2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature 3. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all- pervasive space 4. Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	4
V	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** 1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems 6. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations	6

Recommended Books and Resources

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.
2. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
3. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
4. A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
5. Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
6. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
7. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
8. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
9. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limitsto*

Growth – Club of Rome's report, Universe Books.
10. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers ,* Oxford University Press
11. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including HumanValues)*, Eastern Economy Edition, Prentice Hall of India Ltd.
12. B P Banerjee, 2005, *Foundations of Ethics and Management,* Excel Books.
13. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
14. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, *http://uhv.ac.in*
2. Story of Stuff, *http://www.storyofstuff.com*
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology – the Untold Story*

HVPE102-18: HUMAN VALUES, DE-ADDICTION AND TRAFFIC RULES (LAB/ SEMINAR)

Total marks: 25	**L**	**T**	**P**
	0	**0**	**1**

Course objective:

This course aims to facilitate students in self-exploration and understanding of human values to recognize the interconnection between personal well-being and societal harmony, ultimately empowering them to develop sustainable solutions for societal problems.

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

CO1	Students will develop a profound understanding of human values and their relevance in addressing global and societal issues.
CO2	They will gain skills in self-exploration and reflection, enabling them to set and achieve personal and professional goals aligned with ethical principles.
CO3	The course will equip students with the ability to distinguish between the needs of the self and the body, fostering holistic well-being.
CO4	Students will learn to apply their knowledge to improve interpersonal relationships and contribute positively to society.
CO5	They will be empowered to devise and implement sustainable solutions for societal challenges, promoting a harmonious and prosperous community.

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	1	1	1	2	2
CO2	2	1	1	2	3
CO3	1	2	1	2	3
CO4	1	1	2	3	2
CO5	1	2	2	3	3

Details of the Course Content -Human Values, De-Addiction And Traffic Rules (Lab/ Seminar) (HVPE102-18)

Practical no.	Contents	Contact Hours
1	Course Introduction - Need, Basic Guidelines, Content and Process for Value Education	14
2	Understanding Harmony in the Human Being - Harmony in Myself!	
3	Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship	
4	Understanding Harmony in the Nature and Existence - Whole existence as Co-existence	
5	Implications of the above Holistic Understanding of Harmony at all Levels of Existence	
6	One each seminar will be orgnizied on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar atleast once during the semester. It will be binding for all the students to attend the seminar.	

Recommended Books and Resources

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Value Education.
2. Ivan Illich, 1974, *Energy & Equity,* The Trinity Press, Worcester, and HarperCollins, USA
3. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
4. A Nagraj, 1998, *Jeevan Vidya ek Parichay,* Divya Path Sansthan, Amarkantak.
5. Sussan George, 1976, *How the Other Half Dies,* Penguin Press. Reprinted 1986, 1991
6. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Purblishers.
7. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
8. Subhas Palekar, 2000, *How to practice Natural Farming,* Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
9. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limitsto Growth – Club of Rome's report*, Universe Books.
10. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers ,* Oxford University Press
11. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including HumanValues)*, Eastern Economy Edition, Prentice Hall of India Ltd.
12. B P Banerjee, 2005, *Foundations of Ethics and Management,* Excel Books.
13. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
14. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, *http://uhv.ac.in*
2. Story of Stuff, *http://www.storyofstuff.com*
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology – the Untold Story*

BTHU103-18: ENGLISH

Total marks: 100	**L**	**T**	**P**
	1	**0**	**0**

Course objective:

To equip students with comprehensive communication skills, including theory, types, and modes of communication, proficiency in verbal and non-verbal language, enhanced reading and interpretation abilities, and effective writing techniques, preparing them for diverse personal, social, and professional contexts.

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

CO1	Students will develop a comprehensive understanding of the theory, types, and modes of communication, enabling effective verbal and non-verbal interactions across various contexts.
CO2	Students will gain proficiency in spoken and written communication, encompassing personal, social, and business scenarios, and learn strategies to overcome communication barriers.
CO3	Students will master close reading, comprehension, summary paraphrasing, and analysis, fostering critical thinking and interpretive abilities through diverse texts, including translations between Hindi/Punjabi and English.
CO4	Students will acquire essential writing skills for documenting, report writing, note-making, and letter writing, enhancing their ability to produce clear and structured written communication.
CO5	Students will develop effective intra-personal, inter-personal, and group communication skills, preparing them for collaborative and professional environments.

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	1	1	1	1	2
CO2	1	2	1	2	3
CO3	2	2	1	2	3
CO4	2	1	2	3	3
CO5	2	1	1	2	3

Details of the Course Content - English (BTHU103-18)

Unit	Contents	Contact Hours
I	**Introduction:** Theory of Communication, Types and Modes of Communication	3
II	**Language of Communication:** Verbal and Non-verbal, Spoken and Written, Personal, Social and Business, Barriers and Strategies, Intra-personal, Inter-personal and Group communication	4
III	**Reading and Understanding**: Close Reading, Comprehension, Summary Paraphrasing, Analysis and Interpretation, Translation(from Hindi/Punjabi to English and vice-versa), Literary/Knowledge Texts	4
IV	**Writing Skills:** Documenting, Report Writing, Making notes, Letter writing	4

Recommended Books and Resources

1. Oxford University Press. (2020). *Fluency in English - Part II*.
2. Pearson. (2022). *Business English*.
3. Orient Blackswan. (2023). *Language, Literature and Creativity*.
4. Mishra, G., Kaul, R., & Biswas, B. (Eds.). (forthcoming). *Language through Literature*.
5. Zinsser, W. (2021). *On Writing Well*. Harper Resource Book.
6. Hamp-Lyons, L., & Heasly, B. (2021). *Study Writing*. Cambridge University Press.
7. Crystal, D. (2003). English as a Global Language (2nd ed.). Cambridge University Press.
8. Halliday, M. A. K., & Matthiessen, C. (2014). Halliday's Introduction to Functional Grammar (4th ed.). Routledge.
9. Hyland, K. (2019). Second Language Writing (2nd ed.). Cambridge University Press.
10. McCarthy, M. (1991). Discourse Analysis for Language Teachers. Cambridge University Press.
11. Swales, J. M., & Feak, C. B. (2012). Academic Writing for Graduate Students (3rd ed.). University of Michigan Press.
12. Brown, G., & Yule, G. (1983). *Discourse Analysis*. Cambridge University Press.

BTHU104-18: ENGLISH (LAB)

Total marks: 50	**L**	**T**	**P**
	0	**0**	**2**

Course objective:

The objective of this course is to enhance students' proficiency in oral communication through interactive practice sessions, covering listening comprehension, self-introduction, group discussions, role plays, everyday conversations, workplace communication, interviews, formal presentations, monologues, effective communication strategies, and public speaking.

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

CO1	Demonstrate improved listening comprehension and engage effectively in self-introductions, group discussions, and role plays.
CO2	Navigate common everyday situations with confidence through effective conversations and dialogues.
CO3	Communicate proficiently in workplace settings, including conducting and participating in interviews.
CO4	Deliver formal presentations and monologues with clarity and professionalism.
CO5	Identify and rectify miscommunication, ensuring effective public speaking and overall communication 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	1	1	1	2	1
CO2	1	1	1	2	1
CO3	1	1	1	2	2
CO4	1	1	1	2	2
CO5	1	1	1	2	2

Details of the Course Content - English (Lab) (BTHU104-18)

Practical no.	Contents	Contact Hours
	Interactive practice sessions in Language Lab on Oral Communication	
1	Listening Comprehension	2
2	Self Introduction, Group Discussion and Role Play	4
3	Common Everyday Situations: Conversations and Dialogues	4
4	Communication at Workplace	2
5	Interviews	2
6	Formal Presentations	4
7	Monologue	2
8	Effective Communication/ Mis- Communication	2
9	Public Speaking	4

Recommended Books and Resources

1. Oxford University Press. (2020). *Fluency in English - Part II*.
2. Pearson. (2022). *Business English*.
3. Swan, M. (2021). *Practical English Usage* (4th ed.). Oxford University Press.
4. Kumar, S., & Lata, P. (2018). *Communication Skills* (2nd ed.). Oxford University Press.
5. CIEFL, Hyderabad. (2019). *Exercises in Spoken English* (Parts I-III). Oxford University Press.

BMPD101-18: MENTORING AND PROFESSIONAL DEVELOPMENT

Total marks: 25	**L**	**T**	**P**
	0	**0**	**1**

Course objective:

The objective of mentoring is to develop overall personality, technical and general aptitude, general awareness, communication skills, and presentation skills.

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

CO1	Demonstrate enhanced technical and general aptitude through expert lectures and aptitude tests.
CO2	Exhibit improved communication and presentation skills via group discussions, quizzes, and student presentations.
CO3	Develop effective teamwork and leadership abilities through team-building exercises and outdoor activities.
CO4	Gain a broader understanding of current affairs and general knowledge, facilitated by diverse classroom interactions and society activities.
CO5	Show increased engagement in extracurricular and community service activities, contributing to holistic personal and professional growth.

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	2	1	1	2	2
CO3	2	1	1	2	2
CO4	2	1	1	2	2
CO5	2	1	1	2	2

Details of the Course Content - Mentoring and Professional Development (BMPD101-18): The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Practical no.	Contents	Contact Hours
	Part – A (Class Activities)	14
1	Expert and video lectures	
2	Aptitude Test	
3	Group Discussion	
4	Quiz (General/Technical)	
5	Presentations by the students	
6	Team building Exercises	
	Part – B (Outdoor Activities)	
1	Sports/NSS/NCC	
2	Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc	

The evaluation shall be based on rubrics for Part – A & B Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

BSFT114-24: 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 (BSFT114-24)

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		
BSFT121-24	Food Chemistry and Biochemistry	DSC	4	0	0	40	60	100	4
BSFT122-24	Applied Chemistry and Physics in Food Science	OE	4	0	0	40	60	100	4
BSFT123-24	Applied Chemistry and Physics in Food Science (Lab)	OE	0	0	4	30	20	50	2
BSFT124-24	Dairy Technology	DSE	4	0	0	40	60	100	4
BSFT125-24	Dairy Technology (Lab)	DSE	0	0	4	30	20	50	2
B/FIC/Q9001	Processed Food Entrepreneur	SEC-SB/ QP-NOS	4	0	0	40	60	100	4
EVS102-18	Environmental Science	AECC	2	0	0	40	60	100	2
BSFT126-24	Indutsrial Visit with Cold Storage Technician Course	AECC	0	0	3	40##	--	40	3
BMPD202-18	Mentoring and Professional Development	SEC-VB	0	0	1	25##	--	25	1
	Total		**18**	**0**	**12**	325	340	665	26

Indutsrial Visit with Cold Storage Technician Course and Mentoring and Professional Development 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

BSFT121-24: Food Chemistry and 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 (BSFT121-24)

Unit	Contents	Contact Hours
I	**Introduction to Food Chemistry and Biochemistry:** Definition and scope of food chemistry and biochemistry. Food composition. Role of food chemistry in processing, preservation, and its connection to nutrition and health. **Carbohydrates in Foods:** Structure and classification of Carbohydrates. Functional properties. Metabolism, dietary fiber, and related deficiency diseases (ketosis). **Proteins in Foods:** Structure and classification of protein and amino acids. Functional properties. Protein denaturation, enzymatic activity, and deficiency diseases (Kwashiorkor, Marasmus).	12
II	**Lipids in Foods:** Structure, classification and Functional properties of lipids. Role in flavor and texture; health issues (cardiovascular diseases, obesity). **Vitamins and Minerals:** Vitamins: classification, functions, stability, degradation. Minerals: Macro and micro minerals; bioavailability and absorption factors. Deficiency diseases: Scurvy, beri-beri, goitre, rickets, anemia, osteoporosis.	11
III	**Enzymes in Foods:** Nature, classification, and mechanism of enzyme action. Enzyme roles in food processing: Proteases, amylases, lipases, pectinases. Enzyme inhibition and its effects. **Food Colors and Pigments:** Natural pigments: Chlorophyll, carotenoids, anthocyanins, betalains. Synthetic colors and regulations; pigment stability under conditions. Role in food quality and acceptability. **Food Additives:** Definition, classification: Preservatives, antioxidants, emulsifiers, stabilizers. Safety, regulations, and role in improving food quality and shelf life.	11
IV	**Food Flavors and Aromas:** Chemical basis of flavors; natural and synthetic flavoring agents. Aroma compounds and factors affecting flavor stability in processing/storage. **Nutraceuticals and Functional Foods:** Introduction to nutraceuticals and functional foods. Overview of bioactive compounds (e.g., polyphenols, phytosterols, omega-3s). Health benefits and regulatory aspects. **Food Biochemistry of Fermentation:** Principles and applications of fermentation; role of microorganisms. Biochemical changes: Alcoholic, lactic acid, and acetic acid fermentation. Probiotics and health benefits.	12

	Advanced Topics in Food Biochemistry: Recent research and advancements. Genetic engineering in food composition. Role of omics technologies (genomics, proteomics, 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

BSFT122-24: Applied Chemistry and Physics in Food Science

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

Course objective:

To provide an interdisciplinary understanding of applied chemistry and physics principles in food science, focusing on their role in food processing, preservation, product quality, and innovative applications in the food industry.

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

CO1	Demonstrate a foundational understanding of chemical principles in food science, including the role of atoms, molecules, bonds, and solutions in food processing and preservation.
CO2	Apply concepts of pH, buffers, acid-base reactions, and phase transitions to optimize food quality and stability during various processing methods.
CO3	Analyze the role of oxidation, reduction, hydrolysis, polymerization, and reaction rates in ensuring food safety, shelf life, and textural integrity.
CO4	Utilize principles of physics, including thermodynamics, heat and mass transfer, fluid mechanics, and rheology, to enhance food production, preservation, and equipment efficiency.
CO5	Integrate advanced analytical techniques, such as spectroscopy and polarimetry, to ensure quality control and innovative solutions in food technology applications.

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	3	3	2	2	2
CO3	2	2	3	3	3
CO4	3	2	2	3	3
CO5	2	3	2	3	3

Details of the Course Content - Applied Chemistry and Physics in Food Science (BSFT122-24)

Unit	Contents	Contact Hours
I	**Applied Chemistry-I** **Introduction to Basic Chemistry in Food Science**, Importance of chemistry in food science: Comprehensive focus on food chemistry for processing, preservation, and product quality. **Atoms, Molecules, and Bonds**: Structure, elements, compounds, and bonds (ionic, covalent, hydrogen); interactions in food macromolecules (carbohydate, protein and lipid) and micromolecules (mineral and vitamins). **States of Matter**: Solids, liquids, gases; phase transitions and food behavior during freezing, boiling, and drying. **Solutions and Concentrations**: Types, solubility, and calculations (molarity, molality and normality); applications in syrups, beverages, and brines. **pH and Buffers**: pH concepts, and their measurement, neutralization reactions. Buffer systems in food, and roles in preservation, fermentation, and flavor. Overview of Titration. **Acid-Base Reactions**: Neutralization, with applications in baking, pickling, and emulsions.	11
II	**Applied Chemistry-II** **Oxidation and Reduction**: Basics of electron transfer and their role in food spoilage, autooxidation, lipid oxidation, iodine value, peroxide value and acid value. **Hydrolysis**: Breakdown of molecules with water (e.g., starch to sugar), focusing on enzymatic roles in food processing. **Polymerization**: Large molecule formation (e.g., starch gelatinization) and its role in food texture and structure. **Energy in Reactions**: Enthalpy, entropy, free energy, reaction feasibility and their role in cooking processes and food stability. **Reaction Rates**: Rate of reaction, Order of reaction, Factors affecting rates, and their relevance to shelf life and chemical stability.	12
III	**Applied Physics-I** **Introduction to Physics in Food Science**: Role of physics in food processes: Physics principles in product development, processing, and quality. **Mechanics**: Force and pressure in food processing equipment; applications in packaging, grinding, and mixing systems. **Thermodynamics**: Heat transfer principles (conduction, convection, radiation); energy balance in cooking, freezing, evaporation, drying, and phase transitions in preservation. **Heat and Mass Transfer**: Basics, principles, and mechanisms; applications in baking, frying, and dehydration of foods.	11
IV	**Applied Physics-II**	12

	Fluid Mechanics: Properties of fluids (density, viscosity, specific gravity, surface tension); statics and dynamics; Applications in mixing, pumping, aeration, extrusion, and coating processes. **Rheology**: Concepts of flow, deformation, viscosity, elasticity, plasticity; applications in texture analysis, stability of emulsions, foams, and gels. **Electromagnetic Radiation**: Basics of microwaves and infrared; applications in cooking, drying, and sterilization. **Optics**: Reflection, refraction, and diffraction; lenses, light dispersion, and color measurement in quality control. Spectroscopic Techniques: Applications in food analysis; refractive index testing for quality control. **Polarimetry**: Basics and application in sugar analysis.	

Recommended Books and Resources

1. Atkins, P., & De Paula, J. (2018). *Atkins' Physical Chemistry* (11th ed.). Oxford University Press.
2. Belitz, H. D., Grosch, W., & Schieberle, P. (2009). *Food Chemistry* (4th ed.). Springer.
3. Brown, T. L., LeMay, H. E., & Bursten, B. E. (2017). *Chemistry: The Central Science* (14th ed.). Pearson.
4. Coultate, T. P. (2009). *Food: The Chemistry of Its Components* (5th ed.). Royal Society of Chemistry.
5. Damodaran, S., Parkin, K. L., & Fennema, O. R. (2017). *Fennema's Food Chemistry* (5th ed.). CRC Press.
6. Griffiths, D. J. (2017). *Introduction to Electrodynamics* (4th ed.). Pearson.
7. Halliday, D., Resnick, R., & Walker, J. (2018). *Fundamentals of Physics* (11th ed.). Wiley.
8. Heldman, D. R., & Singh, R. P. (2018). *Introduction to Food Engineering* (6th ed.). Academic Press.
9. Hui, Y. H. (Ed.). (2006). *Handbook of Food Science, Technology, and Engineering*. CRC Press.
10. Pomeranz, Y., & Meloan, C. E. (2000). *Food Analysis: Theory and Practice* (3rd ed.). Springer.
11. Rao, M. A., Rizvi, S. S. H., & Datta, A. K. (2005). *Engineering Properties of Foods* (3rd ed.). CRC Press.
12. Rao, M. A., & Rizvi, S. S. H. (2002). *Rheology of Fluid and Semisolid Foods: Principles and Applications*. Springer.

BSFT123-24: Applied Chemistry and Physics in Food Science (Lab)

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

Course objective:

To provide hands-on experience and technical skills in analyzing chemical and physical properties of food systems, applying principles of food science to assess quality, processing, preservation, and innovation using advanced analytical techniques and experimental methodologies.

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

CO1	Develop proficiency in performing key analytical techniques for determining chemical properties such as pH, solubility, buffer capacity, and peroxide values in food samples.
CO2	Gain hands-on experience in studying physical changes in food systems, including phase transitions, viscosity, and gelatinization, to understand food behavior during processing.
CO3	Analyze enzymatic reactions, reaction rates, and energy transformations to optimize food quality and stability under varying conditions of temperature and pH.
CO4	Apply principles of rheology, heat transfer, and mass transfer to evaluate texture, dehydration, and cooking methods for diverse food products.
CO5	Utilize advanced instruments like polarimeters, spectrophotometers, and refractometers for quantitative and qualitative analysis to ensure food quality and innovation.

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	3	3	3	2	2
CO3	3	3	2	3	3
CO4	3	2	3	3	3
CO5	2	3	2	3	3

Details of the Course Content - Applied Chemistry and Physics in Food Science (Lab) (BSFT123-24)

Practical no.	Contents	Contact Hours
1	Determination of the pH of Various Food Products	1
2	Preparation and Standardization of Solutions	1
3	To determine the neutralization capacity of vinegar and other acidic food samples.	1
4	To analyze the buffer capacity of food items like yogurt and brine.	1
5	To observe freezing and boiling point changes in water and sugar solutions	1
6	To determine the solubility of common salts and sugars in water at different temperatures.	1
7	To demonstrate hydrogen bonding in protein and starch solutions.	1
8	To analyze the role of oxidation in lipid spoilage by testing peroxide values in oils.	1
9	To study starch hydrolysis using amylase enzymes and test for sugar formation using iodine.	1
10	To observe the gelatinization of starch during heating and analyze its effect on viscosity.	1
11	To study the effect of temperature and pH on the reaction rate of enzymatic browning in fruits.	1
12	To analyze the energy changes (enthalpy and entropy) during food heating and cooling processes.	1
13	To measure the pressure applied during dough kneading or food compression using a hydraulic press.	1
14	To investigate conduction, convection, and radiation during food cooking using boiling water, ovens, and microwaves.	1
15	To measure water loss during the drying of fruits and vegetables in a dehydrator.	1
16	To study energy balance and phase transitions during the freezing and thawing of food samples.	1
17	To measure the viscosity, density, and specific gravity of various liquids such as juices, syrups, and oils.	1
18	To test the flow and deformation properties of sauces, gels, and emulsions using a rheometer.	1
19	To analyze the effect of microwave radiation on cooking time and texture of food samples.	1
20	To measure the refractive index of sugar solutions using a refractometer.	1
21	To perform qualitative analysis of food dyes and pigments using a UV-visible spectrophotometer.	1
22	To determine the concentration of sugar solutions using a polarimeter.	1

Recommended Books and Resources

1. AOAC International. (2019). *Official Methods of Analysis* (21st ed.). AOAC International. A comprehensive guide to standardized food analysis methods.

2. BIS. (2020). *Bureau of Indian Standards: Food Testing and Analysis Standards*. Bureau of Indian Standards. Retrieved from https://www.bis.gov.in/
3. Ranganna, S. (1986). *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. Tata McGraw-Hill Publishing.
4. Nielsen, S. S. (2017). *Food Analysis* (5th ed.). Springer. A foundational text for various food analytical techniques.
5. Pomeranz, Y., & Meloan, C. E. (2000). *Food Analysis: Theory and Practice* (3rd ed.). Springer. Covers practical approaches to food testing.
6. Heldman, D. R., & Singh, R. P. (2018). *Introduction to Food Engineering* (6th ed.). Academic Press. Practical applications of thermodynamics and mass transfer.
7. Griffiths, D. J. (2017). *Introduction to Electrodynamics* (4th ed.). Pearson. Fundamentals of electromagnetic radiation.
8. Chemistry LibreTexts. (n.d.). *Food Chemistry and Physical Properties* [Online resource]. Retrieved from https://chem.libretexts.org/

BSFT124-24: 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	2	3	2	3	2
CO2	2	2	3	3	3
CO3	2	2	3	2	3
CO4	3	3	2	**3**	3
CO5	2	3	2	3	3

Details of the Course Content - Dairy Technology (BSFT124-24)

Unit	Contents	Contact Hours
I	**Introduction to Dairy Technology:** Global and Indian dairy industry overview; role of milk in nutrition and economy. **Milk:** Definition, composition, nutritive value, and factors affecting it.Physicochemical properties. Milk Lipids: Chemical and functional properties; reactions (hydrolysis, auto-oxidation), oxidation prevention, and measurement. Milk Proteins: Types (caseins, whey proteins), micellar structure, precipitation, and functional roles in emulsification, foaming, and gelation. Milk Enzymes: Key enzymes (catalase, alkaline phosphatase, lipases, proteases) in processing, freshness, and quality. Coagulation of Milk: Enzymatic (rennet) and acid coagulation; casein aggregation and gel formation in cheese/yogurt. **Milk Procurement and Quality Testing:** Clean milk production, procurement systems, collection/chilling centers. Raw milk quality tests. **Liquid Milk Products:** Standardization (fat/SNF adjustment): Full-cream, standard, toned, double-toned, skimmed milk. Flavored, reconstituted, recombined milk; fortification with micronutrients. Adulteration detection and preservatives in milk.	11
II	**Milk Processing Techniques:** Principles and stages: Filtration, clarification, pasteurization, sterilization, UHT processing, aseptic packaging, and homogenization (principles, types, applications). **Fermented Dairy Products:** **Cheese Technology:** Classification, Production Process, Characteristics, Health Benefits, Common cream defects, their causes, and remedies of various cheese, 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 and fat content, composition, and production methods. Factors affecting richness, cream separation efficiency, and	12

	optimization. Cream ripening: Natural and starter culture-based; biochemical changes. Common defects, causes, and remedies. **Butter:** Types, composition, and preparation methods. Factors influencing churnability, churning theories, and butter grading. Common defects, causes, remedies, and shelf-life enhancement. **Ghee Production:** Traditional and industrial methods. Nutritional aspects and shelf-life improvement. **Concentrated and Evaporated Milk Products:** Condensed and evaporated milk: Processing, packaging, and uses. Common defects, causes, and remedies. **Dried Milk Products:** Whole and skimmed milk powder: Composition, nutritive value, manufacturing. Common defects, causes, remedies, instantization, and infant milk food. **Ice Cream and Frozen Dairy Products:** Composition, nutritive value, manufacturing process. Common defects, causes, remedies, stabilizers, and emulsifiers in frozen desserts.	
IV	**Indigenous Dairy Products:** Production of khoa, paneer, chhana, shrikhand, and traditional sweets (rasgulla, gulab jamun, peda, burfi). Technological interventions for scaling up production and shelf-life enhancement. Challenges in scaling up traditional processes. **By-Products and Value-Added Dairy Products:** **Dairy By-Products:** Definition, classification, derived products, processing/storage challenges, and utilization benefits. **Value-Added Products:** Cream powder, sterilized cream, butter powder, butter spread, and cheese spread – production and applications. **Standards and Legislations:** Milk and milk product standards under Food Safety & Standards Regulation, 2011 (Schedule 4, Part III). Dairy plant sanitation: Hygiene, cleansing/sanitizing agents, cleaning systems (CIP, central, self-contained). Documentation and record-keeping practices.	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

BSFT125-24: 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	2	3	2	3	2
CO2	2	3	2	3	3
CO3	2	3	3	3	3
CO4	2	2	3	3	3
CO5	2	2	3	3	3

Details of the Course Content - Dairy Technology (Lab) (BSFT125-24)

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.

B/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	3	2
CO2	2	2	3	3	3
CO3	2	2	3	3	3
CO4	2	3	3	3	3
CO5	2	2	3	3	3

Details of the Course Content - Processed Food Entrepreneur (B/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	12

	Finance Management: Methods for arranging finance, Financial institutions offering loans, Requirements and procedures for securing loans, Types of loans available for food entrepreneurs **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.

EVS102-18: Environmental Science

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

Course objective:

To impart comprehensive knowledge of environmental science, focusing on ecosystems, natural resources, biodiversity, pollution, environmental policies, human-environment interactions, and sustainable development, while fostering practical skills through fieldwork and case studies.

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

CO1	Develop an understanding of the multidisciplinary nature, scope, and importance of environmental studies, with a focus on sustainability and sustainable development.
CO2	Analyze ecosystem structure, functions, energy flow, and biodiversity through theoretical concepts and real-world case studies of various ecosystems.
CO3	Evaluate the impact of human activities on natural resources, biodiversity, and the environment, and propose sustainable solutions.
CO4	Demonstrate knowledge of environmental pollution, laws, policies, and international agreements to address global environmental challenges effectively.
CO5	Apply theoretical knowledge through fieldwork to document environmental assets, assess local pollution, and study ecosystems for practical understanding and conservation efforts.

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	1
CO2	3	2	1	1	2
CO3	2	2	1	3	2
CO4	2	1	1	3	2
CO5	3	2	2	2	3

Details of the Course Content - Environmental Science (EVS102-18)

Unit	Contents	Contact Hours
I	**Introduction to environmental studies:** Multidisciplinary nature of environmental studies; Scope and importance; Concept of sustainability and sustainable development. **Ecosystems:** What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems : Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	8
II	**Natural Resources : Renewable and Non---renewable Resources:** Land resources and landuse change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water : Use and over---exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter---state). Energy resources : Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies. **Biodiversity and Conservation :** Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega---biodiversity nation; Endangered and endemic species of India. Threats to biodiversity : Habitat loss, poaching of wildlife, man---wildlife conflicts, biological invasions; Conservation of biodiversity : In---situ and Ex---situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.	14
III	**Environmental Pollution: E**nvironmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution. Nuclear hazards and human health risks. Solid waste management : Control measures of urban and industrial waste. Pollution case studies. **Environmental Policies & Practices: C**limate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture. Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act. International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.	16
IV	**Human Communities and the Environment:** Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management : floods, earthquake, cyclones and landslides. Environmental movements : Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of	11

	Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi). **Field work:** Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. Visit to a local polluted site---Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems---pond, river, Delhi Ridge, etc	

Recommended Books and Resources

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999.*Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll.*Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. *Science,* 339: 36---37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams*(pp. 29---64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971.*Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012.*Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India*. *Tripathi 1992*.
14. Sengupta, R. 2003. *Ecology and economics*: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology*: *Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger*: *A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006.*The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987.*Our Common Future*. Oxford University Press.

BSFT126-24: 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 (BSFT126-24)

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

BMPD202-18: Mentoring And Professional Development

Total marks: 25	**L**	**T**	**P**
	0	**0**	**1**

Course objective:

The objective of mentoring is to develop overall personality, technical and general aptitude, general awareness, communication skills, and presentation skills.

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

CO1	Demonstrate enhanced technical and general aptitude through expert lectures and aptitude tests.
CO2	Exhibit improved communication and presentation skills via group discussions, quizzes, and student presentations.
CO3	Develop effective teamwork and leadership abilities through team-building exercises and outdoor activities.
CO4	Gain a broader understanding of current affairs and general knowledge, facilitated by diverse classroom interactions and society activities.
CO5	Show increased engagement in extracurricular and community service activities, contributing to holistic personal and professional growth.

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	2	1	1	2	2
CO3	2	1	1	2	2
CO4	2	1	1	2	2
CO5	2	1	1	2	2

Details of the Course Content - Mentoring and Professional Development (BMPD202-18):
The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Practical no.	Contents	Contact Hours
	Part – A (Class Activities)	14
1	Expert and video lectures	
2	Aptitude Test	
3	Group Discussion	
4	Quiz (General/Technical)	
5	Presentations by the students	
6	Team building Exercises	
	Part – B (Outdoor Activities)	
1	Sports/NSS/NCC	
2	Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc	

The evaluation shall be based on rubrics for Part – A & B Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

SEMESTER- III

Program Scheme & Syllabus

Semester III

Course Code	Course Title	Course Type	Load			Marks Distribution		Total	Credits
			L	T	P	Internal	External		
BSFT211-24	Food Microbiology	DSC	4	0	0	40	60	100	4
BSFT212-24	Food Microbiology (Lab)	DSC	0	0	4	30	20	50	2
BSFT213-24	Applied Mathematics and Biology in Food Science	GE	4	0	0	40	60	100	4
BSFT214-24	Applied Mathematics and Biology in Food Science (Lab)	GE	0	0	4	30	20	50	2
BSFT215-24	Technology of Fruits & Vegetables	DSE	4	0	0	40	60	100	4
BSFT216-24	Technology of Fruits & Vegetables (Lab)	DSE	0	0	4	30	20	50	2
BSFT217-24	Quality Control In Food Industry	DSC	4	0	0	40	60	100	4
BSFT218-24	Industrial Visit with FoSTaC Course	AECC/ SEC-SB	0	0	2	40	--	40	1
BMPD302-18	Mentoring and Professional Development	SEC-VB	0	0	1	25[##]	--	25	1
	Total		16	**0**	**15**	315	300	615	24

[#] Students will learn the practical application of FoSTaC-Advance Retail and Distribution skills in the food industry through summer training after their second year.

[##]The mentoring and Professional Development courses will be evaluated internally only.

BSFT211-24: Food Microbiology

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

Course objective:

To provide an in-depth understanding of food microbiology, focusing on microbial growth dynamics, foodborne pathogens, food preservation techniques, and safety systems, while emphasizing the role of microbes in food fermentation and the management of food safety through national and international standards.

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

CO1	Understand the principles of food microbiology and the role of microorganisms in food spoilage and preservation.
CO2	Analyze the impact of microbial growth factors and apply appropriate food preservation techniques, including thermal processing, chemical preservatives, and high-pressure methods.
CO3	Demonstrate knowledge of microbial fermentation processes and their application in the production of fermented foods and beverages.
CO4	Identify common foodborne pathogens, understand their modes of transmission, and implement preventive measures for foodborne illnesses.
CO5	Apply food safety management systems, including HACCP and regulatory guidelines, to ensure compliance with food safety standards and regulations.

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	3	3	2	3
CO3	2	2	3	2	3
CO4	3	3	1	3	2
CO5	2	**3**	2	3	3

Details of the Course Content - Food Microbiology (BSFT211-24)

Unit	Contents	Contact Hours
I	Fundamentals of Microbiology and Food Microbiology Introduction to food microbiology: scope and significance ; Historical milestones and pioneers in microbiology; Principles and basis of microbial classification; Overview of three- and five-kingdom classification systems; Distinctions between prokaryotic and eukaryotic organisms;; Classification of microorganisms in food (bacteria, yeasts, molds); Sources and types of microbial contamination in foods: Fresh produce (vegetables, fruits), Cereals, pulses, oilseeds, Dairy and meat products; Hygiene and handling practices to prevent spoilage; Overview of microbiological hazards in food systems	12
II	Microbial Growth Dynamics and Food Preservation Microbial growth phases and nutritional requirements; Intrinsic and Extrinsic factors influencing microbial growth; Spoilage mechanisms and biochemical deterioration in various food commodities; Principles and techniques of food preservation:Thermal processing (pasteurization, sterilization), Cold chain management and low-temperature storage, Radiation methods (ionizing and non-ionizing), Use of chemical preservatives and natural antimicrobials, High-pressure processing (HPP); Control of water activity (aw)	12
III	Microbiology of Fermented Foods and Microbial Applications Microbial roles in food fermentation: metabolic pathways and functional microbes; Production and characteristics of fermented dairy products (e.g., yogurt, cheese); Introduction to Fermented plant-based foods: pickles, sauerkraut, kimchi; Introduction to Fermented animal-based products: fish sauces, fermented meats; Alcoholic and non-alcoholic fermented beverages: beer, wine, vinegar, kombucha; Introduction to single-cell protein (SCP): sources, production, and nutritional value; Industrial and traditional perspectives on microbial food processing	12
IV	Foodborne Pathogens, Public Health, and Safety Systems Food poisoning and microbial toxins, types of food poisonings; Foodborne illnesses: types, symptoms, and prevention; Bacterial pathogens associated with food poisoning (e.g., *Salmonella*, *Listeria*, *E. coli*, *Clostridium*); Non-bacterial causes of foodborne diseases: Toxic algae and mycotoxins from fungi, Viral pathogens (e.g., Norovirus, Hepatitis A); Food microbiological quality standards and regulatory guidelines; Food safety management systems:HACCP (Hazard Analysis and Critical Control Points) principles and implementation, Hurdle technology: multi-factorial approach to food preservation, Food hygiene audits and microbiological surveillance, National and international food safety regulations (e.g., FSSAI, Codex Alimentarius)	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.

BSFT212-24: Food Microbiology (Lab)

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

Course objective:

To equip students with the skills and knowledge required for setting up and maintaining a microbiological laboratory, operating and maintaining lab equipment, preparing culture media, conducting microbiological assays, and ensuring hygiene, sanitation, and quality assurance in food microbiology.

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	1	3	2
CO2	2	3	1	3	2
CO3	3	2	2	3	3
CO4	3	3	2	3	3
CO5	3	3	2	3	3

Details of the Course Content - Food Microbiology (Lab) (BSFT212-24)

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/

BSFT213-24: Applied Mathematics and Biology in Food Science

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

Course objective:

To equip students with essential mathematical and biological concepts and techniques, focusing on their applications in food science, including food quality, preservation, microbial growth, enzymology, and biotechnology for food technology.

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

CO1	Apply mathematical tools, such as algebra, statistics, and calculus, to solve real-world problems in food quality, preservation, and process efficiency.
CO2	Utilize logarithmic and exponential functions to model microbial growth, pH, and acidity changes in food products.
CO3	Understand and apply cell biology concepts, including enzymatic processes in food technology like juice clarification and meat tenderization.
CO4	Identify and classify microorganisms, analyze microbial growth factors, and apply control measures in food preservation and safety.
CO5	Comprehend the basics of genetic engineering and biotechnology and their applications in food technology, including the role of GMOs.

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	3	2	2	3
CO3	3	3	2	2	3
CO4	3	3	**2**	3	3
CO5	3	2	1	2	3

Details of the Course Content - Applied Mathematics and Biology in Food Science (BSFT213-24)

Unit	Contents	Contact Hours
I	Mathematics-I Introduction to Mathematics in Food Science: Applications in Food Science: Mathematical tools in food quality, preservation, and process efficiency. Algebra: Basic operations, simplification, and solving linear and quadratic equations, Solving systems of two linear equations; ratio and proportion calculations for concentration and dilution. Statistics: Mean, median, mode, and standard deviation; applications in quality control and sensory analysis.	11
II	Mathematics-II Logarithms and Exponentials: Concepts of logarithmic and exponential functions; applications in modeling microbial growth, pH, and acidity changes in food. Calculus: Differentiation and integration; applications in enzyme kinetics, heat transfer, and modeling microorganism growth kinetics. Dimensional Analysis: Unit conversions and dimensionless numbers; applications in scaling production processes.	11
III	Biology-I Cell Biology- Structure of Cells: Overview of prokaryotic and eukaryotic cells; key organelles and their functions. Cellular Processes: Respiration and fermentation relevant to food science. Enzymology: Introduction to Enzymes: Functions, factors affecting activity, and examples in food processing. Applications in Food Technology: Enzymatic processes like juice clarification and meat tenderization.	11
IV	Biology-II Microbiology Basics- Microbial Classification: Introduction to bacteria, fungi, yeasts, and molds. Microbial Growth: Factors influencing growth and their implications in food preservation. Microbiology and Food Safety; Beneficial microorganisms in fermentation. Pathogens and Spoilage Organisms: Key examples and control measures. Genetics and Biotechnology : Basics of DNA, Introduction in GMOs, and their application in food technology.	11

Recommended Books and Resources

1. Singh, R. P., & Heldman, D. R. (2013). *Introduction to food engineering* (5th ed.). Academic Press.
2. Shideler, R. W. (1983). *Introductory mathematics for food science and technology*. CRC Press.
3. Bluman, A. G. (2017). *Elementary statistics: A step-by-step approach* (10th ed.). McGraw-Hill Education.
4. Billo, E. J. (2007). *Excel for scientists and engineers: Numerical methods*. Wiley.
5. Spiegel, M. R. (2000). *Schaum's outline of college algebra* (3rd ed.). McGraw-Hill Education.
6. Ayers, F. (2005). *Schaum's outline of calculus* (4th ed.). McGraw-Hill Education.
7. Toledo, R. T. (2007). *Fundamentals of food process engineering* (3rd ed.). Springer.
8. Mader, S. S. (2014). *Biology* (11th ed.). McGraw-Hill Education.
9. Deb, A. C. (2001). *A textbook of biochemistry*. New Central Book Agency.
10. Whitaker, J. R. (1994). *Principles of enzymology for the food sciences* (2nd ed.). CRC Press.
11. Schlegel, H. G. (1993). *General microbiology* (7th ed.). Cambridge University Press.
12. Doyle, M. P., & Buchanan, R. L. (Eds.). (2012). *Food microbiology: Fundamentals and frontiers* (4th ed.). ASM Press.
13. Shetty, K., & Paliyath, G. (Eds.). (2006). *Food biotechnology* (2nd ed.). CRC Press.
14. Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., & Stahl, D. A. (2017). *Brock biology of microorganisms* (15th ed.). Pearson.
15. NCERT. (2021). *Biology: Textbook for Class XI & XII*. National Council of Educational Research and Training.
16. Virtual Labs. (n.d.). Biotechnology and Biomedical Engineering Labs. Government of India. Retrieved May 31, 2025, from http://vlab.co.in.

BSFT214-24: Applied Mathematics and Biology in Food Science (Lab)

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

Course objective:

To develop hands-on skills in applying quantitative, microbiological, enzymatic, and sensory techniques for analysis, preservation, and quality assessment of food products using modern laboratory tools and methodologies.

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

CO1	Accurately determine concentrations, prepare and dilute food solutions, and perform ingredient adjustments using mathematical principles.
CO2	Conduct sensory evaluations and analyze statistical data using software tools like Excel and SPSS for informed food quality assessment.
CO3	Perform microbiological techniques including aseptic inoculation, serial dilution, microbial enumeration, and observe microbial growth dynamics.
CO4	Evaluate enzymatic activities and apply biochemical assays related to food processing, such as amylase and pectinase functions.
CO5	Demonstrate practical skills in food preservation methods, microbial identification, DNA isolation, and molecular techniques for GMO detection.

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	1	2
CO2	3	3	1	2	2
CO3	3	3	2	3	3
CO4	3	3	2	2	3
CO5	3	3	3	3	3

Details of the Course Content - Applied Mathematics and Biology in Food Science (Lab) (BSFT214-24)

Practical no.	Contents	Contact Hours
1	Determination of concentration using ratio and proportion in food solutions.	1
2	Preparation and dilution of salt/sugar solutions for food preservation.	2
3	Solving linear equations for ingredient substitution and recipe adjustment.	1
4	Calculation of mean, median, mode, and standard deviation from food sample data.	2
5	Sensory evaluation using the 9-point hedonic scale and analysis of results.	2
6	Graphical representation of statistical data using Excel or SPSS.	2
7	Plotting microbial growth curves using log CFU/mL data.	2
8	Estimation of shelf life using exponential decay modeling.	1
9	Analysis of enzymatic reaction rates (e.g., amylase activity) using Michaelis-Menten kinetics.	2
10	Calculation of heat transfer in food using integration (area under the curve).	2
11	Unit conversions in food process calculations (metric to imperial and vice versa).	1
12	Calculation of Reynolds number and other dimensionless quantities in fluid flow.	2
13	Microscopic observation and differentiation of prokaryotic and eukaryotic cells.	2
14	Observation of yeast fermentation and CO_2 production using balloon setup.	2
15	Comparative sugar utilization by yeast in different substrates.	2
16	Enzyme activity test: Amylase breakdown of starch.	2
17	Application of pectinase enzyme in fruit juice clarification.	2
18	Aseptic technique and preparation of microbial streak plates.	2
19	Serial dilution and standard plate count for microbial enumeration.	2
20	Study of temperature and pH effects on microbial growth.	2
21	Demonstration of food preservation using salt, sugar, and vinegar.	2
22	Identification of beneficial microorganisms in curd, bread, and fermented foods.	2
23	Isolation of DNA from plant material (banana/onion)	2
24	Demonstration or simulation of GMO detection (ELISA/PCR based)	2

Recommended Books and Resources

1. Singh, R. P., & Heldman, D. R. (2013). *Introduction to food engineering* (5th ed.). Academic Press.
2. Bluman, A. G. (2017). *Elementary statistics: A step-by-step approach* (10th ed.). McGraw-Hill Education.
3. Shideler, R. W. (1983). *Introductory mathematics for food science and technology*. CRC Press.
4. Doyle, M. P., & Buchanan, R. L. (Eds.). (2012). *Food microbiology: Fundamentals and frontiers* (4th ed.). ASM Press.
5. Cappuccino, J. G., & Sherman, N. (2013). *Microbiology: A laboratory manual* (10th ed.). Pearson.
6. Schlegel, H. G. (1993). *General microbiology* (7th ed.). Cambridge University Press.

7. Deb, A. C. (2001). *A textbook of practical biochemistry*. New Central Book Agency.
8. Whitaker, J. R. (1994). *Principles of enzymology for the food sciences* (2nd ed.). CRC Press.
9. Shetty, K., & Paliyath, G. (Eds.). (2006). *Food biotechnology* (2nd ed.). CRC Press.
10. Mader, S. S. (2014). *Biology laboratory manual* (11th ed.). McGraw-Hill Education.
11. Toledo, R. T. (2007). *Fundamentals of food process engineering* (3rd ed.). Springer.
12. Billo, E. J. (2007). *Excel for scientists and engineers: Numerical methods*. Wiley.
13. Virtual Labs. (n.d.). Biotechnology and Biomedical Engineering Labs. Government of India. Retrieved May 31, 2025, from http://vlab.co.in

BSFT215-24: Technology of Fruits and Vegetables

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

Course objective:

To equip learners with in-depth knowledge and practical understanding of the current trends, processing technologies, preservation methods, quality standards, and regulatory frameworks in the postharvest management and value addition of fruits and vegetables, emphasizing sustainable practices and food safety compliance.

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

CO1	Demonstrate comprehensive understanding of fruit and vegetable classification, chemical composition, and nutritional significance, along with current industry trends.
CO2	Analyze the physiological and biochemical changes during harvesting, ripening, and storage, and their impact on postharvest quality and shelf life.
CO3	Apply knowledge of preharvest and postharvest handling, minimal processing, preservation techniques, and packaging to maintain quality and safety.
CO4	Evaluate processing technologies for diverse fruit and vegetable products including juices, jams, pickles, and beverages, ensuring compliance with quality standards and regulations.
CO5	Develop sustainable approaches for waste management and implement food safety, hygiene, and regulatory standards, including FSSAI guidelines, in 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	1	3	2
CO2	3	3	1	2	3
CO3	3	2	2	3	3
CO4	3	2	2	3	3
CO5	3	3	2	3	3

Details of the Course Content - Technology of Fruits and Vegetables (BSFT215-24)

Unit	Contents	Contact Hours
I	Overview of trends in fruit and vegetable processing, including classification, composition, and nutrition. Preharvest and postharvest physiology focusing on factors affecting quality, maturity indices, ripening, and biochemical changes influencing shelf life. Postharvest handling covering cleaning, sorting, grading, pre-packaging, edible coatings, and the significance of postharvest technology. Precooling and cooling systems such as hydrocooling, forced-air, vacuum, evaporative cooling, and cold chain management for quality preservation.	11
II	Fundamentals of processing including washing, sorting, grading, peeling, blanching, coring, pitting, and minimal processing with quality considerations. Preservation methods: canning, bottling (conventional & aseptic), freezing, dehydration, including principles, equipment, storage, spoilage, labeling and standards. Fruit juice processing—types (fresh, concentrates, squash, RTS, syrups, powders), extraction, preservation (pasteurization, freezing, drying, aseptic packaging), clarification, concentration, packaging, defects, and quality standards.	12
III	Fruits and Vegetable Derived Products: Processing of fruit and vegetable products like jams, jellies, marmalades: Pectin role, processing, equipment, preservation principle, packaging, storage, defects, and quality standards. Preserved and candied fruits—types, Preservation principles (osmotic dehydration, sugar crystallization,), processing, packaging, storage, defects, and quality standards. Vegetable juices and derivatives (puree, paste, ketchup, soup, sauces)—processing, equipment, preservation principle, packaging, storage, defects, and quality standards. Tomato products (puree, paste, ketchup, soup, sauces), potato chips, pickles, chutneys, and sauces: Processing, equipment, preservation principle, packaging, storage, defects, and quality standards.	14
IV	Vinegar production (synthetic & brewed)—raw materials, Processing, equipment, preservation principle, packaging, storage, defects, and quality standards.	12

	Wine, perry, cider, champagne, and brandy processing—classification, raw materials, fermentation, aging, Processing, equipment, preservation principle, packaging, storage, defects, and quality standards. Soft drink production—types, formulation, Processing, equipment, preservation principle, packaging, storage, defects, and quality standards. Coconut technology: composition, processing, products. Storage technologies: Ambient, refrigerated, modified and controlled atmosphere, hypobaric storage principles and applications. Packaging materials for fruits and vegetable and techniques for shelf-life extension, including active/intelligent packaging, controlled atmosphere packaging (CAP) and modified atmosphere packaging (MAP) with its microbial effects and commercial uses. Waste management—utilization/disposal of fruit and vegetable processing wastes and by-products. Quality standards, plant sanitation, hygiene, and FSSAI regulations.	

Note: Students must complete the following courses as part of their assignment requirements:

- Jam, Jelly Processing Technician (https://elearning.ficsi.in/courses/Jam-Jelly-and-Ketchup-Processing-Technician-62467cbf0cf25cc910623dbc or https://www.skillindiadigital.gov.in/courses/detail/ecf2ed16-115e-44a8-a817-ec6e1346be1a)
- Pickle-making technician (https://elearning.ficsi.in/courses/Pickle-Making-Technician-6246887a0cf296c1fab0380b or https://www.skillindiadigital.gov.in/courses/detail/24075142-ea6c-48f6-8526-c47b0c4e10ec)

Recommended Books and Resources

1. Yahia, E. M. (Ed.). (2019). *Postharvest Physiology and Biochemistry of Fruits and Vegetables*. Woodhead Publishing.
2. Kader, A. A. (Ed.). (2002). *Postharvest Technology of Horticultural Crops* (3rd ed.). University of California Agriculture and Natural Resources.
3. Singh, R. P., & Heldman, D. R. (2014). *Introduction to Food Engineering* (5th ed.). Academic Press.
4. Potter, N. N., & Hotchkiss, J. H. (1998). *Food Science* (5th ed.). Springer.
5. Verma, L. R., Joshi, V. K., & Srivastava, A. K. (2007). *Postharvest Technology of Fruits and Vegetables: Handling, Processing, Packaging and Storage*. Indus Publishing.
6. Lee, C. Y., & Coates, G. A. (Eds.). (2009). *Fruit and Vegetable Juice Processing Technology*. Wiley-Blackwell.
7. Bhat, R., & Shobha Rani, R. H. (2009). *Technology of Fruits and Vegetables: Processing and Preservation*. IK International Publishing.
8. Sablani, S. S., & Rahman, M. S. (Eds.). (2017). *Food Packaging: Principles and Practice* (3rd ed.). CRC Press.
9. Food Safety and Standards Authority of India. (2023). *Food Safety and Standards (Food Products Standards and Food Additives) Regulations*. Retrieved from https://fssai.gov.in/cms/food-safety-and-standards-regulations.php
10. United States Department of Agriculture. (2018). *Commercial Processing of Fruits and Vegetables* (Agricultural Handbook No. 66).

11. Food and Agriculture Organization of the United Nations. (2011). *Fruit and Vegetable Processing: Technology and Quality*. Retrieved from http://www.fao.org/3/i2877e/i2877e.pdf
12. Arora, A. (2021). *Fruit and Vegetable Processing Technology* [Video lectures]. National Programme on Technology Enhanced Learning (NPTEL). Retrieved from https://nptel.ac.in/courses/
13. Singh, J., & Kaur, L. (2015). *Advances in Fruit and Vegetable Processing*. Apple Academic Press.
14. Singh, R. K., & Pandey, R. K. (2020). *Waste Management in Fruit and Vegetable Processing Industry*. Springer.
15. FoodTech Solutions. (2023). *Modern Technologies in Fruits and Vegetables Processing* [Website]. Retrieved from https://www.foodtechsolutions.com/fruits-vegetables-processing

BSFT216-24: Technology of Fruits and Vegetables (Lab)

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

Course objective:

To develop hands-on skills in the quantitative analysis, quality evaluation, processing, and preservation techniques of fruits and vegetables, enabling students to apply scientific methods for ensuring product quality, safety, and shelf-life enhancement.

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

CO1	Demonstrate proficiency in determining maturity indices, chemical properties, and enzymatic activities critical to fruit and vegetable quality assessment.
CO2	Apply quantitative techniques for estimating key nutritional and biochemical constituents, including sugars, acids, vitamins, and pigments.
CO3	Conduct preparation and quality evaluation of processed fruit and vegetable products such as jams, juices, candies, and canned goods.
CO4	Evaluate the effects of preservation methods, thermal processing, dehydration, and storage conditions on product safety and shelf life.
CO5	Implement postharvest handling practices including pre-cooling, coating, and packaging to enhance quality retention and reduce postharvest losses.

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	3	1	2	3
CO3	3	2	2	3	3
CO4	3	3	2	3	3
CO5	3	2	2	3	3

Details of the Course Content - Technology of Fruits and Vegetables (Lab) (BSFT216-24)

Practical no.	Contents	Contact Hours
1	Assessment of Fruit Maturity Using Standard Maturity Indicators	2
2	Measurement of Total Soluble Solids (TSS) in Fruits via Refractometer	2
3	Determination of pH Levels and Titratable Acidity in Fresh Fruits and Vegetables	2
4	Calculation of the Ratio Between Brix and Acidity in Fruit Samples	2
5	Analysis of Moisture Content and Total Solids in Fruits and Vegetables	2
6	Evaluation of Enzyme Activities (Polyphenol Oxidase, Peroxidase, Pectinase) in Mature Fruit Samples	2
7	Quantification of Vitamin C (Ascorbic Acid) and Its Heat Stability in Fruit Samples	2
8	Estimation of Total and Reducing Sugars Using the Lane and Eynon Titration Method	2
9	Measurement of Non-Enzymatic Browning in Processed Fruit Products	2
10	Determination of Total Polyphenols and Tannin Contents in Fruits	2
11	Quantification of Total Carotenoids Present in Fruits and Vegetables	2
12	Determination of Volatile Acid Content by Steam Distillation Technique	2
13	Measurement of Ethanol Concentration in Fermented Fruit Products	2
14	Quantitative Analysis of Pectin Content in Fruit-Based Products	2
15	Color Evaluation of Fruits and Vegetables Using Colorimetric and Tintometric Methods	2
16	Quality Assessment and Cutout Analysis of Canned Fruits and Vegetables	2
17	Analysis of Hydrochloric Acid-Insoluble Ash in Processed Food Products	2
18	Preparation and Quality Assessment of Pectin-Based Products Such as Jams, Jellies, and Marmalades	2
19	Production and Quality Evaluation of Various Fruit Juice Products: Squash, Nectar, Cordial, Fruit Bars, Murabba, and Tomato Derivatives (Puree, Paste, Sauce)	2
20	Preparation and Quality Analysis of Candied and Preserved Fruits	2
21	Extraction of Enzymes and Clarification Processes for Fruit Pulps and Juices	2
22	Drying and Rehydration Studies of Fruits and Vegetables Using Sun-Drying and Mechanical Dryers	2
23	Thermal Processing and Its Impact on the Quality Attributes of Fruit and Vegetable Products	2
24	Investigation of Pre-Packaging and Pre-Cooling Effects on the Quality and Shelf Life of Fresh Produce	2
25	Evaluation of Wax Coatings Combined with Low-Temperature Storage to Enhance Shelf Life of Fruits and Vegetables	2

Recommended Books and Resources

1. FSSAI Manual of Methods of Analysis of Foods – Fruits and Vegetable Products (PDF) https://fssai.gov.in/upload/uploadfiles/files/Manual_Fruits_Veg_25_05_2016.pdf?utm_source=chatgpt.com
2. Girdharilal, Siddappaa, G.S and Tandon, G.L.1998. Preservation of fruits & Vegetables, ICAR, New Delhi

3. W B Crusess.2004. Commercial Unit and Vegetable Products, W.V. Special Indian Edition, Pub: Agrobios India
4. Manay, S. & Shadaksharaswami, M.2004. Foods: Facts and Principles, New Age Publishers.
5. Ranganna S.1986. Handbook of analysis and quality control for fruits and vegetable products, Tata Mc Graw-Hill publishing company limited, Second edition.
6. Srivastava, R.P. and Kumar, S. 2006 . Fruits and Vegetables Preservation- Principles and Practices. 3rd Ed. International Book Distributing Co.

BSFT217-24: Quality Control In Food Industry

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

Course objective:

To equip students with comprehensive knowledge and practical skills in food quality control, analytical testing methods, quality management systems, and operational strategies for ensuring safety, compliance, and excellence in the food industry.

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

CO1	Explain the fundamentals of food quality, regulatory frameworks, and the role of quality control departments in the food industry.
CO2	Apply various analytical and sensory evaluation techniques to assess the physical, chemical, and microbiological quality of food products.
CO3	Implement quality management systems, certifications, and standards such as ISO 9001, HACCP, and FSSC 22000 in food quality assurance.
CO4	Conduct quality audits, sampling, inspections, and use quality enhancement models like Six Sigma and Kaizen to improve food quality.
CO5	Manage practical aspects of food quality control including inventory, production, storage, transportation, and detect food adulteration and fraud effectively.

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	3	3
CO3	3	2	2	3	3
CO4	3	2	**2**	3	3
CO5	3	2	3	3	3

Details of the Course Content - Quality Control In Food Industry (BSFT217-24)

Unit	Contents	Contact Hours
I	Fundamentals of Food Quality and Quality Control • Definition, Objectives, Scope, and Functions of Food Quality and Quality Control/Assurance • Relationship Between Food Quality and Food Safety: Integrated Overview • Regulatory Frameworks Relevant to Food Quality • Quality Attributes of Food Products: Classification of Objective and Subjective Attributes • Characteristics of Objective and Subjective Measurement • Responsibility of the Quality Control Department • Relationship of Quality Control Department with Other Departments • Quality Specifications for the Buyer • Organizational Structure and Roles in Quality Control • Supplier Quality Management • Emerging Trends and Innovations in Food Quality • Case Studies on Food Quality Challenges	12
II	Analytical Techniques and Testing in Food Quality Control • Sampling Methods in Food Quality Control • Physical Testing Methods: Texture, Size and Shape, Defects, Viscosity and Consistency, Kinetics of Quality Changes, Color and Gloss • Chemical Testing Methods: pH, Acidity, Soluble Solids, Nutritional Analysis • Brief Microbiological Quality Indicators • Pesticide Residue Analysis • Heavy Metals and Contaminants Testing • Instrumental Analysis Techniques: Spectrophotometry, HPLC, GC • Rapid Testing Methods: Biosensors and Rapid Detection Systems • Sensory Evaluation Techniques: Flavours, Taste Testing, Descriptive & Affective Methods • Data Analysis and Interpretation • Quality Control in Laboratory Settings • Control Charts for Recording and Reporting (Statistical Quality Control) • Case Studies in Analytical Testing	12
III	Quality Control Systems, Enhancement Models and Standards Implementation • Quality Management Systems in Food Industry (ISO 9001) • Overview for Food Quality Certifications: FSSC 22000, SQF, BRC, ISO 22000 and HACCP (Quality Perspective Only) • Good Laboratory Practices (GLP) • Traceability and Recall Procedures (Quality-Focused) • Quality Audits: Internal and External	11

	• Acceptance Sampling and Inspections: Sampling Plans, Inspection Procedures, Decision Rules • Evolutionary Operations (EVOP): Advanced Quality Improvement Technique • Quality Enhancement Models: TQM, Six Sigma, Kaizen for Food Quality • Calibration and Maintenance of QC Instruments	
IV	Practical and Operational Aspects of Food Quality Control • Inventory Control and Budgeting in Food Industry • Production Control: Managing Processes and Quality • Storage and Transportation - Supply Chain Quality Control • Quality Control in Dairy Products • Quality Control in Meat and Poultry Products • Quality Control in Fruits and Vegetables • Quality Control in Cereal and Cereal Products • Quality Control in Fats and Oils • Quality Control in Spices • Quality Control in Beverages and Water: Water Quality Control and Testing • Food Fraud and Adulteration Detection, Sustainability, and Digitalization in Food Quality Control	12

Recommended Books and Resources

1. Kramer, A., & Twigg, B. A. (1970). *Quality control for the food industry* (3rd ed., Vol. 1). AVI Publishing Company.
2. Kramer, A., & Twigg, B. A. (1973). *Quality control for the food industry* (3rd ed., Vol. 2). AVI Publishing Company.
3. Rice, R. C. (2016). *Food quality assurance: Principles and practices* (4th ed.). Springer. https://doi.org/10.1007/978-1-4939-3489-5
4. Zeuthen, P., & Brandt, A. (2010). *Quality assurance for the food industry: A practical approach* (3rd ed.). Wiley-Blackwell.
5. Charalambous, G. (Ed.). (2014). *Food analysis and quality control* (2nd ed.). Springer.
6. Bolling, B. W. (Ed.). (2016). *Food quality control: Analytical techniques for the food and beverage industry*. Woodhead Publishing.
7. Fox, P. F., & McSweeney, P. L. H. (2015). *Principles and practices of modern dairy technology* (4th ed.). Wiley-Blackwell.
8. Man, C. M. D., & Jones, A. A. (Eds.). (1990). *Handbook of food quality control*. CRC Press.
9. Doyle, M. P., & Buchanan, R. L. (2013). *Food microbiology: Fundamentals and frontiers* (4th ed.). ASM Press.
10. Zhang, H. Q., & Mittal, G. S. (Eds.). (2015). *Handbook of food safety engineering*. CRC Press.
11. Heldman, D. R., & Hartel, R. W. (2015). *Food process engineering and quality assurance*. Springer.
12. Heldman, D. R., & Liu, C. (Eds.). (2007). *Handbook of food preservation*. CRC Press.
13. Lee, H. H., & Motarjemi, Y. (Eds.). (2013). *Food inspection and quality control*. CRC Press.
14. Motarjemi, Y., & Mortimore, S. (2013). *Food quality management: Technological and managerial principles and practices*. Academic Press.
15. Chambers, D. H. (2008). *Statistical quality control for the food industry*. Wiley.

16. Yiannas, F. (2018). *Food safety culture: Creating a behavior-based food safety management system*. Springer.
17. Jay, J. M., Loessner, M. J., & Golden, D. A. (2005). *Modern food microbiology*. Springer.
18. Robertson, G. L. (2012). *Food packaging: Principles and practice* (3rd ed.). CRC Press.
19. World Health Organization. (2020). *Good manufacturing practices for food* (GMP Guide). WHO Publications.
20. Chambers, D. H. (2008). *Statistical quality control for the food industry*. Wiley.
21. Yiannas, F. (2018). *Food safety culture: Creating a behavior-based food safety management system*. Springer.
22. Jay, J. M., Loessner, M. J., & Golden, D. A. (2005). *Modern food microbiology*. Springer.
23. Robertson, G. L. (2012). *Food packaging: Principles and practice* (3rd ed.). CRC Press.
24. World Health Organization. (2020). *Good manufacturing practices for food* (GMP Guide). WHO Publications.
25. Food Safety and Standards Authority of India (FSSAI). https://www.fssai.gov.in/
26. Codex Alimentarius – Food Standards Programme. http://www.fao.org/fao-who-codexalimentarius/en/
27. International Organization for Standardization (ISO). https://www.iso.org/iso-22000-food-safety-management.html
28. U.S. Food and Drug Administration (FDA) – Food Safety. https://www.fda.gov/food
29. Indian Institute of Technology (IIT) Bombay. (n.d.). *Quality control in food industry* [NPTEL course]. https://onlinecourses.nptel.ac.in/noc22_bt12/preview
30. University of Illinois. (n.d.). *Food quality and safety: An introduction* [Coursera course]. https://www.coursera.org/learn/food-safety

BSFT218-24: Industrial Visit and FoSTaC Course

Total marks: 40	**L**	**T**	**P**
	0	**0**	**2**

Course objective:

To equip students with practical industry exposure and essential food safety knowledge through industrial visits, expert lectures, and completion of the FoSTaC - Food Safety Supervisor - Advance Storage and Transportation course, fostering their competence in food Storage and Transportation 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 (BSFT218-24)

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 - Advance Retail and Distribution. This course should be completed through https://www.skillindiadigital.gov.in/courses/detail/98f276bf-baf6-4433-a6b8-faabcf78f833 or https://elearning.ficsi.in/courses/Food-Safety-Supervisor---Retail-and-Distribution-Advanced-Level-II-6242a8390cf2d3e7695238a6 or any FSSAI-recognized training center.	
III	Students are required to submit a detailed daily in-plant training diary along with a comprehensive training report documenting the in-plant training they completed during the summer vacation after the second semester. Subsequently, a seminar presentation and viva-voce will be conducted by the Course Coordinator based on their training experience and report.	

Recommended Books and Resources

1. https://www.skillindiadigital.gov.in/courses/detail/98f276bf-baf6-4433-a6b8-faabcf78f833
2. https://elearning.ficsi.in/courses/Food-Safety-Supervisor---Retail-and-Distribution-Advanced-Level-II-6242a8390cf2d3e7695238a6

BMPD302-18: MENTORING AND PROFESSIONAL DEVELOPMENT

Total marks: 25	**L**	**T**	**P**
	0	**0**	**1**

Course objective:

The objective of mentoring is to develop overall personality, technical and general aptitude, general awareness, communication skills, and presentation skills.

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

CO1	Demonstrate enhanced technical and general aptitude through expert lectures and aptitude tests.
CO2	Exhibit improved communication and presentation skills via group discussions, quizzes, and student presentations.
CO3	Develop effective teamwork and leadership abilities through team-building exercises and outdoor activities.
CO4	Gain a broader understanding of current affairs and general knowledge, facilitated by diverse classroom interactions and society activities.
CO5	Show increased engagement in extracurricular and community service activities, contributing to holistic personal and professional growth.

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	2	1	1	2	2
CO3	2	1	1	2	2
CO4	2	1	1	2	2
CO5	2	1	1	2	2

Details of the Course Content - Mentoring and Professional Development (BMPD302-18): The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Practical no.	Contents	Contact Hours
	Part – A (Class Activities)	14
1	Expert and video lectures	
2	Aptitude Test	
3	Group Discussion	
4	Quiz (General/Technical)	
5	Presentations by the students	
6	Team building Exercises	
	Part – B (Outdoor Activities)	
1	Sports/NSS/NCC	
2	Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc	

The evaluation shall be based on rubrics for Part – A & B Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

SEMESTER- IV

Course Code	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BSFT221-24	Principles of Food Engineering	3	1	0	40	60	100	4
BSFT222-24	Principles of Food Engineering (LAB)	0	0	4	30	20	50	2
BSFT223-24	Technology of Meat, Fish & Poultry Compulsory	3	1	0	40	60	100	4
BSFT224-24	Technology of Meat Fish and Poultry (LAB)	0	0	4	30	20	50	2
BSFT225-24	Principles and Practices of Food Packaging	3	1	0	40	60	100	4
BSFT226-24	Principles and Practices of Food Packaging (Lab)	0	0	4	30	20	50	2
BSFT227-24	Food Hygiene and Safety	3	1	0	40	60	100	4
BSFT228-24	Industrial Visit with FosTac Course	0	0	3	40	0	40	3
BMPD402-18	Mentoring and Professional Development	0	0	2	25	0	25	1
	TOTAL	12	4	17	315	300	615	26

BSFT221-24: Principles of Food Engineering

Total marks: 100

L	T	P
3	1	0

Course objective:

To provide students with a comprehensive understanding of physical, thermal, and rheological properties of foods while developing the analytical and design skills necessary to apply conservation laws, transport phenomena, and mechanical operations in the systematic design and control of efficient, sanitary food processing systems.

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

CO1	Explain the foundational principles of food engineering, including systems of units, and measure the physical, gravimetric, and optical properties of biological materials required for process modelling.
CO2	Solve material and energy balance equations for steady-state and unsteady-state food processing operations to quantify yield and thermal requirements.
CO3	Application of transport laws and rheological models to predict food behavior during thermal and mechanical processing.
CO4	Demonstration of mechanical operations, including size reduction, mixing, and separation processes, while utilizing process control loops for automation.
CO5	Synthesize engineering data to design sanitary food processing equipment and functional plant layouts that adhere to global hygiene standards (3-A/EHEDG) and energy efficiency goals.

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	1	2	2
CO2	3	2	2	2	3
CO3	3	3	2	2	3
CO4	2	1	3	3	3
CO5	2	1	3	3	3

Unit	Content	Contact Hours
I	**Fundamentals and Engineering Properties of Foods** **Introduction to Food Engineering in Food Industry** Role in processing, preservation, packaging, and storage Overview of small and medium-scale food industries **Systems of Units and Basic Engineering Calculations** SI units, unit conversions, dimensional consistency **Physical and Gravimetric Properties** Size, shape, density, bulk density, porosity	**10**

	Moisture content (wet & dry basis), water activity Practical relevance in storage, grading, and handling **Optical Properties** Color measurement basics Refractive index and Brix measurement Applications in quality control and sorting	
II	**Material and Energy Balances & Heat Transfer** **Principles of Mass Balance** Steady-state mass balance in mixing, drying, evaporation **Basic Energy Balance** Sensible heat, latent heat, simple heating/cooling calculations **Fundamentals of Heat Transfer** Conduction, convection, radiation (conceptual + simple problems) Heat Load Calculations Applications in pasteurization, sterilization, refrigeration **Introduction to Heat Exchangers** Types and basic working principles and constructional features (no detailed design)	**11**
III	**Unit III: Fluid Flow, Mass Transfer and Rheology** **Basics of Fluid Flow** Laminar and turbulent flow (Reynolds number concept) Continuity Equation and Bernoulli's equation (concept and applications) Introduction to pumps used in food industry **Mass Transfer Basics** Drying principles Diffusion concept and applications in dehydration **Rheology of Foods** Newtonian and Non-Newtonian fluids Practical examples: milk, ketchup, dough Importance in equipment selection **Textural Attributes of Foods** Mechanical properties including Hardness, Cohesiveness, Adhesiveness, and Chewiness engineering implications of Texture Profile Analysis (TPA)	**12**
IV	**Mechanical Operations & Food Plant Practices** **Size Reduction Equipment** Crushers, grinders, mills: their working principles and constructional features **Mixing and Emulsification** Types of mixers for dry and wet grinding, their working principles and constructional features Basic homogenization and emulsification concepts and equipment **Separation Processes** Mechanism and equipment for Sieving, Filtration, and Centrifugation (practical applications) **Basics of Hygienic Design** FSSAI Guidelines Food-grade materials (Stainless steel) Cleaning and sanitation principles	**12**

Recommended Books and Resources

1. American Society of Agricultural and Biological Engineers, (2020). ASABE Standards: Physical properties of agricultural products, St. Joseph, MI: ASABE.
2. R. Paul Singh, Dennis R. Heldman and Ferruh Erdogdu **(2024)** Introduction to Food Engineering (6^{th} edn). Academic Press
3. Brennan, J. G., & Grandison, A, S. (2011). Food processing handbook (2nd ed.). Wiley-VCH.
4. Chandra, P., & Singh, R. P. (1995). Applied numerical methods for food and agricultural engineers. CRC Press.
5. Fellows P.J. (2017) Food processing technology: Principles and practice (4^{th} ed.) Woodhead Pb.
6. McCabe W.L, Smith J.C, Harriott P. Unit operations of chemical engineering. McGraw Hill Ed.
7. Earle R.L , Earle M.D (2004) Unit operations in food processing. NZIFST (Inc.)
8. D. G. Rao (2023) Fundamentals of Food Engineering. PHI Learning

BSFT222-24: Principles of Food Engineering (LAB)

Total marks: 50

L	T	P
0	0	4

Course objective:

To enable students to apply engineering principles in measuring physical, thermal, and rheological properties of foods while performing unit operations, mass-energy balances, and process validation through standardized laboratory practices to design efficient and sanitary food processing systems.

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

CO1	Demonstrate proficiency in Good Food Laboratory Practices (GFLP), unit calibrations, and the interpretation of standardized PFD symbols to ensure a safe and professional engineering environment.
CO2	Quantify the physical, gravimetric, and optical properties of diverse food materials using precision instrumentation to facilitate accurate process modeling and material handling.
CO3	Apply psychrometrics, drying kinetics, and steady-state conductivity measurements to optimize energy-intensive food operations.
CO4	Demonstrate the performance of pilot-scale equipment, including heat exchangers, evaporators, and pumps, while validating thermal lethality (F. value) to ensure both processing efficiency and biological safety.
CO5	Develop food plant layouts and characterize complex rheological and textural behaviors of food systems to solve real-world industrial processing and product development challenges.

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

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

Practical no	Content	Contact Hours
1.	Familiarization with Food Engineering Lab layout, safety protocols (GFLP), and instrumentation.	**1**
2.	Practice in unit conversion and calibration of measuring instruments (vernier calipers, screw gauge, digital balances).	**1**
3.	Identification and drafting of standard Process Flow Diagram (PFD) symbols for food equipment.	**1**
4.	Determination of geometric properties (size and shape) of food grains.	**1**
5.	Measurement of 1000-kernel weight and bulk density of grains and pulses.	**1**
6.	Determination of specific gravity and porosity of liquid and solid food materials.	**1**
7.	Measurement of Water Activity (a_w) in dehydrated food samples using a digital water activity meter.	**1**
8.	Psychrometrics: Use of psychrometric charts to determine properties of air-water vapor mixtures.	**1**
9.	Psychrometrics: Application in calculating humidification and dehumidification	**1**

	requirements.	
10.	Mass balance calculation during a size reduction process (Grinding/Milling).	**1**
11.	Screen analysis of food samples: Determination of mean particle diameter and sorting efficiency.	**1**
12.	Energy balance calculation for a simple heating/cooling process (e.g.. water bath heating).	**1**
13.	Measurement of Thermal Conductivity of a liquid food sample using a steady-state method.	**1**
14.	Determination of Specific Heat Capacity of food materials using the Method of Mixtures.	**1**
15.	Determination of drying characteristics: Plotting drying rate curves (Moisture content vs. Time).	**1**
16.	Determination of Reynolds Number and flow type (Laminar/Turbulent) in a pipe flow system.	**1**
17.	Verification of Bernoulli's Principle and performance testing of a Centrifugal Pump.	**1**
18.	Study of the effect of temperature on viscosity: Determination of activation energy for fluid flow.	**1**

Recommended Books and Resources

1. American Society of Agricultural and Biological Engineers. (2020). ASABE Standards: Physical properties of agricultural products. St. Joseph, MI: ASABE.
2. Bourne, M. C. (2002). Food texture and viscosity: Concept and measurement (2nd ed.). Academic Press.
3. Creately. (2025). Process flow diagram symbols: A complete guide for engineers. https://creately.com/guides/pfd-symbols/
4. Earle, R. L., & Earle, M. D. (2004). Unit operations in food processing. NZIFST (Inc.). https://www.nzifst.org.nz/resources/unitoperations/index.htm
5. Food Safety and Standards Authority of India. (2021). Manual on good food laboratory practices. Ministry of Health and Family Welfare, Government of India.
6. Food Safety and Standards Authority of India. (2022). Manual of methods of analysis of foods: Cereals and cereal products (Method 03.018:2022). Ministry of Health and Farmily Welfare, Government of India.
7. Food Safety and Standards Authority of India. (2022). Manual of methods of analysis of foods: Oils and fats (Method 01.097:2022). Ministry of Health and Family Welfare, Government of India.
8. Lewis, M. J. (1990). Physical properties of foods and food processing systems. Woodhead
9. Rao, M. A., Rizvi, S. S. H., Datta, A. K., & Ahmed, J. (2014), Engineering properties of foods (4th ed.). CRC Press..
10. Sahay, K. M., & Singh, K. K. (2004). Unit operations of agricultural processing (2nd ed.). Vikas Publishing House.

BSFT223-24 Technology of Meat, Fish & Poultry

Total marks: 100

L	T	P
3	1	0

Course objective:

To equip students with a multi-dimensional understanding of muscle biology, processing technologies, and preservation methods for meat, poultry, fish, and egg products, while integrating industrial quality evaluation, by-product valorization, and stringent regulatory compliance through FSSAI standards and HACCP frameworks.

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

CO1	Describe the global and national industry landscape and explain the structural and biochemical transformation of muscle into meat to determine its nutritive and physicochemical quality.
CO2	Explain slaughtering practices, abattoir management, carcass dressing, inspection, grading, and primary processing operations used in meat and poultry processing
CO3	Apply humane slaughter techniques and evaluate primary processing, grading, and preservation methods for various livestock and poultry species.
CO4	Illustrate and apply basic preservation and processing methods such as chilling, freezing, curing, smoking, drying, canning, and value addition in meat and fish products
CO5	Describe and apply principles of egg processing, preservation techniques, by-product utilization, and food safety regulations including

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

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

Unit	Contents	Contact Hours
I	**Fundamentals of Meat Science** • **Industry Overview:** Global and Indian livestock/poultry population; current industry status and economic impact. • **Muscle Biology:** Structure, chemical composition, and nutritive value of meat. • **Biochemical Transformation:** Conversion of muscle to meat; post-mortem changes including pH. Rigor Mortis, Thaw rigor, and Cold shortening. • **Quality Attributes:** Factors affecting post-mortem changes and physicochemical properties	10
II	**Slaughter and Meat Processing Technology** • **By-product utilization of Meat:** • **Abattoir Management:** Ante-mortem/Post-mortem examination; Humane slaughter techniques for buffalo, sheep, goat, poultry, and pig. • **Primary Processing:** Carcass dressing, inspection, and grading • **Preservation & value addition:** Preservation by chilling, freezing, pickling, curing, smoking, cooking, canning, dehydration, radiation, chemical and biological preservatives. Technology of sausages (processing, types, and defects); Ready-to-Eat (RTE) meat products.	11

III	**Seafood and Fish Technology** • Primary processing: Handling of fish washing, gutting, filleting, beheading, peeling, deveining etc, factors affecting fish quality • **Cold Chain & Storage:** Chilling/Freezing systems; Onboard/Onshore chilling: changes in quality in chilled and frozen storage, thawing and MAP applications. • **Processing & Preservation:** Salting, smoking, canning, drying, pickling, irradiation, chemical preservation-principles, processes and effect on quality • **Fish Products & Quality:** Fish mince, fish fillets, fish paste, sauce, pickles, surimi and surimi-based products, battered and breaded products, sausages and product quality • **P**rocessing and storage of shellfish (crabs, lobsters, prawns).	12
IV	**Egg Technology and By-Product Valorization** • **Egg Science:** Structure, composition, and nutritive value. • **Egg Preservation & Grading:** Refrigeration, freezing, dehydration. and surface coating: Factors affecting shell egg quality. • **By-Product Utilization:** Valorization of meat, fish, and egg waste: Manufacture of natural casings. • **Safety & Regulatory Compliance:** FSSAI standards for meat and poultry products, microbiological limits for animal proteins, HACCP, GMP/GHP	12

Recommended Books and Resources

1. Lawrie, R. A., & Ledward. D. A. (2006). Lawrie's meat science (7th ed.). Woodhead Publishing.
2. Biswas, A. K., & Mandal, P. K. (2020). Meat science and technology. Biotech Books.
3. Sharma, B. D., & Padda, G. S. (2012). Manual on meat and meat products technology. Indian Council of Agricultural Research (ICAR).
4. Sen. D. P. (2005). Advances in fish processing technology. Allied Publishers.
5. Balachandran, K. K. (2016). Post-harvest technology of fish and fish products. Daya Publishing House.
6. Ninan, G., Zynudheen, A. A., & Panda, S. K. (2019). Surimi and surimi-based products. Central Institute of Fisheries Technology (CIFT).
7. Sarkar B. K. (2026). Production, preservation and processing of egg. CRC Press
8. Sahoo J., Sharma, D. K., & Chatli, M. K. (2016). Practical Handbook on Meat Science and Technology, Daya Pub. House
9. Food Safety and Standards Authority of India. (2022). Manual of methods of analysis of foods: Meat and meat products. Ministry of Health and Family Welfare, Government of India.
10. Food Safety and Standards Authority of India. (2023). Food Safety and Standards (Food Products Standards and Food Additives) Regulations. Ministry of Health and Family Welfare, Government of India.

BSFT224-24 Technology of Meat, Fish & Poultry (LAB)

Total marks: 50

L	T	P
0	0	4

Course objective:

To provide comprehensive hands-on training in the multi-species processing of meat, fish, poultry, and eggs by integrating advanced analytical techniques for quality evaluation, industrial value-addition, by-product valorization, and the implementation of FSSAI-mandated safety protocols and HACCP frameworks.

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

CO1	Demonstrate proficiency in primary processing, carcass dressing, and the evaluation of post-mortem biochemical changes to determine meat quality and functional properties.
CO2	Execute standardized FSSAI-compliant chemical and instrumental analyses for proximate composition, oxidative stability, and texture profile of animal protein products.
CO3	Develop value-added meat, fish, and egg formulations while applying thermal process validation techniques and cut-out analysis for canned and retort-packed foods.
CO4	Assess the quality of marine products and eggs using biochemical and sensory indices, and implement advanced surimi technology and protein extraction protocols.
CO5	Apply industrial valorization strategies for slaughterhouse and egg waste, and formulate generic HACCP plans and FSSAI-compliant labeling for the animal protein sector.

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	3	2	1
CO2	2	3	2	3	3
CO3	2	2	3	3	3
CO4	2	3	3	2	3
CO5	2	1	3	3	2

Practical No.	Contents	Contact Hours
1.	Orientation to slaughterhouse hygiene and performance of ante-mortem and post-mortem examination protocols.	1
2.	Measurement of post-mortem pH and determination of Rigor Mortis onset.	1
3.	Assessment of Water-Holding Capacity (WHC) of minced meat using filter paper press and centrifugal methods.	1
4.	Estimation of moisture content in fresh and processed meat	1
5.	Estimation of total protein content of meat using Kjeldahl method.	2
6.	Quantitative estimation of crude fat, ash, and phosphorus in meat samples.	2
7.	Physical and chemical analysis of frozen meat and meat emulsion products including stability and drip loss.	1
8.	Preparation of curing brines and calculation of curing ingredient uptake.	1

9.	Development and sensory evaluation of value-added meat product formulations (patties and nuggets).	1
10.	Cut-out analysis of canned meats/fish and retort pouches including vacuum, headspace, net weight, and can seam evaluation.	1
11.	Subjective and organoleptic evaluation of fresh fish using the Quality Index Method (QIM).	1
12.	Traditional fish curing technology: Salting, sun-drying, and pickling.	2
13.	Fish product formulation and canning including pre-processing, exhausting, and seaming.	1
14.	Evaluation of eggs for quality parameters through a comparative study of market eggs versus branded eggs.	1
15.	Determination of internal egg quality using Haugh Units, Yolk Index, and Shell Thickness.	1
16.	Study of egg shelf-life extension by different preservation methods including oil coating, lime-sealing, and refrigeration.	1
17.	Formulation and preparation of specialty egg products (liquid egg, omelet mixes, or egg-based snacks).	1
18.	Assessment of foaming capacity and emulsifying stability of egg white and yolk components.	1

Recommended Books and Resources

1. Lawrie, R. A., & Ledward. D. A. (2006). Lawrie's meat science (7th ed.). Woodhead Publishing.
2. Biswas, A. K., & Mandal, P. K. (2020). Meat science and technology. Biotech Books.
3. Sharma, B. D., & Padda, G. S. (2012). Manual on meat and meat products technology. Indian Council of Agricultural Research (ICAR).
4. Sen. D. P. (2005). Advances in fish processing technology. Allied Publishers.
5. Balachandran, K. K. (2016). Post-harvest technology of fish and fish products. Daya Publishing House.
6. Ninan, G., Zynudheen, A. A., & Panda, S. K. (2019). Surimi and surimi-based products. Central Institute of Fisheries Technology (CIFT).
7. Sarkar B. K. (2026). Production, preservation and processing of egg. CRC Press
8. Sahoo J., Sharma, D. K., & Chatli, M. K. (2016). Practical Handbook on Meat Science and Technology, Daya Pub. House
9. Food Safety and Standards Authority of India. (2022). Manual of methods of analysis of foods: Meat and meat products. Ministry of Health and Family Welfare, Government of India.
10. Food Safety and Standards Authority of India. (2023). Food Safety and Standards (Food Products Standards and Food Additives) Regulations. Ministry of Health and Family Welfare, Government of India.

BSFT225-24: Principles and Practices of Food Packaging

Total marks: 100	**L**	**T**	**P**
	3	**1**	**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	Understand the fundamentals of food packaging, including materials, types, and their properties, enabling them to make informed decisions on packaging solutions.
CO2	Understand advanced packaging technologies such as aseptic, active, intelligent packaging, and the application of edible films and coatings.
CO3	Develop hands-on expertise in operating and troubleshooting various packaging machines and systems used in the food industry.
CO4	Demonstrate an understanding of safety considerations, environmental requirements, and waste management practices in food packaging operations.
CO5	Apply 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	1	1	1	1	1
CO2	1	1	2	2	2
CO3	1	1	1	2	2
CO4	1	1	1	3	2
CO5	2	1	3	3	3

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. Soroka, W. (2009). Fundamentals of Packaging Technology (4th ed.). IoPP.
6. Yam, K. L. (2009). The Wiley Encyclopedia of Packaging Technology (3rd ed.). Wiley.
7. Lee, D. S., Yam, K. L., & Piergiovanni, L. (2008). Food Packaging Science and Technology. CRC Press.
8. Mahalik, N. P. (2014). Automation in Packaging and Food Processing. CRC Press.
9. Singh, S. P., & Singh, J. (2011). Packaging Materials and Systems for Food Products. Wiley-Blackwell.
10. Food Safety and Standards Authority of India (FSSAI). (2011). Packaging and Labeling Regulations. Accessible at www.fssai.gov.in.
11. Food Packaging Developer, FIC/Q9302 (2022). Accessible at https://www.ficsi.in/upload/participant_handbook/Food%20Packaging%20Developer%20PHB%20English_Final.pdf
12. Food Packer, FIC/Q7006 (2023). Accessible at https://www.ficsi.in/upload/participant_handbook/Food%20Packer%20PH%20V1.0%20english.pdf
13. Food Products Packaging Technician, FIC/Q7001 (2016). Accessible at https://www.ficsi.in/upload/practical_guides/3f7942240cacd95c45a0c93b01d118c1.pdf

BSFT226-24: Principles and Practices of Food Packaging (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	Demonstrate the ability to clean, maintain, and operate packaging machinery and work areas to ensure efficiency and hygiene.
CO2	Develop skills in planning and calculating packaging materials, machinery, and manpower requirements for optimal production output.
CO3	Identify various packaging materials, understanding packaging regulations, and addressing packaging defects.
CO4	Perform quality tests on diverse packaging materials such as paper, plastic, metal, glass, and composites, ensuring compliance with industry standards.
CO5	Summarize 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	1	1	1	2	1
CO2	1	1	1	2	3
CO3	1	1	1	3	2
CO4	1	1	1	3	2
CO5	1	1	2	2	2

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.	Performance Tests of Corrugated Fibre Board Boxes	1
17.	Peel Test of Adhesive Tapes	1
18.	Unscrewing Lids/Torsion Testing	1
19.	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%20englis h.pdf
4. Robertson, G. L. (2016). Food Packaging: Principles and Practice (3rd ed.). CRC Press.
5. Emblem, A., & Emblem, H. (Eds.). (2012). Packaging Technology: Fundamentals, Materials and Processes. Woodhead Publishing.
6. Soroka, W. (2009). Fundamentals of Packaging Technology (4th ed.). IoPP.
7. Bureau of Indian Standards (BIS): IS 8312: Specification for Food Packaging Materials
8. Indian Standards for Paper Testing - IS 1060 (Part 1 to 3): Testing of Paper and Paperboard.
9. Food Packaging: Principles and Practice by Gordon L. Robertson, CRC Press.
10. Testing and Quality Assurance in Packaging - ASTM D4169 for Performance Testing of Shipping Containers.
11. Metal Containers Testing Standards - IS 14002: Testing of Tin and Steel Containers.
12. Peel Testing and Adhesive Strength Analysis - ASTM D3330: Standard Test Method for Peel Adhesion.
13. Practical Guide to Packaging Materials by Deborah L. Dull.
14. Sorption Isotherm and Shelf-Life Estimation - CRC Handbook of Food Science and Technology.

BSFT227-24: Food Hygiene and Safety

Total marks: 100

L	T	P
3	1	0

Course objectives:

To prepare students with comprehensive knowledge and practical skills in food hygiene, sanitation, safety management, workplace organization, and resource conservation, enabling them to effectively coordinate hygiene practices, ensure regulatory compliance, manage emergencies, and promote safe, ethical, and sustainable operations in food processing and handling environments.

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

CO1	Explain the structure of the food processing industry and apply standard hygiene, sanitation, and personal safety practices in compliance with food safety regulations (FSSAI, SOPs).
CO2	Identify food hazards, contamination risks, and safety issues, and implement preventive measures through audits, documentation, and sanitation supervision.
CO3	Manage workplace hazards, accidents, and emergencies by applying safety protocols, first aid, fire safety, PPE usage, and emergency response procedures.
CO4	Demonstrate effective organizational behavior through communication skills, teamwork, ethical conduct, grievance handling, and adherence to legislative and institutional policies.
CO5	Apply principles of material, energy, and waste conservation by implementing efficient resource management, electricity conservation, and waste management practices to promote sustainability.

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

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

Unit	Contents	Contact hours
I	• **Introduction and Overview of the Food Processing Industry** Introduction to the Hygiene Coordinator Programme Introduction to the Food Processing Industry • **Cleaning and sanitation of food processing facility** Prepare the work area and facilities • **Supervise Hygiene Practices** Monitor and Supervise the Cleaning & Sanitation Tasks • **Food Spoilage and Foodborne Diseases** Food spoilage – Causes and types Common food borne pathogens (*Salmonella, E. coli, Listeria, Staphylococcus*) and their health hazards Safe food handling practices Food preservation methods and their role in safety • **Basic Food Safety Standard** Food Hazards and Contamination- Causes and Prevention HACCP, GMPs and GHPs Food Safety – Standard Operating Procedures(SOPs) Food Safety Audits– Measures & Management Food Production Process– Record and Documentation • **Ensuring Food Safety and Personal Hygiene** Introduction to Food Safety Schedule IV requirements of FSSAI Personal Hygiene Health Safety	10
II	• **Managing accidents and emergencies** Hazard, Risk and Accidents Standard Practices and Precautions Uses of Electrical Equipment Usage of Personal Protective Equipment(PPE) Organisational Protocols Dealing with Toxics Fire Prevention and Fire Extinguishers Rescue and Evacuation In Case of Fire First Aid Potential Injuries Precautions in Mobility Significance of various types of hazard and safety signs	11
III	• **Working Effectively in an Organization** Organizational Policies Legislations, standard, policies, and procedures Reporting Structure Inter-Dependent Functions Prioritising Tasks Communication Skills Teamwork Ethics and Discipline Grievances Solution	12

	Interpersonal Conflicts Applicable Legislation, Grievance Redressal Mechanisms	
IV	• **Material Conservation** Material Handling Workstation Layout, Electrical and Thermal Equipment Organisational Procedures for Minimising Waste Practices of Efficient and Inefficient Management Material and Water Usage • **Waste Management and Recycling** Types of waste Waste Management and Disposal Solutions Pollution and Remedies	12

Recommended Books and Resources

1. Marwaha Kavita . *Food Hygiene*. Genetech
2 Kumar Alok . *Fundamentals of food hygiene, safety and quality*. Techsar Pvt. Ltd.
3. Thakur A.N, Sharma Priti. *Food Safety and Hygiene Management System*. Pencil (One Point Six Technologies Pvt. Ltd.)
4. Lelievield H, Holah J, Gabric D (Editors). *Handbook of Hygiene Control in Food Industry Second Edition*. Woodhead Publishing Elsevier
5. https://www.skillindiadigital.gov.in/learning_resources/885f0c05-afd3-4464-8263-b965e8fd122e

BSFT228-24: 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

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.	25
II	Students must complete the FoSTaC - Basic Retail and Distribution course. This course should be completed through https://www.skillindiadigital.gov.in/courses/detail/71bd5b54-6a07-491c-be85-6ff649414e9c or any FSSAI-recognized training center.	

Recommended Books and Resources

1. https://www.skillindiadigital.gov.in/courses/detail/71bd5b54-6a07-491c-be85-6ff649414e9c

BMPD402-18: Mentoring and Professional Development

Total marks: 25	**L**	**T**	**P**
	0	**0**	**1**

Course objective:

The objective of mentoring is to develop overall personality, technical and general aptitude, general awareness, communication skills, and presentation skills.

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

CO1	Demonstrate enhanced technical and general aptitude through expert lectures and aptitude tests.
CO2	Exhibit improved communication and presentation skills via group discussions, quizzes, and student presentations.
CO3	Develop effective teamwork and leadership abilities through team-building exercises and outdoor activities.
CO4	Gain a broader understanding of current affairs and general knowledge, facilitated by diverse classroom interactions and society activities.
CO5	Show increased engagement in extracurricular and community service activities, contributing to holistic personal and professional growth.

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	2	1	1	2	2
CO3	2	1	1	2	2
CO4	2	1	1	2	2
CO5	2	1	1	2	2

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Practical no.	Contents	Contact Hours
	Part – A (Class Activities)	14
1	Expert and video lectures	
2	Aptitude Test	
3	Group Discussion	
4	Quiz (General/Technical)	
5	Presentations by the students	
6	Team building Exercises	
	Part – B (Outdoor Activities)	
1	Sports/NSS/NCC	
2	Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc	

The evaluation shall be based on rubrics for Part – A & B Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.