

**SEMESTER WISE COURSE STRUCTURE
&
EVALUATION SCHEME**

B. Tech. FOOD TECHNOLOGY
(Effective from the session 2022-23 for new entrants)



HARCOURT BUTLER TECHNICAL UNIVERSITY
KANPUR-208002 (UP) – INDIA

HARCOURT BUTLER TECHNICAL UNIVERSITY
DEPARTMENT OF CHEMICAL TECHNOLOGY - FOOD TECHNOLOGY
SCHOOL OF CHEMICAL TECHNOLOGY

THE UNIVERSITY

VISION

“To achieve excellence in technical education, research and innovation”

MISSION

- 1. Imparting Knowledge to develop analytical ability in science and technology to serve the industry and society at large.*
- 2. Equip and enable students with conceptual, technical and managerial skills to transform the organization and society.*
- 3. Inculcating entrepreneurial philosophy and innovative thinking to promote research, consultancy and institutional social responsibility.*
- 4. Serving people, society and nation with utmost professionalism, values and ethics to make development sustainable and quality of life.*

THE DEPARTMENT

VISION

“To develop technically sound food technocrats, to cater the needs of food processing industries, Research & Development organizations and society”

MISSION

The missions of the Department of Food Technology are:

- M1 : Imparting technical knowledge to develop human resources for food processing sectors.*
- M2 : Imparting knowledge & technical skills for better processing and value addition of Food & Agro-products through R&D.*
- M3 : Inculcating innovative thinking with the aim to support entrepreneurship and to develop state-of-art technologies for testing and consultancy to fulfill the needs of industry and society.*
- M4 : Cultivating strong ethical values for sustainable modern and safe food to society.*

I. Program Educational objectives (PEOs) for B. Tech. Chemical Technology-Food Technology

The educational objectives of B. Tech. Chemical Technology - Food Technology program are:

PEO1:	Graduates of the program will contribute to the development of sustainable growth of food processing sector for the betterment of society
PEO2:	Graduates of the program will accept and create innovations in providing solution for sustainable technological development
PEO3:	Graduates of the program will meet challenges in terms of quality assurance and standardization to withstand the global competitiveness
PEO4:	Graduates of the program will exhibit professionalism, ethical attitude, team spirit and pursue lifelong learning for betterment of society

Consistency of PEOs with Mission of the Department

PEO Statements		M1	M2	M3	M4
PEO1:	Graduates of the program will contribute to the development of sustainable growth of food processing sector for the betterment of society	3	3	2	1
PEO2:	Graduates of the program will accept and create innovations in providing solution for sustainable technological development	3	2	2	1
PEO3:	Graduates of the program will meet challenges in terms of quality assurance and standardization to withstand the global competitiveness	3	2	2	1
PEO4:	Exhibit professionalism, ethical attitude, team spirit and pursue lifelong learning for betterment of society	2	2	2	3

Program Outcomes (POs) of B. Tech. Chemical Technology - Food Technology

Graduating Students of B. Tech. Chemical Technology - Food Technology program will be able to:

Program Outcomes (POs)		Graduate Attributes(GAs)
PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.	Engineering Knowledge

PO2	Identify, formulate, review research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	Problem Analysis
PO3	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	Design/Development of solutions
PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	Conduct Investigations of complex problems
PO5	Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.	Modern Tool Usage
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	The Engineer & Society
PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	Environment and sustainability
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	Ethics
PO9	Function effectively as an individual, and as a	Individual and team work

	member or leader in diverse teams, and in multidisciplinary settings.	
PO10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	Communication
PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	Project management and finance
PO12	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	Life-long learning

Program Specific Outcomes (PSOs) for B. Tech. Chemical Technology - Food Technology program are:

Graduating students of B. Tech. Chemical Technology - Food Technology program will be able:

PSO1	to apply practical skills, technical knowledge in major streams such as chemistry, manufacturing, processing, and to application areas of engineering & technology in food industries
PSO2	to take-up career in research organizations and to pursue higher studies in food technology and interdisciplinary programs with high regard for ethical values, environmental and social issues.

HARCOURT BULTER TECHNICAL UNIVERSITY KANPUR
SCHOOL OF CHEMICAL TECHNOLOGY
DEPARTMENT OF FOOD TECHNOLOGY
Semester wise Course Structure
B. Tech. Chemical Technology - Food Technology
(Applicable from Session 2022-2023 for new entrants)
Year I, Semester-I

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Engineering Physics	NPH-101	4	3	0	2	15	20	15	50	50	100
2	BSC	Engineering Mathematics-I	NMA-101	4	3	1	0	30	20	-	50	50	100
3	ESC	Introduction to Electrical Engineering	NEE-101	4	3	0	2	15	20	15	50	50	100
4	ESC	Introduction to Mechanical Engineering	NME-101	4	3	1	0	30	20	-	50	50	100
5	HSMC	Professional Communication	NHS-101	4	2	1	2	15	20	15	50	50	100
6	ESC	Engineering Graphics	NCE-103	2	0	0	4	30	20	-	50	50	100
Total Credits: 22												600	

(Applicable from Session 2022-2023 for new entrants)
Year I, Semester-II

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Engineering Chemistry	NCY-102	4	3	0	2	15	20	15	50	50	100
2	ESC	Introduction to Computer Science & Engineering	NCS-102	4	3	1	0	30	20	-	50	50	100
3	ESC	Introduction to Electronics Engineering	NET-102	4	3	1	0	30	20	-	50	50	100
4	ESC	Introduction to Civil Engineering	NCE-102	4	3	1	0	30	20	-	50	50	100
5	ESC	Introduction to Chemical Engineering & Chemical Technology	NCT-102	4	3	1	0	30	20	-	50	50	100
6	ESC	Workshop Practice	NWS-102	2	0	0	4	-	20	30	50	50	100
Total Credits: 22												600	

(Applicable from Session 2023-2024)
Year II, Semester-III

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Engineering Mathematics-II	NMA-201	4	3	1	0	30	20	-	50	50	100
2	ESC	Fluid Mechanics and Mechanical Operations	NCT-201	4	3	0	2	15	20	15	50	50	100
3	PCC	Fundamentals of Food Science and Human Nutrition	NFT-201	4	3	1	0	30	20	-	50	50	100
4	PCC	Microbiology and Biochemistry of Food	NFT-203	4	3	1	0	30	20	-	50	50	100
5	PCC	Chemical Process Calculations	NCT-203	3	3	0	0	30	20	-	50	50	100
6	HSMC	Economics & Management	NHS-201	3	3	0	0	30	20	-	50	50	100
7	PCC	Food Analysis Lab	NFT 205	2	0	0	4	-	20	30	50	50	100
Total Credits: 24												700	

(Applicable from Session 2023-2024)
Year II, Semester-IV

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	BSC	Modern Analytical Techniques	NCY-202	4	3	0	2	15	20	15	50	50	100
2	ESC	Computer Oriented Numerical Methods	NMA-204	4	3	0	2	15	20	15	50	50	100
3	PCC	Food Chemistry	NFT-202	4	3	1	0	30	20	-	50	50	100
4	PCC	Chemical Engineering Thermodynamics	NCT-204	4	3	1	0	30	20	-	50	50	100
5	PCC	Heat Transfer Operations	NCT-202	3	3	0	0	30	20	-	50	50	100
6	PCC	Principles of Food Preservation	NFT-204	3	3	0	0	30	20	-	50	50	100
7	PCC	Food Chemistry Lab	NFT-206	2	0	0	4	30	20	-	50	50	100
Total Credits: 24												700	

(Applicable from Session 2024-2025)
Year III, Semester-V

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	PCC	Technology of Animal & Milk Products	NFT-301	4	3	0	2	15	20	15	50	50	100
2	PCC	Technology of Cereals, Pulses and Oilseeds	NFT-303	4	3	1	0	30	20	-	50	50	100
3	PCC	Fruits, Vegetable and Plantation Products	NFT-305	3	3	0	0	30	20	-	50	50	100
4	PCC	Mass Transfer Operations	NCT-307	3	3	0	0	30	20	-	50	50	100
5	PCC	Chemical Reaction Engineering	NCT-309	3	3	0	0	30	20	-	50	50	100
6	PCC	Food Processing Lab	NFT-307	3	0	0	6	-	20	30	50	50	100
7	HSMC	Entrepreneurship Development	NHS-301	2	2	0	0	30	20	-	50	50	100
	Total Credits: 22											700	

(Applicable from Session 2024-2025)
Year III, Semester-VI

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	PCC	Instrumentation & Process Control	NCT-302	4	3	0	2	15	20	15	50	50	100
2	PCC	Food Safety and Quality Control	NFT-302	4	3	0	2	15	20	15	50	50	100
3	PCC	Fermented Foods & Beverage Technology	NFT-304	3	3	0	0	30	20	-	50	50	100
4	PCC	Food Packaging & Storage Engineering	NFT-306	3	3	0	0	30	20	-	50	50	100
5	PCC	Advance Food Instrumentation Lab	NFT-308	3	0	0	6	-	20	30	50	50	100
6	PEC-I	Program Elective –I	NCT-322	3	3	0	0	30	20	-	50	50	100
		1. Process Equipment Design	NCT-324										
		2. Process Modeling & Simulation	NCT-326										
		3. Process Optimization											
7	OEC-I	Basic Concepts of Food Processing & Preservation	OFT-302	2	2	0	0	30	20	-	50	50	100
Total Credits: 22												700	

(Applicable from Session 2025-2026)
Year IV, Semester-VII

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	PEC-II	Program Elective-II 1. Nutraceutical & Functional Foods 2. Speciality Foods 3. Flavour Technology	NFT-401 NFT-403 NFT-405	4	3	1	0	30	20	-	50	50	100
2	PEC-III	Program Elective-III 1. Food Processing Waste Management 2. Food Supply chain Management 3. Total Quality Management	NFT-407 NFT-409 NFT-411	3	3	0	0	30	20	-	50	50	100
3	PEC-IV	Program Elective-IV 1. Food Product and Process Development 2. Food Traceability, authenticity & Recall 3. Food Plant Design & Layout	NFT-413 NFT-415 NFT-417	3	3	0	0	30	20	-	50	50	100
4	Industrial Training	Industrial Training	NFT-419	2	0	0	4	-	20	30	50	50	100
5	OEC-II	Nutritional aspects of Natural & Processed Foods	OFT-401	2	2	0	0	30	20	-	50	50	100
6	Minor	Minor Project	NFT-421	6	0	0	12	-	20	30	50	50	100

	Project												
7	Seminar	Seminar	NFT-423	2	0	0	4	-	50	-	50	50	100
Total Credits: 22													700

**(Applicable from Session 2025-2026)
Year IV, Semester-VIII**

S. No.	Course Type	Course Title	Subject Code	Credits	Periods			Sessional Marks				ESE	Total Marks
					L	T	P	MSE	TA	Lab	Total		
1	PEC-V	Program Elective-V											
		1. Innovative Techniques in Food Processing	NFT-402										
		2. Application of Computer in Food Processing	NFT-404	4	3	1	0	30	20	-	50	50	100
		3. Nano Technology in Food Applications	NFT-406										
2	OEC-III	Fundamentals of quality and packaging of foods	OFT-402	2	2	0	0	30	20	-	50	50	100
3	Project	Project	NFT-410	16	0	0	24	-	100	100	200	200	400
Total Credits: 22													600

NFT-201: Fundamentals of Food Science and Human Nutrition

L	T	P	C
3	1	0	4

Course objectives: The objective of the course is to impart

- The knowledge about basic concepts of food technology and recent trends of food processing industries in India.
- The knowledge about role of food in human nutrition and protection from various ailments.
- The knowledge about basic biology, chemistry, microbiology and biochemistry of foods.

Course outcomes: On the successful completion of the course, students will be able to

CO1	Understand the status and opportunities in Indian and global Food Industries	Understanding
CO2	Understand the chemical composition of various foods and basic concepts of food processing and preservation.	Understanding
CO3	Understand fundamentals of human nutrition and prevention of human beings from various ailments.	Understanding
CO4	Understand the basics concepts related with microbiological aspects of Food.	Understanding
CO5	Understand the role of Biochemistry in Food.	Understanding

CO-PO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	-	-	-	1	-	2	-	-	-	1	2	3
CO2	3	1	1	1	-	1	1	2	-	-	-	2	3	3
CO3	3	-	-	-	1	-	1	2	-	-	1	1	1	1
CO4	3	1	-	-	-	1	1	2	1	-	-	2	2	2
CO5	3	1	-	-	-	1	1	2	-	1	-	2	2	2
Average	3	1	-	-	-	1	1	2	-	-	-	2	2	2

1: Slight(Low) 2: Moderate (Medium) 3: Substantial(High) If there is no correlation, put “-”

Syllabus

Module-I: Introduction to Food Technology, Its Scope, Opportunities & Challenges

Status of food processes industry in India and globally, Factors affecting the growth of Indian food industries, Opportunities and challenges in Indian food industry, Market scenario of various segments of food industry, Scope and Job opportunities for food technologists

Module-II: Composition of Foods

Definition, classification and functions of foods, constituents of food, , Food spoilage, causes of spoilage, Basics about food preservation, Desirable and potentially undesirable food constituents and their importance, General causes of loss of nutrients during processing and storage.

Module-III : Concept of Food Nutrition and Human Health

Human nutrition and health, Recommended Dietary Allowances, Factors affecting bioavailability of nutrients, Enrichment, Fortification, Restoration and Supplementation of foods, Digestion and absorption of bio-molecules, common nutritional deficiencies such as PEM, iron, vitamin A, iodine, calcium and vitamin D, zinc etc., Nutritive value and its assessment.

Module-IV: Basic biology & Microbiological Aspects of Food

Living cells, organization of living system, characteristics, Plant and animal diversity, Basics about general microbiology: Culture, media and their types, features of growth in nutrient broth and agar, Staining techniques, Culture preservation techniques, Characterization, classification and identification of microorganisms, Microscopy, Morphology and Structure, Growth, Reproduction and Cultivation of microorganisms, Pure culture and its isolation, Control of microorganisms. Role of microorganisms in food spoilage and preservation

Module-V: Role of Biochemistry in Food

Bioenergetics, Energy transformation in living cells, metabolic pathways, Regulation and Control

Reference Books and Suggested Readings:

Title

Author

Agriculture Survey of India

The Hindu

Nutritive value of Indian Foods
Food Chemistry
Quality control for Food Industry
Food facts and Principles.
Microbiology
Principle of biochemistry

C. Gopalan
L.H. Mayer
Kramner & Twigg
Manay N.S. Shadakshasawamy M
M.J.Pelczar
A.L.Lehninger

NFT-203: Microbiology and Biochemistry of Food

L	T	P	C
3	1	0	4

Course objectives: The objective of this course is to impart

- Knowledge of the characteristics of spoilage, pathogenic and food borne infections microorganisms in foods and identifying the ways to control them during processing, preservation, storage, transportation and marketing of foods.
- Knowledge about food plant sanitation and ensure about food safety to the consumers.
- Knowledge of engineering principles applied in post-harvest technology with particular reference to horticulture produce.
- Understanding and ability to control the major chemical and biochemical reactions that influence food quality with emphasis on food industry applications.
- Knowledge of animal tissues and biochemical reactions responsible for quality of the food.

Syllabus: On the successful completion of the course, students will be able to

CO1	Understand the environmental factors affecting microbiological stability /spoilage and techniques by which the important pathogens and spoilage microorganisms are commonly inactivated, killed or made harmless in foods.	Understanding
CO2	Understand the characteristics of foodborne, waterborne and spoilage microorganisms, and methods for their isolation, detection and identification and the microbiology of different types of food commodities	Understanding
CO3	Understand the necessity of food safety, plant sanitation and control of hazards in food processing.	Understanding
CO4	Understand the basic post-harvest physiology and consequences during handling of fresh produces and the facilities and techniques of treatment & storage of fruit and vegetables.	Understanding
CO5	Understand the major biochemical reactions that affects the quality of Meat and meat products. Role of enzymes in food processing industry	Understanding

CO-PO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	2	-	1	1	-	-	-	-	1	3	3
CO2	3	2	1	-	1	1	1	-	1	-	-	2	2	2
CO3	3	1	-	-	1	2	1	1	-	-	1	2	3	3
CO4	2	1	-	-	-	2	1	-	-	1	-	2	3	3
CO5	3	2	1	1	-	1	1	-	-	-	-	2	3	3
Average	3	1	1	1	-	1	1	-	-	-	-	2	3	3

1:Slight (Low)

2:Moderate(Medium)

3:Substantial(High)

If there is no correlation, put "-"

Syllabus

Module-I: Microorganisms in Foods, Spoilage and Preservation

Incidence of microorganisms in foods, Primary sources of contamination in foods, Intrinsic and Extrinsic parameters of foods that affect microbial growth, Food Spoilage, Causes of Food spoilage, Food Preservation, Principles underlying preservation of foods, Methods of food preservation, Fitness of foods, Determination of thermal resistance of bacterial spores, Radiation-resistant bacteria, Mechanism of action of antimicrobial agents

Module–II: Food Poisoning, Spoilage and Preservation of Various Food Products

Food poisoning and food-borne infections, Screening, detection and enumeration techniques including rapid detection techniques for Food Micro-organisms including pathogens. Contamination, spoilage and preservation of Fruit and Vegetable products, Milk and Milk products, Cereal products, Sugar products, , Meat products, Fish and Sea foods, Egg and Poultry products and other foods.

Module-III: Food Safety, Plant Sanitation & HACCP

Indicators of Food Safety and Quality, Microbiological Standards of foods, Food Plant Sanitation, inspection and control, Personnel Hygiene, HACCP in Food Industry in controlling microbial hazards, Beneficial microorganisms and their utilization in food fermentation, Introduction to abiotic, biotic and probiotics.

Module-IV: Post Harvest physiology, Handling and Storage of Fruits and Vegetables

Structure and composition of fruit and vegetables: Definition, cellular components, chemical composition and nutritional value. Physiology and biochemistry of fruit and vegetables: Post-harvest handling, physiological development; growth, maturation and senescence, fruit ripening, physiology of respiration, effect and role of ethylene, biochemistry of respiration; aerobic and anaerobic metabolism, chemical changes during maturation. Control atmosphere storages, effect of temperature, water loss and humidity,

methods for modifying carbon dioxide and oxygen concentration, physiological disorders: low temperature disorders.

Module-IV: Biochemistry of Meat and Enzymes in Food industry

Structure and growth of muscle, chemical and biochemical constitution of muscle, ante-mortem and post-mortem factors affecting quality of meat, Biochemical reactions leading to changes in composition, color, flavour and texture of meat. Application of enzymes in food processing: Endogenous enzymes and their role in modification of foods, enzyme added to foods during processing sources, conversions and specific applications.

Reference Books and Suggested Readings

Title

Modern Food Microbiology
Food Microbiology
Food Microbiology
Food Microbiology

Authors

James M.J.
Frazier W.C. & Westhoff D.C.
Adam M. R. & Moss M.O.
Roberts D. & Greenwood M.

NFT-205: Food Analysis Lab

L	T	P	C
0	0	4	2

Course objectives: The objective of this course is to impart

- Knowledge to utilize laboratory techniques to detect, quantify, and identify microorganisms in foods.
- Knowledge to determine the chemical composition of various foods experimentally.
- Knowledge for kinetic study of enzymes in biochemical reactions of foods.

Course Outcome: On the successful completion of the course, students will be able to

CO1	Determine the best microbiological laboratory practices and evaluate microbial data for food analysis.	Applying
CO2	Determine the basic composition of foods experimentally	Applying
CO3	Calculation of Km with the study, the effect of substrate concentration, temperature and pH on enzyme activity.	Applying

CO-PO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	2	-	2	1	1	1	2	1	1	3	3
CO2	3	2	1	1	-	1	2	1	2	2	1	2	2	2
CO3	3	1	1	1	1	2	1	1	2	2	1	2	3	3
Average	3	1	1	1	1	2	1	1	2	2	1	2	3	3

1:Slight (Low)

2:Moderate(Medium)

3:Substantial(High)

If there is no correlation, put "-"

	Laboratory Experiments	No of periods
1	Microscope its parts and utility in identification and differentiation of bacteria, yeast and mold.	03
2	Familiarization with Culture, Inoculation, Incubation, features of growth and slide preparation, Wet mount preparation, staining with basic dye and Gram staining.	03
3	Cell size measurement, total cell count	03

4	Preparation and sterilization of media and glass ware for microbial counts.	03
5	Introduction to Food Analysis techniques.	03
6	Sampling techniques and method of sample preparation.	03
7	Determination of moisture content of foods.	03
8	Determination of Total and Acid insoluble ash content in foods.	03
9	Determination of Crude fat content by solvent extraction methods in foods.	03
10	Determination of crude Protein in foods by Kjeldhal methods.	06
11	Determination of reducing and total sugar content in foods.	06
12	Determination of crude fibre content in foods.	03
13	Determination of specific vitamin content of food such as ascorbic acid.	03
14	Chromatographic Separation and identification of sugars and amino acids.	03
15	Determination of nutritive value of foods	03
16	Effect of substrate concentration on enzyme activity	03
17	Effect of temperature on enzyme activity	03
18	Effect of pH on enzyme activity	03
19	Analysis of foods for pesticides.	06
20	Determination of various adulterants in foods.	03
Total Hours		69

NFT-202:FOOD CHEMISTRY

L	T	P	C
3	1	0	4

Course objectives: The objectives of this course are to impart

- Knowledge on innate properties of food molecules and their interactions with other food constituents
- The knowledge of food additives and their applications in food processing
- Understanding of analytical techniques for identification and quantification of various biomolecules present in the food

Course out comes: On the successful completion of the course the students will be able to

CO1	Understand the chemistry of water and carbohydrate and their interaction with other food components	Understanding
CO2	Understand the basic structure of lipid and reaction involved during processing	Understanding
CO3	Understand the chemistry and properties of food proteins and modification of food proteins during processing	Understanding
CO4	Understand the sources and their deficiency during processing and apply the knowledge to minimize their losses during processing	Applying
CO5	Discuss the functionality of food additives and their application in food industry	Applying

CO-PO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	-	-	-	-	1	-	-	-	-	1	3	3
CO2	3	1	-	-	-	-	-	1	-	1	-	1	3	3
CO3	3	2	-	-	1	-	-	-	2	-	-	1	3	3
CO4	3	2	1	1	-	1	1	-	-	-	1	1	3	3
CO5	3	2	1	-	-	1	1	-	-	-	-	1	3	3
Average	3	2	-	-	-	-	1	-	-	-	-	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put “-”

Syllabus

Module-I: Water and Carbohydrate

Water in Foods: Structure, Properties, Interactions, Water activity and sorption isotherm, Molecular mobility and food stability

Carbohydrates: Classification, Functions, Reactions and properties of simple and complex carbohydrate, Selection of Natural or Modified carbohydrates for incorporation into processed food.

Module-II: Lipids

Classification, Consistency of commercial fat, Lipolysis, Autooxidation, Thermal decomposition and effect of ionizing radiation, Refining of oils, Modification of oils and fats, Role of food lipids in flavor, Nutritional and safety aspects of natural and modified fats.

Module-III: Proteins

Classification, nutritional and functional properties of food proteins, Nutritive value and its determination, Chemical reactions and interactions of amino acids and proteins, De-naturation and its implications, Functional properties of food proteins, Modification of food proteins in processing and storage and its implications.

Module-IV: Vitamins, Minerals, Pigments and Flavors

Vitamins, Minerals, Pigments and Flavors: Sources, Functions, Deficiency diseases, Chemistry and stability of water and fat-soluble vitamins during processing, Chemical properties of minerals and their bioavailability, Enrichment and fortification. Natural pigments in foods and their retention in processed foods, Flavoring constituents in foods, Development of process and reaction of flavor volatiles.

Module-V: Food Additives

Definitions, sources, uses and functions and regulatory aspects of food additives

Reference Books and Suggested Readings:

Title	Author
Food Chemistry	O.R. Fennema
Food Facts and Principal	N. Shakuntala Manay & M. Shadaksharaswamy
Food Chemistry	L.H. Meyer
Food Chemistry	H.D. Belitz and W. Grosch
Food Additives	S.N. Mahindru
Hand book of analysis and quality control for fruits and vegetable products	S. Ranganna

NFT-204: PRINCIPLES OF FOOD PRESERVATION

L	T	P	C
3	0	0	3

Course Objectives: The objective of this course is to impart

- Knowledge of basic principles in food preservation.
- Knowledge of processing methods to control food spoilage and deterioration
- Knowledge of equipment used in food processing for value addition

Course Outcomes: Upon the successful completion of the course, the student will be able to

CO1	Understand fundamental principles of food preservation	Understanding
CO2	Understand the principles of low-temperature preservation	Understanding
CO3	Understand the principle of thermal processing and applying high-temperature processing in the food industry	Applying
CO4	Understand the concept of water activity and preservation by reduction of water removal	Understanding
CO5	Understand the principles of non-thermal preservation methods	Understanding

CO-PO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	-	1	-	1	1	-	-	-	-	1	3	3
CO2	3	2	-	1	-	1	1	-	-	1	-	1	3	3
CO3	3	2	-	1	1	1	1	1	-	-	-	1	3	3
CO4	3	2	-	1	-	1	-	-	1	-	1	1	3	3
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	3
Average	3	2	-	1	-	1	1	-	-	-	-	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put “-”

Syllabus

Module-I: Introduction and need for food preservation

Aims and objectives of preservation of foods, Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods: Microbial, Physical, Chemical & Miscellaneous, wastage of foods. Concept of Water activity, Intermediate moisture Food, osmosis, and diffusion

Module – II: Preservation of foods by low temperatures

Chilling temperatures: Consideration relating to storage of foods at chilling temperatures, Applications, and procedures, Controlled and Modified atmosphere storage of foods, Post storage handling of foods. Freezing temperatures: Freezing process, slow and fast freezing of foods and its consequence, and other occurrences associated with freezing of foods. Technological aspects of pre-freezing, Actual freezing, Frozen storage, and thawing of foods,

Module –III: Preservation of foods by high temperatures

Basic concepts. Lethality requirement and assessing the adequacy of a thermal process: D value, Z Value, F value etc., Blanching, Pasteurization: Batch and continuous. Commercial sterilization of foods: Conventional canning process, batch and continuous retorts, aseptic processing.

Module – IV: Preservation by water removal

Food concentration: Principles, Technological aspects, and application of evaporative concentration process; Freeze concentration and membrane process. Drying and dehydration of foods: Principles, Technological aspects, and application. Types of dryers: Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized-bed, and freeze drying of foods.

Module – V: Preservation by Non-thermal methods

Principles, Technological aspects and application of sugar and salt, Natural food preservation system, Antimicrobial agents (Nitrates, Benzoates, Propionates, Sorbates etc.), mechanism of actions of different preservatives, Biological agents, nonionizing and ionizing radiations in the preservation of foods. Hurdle technology.

Reference Books and Suggested Readings:

Title	Author
Food Process Engineering & Technology	ZekiBerk
Food Processing and Preservation	B. Sivasankar
Food Processing Technology: Principles and Practice	P.J Fellows
Food Processing Technology: Principles and Practice	M.ShafeiurRahman
Fruits and Vegetable Processing: Improving Quality	WimJongen
Introduction of Food Processing Engineering	P. G. Smith

NFT-206:FOOD CHEMISTRY LAB

L	T	P	C
0	0	4	2

Course objectives: The objectives of this course are

- To train the students with hands on experience with chemical compositions of foods.
- To assist them in analysis of various food constituents, additives present in the food such as nutrients (vitamins), anti nutritional factor (tannins, anthocyanins, flavonoids) etc

Course outcomes: On the successful completion of the course the students will be able to

CO1	Understand the principles behind analytical techniques associated with food	Understanding
CO2	Be able to select the appropriate analytical technique when presented with practical problem	Understanding
CO3	Demonstrate practical proficiency in a food analysis laboratory	Understanding
CO4	Describe and use principal analytical methods used for quantifying the composition and reactions of food components	Applying
CO5	Interpret and report data derived from chemical experiments/analysis in a meaningful way	Analyzing

CO-PO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	2	1	2	1	2	2	2	1	1	3	3
CO2	3	1	2	2	1	2	2	1	1	1	-	1	3	3
CO3	3	2	2	1	1	2	2	1	2	2	1	1	3	3
CO4	3	2	1	1	1	1	1	1	1	1	1	1	3	3
CO5	3	2	1	1	1	1	1	1	1	2	-	1	3	3
Average	3	2	1	1	1	2	1	1	1	2	1	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put “-”

Laboratory Experiments

1. Quality analysis of water
2. Determination of moisture content in food by hot air oven method
3. Non-enzymatic browning reactions and its determinations
4. Determination of rate of hydrolysis of sucrose/starch
5. Determination of free fatty acid content and oxidative rancidity in fats and oils
6. Determination of heat stability of vitamin C
7. Determination of functional properties of proteins
8. Determination and identification of additives added to food
9. Determination and identification of adulterants in some foods
10. Determination of salt content in processed products

Reference Books and Suggested Readings:

1. Principles of Food Chemistry, John M, Deman, Chapman and Hall, 3rd Edition, 1999.
2. Food Chemistry, Fennema Owen R., Food Science & Technology series, CRC press, New York, 4th edition, 2007.
3. Food chemistry, Lillian Hoagland Meyer, CBS publication, New Delhi, 2nd Edition, 2006.
4. Food Science Chemistry & Experimental Foods, Dr. M. Swaminathan, Bappco Ltd 2nd Edition, 2001.
5. Food chemistry, S. Yadav, Anmol Publications 1st Edition, 1997

		L	T	P	C									
NFT-301	Technology of Animal and Milk Products	3	0	2	4									
Course Objectives: The objectives of this course are to impart-														
<ul style="list-style-type: none"> • Knowledge about milk industry evolution & physicochemical characteristics of milk • Knowledge of commercial milk and milk products processing technology • Knowledge about the structure and processing of meat, fish, poultry, and eggs 														
Course Outcomes: On the successful completion of the course, students will be able to-														
CO-1	Understand and analyze the scenario of the milk industry, compositional variability of milk, and adulteration in milk	Understanding												
CO-2	Understand and explain various types of market milk and their processing technology	Analyzing												
CO-3	Understand and evaluate various milk products processing, byproducts, and plant sanitation	Understanding												
CO-4	Understand and explain the concepts involved in meat and fish products processing	Analyzing												
CO-5	Understand and explain the concept involved in poultry and egg processing	Understanding												
CO-6	Evaluate various quality characteristics of milk and milk products, meat, and egg	Analyzing												
CO-PO Mapping														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	-	2	2	1	1	1	1	1	1	1	2	2	1
CO2	-	1	1	1	1	1	1	1	1	1	1	1	2	1
CO3	1	1	2	1	1	1	1	1	1	-	1	1	2	1
CO4	-	-	2	-	-	1	-	1	1	-	-	2	2	2
CO5	-	-	2	-	-	1	-	1	1	-	-	2	2	2
CO6	1	1	2	1	2	2	1	1	-	-	1	1	2	2
Average	1	1	2	1	1	1	1	1	1	1	1	2	2	1
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”														
Course Level Assessment Questions														
Course Outcome-1 (CO-1)														
➤ History of the milk revolution and scenario of the milk industry														
➤ Concept of physicochemical characteristics of milk														

➤ Production and collection systems of milk	
➤ Common adulteration in milk	
Course Outcome-2 (CO-2)	
➤ Quality tests of received milk	
➤ Working principles and parts of Plate heat exchanger	
➤ Working principle of homogenizer, clarifier, bactofuge	
➤ Sterilization and UHT processing of milk	
Course Outcome-3 (CO-3)	
➤ Classification, and processing of cream, butter, butter oil, and Ghee	
➤ Concept of manufacturing evaporated, condensed, roller, and spray dried milk	
➤ Manufacturing technology of frozen milk products	
➤ Cleaning and sanitization of dairy equipment	
➤ By-products utilization in the dairy industry	
Course Outcome-4 (CO-4)	
➤ Structure, processing, and by-product utilization of meat	
➤ Modern slaughterhouse practices	
➤ Structure, processing, and by-product utilization of fish	
➤ Value-added products from fish	
Course Outcome-5 (CO-5)	
➤ Structure, processing, and by-products processing of poultry	
➤ Grading and inspection of eggs	
➤ Processing methods and value-added products from eggs	
SYLLABUS	
Module -I: Basic Idea of Milk	No. of Hours
White revolution; Present milk industry scenario; Composition of milk; Physico-chemical characteristics; Microbiology of Milk, Collection, cooling, and transportation of milk; Platform tests; Common adulterations in milk; Dairy industry plant layout.	06
Module -II: Processing of Market Milk	
Reception, chilling, clarification, Bactofugation, and storage of milk; Quality tests for milk; Standardization; Homogenization: <i>Definition, principles, types, and application</i> , Pasteurization: <i>Definition, principles, types, and application</i> . Types of market milk; Packaging, storage, and distribution of pasteurized milk: whole, standardized, toned,	08

double toned and skim milk; Sterilization; UHT Processing.	
Module -III: Milk Products Processing and Plant Sanitation	
<i>Fat Rich dairy products:</i> Cream, Butter, Butter oil, Ghee: Definition, classification, and processing; <i>Condensed and dried milk products:</i> Evaporated milk, Condensed milk; Spray and drum dried milk solids: Processing, packaging and storage; <i>Frozen dairy products:</i> Ice-cream, Frozen dessert, Kulfi: Ingredients, processing, storage; <i>Fermented dairy products:</i> Cheese, Yoghurt, Acidophilus milk, Kefir; <i>Indian traditional dairy products:</i> Dahi, Channa, Paneer, Khoa etc. ; Dairy plant sanitation: Types of sanitizers, Types of detergents, Cleaning in Place; Byproducts utilization in dairy industry; Whey protein concentrates and isolates.	10
Module -IV: Technology of meat and fish products	
Meat: Status of meat and meat products in India and globally; Chemical composition and structure of meat; Pre-mortem and post-mortem changes influencing the quality of meat; Modern slaughter house practices; Different types of meat cuts; Meat by-product utilization. Fish: Chemical composition and structure of fish; Fresh water and marine fish; Harvesting and transportation of fish; Processing and value addition of fish: Pickling, fish protein concentrate, fish oil, and other byproducts.	08
Module -V: Technology of Poultry and Egg	
Poultry: Quality characteristics of poultry products, Poultry meat processing operations and equipment; Poultry meat products; Poultry meat by-products; Plant sanitation. Egg: Structure of egg; Structural abnormalities; Functions of egg in the food system; Egg products: liquid whole egg, whole egg powder, egg yolk products; By-products: processing, packaging, and storage, Quality evaluation of eggs.	08
List of experiments	
1. To perform various platform tests for milk	02
2. To estimate various physicochemical properties of milk	02
3. To determine various types of adulterations in milk	02
4. To estimate the pasteurization efficacy of milk	02
5. To study the standardization of milk	02
6. To determine the overrun in the given ice-cream sample	02
7. To prepare flavoured milk	02
8. To prepare a layout of a milk processing plant	02
9. To estimate the water-holding capacity of meat	02
10. To conduct the Candling and Grading of eggs	02
11. Field visit to any dairy/ meat processing industry	

Reference books and suggested readings	
Title	Author
Outlines of Dairy Technology. Oxford University Press	De Sukumar
Dairy Technology- Principles of Milk Properties and Processes; Marcel Dekker Inc.	P. Walstra., T.J. Geuits., A. Noomen, A. Jellema and M.A.J.S. Van Boekel
Meat and Meat Products: Technology, Chemistry and Microbiology, Champan & Hill, London, 1995.	H.V. Alan and P.S. Jane
Poultry Meat and Egg Production, CBS Publications, New Delhi	R.O Carmen and J.M. George
Fish and Fish Products, Agrobios, Bikaner	A.L. Winton and K.B. Winton

		L	T	P	C									
NFT-303	Technology of Cereals, Pulses and Oilseeds	3	1	0	4									
Course Objectives: The objectives of this course are to impart-														
<ul style="list-style-type: none"> • Knowledge about the structure and processing of cereals, pulses and oilseeds • Knowledge about technology of bakery products • Knowledge on processing of edible oil and its modification 														
Course Outcomes: On the successful completion of the course, students will be able to-														
CO-1	Understand the composition, structure and storage of food grains	Understanding												
CO-2	Understand the technology of paddy processing and its products	Understanding												
CO-3	Understand the traditional and modern milling operations of wheat and technology of bakery and extruded products	Understanding												
CO-4	Understand the processing of coarse cereals and legume-pulses and their value added products	Understanding												
CO-5	Understand the processing of oil & oilseeds and utilization of their byproducts	Understanding												
CO-PO Mapping														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	1	-	2	1	1	-	-	-	1	2	2
CO2	2	1	1	1	-	2	1	1	-	-	-	1	2	2
CO3	2	1	1	1	-	2	1	1	-	-	-	1	2	2
CO4	1	1	1	1	-	2	1	1	-	-	-	1	2	2
CO5	2	1	1	1	-	2	1	1	-	-	-	1	2	2
Average	2	1	1	1	-	2	1	1	-	-	-	1	2	2
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”														
Course Level Assessment Questions														
Course Outcome-1 (CO-1)														
➤ Production status of cereal grains														
➤ Composition, structure and processing characteristic of cereal grains, legumes and oilseeds														
➤ Post-harvest practices for their safe storage														
Course Outcome-2 (CO-2)														
➤ Different methods of parboiling and milling of paddy														
➤ Processing of rice														
➤ Different types of processed rice products														
Course Outcome-3 (CO-3)														
➤ Milling of wheat into flour and semolina														
➤ Grading and quality characteristics of flour and semolina														
➤ Baked products														
➤ Breakfast cereals and Macaroni products														

Course Outcome-4 (CO-4)	
➤ Milling of corn	
➤ Barley and millet processing	
➤ Processing of legume-pulses	
Course Outcome-5 (CO-5)	
➤ Processing of oil seeds	
➤ Refining and modifications of oils	
➤ Processing of de-oiled cake (DOC)	
➤ Application of DOC into protein products	
➤ Oil based food products	
SYLLABUS	
Modules	No. of Hours
Module -I: Composition and Structure	
Production trends, Composition, structure and processing characteristic of cereal grains, Legumes, oil seed processing, Post-harvest and post processing practices for their safe storage.	06
Module -II: Paddy Processing and Processed Products	
Parboiling and milling of paddy, curing and aging of rice, processed rice products.	08
Module -III: Wheat Processing and Processed Products	
Wheat and its quality characteristics for milling into flour and semolina, Flour milling, Turbo grinding and air classification, Flour grades and their suitability for baking purposes, Assessment of flour quality and characteristics, Milling of Durum wheat, Ingredients, production and quality parameters for baked products: Bread, biscuits and cakes; Breakfast cereals, Macaroni products.	10
Module -IV: Coarse Cereals and Legume-Pulses Processing	
Dry and Wet milling of corn, Starches and its conversion products, Malting of barley, Pearlring of millets, Milling of legume-pulses by traditional and improved processes.	08
Module -V: Oilseeds Processing and Processed Products	
Processing of oil seeds for direct use and consumption, Oil and protein products, Refining: Physical and Biorefining, Hydrogenation and Interstratification of oil, Processing of de-oiled cake into protein concentrates and isolates, Textured protein, Functional protein preparations, Peanut butter, Margarine and Spread.	08
Reference books and suggested readings	
Title	Author
Manuals on Rice and its Processing	CFTRI, Mysore
Food Science	N. N. Potter
Cereal Technology	SA Matz
Bakery Technology	SA Matz
Cereals and Cereal Processing: Chemistry and Technology	DAV Dendy and B.J. Dobrazczyk
Cereal Technology	Kent

		L	T	P	C									
NFT-305	Fruits, Vegetables and Plantation Products	3	0	0	3									
Course Objectives: The objectives of this course are to impart-														
<ul style="list-style-type: none"> • Skill and Knowledge required to apply the concepts of post-harvest handling, supply chain management, preservation techniques, and value addition of fresh fruits and vegetables for extending the shelf life. • Knowledge about the processing of spices and other plantation products besides the application of emerging technologies for shelf life extension and value addition of fresh produce. 														
Course Outcomes: On the successful completion of the course, students will be able to-														
CO-1	Understand and analyze the post-harvest changes and handling of fresh fruits and vegetables	Analyzing												
CO-2	Understand and apply various conventional preservation techniques for shelf life extension of fruits and vegetables	Applying												
CO-3	Understand and apply the concepts of processing various fruits and vegetable based value added products	Applying												
CO-4	Understand the processing of spices and other plantation products	Understanding												
CO-5	Understand the application of emerging technologies for the shelf life extension and processing of fruits and vegetables	Understanding												
CO-PO Mapping														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	-	2	-	-	1	1	1	1	-	1	2	2	2
CO2	-	1	2	1	1	2	1	1	1	-	1	2	2	2
CO3	-	-	1	-	1	2	1	1	1	-	1	1	2	2
CO4	-	-	1	-	1	1	1	1	-	-	-	1	2	2
CO5	1	1	2	1	2	2	1	1	-	1	2	2	2	2
Average	1	1	2	1	1	2	1	1	1	1	1	2	2	2
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”														
Course Level Assessment Questions														
Course Outcome-1 (CO-1)														
➤ Review on the status of production and processing of fruits and vegetables														
➤ Chemical composition and nutritive value of fruits and vegetables														

➤ Post-harvest changes in fresh produce	
➤ Physicochemical treatments to improve the shelf life of fruits and vegetables	
➤ Supply chain management of fresh fruits and vegetables	
Course Outcome-2 (CO-2)	
➤ Methods of chilling and freezing fruits and vegetable	
➤ Changes during chilling and freezing fruits and vegetable	
➤ Canning and aseptic processing of fruits and vegetables	
➤ Different drying techniques for fruits and vegetables	
Course Outcome-3 (CO-3)	
➤ Processing of fruit juices and beverages	
➤ Processing of pectin based jel like products	
➤ Processing of tomato products	
➤ Processing of sugar-impregnated fruits and vegetable products	
➤ Processing of fermented fruits and vegetable-based products	
Course Outcome-4 (CO-4)	
➤ Processing of major and minor spices	
➤ Processing of Plantation products	
➤ Processing of Cocoa and Cocoa products	
➤ Processing of major nuts	
Course Outcome-5 (CO-5)	
➤ Emerging technologies for processing fruits and vegetable	
➤ Minimal processing of fruits and vegetables	
➤ Concept of Hurdle Technology	
SYLLABUS	
Module-1: Post-Harvest Handling of Fruits & Vegetables	No. of Hours
Current status of production and processing of fruits and vegetables; Chemical composition and nutritional value of fruits and vegetables; Pre and post-harvest changes; Maturity indices for harvesting and storage; Desirable characteristics of fruits and vegetables for processing; Post-harvest management of fruits and vegetables; Transportation and storage of fresh produce; Supply chain management for fresh produce.	08
Module – II: Preservation of Fruits & Vegetables	
Low-temperature preservation: Chilling/ refrigeration, Freezing, Cryogenic freezing,	06

Frozen storage, Thawing, Defects during low-temperature storage. Thermal processing: Canning and bottling, Spoilage of canned foods, Aseptic processing. Drying and dehydration: Types of dryers, Changes during drying, Quality of dried products	
Module – III: Processing Technology of Fruits & vegetables based Products	
Juices; Pulps; Squashes; Cordials, and other beverages; Concentrates; Powders; Jams, Jellies, Marmalades; Preserves, Candies, and Crystallized fruits; Chutneys; Pickles; Vinegar; Fruit wine; and other products. Tomato processing: Puree, Paste, Ketchup, Sauce, and soup.	10
Module – IV: Processing Technology of Spices & Plantation Products.	
Spices: Composition, Structure, and characteristics; Preservation and processing of major and minor spices of India; Whole spice, Spice powder, Paste and extracts, Spice oils, and Oleoresins. Tea: Composition, production, and processing of Tea leaves: Black tea, Green tea, Oolong tea, Instant tea. Coffee: Production and processing of coffee cherries: wet and dry methods, grinding, storage, and preparation of brew; Soluble/Instant coffee; Use of chicory in coffee; decaffeinated coffee. Nuts: Composition, structure, and processing of cashew nuts, Sprouted cashew, cashew milk and other dry fruits. Cocoa: Production, Chemical composition, and Processing of cocoa beans. Manufacturing of chocolate: Ingredients, Processing, and Defects.	10
Module – V: Emerging Technologies for fruits and vegetable processing	
Irradiation application; Ozone application; High-Pressure Processing; Pulsed Electric Field processing; Ultrasound treatment, and other novel fruit and vegetable processing techniques. Minimal processing; Hurdle Technology.	06
Reference books and suggested readings	
Title	Author
Advances in Postharvest Fruit and Vegetable Technology	Ron B.H. Wills., John Golding
Preservation of fruits and vegetables	Girdharilal, Siddappaa, G.S.
Handbook of analysis and quality control for fruits and vegetable products	Ranganna S.
Foods: Facts and Principles, New Age Publishers.	Manay, S. & Shadaksharaswam
Food Science	Potter, Norman
Harvest Technology of Fruits and Vegetables	Verma, L.R and Joshi, V.K.

		L	T	P	C										
NFT-307	Food Processing Laboratory	0	0	6	3										
Course Objectives: The objective of this Laboratory is to															
<ul style="list-style-type: none"> Enable students to understand the food preservation and processing operations and their practical applications in food processing Industries. 															
Course Outcomes: On the successful completion of the course, students will be able to															
CO1	Understand processing and preservation of Fruits and Vegetables and their value added products.	Understanding													
CO2	Understand processing of Cereals, Pulses And Oilseeds.	Understanding													
CO3	Assess the quality of finished food products, including sensory evaluation, chemical composition, and shelf-life assessment.	Evaluating													
CO4	Apply food labeling requirements and regulations to ensure compliance with industry standards.	Applying													
CO-PO Mapping															
COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	2	2	3	2	1	3	3	2	3	3	2	2	3	1	
CO2	2	2	3	2	1	3	3	2	3	3	2	2	3	1	
CO3	2	2	3	2	3	1	3	2	3	3	2	3	1	1	
CO4	1	1	1	1	-	1	2	2	3	3	2	3	1	1	
Average	2	2	3	2	1	2	3	2	3	3	2	3	2	1	
<i>1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”</i>															
Sr. No.	Name of Practical													Contact Hrs.	
1	Processing and preservation of non-alcoholic fruit beverages (RTS, cordial, and squash) using permitted chemical preservatives.													6	
2	Processing and Preservation of Jam, Jelly and Marmalade.													6	
3	Processing and Preservation of Tomato Sauce.													6	
4	Processing and Preservation of Fruits/Vegetables by Canning Method.													6	

5	Osmotic dehydration of fruits/vegetables by sugar and salt solution.	6
6	Processing of Dehydrated Onion Powder/Flakes.	6
7	Milling of Pulses and Effect of Pretreatments on Dal Recovery and milling Efficiency.	6
8	Preparation of Bread, Biscuit and Cake.	6
9	Preparation of Soy Milk and Tofu (Soy Paneer).	6
10	Processing and quality assessment of oil seeds.	6
11	Production & Processing of Potato Chips.	6
12	Determination of Average Size of Cereal/pulses Flour by Sieve Analysis.	6

Reference books and suggested readings

Title	Author
Laboratory Manual	-
Preservation of fruits and vegetables	Girdharilal, Siddappaa, G.S.
Handbook of analysis and quality control for fruits and vegetable products	Ranganna S
FSSAI Manual of Methods of Analysis of Foods – Cereal and Cereal Products -2nd edition.	FSSAI
FSSAI Manual of Methods of Analysis of Foods – Oil and Fats	FSSAI
FSSAI Manual of Methods of Analysis of Foods-Fruit and Vegetable products	FSSAI
Food Safety and Standards (Food Products Standards and Food Additives) Regulation, 2011	-
Food Safety and Standards (Labelling and Display) Regulations, 2020	-

		L	T	P	C									
NFT-302	Food Safety and Quality Control	3	0	2	4									
Course Objectives: The objectives of this course are to impart-														
<ul style="list-style-type: none"> Fundamental knowledge of quality control and total quality management systems in the food industry. Knowledge about food hygiene and the importance of safe food Knowledge about the regulatory framework for ensuring food quality and safety Knowledge of Food safety management system 														
Course Outcomes: On the successful completion of the course, students will be able to-														
CO-1	Understand concepts of Food Quality and the role of a Total Quality Management system in the food industry	Understanding												
CO-2	Understand the concepts of food safety and risk management	Understanding												
CO-3	Understand the concept and application of knowledge about food safety management systems in the food industry	Analyzing												
CO-4	Understand the national and international food laws and regulations	Understanding												
CO-5	Understand various international certifications for the food industry	Applying												
CO-6	Evaluate the quality characteristics of various food products	Applying												
CO-PO Mapping														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO-1	1	-	1	-	-	2	1	1	1	-	1	1	1	1
CO-2	-	1	2	-	1	2	1	1	1	-	2	1	1	1
CO-3	1	1	2	-	1	2	1	2	1	1	2	1	1	2
CO-4	-	-	1	-	-	2	1	2	1	-	2	1	2	2
CO-5	-	-	1	-	1	2	-	2	1	-	2	1	2	2
CO-6	1	1	2	1	2	2	1	1	-	-	1	1	2	2
Average	1	1	2	1	1	2	1	2	1	1	2	1	2	2
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”														
Course Level Assessment Questions														
Course Outcome-1 (CO-1)														
➤ Fundamentals of Food Quality														
➤ Aspects of Food Quality Control and Quality Assurance														
➤ Sensory evaluation of food products														

➤ Concepts of TQM	
➤ Determining the quality attributes of food products	
Course Outcome-2 (CO-2)	
➤ Principles of Food Safety	
➤ Various food hazards	
➤ Risk management protocols	
➤ Concepts of Food Adulteration	
Course Outcome-3 (CO-3)	
➤ Implementation of HACCP systems	
➤ Food Safety Management System and its significance	
➤ Various Prerequisite programs (PRPs)	
➤ Importance of Food safety audit	
Course Outcome-4 (CO-4)	
➤ Provisions of Food Safety and Standards Act (2006)	
➤ Functions of Food Safety and Standards Authority of India (FSSAI)	
➤ Role of Codex Alimentarius Commission in international trade	
➤ harmonization of food standards	
Course Outcome-5 (CO-5)	
➤ Various ISO certifications for the food industry	
➤ Provisions of BRC and other certification	
➤ Provisions for Kosher and Halal types community specific certifications	
➤ Provisions of the Global Food Safety Initiative	
Course Outcome-6 (CO-6)	
➤ Testing and evaluation of various parameters of food quality	
➤ Assessment of quality of foods from different food categories	
➤ Different techniques to perform sensory evaluation study of foods	
SYLLABUS	
Module-1: Concepts of Food Quality	No. of Hours
Concept of Food Quality: Definitions, importance, and factors influencing food quality; Quality attributes of food; Sensory evaluation of quality characteristics; Quality attributes of various food commodities- water, dairy, fruits, and vegetables, etc.; Instrumental measurement of food quality: Techniques for analyzing physical and chemical properties (pH, moisture content, color, texture etc.); Quality Control vs. Quality Assurance:	10

Definitions, roles, and differences between QC and QA.; Statistical quality control: Techniques for monitoring and controlling variability in food production processes; Quality Cost; Total Quality Control (TQC); Total Quality Management (TQM).	
Module-2: Food Safety Fundamentals	
Introduction to Food Safety: Definitions, importance, and historical perspectives; Food Hazards: Physical, chemical, and microbiological hazards; Food Allergens; Foodborne infection and intoxication; Food adulteration; Food Fraud; Food Additives; Risk Analysis, Risk Management, Risk Assessment, Risk Communication; Traceability and authentication, Food Recall, Blockchain Technology.	08
Module-3: Food Safety Management Systems	
Introduction; Components of food safety management system; Hazard Analysis Critical Control Point (HACCP); Prerequisite programs (PRPs): Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practices (GAP); Food Safety Audits: Internal audit, Third-party audit.	08
Module-4: Regulatory Framework for Food Safety	
Food Safety and Standards Act, 2006: Provisions, various regulations; Food Safety and Standards Authority of India (FSSAI): Composition, Functions and responsibilities; Preparation and Enforcement of food regulations in India; Codex Alimentarius Commission (CAC); Sanitary and phytosanitary Measures (SPS); Introduction to major international food safety regulatory bodies: USFDA, CFIA, FSANZ, EFSA, FSIS; Voluntary standards: BIS and AgMark; Harmonization of food standards.	08
Module-5 International Food Quality and Safety Certification	
ISO 9000; ISO 22000; FSSC 22000 (Food Safety System Certification); BRC Global Standard for Food Safety; GFSI (Global Food Safety Initiative) Certification; Kosher Certification; Halal Certification; other similar certifications	06
List of experiments	
1. To conduct sensory analysis of food samples	02
2. To detect the adulteration in food samples	02
3. Texture profile analysis of food samples	02
4. To evaluate the quality characteristics of Bakery Products	02
5. To evaluate the quality characteristics of Dairy Products	02

6. To assess the quality characteristics of wheat flour	02
7. To evaluate the quality characteristics of fruit-based beverages	02
8. To evaluate the quality characteristics of Jam, Jelly, Marmalades	02
9. To evaluate the labels of packaged food samples in light of regulations	02
10. To evaluate the microbial quality of food product	02
11. To visit any food testing laboratory/ organization	
Reference books and suggested readings	
Title	Author
Food Quality Assurance: Principles and Practices	Inteaz Alli
Rheology and Texture in Food Quality	J.M. DeMan
Food Analysis: Theory and practice	Y. Pomeranz
Principles of Sensory Analysis of Food	M.A. Amerine
FSSA Act and regulations	

		L	T	P	C									
NFT-304	FERMENTED FOODS & BEVERAGE TECHNOLOGY	3	0	0	3									
Course Objectives: The objective of this course is to impart														
<ul style="list-style-type: none"> • Knowledge about types of fermentation and principles & procedures involved in the production of fermented food products. • Characteristics and production methods of both alcoholic and non-alcoholic beverages, basic concepts of their quality parameters. 														
Course Outcomes: On the successful completion of the course, students will be able to														
CO1	Understand the types of fermentation and the importance of fermented food products.	Understanding												
CO2	Understand the principles and apply the processing techniques for plant-based fermented food products.	Understanding , Applying												
CO3	Understand the principles and processing techniques of fermented milk, meat, and fish products, and apply methods to assess their quality.	Understanding , Applying												
CO4	Understand the manufacturing processes and quality evaluation of alcoholic beverages, including the role of yeast, brewing technologies, and different types of alcoholic beverages. .	Understanding												
CO5	Understand the manufacturing processes, quality evaluation, and regulatory standards for packaged drinking water, carbonated beverages, and specialty beverages. .	Understanding												
CO-PO Mapping														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	-	-	-	-	-	-	-	-	-	1	1	1
CO2	1	2	-	-	-	3	2	2	2	-	1	2	2	1
CO3	1	2	-	-	-	3	2	2	2	-	1	2	2	1
CO4	1	2	2	-	-	3	2	2	2	-	1	2	2	1
CO5	1	1	2	-	-	3	1	2	2	-	1	2	2	1
Average	1	2	1	-	-	3	2	2	2	-	1	2	2	1
<i>1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”</i>														
Course Level Assessment Questions														
Course Outcome 1 (CO1)														
➤ Definition and types of fermentation.														

➤ Health benefits of fermented foods.	
➤ Understanding pathways of lactic acid, alcoholic, and acetic acid fermentation.	
➤ Preparation and maintenance of bacterial, yeast, and mold cultures.	
Course Outcome 2 (CO2)	
➤ Production technology of plant-based fermented food products.	
➤ Microorganisms involved and optimum conditions in plant-based fermented food products.	
➤ Basic concept of spoilage and defects in plant-based fermented foods and their control.	
Course Outcome 3 (CO3)	
➤ Production technology of fermented milk, meat, and fish products.	
➤ Microorganisms involved and optimum conditions in animal-based fermented food products.	
➤ Basic concept of spoilage and defects in animal-based fermented foods and their control.	
Course Outcome 4 (CO4)	
➤ Technological concept of beer and wine production	
➤ Role of yeast in beer and other alcoholic beverages.	
➤ Brewing process and equipment used for brewing and distillation	
➤ Quality evaluation of different types of alcoholic beverages.	
Course Outcome 5 (CO5)	
➤ Manufacturing process of packaged drinking water.	
➤ Quality evaluation and regulatory standards for bottled water	
➤ Manufacturing process of carbonated and specialty beverages.	
➤ Role of various ingredients in soft drinks and the carbonation process.	
SYLLABUS	
Module-1: Fermentation types and their pathways	No. of Hours
Fermentation: Definition, Types of fermentation: Lactic acid fermentations, Alcoholic fermentations, Acetic acid fermentations. Application of Fermentation in Food Industries, Advantages & Health Benefits of Fermented Foods, Preparation and Maintenance of bacterial, yeast and mold cultures for food fermentations.	7
Module – II: Fermentation of Plant based Products & Mushrooms cultivation	
Production technology, microorganisms involved, Spoilages & defects, their control of plant based fermented food products: idli, dosa, dhokla, sauerkraut, kimchi, pickles, Natto, Tempeh, Koji & Miso, Kombucha. Fermentation of Vinegar, Mushrooms: types, nutritional importance, cultivation and preservation.	7
Module – III: Fermentation of Animal based Products	

Production technology, microorganisms involved , Spoilages & defects, their control of Animal based fermented food products: Dahi, Yoghurt, Butter milk, Kefir, Kumis, Cheese Fermented fish products, Fermented meat products	7
Module – IV: Alcoholic Beverages	
Alcoholic beverages- types, manufacturing and quality evaluation, role of yeast in beer and other alcoholic beverages, ale & lager type beer, Malting : technology of brewing process, equipment used for brewing and distillation, wine and related beverages, cider, distilled spirits.	7
Module – V: Packaged drinking water, carbonated beverages, and other specialty beverages	
Packaged drinking water- definition, types, manufacturing, processes, quality evaluation, methods of water treatment, BIS Specifications, quality standards of bottled water, mineral water, natural spring water, flavored water, carbonated water, technology of still, carbonated, low-calorie and dry beverages, isotonic and sports drinks, role of various ingredients of soft drinks, carbonation of soft drinks.	7
Reference books and suggested readings	
Title	Author
Microbiology and Technology of Fermented Foods	Hutkins, R. (2006), IFT Press, Blackwell Publishing
Handbook of Food and Beverage Fermentation Technology.	Hui, Y.H.
Food Fermentation and Micro-organisms	Bamforth, C. W. and Cook, D. J. (2019)
Microbiology of fermented foods	
Microbiology and biochemistry of cheese and fermented milk.	Edited by B.A. Law New York, Blackie Academic & professional.
BIS specification IS 10500:2012	-
Beverages: Technology, Chemistry and Microbial	Varnam and Sutherland

		L	T	P	C									
NFT-306	FOOD PACKAGING AND STORAGE ENGINEERING	3	0	0	3									
Course Objectives: The objective of this course is to impart														
<ul style="list-style-type: none"> • Knowledge of packaging, package developments and packaging laws and regulations in food industries. • Knowledge of different types of packaging materials and their forms used in food packaging. • Knowledge about package performance and various testing of packaging materials. • Knowledge about storage of food and food products. 														
Course Outcomes: On the successful completion of the course, students will be able to														
CO1	Understand basic concept of packaging, printing and packaging laws & regulations in food industries.	Understanding												
CO2	Understand different types of packaging material & their properties and apply the knowledge in packaging of various food commodities	Understanding Applying												
CO3	Understand the selection of packages for specific food & agricultural commodities.	Understanding												
CO4	Analyze the performance and quality of packaging materials	Analyzing												
CO5	Understand the designing of storage structures for food commodities	Understanding												
CO-PO Mapping														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	-	2	2	1	-	-	-	2	2	
CO2	3	2	3	2	-	3	3	1	-	-	-	2	2	2
CO3	1	2	3	1	-	3	3	1	-	2	-	1	2	2
CO4	2	2	2	1	-	2	2	1	-	-	-	2	2	2
CO5	3	2	3	2	-	1	2	1	-	2	-	1	2	1
Average	2	2	3	1	-	2	2	1	-	1	-	2	2	2
<i>1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”</i>														
Course Level Assessment Questions														
Course Outcome 1 (CO1)														
➤ Challenges & opportunities in Food packaging industry														
➤ Printing and packaging laws& regulations														
➤ Significance of packaging in Food industry														

Course Outcome 2 (CO2)	
➤ Packaging Materials	
➤ Types of packaging materials in food industry	
➤ Selection criteria for packaging of food products	
Course Outcome 3 (CO3)	
➤ Packages for specific food & agricultural commodities	
➤ Advancement in food packaging	
Course Outcome 4 (CO4)	
➤ Testing of packaging materials	
➤ Shelf life analysis of packaged foods	
Course Outcome 5 (CO5)	
➤ Spoilage of grains, fruits & vegetables and their prevention	
➤ Design parameter for different storage bins	
➤ Designing of cold storage and other types of storage structures	
SYLLABUS	
Module-1: Introduction of Packaging	No. of Hours
Concept of packaging, Important functions of package, Packaging laws and regulations: Printing techniques; Package labeling: functions and regulations; Environmental aspect of food packaging	06
Module – II:	08
Glass containers and closures, Metal containers: tin-plate containers, tin free steel containers, aluminum and other metal containers. Protective lacquers and coatings for metal containers. Wooden crates, plywoods, cellulosic papers, pouches, bags and card board / corrugated paper boxes. Rigid and flexible packaging: laminates, containers and films and their mechanical sealing and barrier properties.	
Module – III:	08
Selection of Packaging materials, forms and machinery for various food commodities: Fruits and vegetable and their products, Milk and milk products, Meat, fish, egg etc., cereals, pulses and oilseeds products, confectionery etc. Evaluation of quality, safety and interaction with foods of various types of packaging materials. Gas, vacuum, CAP, MAP and aseptic packaging, Tetra packing, Smart packaging, Intelligent Packaging, Active Packaging and Antimicrobial packaging, Retortable pouches, biodegradable and edibles packaging materials and films.	

Module – IV:		08
Destructive & Nondestructive test of rigid, semi rigid and flexible packaging material: tensile strength, compression, bursting, tear and impact test for packages, integrity testing. Cushioning effect on packaged foods, deterioration of packaged foods, shelf life study for packaged foods. Corrosion and toxicity of packaging material.		
Module – V:		08
Design parameter for different storage bins for different grains, Milk silo, Design parameter, selection of parameter for designing cold storage for foods different storage. Spoilage of fruits & vegetables during transportation & storage and its prevention. Factors affecting quality of grain during storage. Causes and prevention of spoilage of grain during storage		
Reference books and suggested readings		
Title	Author	
Food Packaging: Principles and Practice	Robertson G.L.	
Food Packaging Materials	Mahadeviah M. and Gowramma R.V	
Principles of Food Packaging	Saclarow S. and Griffin R.C.,	
Food and Package Engineering	Scott A. Morris	
Food Packaging and Preservation	Alexandru Grumezescu Alina Maria Holban	

		L	T	P	C
NFT-308	Advanced Food Instrumentation Lab	0	0	6	3
Course Objectives: The objectives of this course are to impart-					
<ul style="list-style-type: none"> The knowledge about the analysis of food quality characteristics using advanced testing instruments The knowledge to correlate the instrumental analysis with the sensory analysis of foods 					
Course Outcomes: On the successful completion of the course, students will be able to-					
CO-1	Understand the instrumental analysis of the physicochemical properties of foods	Understanding and Analyzing			
CO-2	Understand the instrumental analysis of the thermal properties of foods	Understanding and Analyzing			
CO-3	Understand the instrumental analysis of the functional properties of foods	Understanding and Analyzing			
List of experiments					
		No. of Hours			
	1. To study the textural characteristics of food using Texture Analyzer				
	2. To analyze the antioxidants present in food using a Spectrophotometer	06			
	3. To study the thermal characteristics of food using a Differential Scanning Colorimeter (DSC)	06			
	4. To study the properties of starch using Rapid Visco Analyzer (RVA)	06			
	5. To study the heavy metals in food using Atomic Absorption Spectrometer	06			
	6. To determine the colour values of different food products	06			
	7. To study the effect of Ultrasonication on the extraction of bioactive components of foods	06			
	8. To study the functional groups of food samples using Fourier Transform Infrared (FTIR) Spectroscopy	06			
	9. To study the fatty acid profile of an oil sample using Gas Chromatography	06			
	10. To study the particle size of the food powder using a Particle Size Analyzer	06			
	11. To visit an analytical food testing laboratory/ organization				
Reference books and suggested readings					
Title		Author/ editor			
Laboratory Manual					
Applications of Instrumental Methods for Food and Food By-		Agata Górská			

Products Analysis. MDPI.	
Food Analysis Laboratory Manual, Springer	S. Suzanne Nielsen

		L	T	P	C									
OFT-302	Basic concept of Food Processing and Preservation	2	0	0	2									
Course Objectives: The objective of this course is to impart														
<ul style="list-style-type: none"> • Knowledge of degree of perishability and causes of quality deterioration and spoilage of perishable foods 														
<ul style="list-style-type: none"> • Knowledge in processing and preservation methods to control food spoilage and deterioration. 														
<ul style="list-style-type: none"> • Knowledge of food quality and safety of food. 														
Course Outcomes: On the successful completion of the course, students will be able to														
CO1	Understand the type of food based on perishability and causes of food spoilage	Understanding												
CO2	Understand the principle of low temperature preservation	Understanding												
CO3	Understand the principle of thermal processing and applying high temperature processing in food industry	Understanding, Applying												
CO4	Understand the principles of non-thermal preservation methods	Understanding												
CO5	Understand concepts of Food quality and safety	Understanding												
CO-PO Mapping														
COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	-	1	-	1	1	-	-	-	-	1	2	1
CO2	3	2	-	1	-	1	1	-	-	-	-	1	2	1
CO3	3	2	-	1	-	1	1	-	-	-	-	1	2	1
CO4	3	2	-	1	-	1	-	-	-	-	-	1	2	1
CO5	3	2	1	-	-	-	-	-	-	-	-	1	2	1
Average	3	2	1	1	-	1	1	-	-	-	-	1	2	1
<i>1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no correlation, put “-”</i>														
Course Level Assessment Questions														
Course Outcome 1 (CO1)														
➤ Aims and objectives of food preservation														
➤ Composition and types of food based on perishability														
➤ Causes of food spoilage: microbial, physical, chemical, and other factors														
Course Outcome 2 (CO2)														
➤ Principles of low temperature preservation														

➤ Methods and effects of refrigeration and freezing on food quality	
➤ Controlled and modified atmosphere storage	
Course Outcome 3 (CO3)	
➤ Principles of heat preservation and thermal resistance of microorganisms	
➤ Impact of thermal treatments (boiling, pasteurization, UHT, sterilization, canning, blanching) on food quality	
Course Outcome 4 (CO4)	
➤ Principles and working mechanisms of non-thermal preservation methods	
➤ Mechanisms of action of chemical preservatives	
➤ Introduction to advanced preservation techniques (high pressure processing, ohmic heating, pulse electric field processing, irradiation)	
➤ Concept of hurdle technology	
Course Outcome 5 (CO5)	
➤ Concepts of food quality: definitions, importance, and influencing factors	
➤ Introduction to food safety: definitions, importance, historical perspective	
➤ Identification and management of food hazards (physical, chemical, microbiological)	
➤ Food adulteration and its prevention	
SYLLABUS	
Module-1: Composition of Food and causes of food spoilage	No. of Hours
Introduction and Historical Development of Food Preservation ,Composition of Food, Type of Food based on perishability, General Principles of Food Preservation, Basic concepts in microbial growth, Cause of Food Spoilage.	05
Module – II: Preservation of foods by low temperature	06
Preservation by low temperature - Low temperature storage, refrigeration and freezing , slow and fast freezing, Controlled and modified atmosphere storage of foods, Preservation by drying; Phenomenon and methods of drying-dehydration by air drying, sun drying and freeze drying. Intermediate moisture foods.	
Module – III: Preservation of Foods by high temperature	05
Preservation by heat; Principles of heat preservation, heat resistance of micro-organisms and their spores. Thermal death time. Heat treatments- boiling, pasteurization, UHT, sterilization, canning, blanching.	
Module – IV: Non- Thermal Method of Processing and Preservation of Foods	05
Definition of chemical preservatives and types. Introduction to new techniques in preservation of food like high pressure processing, pulse electric field processing,	

irradiation and hurdle technology etc.		
Module – V: Introduction to Food Quality and Safety		04
Food quality: Definitions, importance and factors influencing food quality, Quality attributes of food. Introduction to Food safety : definitions, importance and historical perspective, Food Hazards; Physical, chemical and microbiological hazards, Food adulteration		
Reference books and suggested readings		
Title	Author	
Physical Method of Food Preservation	O.R. Fennema	
Food Processing and Preservation	B. Sivasankar	
Food Processing Technology : Principles and Practice	P.J Fellows	
Food Quality Assurance	I. Ali	
Physical Method of Food Preservation	O.R. Fennema	