# SEMESTER WISE COURSE STRUCTURE & & DETAILED SYLLABUS

# **B.TECH. CHEMICAL TECHNOLOGY-FOOD TECHNOLOGY**

(Effective from the session 2017-18 for new entrants)



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

## HARCOURT BUTLER TECHNICAL UNIVERSITY SCHOOL OF CHEMICAL TECHNOLOGY DEPARTMENT OF FOOD 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
<b>PEO4:</b>	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:

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

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

<b>PO9</b>	Function effectively as an individual, and as a	Individual and team work
	member or leader in diverse teams, and in	
	multidisciplinary settings.	
<b>PO10</b>	Communicate effectively on complex engineering	Communication
	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.	
PO11	Demonstrate knowledge and understanding of the	Project management and
	engineering and management principles and apply	finance
	these to one's own work, as a member and leader in	
	a team, to manage projects and in multidisciplinary	
	environments.	
PO12	Recognize the need for and have the preparation and	Life-long learning
	ability to engage in independent and life-long	
	learning in the broadest context of technological	
	change.	

# **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 2017-2018 for new entrants)

# Year I, Semester-I

S. No.	Course Type	Course Title	Subject Code	Credits	]	Period	s		Sessional	l Marks		ESE	Total Marks
					L	Т	Р	MSE	ТА	Lab	Total		
1	BSC	Chemistry	BCY 101	4	3	0	2	15	20	15	50	50	100
2	BSC	Mathematics I	BMA 101	4	3	1	0	30	20	-	50	50	100
3	ESC	Electronics Engineering	EET 101	3	3	0	0	30	20	-	50	50	100
4	ESC	Engineering Graphics	ECE 101	3	0	0	6	30	20	-	50	50	100
5	ESC	Computer Concept & Programming	ECS 101	4	3	0	2	15	20	15	50	50	100
6	ESC	Workshop Practice	EWS 101	2	0	0	4	00	20	30	50	50	100
7	MC (Non- Credit)	Environment & Ecology	ECE 103	0	2	0	0	30	20	-	50	50	100
				Total	Credi	ts: 22							700*

\* 100 marks will not be added as given in S. No. 7 (Non-Credit)

# (Applicable from Session 2017-2018 for new entrants) Year I, Semester-II

S. No.	Course Type	Course Title	Subject Code	Credits	]	Period	S		Sessional	Marks		ESE	Total Marks
					L	Т	Р	MSE	ТА	Lab	Total		
1	BSC	Physics	BPH 102	4	3	0	2	15	10	10	15	50	100
2	BSC	Mathematics II	BMA 102	4	3	1	0	30	10	10	-	50	100
3	ESC	Electrical Engineering	EEE 102	4	3	0	2	15	10	10	15	50	100
4	ESC	Engineering Mechanics	EME 102	3	3	0	0	30	10	10	-	50	100
5	HSMC	English Language & Comprehensive	HHS 102	2	2	0	0	30	10	10	-	50	100
6	HSMC	HSMCProfessional CommunicationHHS 10432021510101550										100	
				Total	Credi	ts: 20							600

# (Applicable from Session 2018-2019) Year II, Semester-III

S. No.	Course Type	Course Title	Subject Code	Credits	]	Period	5		Sessional	Marks		ESE	Total Marks
					L	Т	Р	MSE	ТА	Lab	Total		
1	BSC	Mathematics III	BMA 201	4	3	1	0	30	20	-	50	50	100
2	ESC	Materials & Energy Balance	TCH 201	5	3	2	0	30	20	-	50	50	100
3	PCC	Fluid Flow & Unit operation	TCH 211	5	3	1	3	15	20	15	50	50	100
4	PCC	Introduction to Food Technology	TFT 201	5	3	0	6	15	20	15	50	50	100
5	HSMC	Organizational Behaviour	HHS 203	3	3	0	0	30	20	-	50	50	100
6	MC (Non- Credit)	Cyber Security (Audit course)	ECS 205	0	2	0	0	30	20		50	50	100
				Total	Credi	ts: 22							600*

\* 100 marks will not be added as given in S. No. 6 (Non-Credit)

# (Applicable from Session 2018-2019) Year II, Semester-IV

S. No.	Course Type	Course Title	Subject Code	Credits	]	Period	S		Sessional	Marks		ESE	Total Marks
					L	Т	Р	MSE	ТА	Lab	Total		
1	BSC	Modern Analytical Techniques	BCY 202	4	3	0	3	15	20	15	50	50	100
2	BSC	Computer Oriented Numerical Methods	BMA 206	5	3	1	3	15	20	15	50	50	100
3	ESC	Heat Transfer Operations	TCH 212	3	3	0	0	30	20	-	50	50	100
4	PCC	Chemical Engineering Thermodynamics	TCH 214	3	3	0	0	30	20	-	50	50	100
5	PCC	Food Microbiology	TFT 202	4	3	0	3	15	20	15	50	50	100
6	HSMC	Engg Economics & Management	HHS 202	3	3	0	0	30	20	-	50	50	100
7	MC (Non- Credit)	Indian Constitution (Audit course)	HHS 206	0	2	0	0	30	20		50	50	100
				Total	Credi	ts: 22							600*

\* 100 marks will not be added as given in S. No. 7 (Non-Credit)

# (Applicable from Session 2019-2020) Year III, Semester-V

S. No.	Course Type	Course Title	Subject Code	Credits	]	Period	ls		Sessional	ESE	Total Marks		
					L	Т	Р	MSE	ТА	Lab	Total		
1	PCC	Mass Transfer Operations	TCH 315	4	3	1	0	30	20	-	50	50	100
2	PCC	Chemical Reaction Engineering	TCH 317	4	3	1	0	30	20	-	50	50	100
3	PCC	Food Biochemistry	TFT 301	3	3	0	0	30	20	-	50	50	100
4	PCC	Food Chemistry	TFT 303	5	3	0	6	15	20	15	50	50	100
5	OEC (Mechanical)	Energy Conversion Systems and Devices	EME 325	3	3	0	0	30	20	-	50	50	100
6	OEC (Humanities)	Entrepreneurship Development	HHS 341	3	3	0	0	30	20	-	50	50	100
				Total Cr	edits:	22							600

# (Applicable from Session 2019-2020) Year III, Semester-VI

S. No.	Course Type	Course Title	Subject Code	Credits	]	Period	S	:	Sessiona	l Marks		ESE	Total Marks
					L	Т	Р	MSE	ТА	Lab	Total		
1	PCC	Instrumentation & Process Control	TCH 316	5	3	1	3	15	20	15	50	50	100
2	PCC	Principle of Food Preservation	TFT 302	4	3	1	0	30	20	-	50	50	100
3	PCC	Technology of Cereals Pulses and Oilseeds	TFT 304	5	3	0	6	15	20	15	50	50	100
4	PCC	Fruits Vegetable and Plantation Products	TFT 306	5	3	0	6	15	20	15	50	50	100
5	OEC (Maths)	Operations Research	BMA 302	3	3	0	0	30	20	-	50	50	100
				Total Cr	edits:	22							600

# (Applicable from Session 2020-2021) Year IV, Semester-VII

S. No.	Course Type	Course Title	Subject Code	Credits	I	Period	S		Sessiona	l Marks		ESE	Total Marks
	¥				L	Т	Р	MSE	TA	Lab	Total		
1	PCC	Food Safety and Quality Control	TFT 401	4	3	0	3	15	20	15	50	50	100
2	PEC	Programme Elective Course I Traditional & Fermented Foods Food Product and Process Development	TFT 403 TFT 405	3	3	0	0	30	20	-	50	50	100
3	PEC	Programme Elective Course II Food Processing Waste Management Quality Management of Frozen Foods	TFT 407 TFT 409	2	2	0	0	30	20	-	50	50	100
4	PEC	Programme Elective Course III Technology of Milk & Milk Products Nutraceutical & Functional Foods	TFT 411 TFT 413	2	2	0	0	30	20	-	50	50	100
5	OEC (Food Tech.)	Nutritional aspects of Natural & Processed Foods	TFT 415	3	3	0	0	30	20	-	50	50	100
6		Industrial Training	TFT 461	2	0	0	4		25		25	25	50
7		Seminar	TFT 471	2	0	0	4		25		25	25	50
8		Project	TFT 497	4	0	0	8		50		50	50	100
9		Educational Tour	TFT 417	0	0	0	0						
				Total Cr	edits:	22							700

# (Applicable from Session 2020-2021) Year IV, Semester-VIII

S. No.	Course Type	Course Title	Subject Code	Credits	]	Period	S		Sessiona	l Marks		ESE	Total Marks
	¥ <b>_</b>				L	Т	Р	MSE	ТА	Lab	Total		
1	PCC	Transport Phenomena*	TCH 420	3	3	0	0	30	20	-	50	50	100
2	PEC	Programme Elective Course IV* Process Modeling & Simulation Process Equipment Design	TCH 422 TCH 406	3	3	0	0	30	20	-	50	50	100
3	PEC	Programme Elective Course V* Innovative Techniques in Food Processing Application of Computer in Food Processing	TFT 402 TFT 404	4	3	1	0	30	20	-	50	50	100
4	PEC	<b>Programme Elective</b> <b>Course VI*</b> Food Packaging & Storage Engineering Principles of Food Analysis	TFT 406 TFT 408	4	3	1	0	30	20	-	50	50	100
5		Project	TFT 498	8	0	0	16	-	50	-	50**	-	100
				Total Cr	edits:	22							700

\*These courses are either MOOC/NPTEL online courses of equal weightage and similar title available at the start of the semester

OR regular courses in case students do not opt industry-based project.

**\*\*** Project Viva-Voice will be conducted by External Examiner.

#### List of Program Elective Courses

S. No.	PEC Names	Subject Name	Subject Code	C (L-T- P) (new)	
1	Dra anna Ella dina Carra I	Traditional & Fermented Foods	TFT 403	2 (2 0 0)	
1	Food Product and Process Development		TFT 405	5 (5-0-0)	
2	Dra anna Ella d'an Carra II	Food Processing Waste Management	TFT 407	2 (2 0 0)	
	Programme Elective Course II	Quality Management of Frozen Foods	TFT 409	2 (2-0-0)	
2	Dra anna Ella d'an Carra III	Technology of Milk & Milk Products	TFT 411	2 (2 0 0)	
3	Programme Elective Course III Nutraceutical & Functional Foods		TFT 413	2 (2-0-0)	
4	Dra ana Elization Common IV	Process Modeling & Simulation	TCH 404	2 (2 0 0)	
4	Programme Elective Course Iv	Process Equipment Design	TCH 406	3 (3-0-0)	
E		Innovative Techniques in Food Processing	TFT 402	4 (2, 1, 0)	
5	Programme Elective Course v	Application of Computer in Food Processing	TFT 404	4 (3-1-0)	
6	Programma Flastiva Course VI	Food Packaging & Storage Engineering	TFT 406	4 (3 1 0)	
U	Frogramme Elective Course VI	Principles of Food Analysis	TFT 408	4 (3-1-0)	

#### List of Open Elective Courses

S. No.	OEC Names	Subject Name	Subject Code	C (L-T-P)
1.	<b>Open Elective Course I (Mechanical)</b>	Energy Conversion Systems and Devices	EME 325	3 (3-0-0)
2.	<b>Open Elective Course II (Humanities)</b>	Entrepreneurship Development	HHS 341	3 (3-0-0)
3.	<b>Open Elective Course III (Maths)</b>	Operations Research	BMA 302	3 (3-0-0)
4	<b>Open Elective Course IV (FOOD TECH)</b> (Except Food Technology Students)	Nutritional aspects of Natural & Processed Foods	TFT 415	3 (3-0-0)
5.	<b>Open Elective Course V (Paint Technology)</b>	Basic Paint Technology	TPL 415	3 (3-0-0)
6.	<b>Open Elective Course VI (Chemical Engg)</b>	Transport Phenomena	TCH 420	3 (3-0-0)

# Seminars, project works may be considered as practical.

\*These courses are either MOOC/NPTEL/Digital online courses of equal weightage and similar title available at the start of the semester OR regular courses in case students do not opt industry-based project. \*\*Project Viva-Voice will be conducted by External Examiner.

L	Τ	Р	С
3	0	6	5

**Course objectives:** The objective of the course is to impart

- The knowledge about basic concepts of food technology and recent trends
- The knowledge about basic biology, chemistry, and microbiology of foods

#### **Course outcomes**

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

CO1	Understand the status of Indian Food Industry	Understanding
CO2	Understand the importance of nutrition, desirable & undesirable components present in food, and Recommended Dietary Allowances (RDA)	Understanding
CO3	Understated the characteristics of living cells, difference between plant animal cells	Understanding
CO4	Understand the basics concepts of food biochemistry	Understanding
CO5	Understand the basics concepts of food microbiology	Understanding
CO6	Determine the basic composition of foods experimentally	Applying

COs						PO	)s						PS	SOs
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1	-	-	-	1	-	-	-	-	-	1	2	2
CO2	2	1	1	1	-	1	1	-	-	-	-	2	3	3
CO3	2	-	-	-	-	-	1	-	-	-	-	1	1	1
CO4	2	1	-	-	-	1	1	-	-	-	-	2	2	2
CO5	2	1	-	-	-	1	1	-	-	-	-	2	2	2
CO6	3	2	1	1	1	1	1	1	3	1	1	2	3	3
Average	2	1	1	1	1	1	1	1	3	1	1	2	2	2
1: Slight	(Low)		2: Mo	derate	(Medi	um)		3: 5	Substa	ntial (I	High)		Į	f there
is no cor	relatio	n, put'	·_ "											

#### **Course Level Assessment Questions**

## **Course Outcome 1 (CO1)**

- Difference between Food Science and Technology
- Sub-disciplines of Food Science
- Challenges & opportunities in Food industry
- Reasons for slow growth of Indian food industry
- Market scenario of food products

# **Course Outcome 2 (CO2)**

- Bioavailability of nutrients
- Importance of desirable & undesirables constituents of food
- Nutritional Deficiencies

## **Course Outcome 3 (CO3)**

- Characteristics of living system
- Plant and animal diversity

## **Course Outcome 4 (CO4)**

- Metabolic Regulations
- Bioenergetics

#### **Course Outcome 5 (CO5)**

- Interactions between microorganisms and the food environment
- Significance and activities of microorganisms in food.
- Food hygiene and application of microbes in food.

#### Syllabus

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

Food Science and Technology, Status of food processing industry in India and abroad Reasons for slow growth of Indian food industry, Market scenario and scope - Dairy, Bakery, Confectionary, Beverages and Snack foods etc Potential and prospects of Indian food Industry.

#### Module-II: Concept of Food Nutrition and Human Health

Human nutrition and health, Recommended Dietary Allowances (RDA), Desirable and potentially undesirable food constituents and their importance, Factors affecting bioavailability of nutrients. Common nutritional deficiencies such as PEM, iron, vitamin A, iodine, calcium and vitamin D, zinc etc, Emerging common degenerated disorders.

#### Module-III: Basic biology related to food

Living cells, organization of living system, characteristics, Plant and animal diversity, digestion and absorption of biomolecules.

#### **Module-IV: Role of Biochemistry in Food**

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

#### **Module-V: Microbiological Aspects of Food**

Characterization, classification and identification of microorganisms, Microscopy, Morphology and Structure, Pure culture and its characteristics, Reproduction Growth and Cultivation, Control of microorganisms, Beneficial uses of microbes in foods, General principles of food hygiene.

#### **Module-VI: Laboratory Experiments**

Determination of Moisture, Fat, Protein, Crude Fibre, Reducing Sugars, Vitamins and Minerals, Sample Preparation Techniques, Microscope and its parts, Determination of Adulterants, Analysis of Pesticide residues.

#### **Reference Books and Suggested Readings:**

Title	Author
Agriculture Survey of India	The Hindu
Nutritive value of Indian Foods	C. Gopalan
Food Chemistry	L. H. Mayer
Quality control for Food Industry	Kramner & Twigg
Food facts and Principles.	Manay N.S. Shadakshasawamy M
Microbiology Principle of biochemistry	M.J. Pelczar A.L. Lehninger

Module		No. of
N0.		Lectures
1.	Introduction to Food Technology, Its Scope, Opportunities & Challenges	
1.1	Introduction to Food Science and Technology	01
1.2	Status of food processing industry in India and abroad	01
1.3	Market scenario and scope - Dairy, Bakery, Confectionary, Beverages and Snack foods	01
1.4	Potential and prospects of Indian food Industry	01
1.5	Basic chemical composition of foods	02
2.	Concept of Food Nutrition and Human Health	
2.1	Human nutrition, Recommended Dietary Allowances	01
2.2	Desirable & Undesirables Constituents of Food	02
2.3	Bioavailability of Nutrients	02
2.4	Protein Energy Malnutrition (PEM)	01
2.5	Common Nutritional Deficiency disorders	01
3.	Basic biology related to food	
3.1	Living cells, organization of living system, characteristics	02
3.2	Bio-molecules and Cells	02
3.3	Plant and Animal Diversity	02
4.	Role of Biochemistry in Food	
4.1	Introduction to Biochemistry and metabolism	01
4.2	Carbohydrate metabolism	02
4.3	Protein metabolism	02
4.4	Bioenergetics	02
5.	Microbiological Aspects of Food	
5.1	Introduction to microbiology and microorganisms	01
5.2	Identification classification and morphology of Bacteria	01
5.3	Identification classification and morphology of yeast, mold and virus	01
54	Beneficial and spoilage micro-organisms and their control	02
5.5	Food Hygiene	01
5.5	Total Hours	34
6	Laboratory Experiments	
•	Microscope its parts and utility in identification and differentiation	
6.1	of bacteria, yeast and mold.	03
6.2	Familiarization with Culture, Inoculation, Incubation and slide	03
6.3	Wet mount preparation and staining with basic dve	03
6.4	Preparation and sterilization of media and glassware for microbial	03
6.5	Introduction to Food Analysis techniques.	06

# **Course contents and Lecture schedule**

6.6	Sampling techniques and method of sample preparation.	03
6.7	Determination of moisture content of foods.	06
6.8	Determination of Total and Acid insoluble ash content in foods.	06
6.9	Determination of Crude fat content by solvent extraction methods in foods.	06
6.10	Determination of crude Protein in foods by Kjeldhal methods.	06
6.11	Determination of reducing and total sugar content in foods.	06
6.12	Determination of crude fibre content in foods.	06
6.13	Determination of specific vitamin content of food such as ascorbic acid.	06
6.14	Chromatographic Separation and identification of sugars and amino acids.	06
6.15	Determination of specific mineral contents in foods such as Calcium, Iron, Phosphorus, Chloride etc.	06
6.16	Analysis of foods for pesticides.	06
6.17	Determination of various adulterants in foods.	03
	Total Hours	84

# **TFT-202: FOOD MICROBIOLOGY**

L	Т	Р	С
3	0	6	5

**Course objectives :** The objective of this course is to impart

- Knowledge of the characteristics of important pathogens and spoilage microorganisms in foods and identifying the ways to control them.
- Knowledge about beneficial role of microorganisms in fermented foods and in food processing.
- Knowledge to utilize laboratory techniques to detect, quantify, and identify microorganisms in foods.

#### **Course Outcome**

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

CO1	Understand the relevant genera and species of microorganisms	Understanding
	determining the microbiological quality and safety of food and	
	environmental factors affecting microbiological stability / spoilage	
CO2	Understand the techniques by which the important pathogens and	Understanding
	spoilage microorganisms are commonly inactivated, killed or made	
	harmless in foods.	
CO3	Understand the characteristics of foodborne, waterborne and spoilage	Understanding
	microorganisms, and methods for their isolation, detection and	
	identification	
~ ~ .		
CO4	Understand the microbiology of different types of food commodities	Understanding
CO4 CO5	Understand the microbiology of different types of food commodities Understand the necessity of microbiological quality control programs	Understanding Understanding
CO4 CO5	Understand the microbiology of different types of food commodities Understand the necessity of microbiological quality control programs in food production.	Understanding Understanding
CO4 CO5 CO6	Understand the microbiology of different types of food commodities Understand the necessity of microbiological quality control programs in food production. Understand the effects of fermentation in food production and its	Understanding Understanding Understanding
CO4 CO5 CO6	Understand the microbiology of different types of food commodities Understand the necessity of microbiological quality control programs in food production. Understand the effects of fermentation in food production and its influence on the microbiological quality and status of the food	Understanding Understanding Understanding
CO4 CO5 CO6	Understand the microbiology of different types of food commodities Understand the necessity of microbiological quality control programs in food production. Understand the effects of fermentation in food production and its influence on the microbiological quality and status of the food product.	Understanding Understanding Understanding
CO4 CO5 CO6	Understand the microbiology of different types of food commodities Understand the necessity of microbiological quality control programs in food production. Understand the effects of fermentation in food production and its influence on the microbiological quality and status of the food product. Understand problem solving capabilities in practicals working in	Understanding Understanding Understanding Applying
CO4 CO5 CO6	Understand the microbiology of different types of food commodities Understand the necessity of microbiological quality control programs in food production. Understand the effects of fermentation in food production and its influence on the microbiological quality and status of the food product. Understand problem solving capabilities in practicals working in teams in laboratory-based virtual experiments to gather and evaluate	Understanding Understanding Understanding Applying

COs	POs												PSOs	
COS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	I	-	1	1	-	-	-	I	1	3	3
CO2	3	2	1	1	-	1	1	-	-	-	1	2	2	2
CO3	3	1	1	I	-	2	1	-	-	-	I	2	3	3
CO4	2	1	-	-	-	2	1	-	-	-	-	2	3	3
CO5	3	2	1	1	-	1	1	-	-	-	I	2	3	3
CO6	3	3	2	2	1	1	1	1	3	1	1	2	3	3
Average	3	2	1	2	1	1	1	1	3	1	1	2	3	3
1: Slight (Low)	2: M	oderate (	Medium)	)	3: Sub	stantial ()	High)		If there i	s no corr	elation. 1	out "-"		

#### **Syllabus**

#### Module -I: Microorganisms in Foods & Spoilage

Introduction to Food Microbiology, Incidence of microorganisms in foods, Microorganisms of importance 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.

#### **Module-II: Preservation of Foods**

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 – III: Food Poisoning & Infection

Food poisoning and food-borne infections, Screening, detection and enumeration techniques including rapid detection techniques for Food Micro-organisms including pathogens.

#### **Module-IV: Spoilage and Preservation of Various Food Products**

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, Indicators of Food Safety and Quality, Microbiological Standards of foods.

#### **Module-V: Food Plant Sanitation & HACCP**

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-VI: Laboratory Experiments**

Preservation techniques of cultures in laboratory., Micrometry and determination of size of microorganisms, Simple and differential staining of microorganisms and their examination, Direct total, viable, and non-viable count of microorganisms in milk and other foods, Pure culture isolation techniques, Determination of Standard Plate Count (SPC) in natural and/or processed foods, Microbiological examination of some selected natural and processed foods, Microbiological examination of potable water and milk: Total and coliform count, Enumeration of coliform organism in some selected processed foods, Detection of Salmonella in foods, Determination of Phosphatase test in milk. **Reference Books and Suggested Readings** 

Keierenee Dooks und Suggested Keduings	
Title	Authors
Modern Food Microbiology	James M. J.
Food Microbiology	Frazier W. C. & Westhoff D.C.
Food Microbiology	Adam M. R. & Moss M.O.
Fundamental Food Microbiology	Bibek Ray
Manual of Food Quality Control- Microbiological Analysis Ref	fai M. K.
Food microbiology	Roberts D. & Greenwood M

<b>Course contents</b>	s and	Lecture	schedule
------------------------	-------	---------	----------

Module		No. of
No.		Lectures
1.	Microorganisms in Foods & Spoilage	8
1.1	Introduction to Food Microbiology, Incidence of microorganisms in foods	02
1.2	Microorganisms of importance in foods, Primary sources of contamination in foods	02
1.3	Intrinsic and Extrinsic parameters of foods that affect microbial growth	02
1.4	Food Spoilage, Causes of Food spoilage, Food Preservation.	02
2.	Preservation of Foods	8
2.1	Principles underlying preservation of foods, Methods of food preservation	02
2.2	Fitness of foods	01
2.3	Determination of thermal resistance of bacterial spores	02
2.4	Radiation-resistant bacteria, Mechanism of action of antimicrobial agents.	03
3.	Food Poisoning & Infection	8
3.1	Food poisoning and food-borne infections	02
3.2	Screening, detection and enumeration techniques for Food Micro- organisms including pathogens	03
3.3	Rapid detection techniques for Food Micro-organisms including pathogens	03
4.	Spoilage and Preservation of Various Food Products	8
4.1	Contamination, spoilage and preservation of Fruit and Vegetable products	02
4.2	Milk and Milk products	02
4.3	Cereal products, Sugar products	01
4.4	Meat products, Fish and Sea foods, Egg and Poultry products and other foods	02

4 5	Indicators of Food Safety and Quality and Microbiological Standards of	01
4.5	foods.	01
5.	Food Plant Sanitation & HACCP	6
5.1	Food Plant Sanitation, inspection and control, Personnel Hygiene	01
5.2	HACCP in Food Industry in controlling microbial hazards	02
5.3	Beneficial microorganisms and their utilization in food fermentation	02
5.4	Introduction to abiotic, biotic and probiotics	01
	Total Hours of Theory	38
6.	Laboratory Experiments	
6.1	Microscopy	03
6.2	Micrometry: determination of size of micro-organisms	03
6.3	Simple staining of microorganisms and their examination	03
6.4	Differential staining of microorganisms and their examination	03
6.5	Preparation of Growth media	03
6.6	Direct total, viable, and non-viable count of microorganisms in milk and	03
	other foods	
6.7	Determination of Standard Plate Count (SPC) in natural and/or processed	03
	foods	
6.8	Microbiological examination of some selected natural and processed	03
	foods	
6.9	Microbiological examination of potable water and milk: Total and	03
	coliform count	
6.10	Enumeration of coliform organism in some selected processed foods	03
6.11	Detection of Salmonella in foods	03
6.12	Determination of Phosphatase test in milk.	03
6.13	Determine the D-value of selected microorganism	03
6.14	Draw the growth curve of selected microorganism	03

## **TFT- 301: FOOD BIOCHEMISTRY**

L	Т	Р	С
3	0	0	3

**Course objectives:** The objective of this course is to impart

- 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 (enzymatic) reactions that influence food quality with emphasis on food industry applications.
- Knowledge of animal tissues and biochemical reactions responsible for quality of the food.
- Knowledge of the principles that underlies the biochemical/enzymatic techniques used in food analysis.

#### **Course Outcome**

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

CO1	Understand the chemical, biological and nutritional properties of fruits	Understanding
	and vegetables.	
CO2	Understand the basic post-harvest physiology and consequences during	Understanding
	handling of fresh produce.	
CO3	Understand the facilities and techniques of treatment & storage of fruit	Understanding
	and vegetables.	
<b>CO4</b>	Understand the major biochemical reactions that affects the quality of	Understanding
	meat and meat products	
CO5	Understanding the role of enzymes in food processing and profits in	Understand ing
	the food industry.	
CO6	Understand problem solving capabilities in practicals working in teams	Applying
	in laboratory-based virtual experiments to gather and evaluate data	
	using a range of current food analysis techniques.	

#### **Syllabus**

#### Module-I: Composition of Fruits and Vegetables

Structure and composition of fruit and vegetables: Definition, cellular components, chemical composition and nutritional value.

#### Module-II: Post Harvest physiology of fruits and vegetables

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

#### Module-III: Post harvest Handling and storage of fruits & vegetables

Control atmosphere storages, effect of temperature, water loss and humidity, methods for modifying carbon dioxide and oxygen concentration, physiological disorders: low temperature disorders, mineral deficiency disorders.

#### Module-IV: Biochemistry of muscle and meat

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.

#### Module-V: Enzymes: Functions, importance and role in food industry

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.

#### **Module-VI: Laboratory Experiments**

Application of polymerization techniques to synthesize polymers at lab scale, Determination of molecular weight of polystyrene and K-value of PVC by Ostwald Viscometer.

#### **Reference Books and Suggested Readings:**

Title	Authors
Food Chemistry	Fennema O.R.
Principles of Biochemistry	Lehninger A.L., Nelson D.L. and Cox MM
Post Harvest Biotechnology of Vegetables	Salunkhe D.K. and Desai B. B
Food Preservation by Modified Atmospheres	Calderon M. and Golan R. V.
Enzymes in Food Technology	Whitehurst R. and Law B. A.

#### **TFT-303: FOOD CHEMISTRY**

L	Т	Р	С
3	0	6	5

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 outcomes: 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
CO6	Determination and analysis of food constituents	Analyzing

COs	POs												PSOs	
COS	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	1	-	-	-	1	-	-	-	-	1	1	3	3
CO3	3	1	-	-	-	1	-	-	-	-	1	1	3	3
CO4	3	2	1	1	-	1	1	-	-	-	-	1	3	3
CO5	3	2	1	-	-	1	1	-	-	-	-	1	3	3
CO6	3	2	1	1	1	1	1	1	2	1	1	1	3	3
Average	3	2	1	1	1	1	1	1	2	1	1	1	3	3
1: Slight (Low)	2: Mod	lerate (Me	dium)	3:	Substanti	al (High)		If there	e is no cor	relation, <sub>l</sub>	out "-"			

#### **Course Level Assessment Questions**

# **Course Outcome 1 (CO1)**

- Concept of water in food and water activity
- Concept of sorption isotherm and molecular mobility and food stability
- Classification and function of carbohydrate
- Reactions and properties of carbohydrate and Modified carbohydrates

# **Course Outcome 2 (CO2)**

- Classification and function of lipids
- Effect of oxidation in lipid
- Processing and modification of oil
- Nutritional and safety aspects of fat

# **Course Outcome 3 (CO3)**

- Classification and function of proteins
- Reactions of protein during processing
- Processing and modification of proteins

# **Course Outcome 4 (CO4)**

- Sources, Functions and Deficiency diseases of vitamins and minerals
- Stability of vitamins during processing
- Bioavailability of minerals
- Pigments and flavors in foods and their retention in processed foods

# **Course Outcome 5 (CO5)**

- Definition and source of food additives used in food industry
- Functions and regulatory aspects of food additives

# 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, Auto oxidation, 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 flavor volatiles.

#### **Module-V: Food Additives**

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

#### **Module-VI: 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:**

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
Basic Food Chemistry	Lee
Principles of Biochemistry	Lehnninger
Food Additives	S.N. Mahindru

Hand book of analysis and quality control for fruits and vegetable products

# S. Ranganna

Module	Course contents and Lecture schedule	No. of Lectures
1.	Water and Carbohydrate	8
1.1	Water in Foods: Structure, Properties, Interactions	02
1.2	Water activity and sorption isotherm, molecular mobility and food stability	01
1.3	Carbohydrates: Classification and Functions	01
1.4	Reactions and properties of simple and complex carbohydrate	02
1.5	Selection of Natural or Modified carbohydrates for incorporation into processed food	02
2.	Lipids	8
2.1	Classification, Consistency of commercial fat	02
2.2	Lipolysis, Auto oxidation, Thermal decomposition and effect of ionizing radiation	02
2.3	Refining of oils, Modification of oils and fats, Role of food lipids in flavor	03
2.4	Nutritional and safety aspects of natural and modified fats	01
3.	Proteins	8
3.1	Classification, nutritional and functional properties of food proteins, Nutritive value and its determination	02
3.2	Chemical reactions and interactions of amino acids and proteins	02
3.3	De-naturation and its implications, Functional properties of food proteins	02
3.4	Modification of food proteins in processing and storage and its implications	02
4.	Vitamins, Minerals, Pigments and Flavors	8
4.1	Vitamins, Minerals, Pigments and Flavors: Sources, Functions, Deficiency diseases	01
4.2	Chemistry and stability of water and fat-soluble vitamins during processing	02
4.3	Chemical properties of minerals and their bioavailability, Enrichment and fortification	01
4.4	Natural pigments in foods and their retention in processed foods	02
4.5	Flavoring constituents in foods, Development of process and reaction flavor volatiles	02
5.	Food Additives	6
5.1	Definitions, sources, uses and functions	03
5.2	Regulatory aspects of food additives	03
Total Hou	urs of Theory	38
6	Laboratory Experiments	

6.1	Quality analysis of water	03			
6.2	Determination of moisture content in food by hot air oven method	03			
6.3	Non-enzymatic browning reactions and its determinations	03			
6.4	Determination of rate of hydrolysis of sucrose/starch	03			
6.5	Determination of free fatty acid content and oxidative rancidity in fats and oils	06			
6.6	Determination of heat stability of vitamin C	03			
6.7	Determination of functional properties of proteins	03			
6.8	Determination and identification of additives added to food	06			
6.9	Determination and identification of adulterants in some foods	03			
6.10	Determination of salt content in processed products	03			
Total Hou	irs of Lab	36			
Total Hours					

#### **TFT-302: PRINCIPLES OF FOOD PRESERVATION**

L	Т	Р	С
3	1	0	4

**Course Objectives:** The objective of this course is to impart

- Knowledge of basic principle in food preservation.
- Knowledge in processing methods to control food spoilage and deterioration
- Knowledge of equipment used in food processing to control spoilage.

# **Course Outcomes:**

On the successful completion of the course the student will be able to

C01	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 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

COs						PO	s						PS	Os
	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	3	3
CO3	3	2	-	1	-	1	1	-	-	-	-	1	3	3
CO4	3	2	-	1	-	1	-	-	-	-	-	1	3	3
CO5	3	2	1	-	-	-	-	-	-	-	-	1	3	3
Average	3	2	1	1	NA	1	1	NA	NA	NA	NA	1	3	3
1: Slight (Low)	2: Me	oderate (N	Aedium)		3: Substa	antial (Hi	gh)	If t	here is no	o correlat	ion, put "	- ''		

#### **Course Level Assessment Questions**

## **Course Outcome 1 (CO1)**

- Aims for preservation
- Processing techniques of Indian crops
- Chemistry of food constituents

# **Course Outcome 2 (CO2)**

- Effect of Refrigeration on food spoilage.
- Freezing process and its consequences on food quality.
- Concept of Modified atmospheric storage and Controlled atmospheric storage.

# **Course Outcome 3 (CO3)**

- Calculation of thermal processing time : D, Z, F value
- Canning and retort processing
- Effect of thermal processing, aseptic processing on food quality.

# **Course Outcome 4 (CO4)**

- Principle and Technological aspect of of evaporation
- Principle of drying and dehydration techniques and drying rate calculations.
- Working principle of different types of dryer.

# **Course Outcome 5 (CO5)**

- Principle and working mechanism of irradiation.
- Mechanism of actions preservatives.
- Concept of hurdle technology

#### Syllabus

# Module-I: Introduction and need of 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 other occurrences associated with freezing of foods. Technological aspects of prefreezing, 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

Principles, Technological aspects and application of evaporative concentration process; Freeze concentration and membrane process for food concentrations. Principles, Technological aspects and application of drying and dehydration of foods, 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 preservation of foods. Hurdle technology.

Author

#### **Reference Books and Suggested Readings:** Title

	1 <b>I U UI</b> OI
Food Process Engineering & Technology	Zeki Berk
Food Processing and Preservation	B. Sivasankar
Food Processing Technology : Principles and Practice	P.J Fellows
Food Processing Technology : Principles and Practice	M.Shafeiur Rahman
Fruits and Vegetables processing: Improving quality	Wim Jongen
Introduction of Food processing Engineering	P. G. Smith

Module No.	Course contents and Lecture schedule							
1.	Introduction and need of food preservation							
1.1	Current scenario and scope of food processing	01						
1.2	Perishability of food and aims of preservation	01						
1.2	Causes of quality deterioration and spoilage of perishable foods	02						
1.3	Miscellaneous, wastage of foods	01						
1.4	Concept of water activity and Intermediate moisture content	02						
1.5	Osmosis and diffusion							
2.	Preservation of foods by low temperatures							
2.1	Overview of low temperature processing: refrigeration, chilling and	01						

	freezing. Effect of low temperature (refrigeration) on food spoilage							
2.2	Applications and procedures, Controlled and Modified atmosphere	02						
2.2	storage of foods, Post storage handling of foods	02						
2.2	Freezing curve of water and real solution, colligative properties in	01						
2.3	freezing							
24	Slow and fast freezing of foods and its consequence other	01						
2.4	occurrences associated with freezing of foods.	01						
2.5	Calculation of freezing rate and freezing time.	01						
2.6	Principles of Vapour Compression Refrigeration	01						
2.7	Freezing equipment's and thawing.	02						
3.	Preservation of foods by high temperatures							
3.1	Basic concepts. Lethality requirement and assessing the adequacy	01						
5.1	of a thermal process: D value, Z value, F value etc.	01						
3.2	Calculation of thermal process time and probability of spoilage.	02						
3.3	Commercial sterilization, concept of 12D and 5D	01						
3.4	Consequences of thermal processing on food quality and safety.	01						
3.5	Canning process	01						
3.6	Spoilage in canned food	01						
3.7	Retorting, batch and continuous retorts and aseptic processing	02						
4.	Preservation by water removal							
<u>4</u> 1	Principles & Technological aspects and application of evaporative	01						
4.1	concentration process;	01						
4.2	Principle and Technological aspects of drying and dehydration,	01						
- <b>T</b> , <b>Z</b>	drying curve.	01						
	Drying time calculation – constant rate drying, falling rate drying,							
4.3	Constant rate of drying including conduction and convection both,							
	constant rate of drying including convection only.							
4.3	Sorption Isotherm and Gab model	01						
4.4	Freeze concentration and membrane process for food	01						
	concentrations.							
4.5	Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat,							
_	fluidized-bed and freeze drying of foods.							
5.	Preservation by Non-thermal methods							
5.1	Principles, Technological aspects and application of sugar and salt,	01						
	Natural food preservation system, Fermentation, pickling, curing,	02						
	smoking	02						
5.2	Antimicrobial agents (Nitrates, Benzoates, Propionates, Sorbates	01						
5.2	etc.), Mechanism of actions of different preservatives,	of different preservatives,						
5.3	Nonionizing and ionizing radiations in preservation of foods	02						
5.4	Hurdle technology	02						
Total Hou	1rs	40						

# TFT-304: TECHNOLOGY OF CEREALS, PULSES AND OILSEEDS

L	Т	P	С
3	0	6	5

Course objectives: The objectives of this course are to impart:

- 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 the 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 6	Analysis of physicochemical properties of food grains and production of extruded and bakery products	Analyzing

COs						PO	S						I	<b>PSOs</b>
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	1	-	1	1	-	-	-	-	1	3	3
CO2	3	1	1	1	-	1	1	-	-	-	-	1	3	3
CO3	3	1	1	1	-	1	1	-	-	-	-	1	3	3
CO4	3	1	1	1	-	1	1	-	-	-	-	1	3	3
CO5	3	1	1	1	-	1	1	-	-	-	-	1	3	3
CO6	3	2	1	2	1	1	1	1	3	1	1	2	3	3
Average	3	1	1	1	1	1	1	1	3	1	1	1	3	3
1: Slight (Low)	2: Mo	derate (N	ledium)		3: Substa	ntial (Hig	gh)	If t	here is no	correlat	ion, put "	_ ''		

# **Course Level Assessment Questions**

#### **Course Outcome 1 (CO1)**

- 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 (CO2)**

- Different methods of parboiling and milling of paddy
- Processing of rice
- Different types of processed rice products

#### **Course Outcome 3 (CO3)**

- Grading and quality characteristics of flour and semolina
- Baked products
- Breakfast cereals

#### **Course Outcome 4 (CO4)**

- Milling of corn
- Barley processing
- Processing of legume-pulses

## **Course Outcome 5 (CO5)**

- Processing of oil seeds and oil
- Processing of de-oiled cake
- Different protein and oil based food products.

#### Syllabus

#### **Module-I: Composition and Structure**

Production treads, Composition, structure and processing characteristic of cereal grains, Legumes and oilseeds, Post harvest, Post processing practices for their safe storage.

#### **Module-II: Paddy Processing and Products**

Parboiling and milling of paddy, curing and aging of rice, processed rice products.

#### **Module-III: Wheat Processing and 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, Technology and quality parameters for baked products: Bread, biscuits and cakes; Breakfast cereals, Macaroni products.

#### Module-IV: Processing of Coarse Cereals and Legumes-Pulses

Dry and Wet milling of corn, Starches and its conversion products, Malting of barley, Pearling of millets, Milling of legume-pulses by traditional and improved processes.
#### **Module-V: Processing of Oil seeds**

Processing of oil seeds for direct use and consumption, Oil and protein products, Refining, Hydrogenation and Interestrification of oil, Processing of de-oiled cake into protein concentrates and isolates, Textured protein, Functional protein preparations, Peanut butter, Margarine and Spread.

## **Module-VI: Laboratory Experiments**

- 1. Determination of physical properties of grains
- 2. Determination of physical properties of pulses
- 3. Evaluation of quality of rice and wheat flours
- 4. Estimation of Gluten content of flour
- 5. Determination of average size of pulses flour by sieve analysis
- 6. Determination of cleaning efficiency of a grading screen
- 7. Preparation of bread
- 8. Preparation of biscuit
- 9. Preparation of cake
- 10. Preparation of macaroni products and other breakfast cereal products
- 11. Preparation of Soy Milk and Tofu (Soy Paneer)

## **Reference Books and Suggested Readings:**

Title	Author
Mysore Manuals on Rice and its Processing	C.F.T.R.I.
Food Science	N.N. Potter
Cereal Technology	S.A. Matz
Bakery Technology	S.A. Matz
Cereals and Cereal Processing: Chemistry and Technology	DAV Dendy and B.J. Dobrazczyk
Cereal Technology	Kent

Practical manual on Processing of Pulses and Oilseeds, Practical manual on Processing of Cereals and Value Addition, published by Indian Institute of Food Processing Technology (http://www.iifpt.edu.in/uploads/1-to-2-week-modules.pdf)

Module	Course contents and Lecture schedule	No. of
<u>No.</u>	Composition and Structure	Lectures
<b>I.</b>	Composition and Structure	<b>5</b>
1.1	Production treads	01
1.2	grains, Legumes and oilseeds	02
1.3	Post harvest, Post processing practices for their safe storage	02
2.	Paddy Processing and Products	7
2.1	Parboiling and milling of paddy	03
2.2	Curing and aging of rice	01
2.3	Processed rice products	03
3.	Wheat Processing and Products	8
3.1	Wheat and its quality characteristics for milling into flour and semolina	01
3.2	Flour milling, Turbo grinding and air classification	01
3.3	Flour grades and their suitability for baking purposes, Assessment of flour quality and characteristics	01
3.4	Milling of Durum wheat	01
3.5	Ingredients, Technology and quality parameters for baked products: Bread, biscuits and cakes; Breakfast cereals & Macaroni products.	04
4.	Processing of Coarse Cereals and Legumes-Pulses	7
4.1	Dry and Wet milling of corn	01
4.2	Starches and its conversion products, malting of barley, Pearling of millets	03
4.3	Milling of legume-pulses by traditional and improved processes	03
5.	Processing of Oilseeds	8
5.1	Processing of oil seeds for direct use and consumption	02
5.2	Oil and protein products, refining, hydrogenation and interestrification of oil	02
5.3	Processing of de-oiled cake into protein concentrates and isolates, textured protein	02
5.4	Functional protein preparations, peanut butter, margarine and spread	02
Total Hou	irs of Theory	35
6.	Laboratory Experiments	
6.1	Determination of physical properties of grains	03
6.2	Determination of physical properties of pulses	03
6.3	Evaluation of quality of rice and wheat flours	06
6.4	Estimation of gluten content of flour	03
6.5	Determination of average size of pulses flour by sieve analysis	03
6.6	Determination of cleaning efficiency of a grading screen	03
6.7	Preparation of bread	03

6.8	Preparation of biscuit	03				
6.9	Preparation of cake	03				
6.10	Preparation of macaroni products and other breakfast cereal products	06				
6.11	Preparation of soy milk and Tofu (Soy paneer)	06				
Total Hours of Lab						
Total Hours						

# **TFT-306: FRUITS, VEGETABLES AND PLANTATION PRODUCTS**

L	Т	Р	С
3	0	6	5

Course objectives: The objective of this course is to impart

- Skill and knowledge required to apply the principles and concepts behind fruit, vegetable, spices and plantation products processing.
- Knowledge on post-harvest handling, specific processing technologies, preparing, quality analysis and stabilizing shelf life of fruit, vegetable, spices and plantation based products

## **Course Outcomes:**

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

CO1	Discuss the factors affecting the shelf life of fruits and vegetables	Analyzing
CO2	Understand the physiological changes in fruits after harvesting	Understanding
CO3	Understand the role and importance of preservation techniques to improve the shelf life of seasonal fruits	Understanding
CO4	Understand the processing of fruits, vegetables, spices and plantation products	Understanding
CO5	Understand the technology behind canning of fruits and vegetable products	Understanding
CO6	Manufacture and preserve different processed products of fruits, vegetables, spices and plantation products	Applying

COs	POs								PS	PSOs				
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	2	-	2	1	-	-	-	-	1	3	3
CO2	3	1	-	1	-	1	1	-	-	-	-	1	3	3
CO3	3	1	1	1	-	2	2	-	-	-	-	1	3	3
CO4	3	1	1	1	-	1	1	-	-	-	-	1	3	3
CO5	3	1	1	1	-	1	1	-	-	-	-	1	3	3
CO6	3	2	2	1	1	1	1	1	3	1	1	2	3	3
Average	3	1	1	1	1	1	1	1	3	1	1	1	3	3
1: Slight (Lo	w) 2: M	oderate (M	edium)		3: Substar	ntial (High	n)	If the	ere is no o	correlatio	n, put "- '	,	•	•

#### **Course Outcome 1 (CO1)**

- Review on status of production and processing of fruits and vegetables
- Factors affecting the shelf
- Chemical composition of fruits and vegetables
- Physicochemical treatments to improve shelf life of fruits and vegetables

## **Course Outcome 2 (CO2)**

- Physiological changes after harvesting
- Maturity indices
- Flavour synthesis during ripening

## **Course Outcome 3 (CO3)**

- Chilling and freezing of fruits and vegetables
- Drying and dehydration of fruits and vegetables

## **Course Outcome 4 (CO4)**

- Processing of fruits and vegetables
- Processing of major and minor spices
- Processing of Plantation products
- Processing of Cocoa and Cocoa products

## **Course Outcome 5 (CO5)**

- Canning of fruits and vegetables
- Factors affecting canning of fruits and vegetables

## **Courses Outcome 6 (CO6)**

- 1. Manufacturing of Jam, jelly, preserve, marmalade, candied fruit etc.
- 2. Manufacturing of RTS, squash, cordial, Nectar, syrup etc.
- 3. Manufacturing of chutneys, pickles
- 4. Extraction of phenolic compounds from tea
- 5. Processing of Tomato
- 6. Canning of peas
- 7. Drying of vegetables

#### **Syllabus**

#### Module - I: Post Harvest Handling of Fruits & Vegetables

Current status of production and processing of fruits and vegetables, Chemical composition, preand post-harvest changes, harvesting and maturity standards for storage and desirable, characteristics of fruits and vegetable for processing. Role of plants growth regulators in relation to storage, Physical and chemical treatment to increase the shelf-life, Conditions for transportation and storage, Disease and injuries during marketing, Biosynthesis of flavours, Flavour characteristics.

#### Module - II: Preservation of Fruits & Vegetables

Low temperature preservation, Types of cold preservation, freezers and freeze concentrates, Thermal processing: Canning and bottling, spoilage of canned foods, detection and control, Drying and dehydration of fruits and vegetables.

#### Module - III: Processing Technology of Fruit & vegetable based Products

Juices, pulps, Concentrates, powders, Squashes, cordials and other beverages. Jams, Jellies, Marmalades, Preserves, candies and crystallized fruits. Tomato processing: Puree, Paste, Ketchup, Sauce and soup. Chutneys, pickles and other products.

#### 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. Composition, Production and processing of Tea leaves: Black tea, Green tea and Oolong tea, Instant tea. 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. Composition, structure and characteristics of Cashew-nut and other dry fruits.

#### Module – V: Processing of Cocoa & Cocoa Products

Production, processing and chemical composition of cocoa beans: Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter and cocoa powder. Manufacturing process for chocolate: Ingredients, Mixing, Refining, Conching, Tempering, Moulding etc. to obtain chocolate slabs, chocolate bars. Enrobed and other confectionary products.

## Module - VI: Laboratory Experiments

Processing and preservation of fruit juice, RTS, Cordial, Nectar, Squash and other beverages, processing and preservation of jam, jelly, marmalade, preserve, crystalized fruit, processing and preservation of chutney, pickle. Processing and preservation of tomato ketchup puree. Canning of peas, drying of vegetables, extraction of volatile oil from spices, total phenolic content of tea.

# **Reference Books and Suggested Readings**

Title	Author
Advances in Fruit Processing Technologies	Jongen
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. & Shadaksharaswami
Introduction to spices, plantation crops, Medicinal and aromatic plants	Kumar N.

Module No.	Course contents and Lecture schedule	No. of Lectures
1.	Post-Harvest Handling of Fruits & Vegetables	06
1.1	Current trends in fruits and vegetable production	01
1.2	Chemical composition of fruits & vegetables	01
1.3	Postharvest Physiology and Biochemistry of Fruits and Vegetables	01
1.4	Biosynthesis of flavor and flavor characteristics	01
1.5	Post-harvest handling of fruits & vegetables	02
2.	Preservation of Fruits & Vegetable	06
2.1	Low temperature preservation	01
2.2	High temperature preservation of fruits & vegetables	01
2.3	Canning of fruits and vegetables	01
2.4	Drying and dehydration of fruits & vegetables	01
2.5	Controlled atmospheric storage of fruits and vegetables	01
2.6	Other preservation techniques for fruits and vegetables	01
3.	Processing Technology of Fruit & vegetable based Products	08
3.1	Processing Technology of fruit beverage, unit operations,	01
	equipment	
3.2	Types of Beverages-Processing technology of RTS, Squash,	02

	Cordial, Nectar						
3.3	Processing Technology of Jam. Jelly and Marmalades	02					
3.4	Processing Technology of, Preserves, candies and crystallized fruits	01					
3.5	Processing Technology of Tomato products	01					
3.5	Processing Technology of Chutneys, pickles and other products	01					
4.	Processing Technology of Spices & Plantation products	09					
4.1	Processing Technology of Major spices	04					
4.2	Processing Technology of Minor spices	02					
4.3	Processing Technology of Plantation products	03					
5.	Processing of Cocoa & Cocoa Products	05					
5.1	Production and chemical composition of cocoa beans	01					
5.2	Processing of cocoa beans: Cleaning, roasting, alkalization, cracking and fanning, Nib grinding for cocoa liquor, cocoa butter and cocoa powder	01					
5.3	Manufacturing process for chocolate: Ingredients, Mixing, Refining, Conching, Tempering, Moulding etc. to obtain chocolate slabs, chocolate bars	02					
5.4	Enrobed and other confectionary products.	01					
Total Hours							
6	Laboratory Experiments						
6.1	Processing and preservation of Non-alcoholic fruit beverages: RTS, Juices, Cordial, Nectar and Squash	06					
6.2	Processing and preservation of Jam	06					
6.3	Processing and preservation of Jelly	06					
6.4	Processing and preservation of marmalade, preserve and crystalized fruit	06					
6.5	Processing and preservation of pickles and chutneys.	06					
6.6	Processing and preservation of Tomato based products: Sauce, Puree.	06					
6.7	Processing and preservation of Tomato based products: Ketchup and Juice	06					
6.8	Canning of Peas.	06					
6.9	Low temperature preservation of fruits & vagatables	06					
6.10	Low temperature preservation of funts & vegetables	06					
6.10	Processing of dehydrated Onion Powder.	06					
6.10 6.11	Processing of dehydrated Onion Powder. Processing of Milk Chocolate.	06 06 06					
6.10 6.11 6.12	Processing of dehydrated Onion Powder.     Processing of Milk Chocolate.     Dehydration of vegetables	06 06 06 06					
6.10   6.11   6.12   6.13	Processing of dehydrated Onion Powder.     Processing of Milk Chocolate.     Dehydration of vegetables     Extraction of volatile oils from spices by steam distillation	06 06 06 06 06					
6.10   6.11   6.12   6.13   6.14	Processing of dehydrated Onion Powder.     Processing of Milk Chocolate.     Dehydration of vegetables     Extraction of volatile oils from spices by steam distillation     Estimation of Total phenolic content in Tea.	06 06 06 06 06 06					

# TFT-401: FOOD SAFETY AND QUALITY CONTROL

L	Т	P	С
3	0	6	5

**OBJECTIVE:** The objectives of this course is to enable the students

- fundamental knowledge of quality control and total quality management system in food industry.
- Knowledge about food hygiene and importance of safe food
- Knowledge about various national and international food standards and regulatory bodies
- Knowledge of Food safety management system

#### **Course Outcome**

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

CO1	Understand concepts of Food quality and role of total quality management system in food industry	Understanding
CO2	Assessments of quality of food products using various techniques	Applying
CO3	Understand the safety aspects of various foods	Understanding
CO4	Understand the national & international food laws and regulations for quality of foods	Analyzing
CO5	Understand the standards of international regulatory bodies	Applying
CO6	Understand the concept and application of knowledge about food safety management system in food industry	Applying

CO	POs										PSOs			
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	-	-	-	-	1	-	-	-	-	1	2	2
CO2	3	2	1	1	-	-	1	-	-	-	-	1	3	3
CO3	3	-	-	-	-	2	2	-	-	-	-	1	2	2
CO4	3	1	-	-	-	1	2	-	-	-	-	1	3	2
CO5	3	1	1	-	-		-	-	-	-	-	1	2	2
CO6	3	2	2	1	2	-	-	1	2	-	-	2	3	3
Average	3	1	1	1	2	2	2	1	2	NA	NA	1	3	2
1: Slight (L	.ow) 2: N	Ioderate (N	ledium)	3: \$	Substantia	ıl (High)		If there	is no cor	relation, p	out ''-"			

## **Course Outcome 1 (CO1)**

- Aspects of Food Quality control and Quality Assurance
- Sensory evaluation of foods & textural characteristics
- Engineering properties of foods and their measurements

## **Course Outcome 2 (CO2)**

- Significance of food safety
- Potential hazards and contaminations in food industry
- Food additives and their functions

## **Course Outcome 3 (CO3)**

- Food standards and Specifications
- National and International food regulations
- Food Safety and Standards Act (2006)

## **Course Outcome 4 (CO4)**

- Global standards for contaminants and toxins in foods
- Codex Alimentarius and different food safety practices

## **Course Outcome 5 (CO5)**

- Food Safety Management System and its significance
- Implementation of food safety management system in food industries
- ISO 22000 role and implementation

## **Course Outcome 6 (CO6)**

- Testing and evaluation of various parameters of food quality
- Assessment of quality of foods from different food category
- Different techniques to perform sensory evaluation study of foods

## Syllabus:

# Module-I: Food Quality and Quality Evaluation

Ways of describing of Food Quality, Quality control and Quality Assurance functions, Total Quality Control (TQC) and the role of management/TQM, Statistical quality control, Quality costs. Sensory evaluation of foods, Instrumental measurements of sensory attribute of foods: Engineering properties. Textural characteristics, Texture profile analysis, Correlation between instrumental and Sensory analysis of food quality attributes

#### **Module-II: Food Safety**

Operational sense of food safety, Potential Food derived health hazard- Microbial contamination, Nutritional Imbalance, Pesticide residues, Environmental Contamination, Naturally occurring compounds and permitted food additives, Consumer awareness about food safety, safety of various food categories: Fruits and vegetables, milk and milk products, meat Fish, Sea foods, Egg and poultry products.

#### **Module-III: Food Standards and Regulations**

Food standards and Specifications: Compulsory and voluntary trade and Company standards. Consumer, company, In-process and finished product specifications, AgMark, and BIS Standards, Food regulations: Food Safety and Standards Act (2006) and subsequent regulation 2012 onwards

#### **Module-IV: Global Scenario of Food Safety Management**

Introduction to Codex Alimentarius and FSIS, Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practices (GAP), ISO series, HACCP systems: Global standards for contaminants and toxins in foods.

#### Module-V: Food Safety Management System

Introduction, prerequisite program of food safety management system, understanding and implementation of food safety management system in food industries, understanding and implementation of ISO 22000.

## **Module-VI: Laboratory Experiments**

Sensitivity tests (Threshold/Dilution) to measure individual ability for sensory analysis, Difference tests to evaluate qualitative and quantitative differences and/or preference between test products, Assessment of quality of wheat flour (Water Absorption Power, Gluten Content, Sedimentation Value etc.), Evaluation of quality of Bakery Products: Bread, Biscuits, Cakes etc. Quality evaluation of Dairy Products (Over run, fat content, Specific gravity), Quality assessment of Jam, Jelly, Marmalades, Squashes& Cordials and Food beverages.

#### **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

Module No.	<b>Topic of Content</b>	
1.	Food Quality and Quality Evaluation	10
1.1	Ways of describing of Food Quality	01
1.2	Quality control and Quality Assurance functions	01
1.3	Total Quality Control (TQC) and the role of management/TQM, Statistical quality control, Quality costs	02
1.4	Sensory evaluation of foods, Instrumental measurements of sensory attribute of foods	02
1.5	Engineering properties of Foods	01
1.6	Textural characteristics and Texture profile analysis	01
1.7	Correlation between instrumental and Sensory analysis of food quality attributes	02
2.	Food Safety	08
2.1	Operational sense of food safety	01
2.2	Potential Food derived health hazard- Microbial contamination	01
2.3	Nutritional Imbalance, Pesticide residues, Environmental Contamination	02
2.4	Naturally occurring compounds and permitted food additives	01
2.5	Consumer awareness about food safety	01
2.6	Safety of various food categories: Fruits and vegetables, milk and milk products, meat Fish, Sea foods, Egg and poultry products	02
3.	Food Standards and Regulations	06
3.1	Food standards and Specifications	01
3.2	Compulsory and voluntary trade and Company standards	01
3.3	Consumer, company, In-process and finished product specifications	01
3.4	AgMark, and BIS Standards	01
3.5	Food regulations: Food Safety and Standards Act (2006) and subsequent regulation 2012 onwards	02
4.	Global Scenario of Food Safety Management	06
4.1	Introduction to Codex Alimentarius and FSIS,	01
4.2	Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practices (GAP),	02
4.3	ISO series, HACCP systems	01
4.4	Global standards for contaminants and toxins in foods	02
5.	Food Safety Management System	06
5.1	Introduction to food safety management system	01

# **Course contents and Lecture schedule**

5.2	Prerequisite program of food safety management system	01			
5.3	Understanding and implementation of food safety management system in food industries	02			
5.4	Understanding and implementation of ISO 22000	02			
Total Hours					
6	Laboratory Experiments				
6.1	Sensitivity tests (Threshold/Dilution) to measure individual ability for sensory analysis	06			
6.2	Difference tests to evaluate qualitative and quantitative differences and/or preference between test products	06			
6.3	Assessment of quality of wheat flour (Water Absorption Power, Gluten Content, Sedimentation Value etc.)	06			
6.4	Assessment of quality of vegetable oils	06			
6.5	Evaluation of quality of Bread	06			
6.6	Evaluation of quality of Biscuits	06			
6.7	Evaluation of quality of Cakes	06			
6.8	Quality evaluation of Milk (fat content, Specific gravity, pH, acidity etc.)	06			
6.9	Quality evaluation of Cheese (fat content, Specific gravity, pH, acidity etc.)	06			
6.10	Quality evaluation of Ice cream (Overrun, fat content, Specific gravity etc.)	06			
6.11	Quality assessment of Jam, Jelly, Marmalades, Squashes & Cordials etc.	06			
6.12	Quality assessment of different food beverages	06			
	Total Hours	72			

## **TFT-403: TRADITIONAL AND FERMENTED FOODS**

L	Т	Р	С
3	0	0	3

**Course objectives:** The objectives of this course are to impart:

- Knowledge about existing Indian traditional foods
- Knowledge on principles and procedures involved in the fermented food production
- Knowledge on Industrial microbial products

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

CO1	Understand the importance and production of common Indian traditional foods	Understanding
CO2	Understand the concept of microbial culture selection for particular fermented product	Understanding
CO3	Understand the processing of fermented milk, meat and fish products and analyze their qualities	Analyzing
CO4	Understand the processing of alcoholic beverages and fermented fruit & vegetables products	Understanding
CO5	Apply the knowledge of fermentation in production of industrial microbial products	Applying

COa						PO	S						I	<b>PSOs</b>
COS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	-	I	-	1	1	-	-	-	-	1	2	2
CO2	3	1	-	I	-	-	1	-	-	-	-	1	2	2
CO3	3	1	1	1	-	-	1	-	-	-	-	1	3	3
CO4	3	1	-	-	-	1	1	-	-	-	-	1	2	2
CO5	3	1	1	1	-	1	1	-	-	-	-	1	3	3
Average	3	1	1	1	NA	1	1	NA	NA	NA	NA	1	2	2
1: Slight (Low)	2: Mo	derate (M	ledium)		3: Substa	ntial (Hig	gh)	If t	here is no	correlat	ion, put "	- "		

#### **Course Outcome 1 (CO1)**

- 1. Knowledge of Indian traditional foods and their basic chemistry
- 2. Preparation methods and health benefits of papads, idli, dosa and dhokla

## **Course Outcome 2 (CO2)**

- 1. Basic concept of preparation and maintenance of microbial culture for fermentation
- 2. Concept of Lactic acid bacteria and their health-promoting effects
- 3. Mushrooms Processing

## Course Outcome 3 (CO3)

- Basic idea of fermentation and different types of microorganisms involved in food fermentations
- Preparation, spoilages, defects and their control of dairy products
- Processing of fermented meat and fish products

## **Course Outcome 4 (CO4)**

- 1. Technological concept of beer and wine production
- 2. Technological concept of cider and vinegar production
- 3. Fermented vegetables

## **Course Outcome 5 (CO5)**

- 1. Technological concept of baker's yeast, microbial proteins, fats and enzymes production
- 2. Concept of oriental fermented foods

## Syllabus

## **Module-I: Indian Traditional Foods**

Indian traditional sweet, savory and snack food products: Sweetmeats, namkins, potato products, papads, idli, dosa and dhokla.

# Module-II: Preparation and Maintenance of Microbial Culture

Preparation and Maintenance of bacterial, yeast and mold cultures for food fermentations, Lactic acid bacteria-activities and health-promoting effects, Mushrooms: Cultivation and preservation.

## Module-III: Fermented Dairy, Meat and Fish Products

Fermentation-Definition and types, Microorganisms used in food fermentations, Dairy Products: Cheeses, curd & yoghurt, Butter milk and the fermented milks, Fermented meat and fish products, Spoilages, defects and their control.

## **Module-IV: Fermented Cereals, Fruits and Vegetables Products**

Production of beer, wines, cider and vinegar, Fermented vegetables.

#### **Module-V: Industrial microbial products**

Production of Baker's yeast, Microbial proteins, fats and enzymes, Oriental fermented foods.

# **Reference Books and Suggested Readings:** Title

Handbook of Indigenous Fermented Foods Outlines of Dairy Technology Industrial Microbiology Industrial Microbiology Food Microbiology Author K.H. Steinkrus De Sukumar Prescott & Dunn L.E. Casida W.C. Frazier and D.C. Westhoff

## **Course contents and Lecture schedule**

Module No.	Course contents and Lecture schedule	No. of Lectures
1.	Indian Traditional Foods	7
1.1	Indian traditional sweet, savory and snack food products: idli, dosa and dhokla	04
1.2	Sweetmeats, namkins, potato products and papads	03
2.	Preparation and Maintenance of Microbial Culture	8
2.1	Preparation and Maintenance of bacterial, yeast and mold cultures for food fermentations	04
2.2	Lactic acid bacteria-activities and health-promoting effects	02
2.3	Mushrooms: Cultivation and preservation	02
3.	Fermented Dairy, Meat and Fish Products	8
3.1	Fermentation-Definition and types, Microorganisms used in food fermentations	01
3.2	Dairy Products: Cheeses, curd & yoghurt, Butter milk and the fermented milks, Spoilages, defects and their control	03
3.3	Fermented meat	02
3.4	Fermented fish products	02
4.	Fermented Cereals, Fruits and Vegetables Products	8
4.1	Production of beer and wines	04
4.2	Production of cider and vinegar	01
4.3	Fermented vegetables	03
5.	Industrial microbial products	7
5.1	Production of Baker's yeast, Microbial proteins, fats and enzymes	04
5.2	Oriental fermented foods	03
Total Hou	irs	38

L	Т	Ρ	С
3	0	0	3

# **Course objectives**: The objective of this course is to impart

- Knowledge about product implementation stage of food product development
- Knowledge for the workforce challenges of creating innovative food products to meet market demand.
- Knowledge to work in teams with cooperating entrepreneurs and companies to develop products of interest.

#### **Course Outcome:**

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

CO1	Understand the basics of innovation in food industry and apply the	Understanding
	stage-gate process to product development.	
CO2	Interpret a brief specifying the requirements for a product	Understanding
CO3	Understand factors that affect viability and potential of new food products. Patent literature, competition, costs.	Understanding
CO4	Understand new products from consumer viewpoint.	Understanding
CO5	Understand critically assessing of the development cycle of a food product and review relevant principles of marketing theory.	Understanding
CO6	Understand the design and execute product development trials to efficiently optimise the product formulation and process	Understanding

## **Syllabus**

#### Module I Concept of product development

Innovation and product development concept. Generation of ideas. Desk Research. Screening/appraisal of initial ideas.

#### **Module II Analysis of market**

Detailed study of product and market, Planning and development activities and evaluating them.

#### Module III Development of product

Development of prototype product and its testing for acceptance.

#### **Module IV Development of process**

Development of process and planning for production trials. Planning the test market. Actual production trials and test marketing. Evaluation of test results.

#### **Module V Launching**

Launching of the product. Advertising and marketing plans. Suggestions for improving success.

#### Suggested References & Books:

Title	Author(s)
Food product development	Earle, M., Earle, R., & Anderson,
	А.
Hydrocolloids: Practical Guides for the Food Industry	Hoefler, A.C.
Food Processing Technology	P.J Fellows
Food Product Development: Based on Experience	Side, C.
New Food Product Development: From	Fuller, G.W.
Concept to Marketplace	

# **TFT-407: FOOD PROCESSING WASTE MANAGEMENT**

L	Τ	P	С
2	0	0	2

**Course objectives:** The objectives of this course are to impart:

- Knowledge of standards and acts for protecting the environment during food processing
- Knowledge of by-products obtained during food processing and their utilization
- To understand the management of wastewater during processing of food

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

CO1	Understand and gain knowledge about food wastage, waste	Understanding
	management and environment (Protection) act standards of food	
	processing wastes	
CO2	Gain knowledge about by-products obtained from different food	Applying
	processing industries and apply the knowledge for their utilization	
CO3	Understand the characteristics of food industry wastes and	Understanding
	involved unit operation in effluent treatment	
CO4	Understand the concept of biological oxidation and aeration	Understanding
	devices systems & their modifications.	
CO5	Understand the advance Technology for waste water treatment	Understanding

COa						PO	S						PSOs	
COS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	-	2	3	-	-	-	-	1	2	2
CO2	3	1	-	-	-	2	3	-	-	-	-	1	2	2
CO3	2	1	-	-	-	1	2	-	-	-	-	1	2	2
CO4	2	1	-	-	-	1	2	-	-	-	-	1	2	2
CO5	3	2	1	1	-	2	3	-	-	-	-	2	3	3
Average	2.4	1.25	1	1	-	1.6	2.6	-	-	-	-	1.2	2.2	2.2
1: Slight (Low)	2: Mo	oderate (M	edium)		3: Substa	ntial (Hig	(h)	If ti	here is no	correlat	ion, put '	-"		

## **Course Outcome 1 (CO1)**

- Introduction of food industry wastes and their treatment
- Concept of ISO 14001 standards and Environment (Protection) Act, 1986
- Management of food processing wastes

# **Course Outcome 2 (CO2)**

- By-products characterization and utilization of cereal, pulses, oilseeds,
- By-products characterization and utilization of milk, fish, meat, egg and poultry processing industries
- By-products characterization and utilization fruits and vegetables.

# **Course Outcome 3 (CO3)**

- Concept of food Industry effluents
- Unit concept of treatment of food industry effluent
- Environmental pollution and their treatment

## **Course Outcome 4 (CO4)**

- Concept of biological oxidation
- Aeration devices systems
- Advanced modifications of aeration devices systems

# **Course Outcome 5 (CO5)**

- Advanced waste water treatment systems
- Membrane technology
- Physico-chemical separations
- Disinfection and handling disposal of sludge

#### **Syllabus**

#### Module-I: Standards and Acts

Food industry wastes, Food waste treatment, ISO 14001 standards, Standards for emission or discharge of environmental pollutants from food processing Industries as per Environment (Protection) Act, 1986, Elements of importance in the efficient management of food processing wastes.

#### Module-II: By products and their utilization

Characterization and utilization of by-products from cereal, pulses, oilseeds, fruits and vegetables, plantation products, fermented foods, milk, fish, meat, egg and poultry processing industries.

#### Module-III: Food Industry Waste and Environmental Pollution

Characterization of food Industry effluents, Physical and chemical parameters, Oxygen demands and their interrelationships, Residues (solids), Fats, Oils and grease, Forms of nitrogen, sulphur and phosphorus, Anions and cations, Surfactants, Color, Odor, Taste, Toxicity, Unit concept of treatment of food industry effluent, Screening, Sedimentation /Floatation as pre and primary reactants.

#### **Module-IV: Biological Oxidation**

Objectives, Organisms, Reactions, Oxygen requirements, Aeration devices Systems: Lagoons, Activated sludge process, Oxidation ditches, Rotating biological contactors and their variations and advanced modifications.

## Module-V: Waste Water Management

Waste water treatment systems, Physical separations, Micro-strainers, Filters, Ultra filtration and reverse osmosis, Physico-chemical separations: activated carbon adsorption, Ion-exchange electro dialysis and magnetic separation, Chemical oxidation and treatment coagulation and flocculation, Disinfection, Handling disposal of sludge.

#### **Reference Books and Suggested Readings:**

Title					Author		
Food	Processing	Waste	Management	Environment	J.H. Green		
(Protee	ction) Act						
Procee	dings of the S	Symposiu	m on By-produ	cts From food	AFST(I) & CFTRI		
Indust	ries: Utilizatio	n and Dis	posal				
Enviro	nmental Prote	ction and	Laws		H. Jadhav & V.M. Bhosale		
Environmental Management K.D Wanger							
Waste	Water treatme	ent			M.N Rao & A.K. Datta		

Module		No. of
No.		Lectures
1.	Standards and Acts	6
1.1	Food industry wastes, Food waste treatment	02
1.2	ISO 14001 standards	02
1.3	Standards for emission or discharge of environmental pollutants from food processing Industries as per Environment (Protection) Act, 1986	01
1.4	Elements of importance in the efficient management of food processing wastes	01
2.	By products and their utilization	7
2.1	Characterization and utilization of by-products from cereal, pulses, oilseeds	02
2.2	Characterization and utilization of by-products from fruits and vegetables, plantation products and fermented foods industries	02
2.3	Characterization and utilization of by-products from milk, fish and meat industries	02
2.4	Characterization and utilization of by-products from egg and poultry processing industries	01
3.	Food Industry Waste and Environmental Pollution	4
3.1	Characterization of food Industry effluents, Physical and chemical parameters, Oxygen demands and their interrelationships	01
3.2	Characterization of surfactants, color, odor, taste and toxicity	01
3.4	Unit concept of treatment of food industry effluent, Screening, Sedimentation /Floatation as pre and primary reactants	02
4.	Biological Oxidation	6
4.1	Secondary treatments: Biological oxidation, aeration, oxidation pond and their designs	02
4.2	Aeration devices Systems: Lagoons, Activated sludge process and Oxidation ditches	02
4.3	Rotating biological contactors and their variations and advanced modifications	02
5.	Waste Water Management	8
5.1	Advanced waste water treatment systems (physical, physicochemical and chemical treatments)	02
5.2	Physical separations, Micro-strainers, Filters, Ultra filtration and reverse osmosis	02
5.3	Physico-chemical separations: activated carbon adsorption, Ion- exchange electro dialysis and magnetic separation	02
5.4	Chemical oxidation and treatment coagulation and flocculation, Disinfection, Handling disposal of sludge	02
Total Hou	Irs	31

# **Course contents and Lecture schedule**

# TFT 409 :-QUALITY MANAGEMENT OF FROZEN FOODS

L	Т	P	C
2	0	0	2

Course objectives: The objective of this course to impart

- The knowledge on quality aspects of frozen foods
- The knowledge on the total quality management of frozen food industry

#### **Course Outcomes:**

On the successful completion of the course the student will be able to

CO1	Understand the concepts of food freezing systems and their aspects	Understand
CO2	Discuss about the quality losses of frozen foods	Analysing
CO3	Apply different techniques to minimize quality losses of frozen foods	Applying
CO4	Identify different tests required for monitoring quality of frozen foods	Remembering
CO5	Identify different strategies to improve frozen food quality in future	Remembering

COs						POs							PS	Os
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	1	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	1	1
CO3	3	1	-	-	-	-	-	-	-	-	-	1	2	2
CO4	3	-	-	-	-	-	-	-	-	-	-	1	2	2
CO5	3	1	2	-	-	1	1	-	3	-	-	2	3	3
Average	3	2	2	-	-	1	1	-	3	-	-	1	2	2
1: Slight	t (Low)	2: Moderate	e (Mediun	n)	3: Sub	stantial (	High)		If there is	no corre	lation, pu	t"-"		

#### **Syllabus**

## Module I: Theoretical and Experimental Aspects of Food Freezing

Introduction, Food freezing systems, overview of physicochemical aspects of Freezing, Future trends in Food freezing Processes Measurement and Interpretation of the Glass Transition in Frozen Food, Modeling of Food Freezing.

#### Module II: Quality Losses associated with Frozen Food

Moisture Migration and Ice Recrystallization in Frozen Foods, Freeze-Cracking, and Quality Deterioration in Frozen Foods Associated with Hydrolytic Enzyme Activities, Protein Denaturation and Functionality Losses, Lipid Oxidation: Flavor and Nutritional Quality Deterioration in Frozen Food, Relationship of Frozen-Food Quality to Microbial Survival.

## Module III: Techniques to Minimize Quality Losses

Cryoprotectants for Improving Frozen-Food Quality, Antioxidants and Their Application to Frozen Food, Edible Coatings and Films Product Composition and the Quality of Frozen Foods, Role of Packaging in Quality Preservation of Frozen Food,

## Module IV: Monitoring of Quality in Frozen Food

Physical and Ultrastructural Measurement, Chemical Measurements of Frozen Foods, Sensory Evaluation Methods to Measure Quality of Frozen Food, Shelf-Life Testing: Procedures and Prediction Methods

#### Module V: Strategies to Ensure Frozen Product Quality Today and Tomorrow

Consumer Acceptance of Frozen Foods: Market Segmentation, Quality in Frozen Foods from the Consumer's Perspective, Consumer Education, Marketing Frozen Foods, Total Quality Management for the Frozen-Food Industry, Quality Enhancement

## **Reference Books and Suggested Readings:**

Title	Author
Quality in Frozen food	Marilin C. Erikson
The Freezing Preservation of Foods	Tressler D.K.& EversC.F
Cold and Chilled Storage Technology	Clive DellinoD.J
Food Processing Technolgy – Principles and applications	Fellows, P.J
Frozen Food Technology	Ed.Mallet C.P

Module		No. of
No.		Lectures
1.	Theoretical and Experimental Aspects of Food Freezing	
1.1	Introduction to food freezing and various methods of food freezing	01
1.2	Physicochemical changes during freezing of foods	02
1.3	Measurement of glass transition temperature	01
1.4	Modeling of food freezing process	02
1.5	Future trends in food freezing	01
2.	Quality Losses associated with Frozen Food	
2.1	Migration of moisture and formation of ice crystals during freezing of foods	01
2.2	Quality losses during freezing of foods, Enzymatic deterioration, protein changes	02
2.3	Flavor and nutritional changes during freezing of foods	01
2.4	Relationship between Quality deterioration & Microbial degradation of frozen foods	01
3.	Techniques to Minimize Quality Losses	
3.1	Application of cryoprotectents for improving quality of frozen foods	01
3.2	Antioxidants used in frozen foods	01
3.3	Edible coatings for frozen foods	01
3.4	Packaging of frozen foods	02
4.	Monitoring of Quality in Frozen Food	
4.1	Physical methods for measuring quality of frozen foods	01
4.2	Instrumental methods used for measuring quality of frozen foods	01
4.3	Sensory methods used for measuring quality of frozen foods	02
4.4	Texture analysis of frozen foods	01
4.5	Time Temperature integrators for monitoring quality of frozen foods	03
5.	Strategies to Ensure Frozen Product Quality Today and Tomorrow	
5.1	Market segmentation of frozen foods	01
5.2	Marketing of frozen foods	02
5.3	TQM of frozen food industry	03
5.4	Consumer perception, education about frozen foods	01
	Total Hours	32

# **Course contents and Lecture schedule**

## **TPL 411-: TECHNOLOGY OF MILK & MILK PRODUCTS**

L	Т		P	С
2	0	0		2

**Course objectives:** The objectives of this course are to impart:

- Knowledge about milk industry evolution & physico-chemical characteristics of milk
- Knowledge of commercial milk processing technology
- Knowledge about the various milk processing equipment
- Knowledge of the production and characteristics of various milk products

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

CO1	Understand scenario of milk industry, compositional variability	Understanding
	of milk and standards of milk & milk products	
CO2	Explain the market milk processing technology & defect in	Applying
	market milk during processing	
CO3	Explain about the various milk processing equipment and	Applying
	adulteration in milk	
CO4	Understand the productions of various milk products	Understanding
CO5	Understand the productions of various dried milk products	Understanding

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

1: Slight (Low)

2: Moderate (Medium) 3:

3: Substantial (High)

If there is no correlation, put "-"

## **Course Outcome 1 (CO1)**

- Concept of physico-chemical characteristics of milk
- History of milk revolution and scenario of milk industry
- Standards of milk and milk products
- Production and collection systems of milk

# **Course Outcome 2 (CO2)**

- Working principles and parts of processing equipment used in dairy industry i.e chiller, clarifier, homogenizer, pasteurizer, sterilizer and UHT Processing
- Defects in market milk processing

# **Course Outcome 3 (CO3)**

- Concept of market milk i.e whole, standardized, toned, double toned and skim milk
- Milk quality and adulteration
- Concept of UHT processed milk, flavoured and sterilized milk
- Cleaning of dairy equipment

# **Course Outcome 4 (CO4)**

• Classification, processing and physico-chemical properties of cream, butter, butter oil and Ice cream

# **Course Outcome 5 (CO5)**

- Concept of manufacturing, packaging and storage of evaporated, condensed, roller and spray dried milk
- Physico-chemical properties of milk powders

#### Syllabus

#### **Module -I: Basic Idea of Milk**

Composition of milk and factors affecting it, Physico-chemical characteristics of milk and milk constituents, production and collection, cooling and transportation of milk, White revolution, Present milk industry scenario and its future, Milk and milk products and its national and international standards.

#### **Module -II: Processing of Market Milk**

Reception, chilling, clarification and storage, Bactofugation: Theory and microbiology, Homogenisation: Definition, pretreatments, theories, synchronization of homogenizer with operation of pasteurizer (HTST), Definition and description of processes: Pasteurization, thermisation, sterilization, UHT Processing, Product control in market milk plant, Defects in market milk processing.

#### Module -III: Packaging, Storage, Distribution and Cleaning

Packaging storage and distribution of pasteurized milk: whole, standardized, toned, double toned and skim milk, Test for milk quality and adulteration, UHT processed milk, flavored, sterilized milk, cleaning and sanitation of dairy equipments.

#### **Module -IV: Milk Products**

Cream: Definition, classification, processing and physico-chemical properties of Cream, Butter, Butter oil and Ice cream.

#### **Module -V: Dried Milk Products**

Evaporated and condensed milk: Method of manufacture, packaging and storage. Roller and spray drying of milk solids, flow ability, reconstituability, dispersability, wet ability, sink ability and appearance of milk powders.

#### **Reference Books and Suggested Readings:**

Title	Author
Food Processing Waste Management Environment (Protection) Act	J.H. Green
Outlines of Dairy Technology. Oxford University Press	De Sukumar
Dairy Processing - Improving Quality; Woodhead Publishing	G. Smit
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
Dairy India Year Book, 2007	R.P Gupta
Milk and Dairy Product Technology; Marcel Dekker Inc.	E. Spreer
Modern Dairy Technology, Vol. I Advances in Milk processing	R.K Robinson

Module		No. of
No.		Lectures
1.	Basic Idea of Milk	8
1.1	Composition of milk and factors affecting it, Physico-chemical characteristics of milk and milk constituents	02
1.2	Production and collection, cooling and transportation of milk, White revolution Present milk industry scenario and its future	02
1.3	Milk and milk products and its national and international standards	04
2.	Processing of Market Milk	8
2.1	Reception, chilling, clarification and storage, Bactofugation: Theory and microbiology	02
2.2	Homogenisation: Definition, pretreatments, theories, synchronization of homogenizer with operation of pasteurizer (HTST)	02
2.3	Definition and description of processes: Pasteurization, thermisation, sterilization and UHT Processing	02
2.4	Product control in market milk plant and Defects in market milk processing	02
3.	Packaging, Storage, Distribution and Cleaning	8
3.1	Packaging storage and distribution of pasteurized milk: whole, standardized, toned, double toned and skim milk	03
3.2	Test for milk quality and adulteration	02
3.3	UHT processed milk, flavored, sterilized milk	01
3.4	Cleaning and sanitation of dairy equipments	02
4.	Milk Products	6
4.1	Cream: Definition, classification, processing and physico-chemical properties of Cream	02
4.2	Butter, Butter oil	02
4.3	Ice cream	02
5.	Dried Milk Products	6
5.1	Evaporated and condensed milk: Method of manufacture, packaging and storage	02
5.2	Roller and spray drying of milk solids	02
5.3	Flow ability, reconstituability, dispersability, wet ability, sink ability and appearance of milk powders	02
Total Hor	Irs	36

# **Course contents and Lecture schedule**

## **TFT-413: NUTRACEUTIAL AND FUNCTIONAL FOODS**

L	Т	Р	С
2	0	0	2

**OBJECTIVE:** The objectives of this course is to enable the students

- fundamental knowledge of nutraceuticals and functional foods
- Knowledge about health promoting effect of nutraceuticals
- Knowledge about various metabolic disorders and their prevention and treatment by nutraceuticals
- Knowledge of processing and storage of functional foods

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

CO1	Understand concepts of nutraceuticals and functional foods and their health benefits	Understanding
CO2	Understand the functional food ingredients of various foods and their mechanism	Understanding
CO3	Understand the national & international food laws and regulations for quality of foods	Analyzing
CO4	Understand the role of functional beverages and herbs and their market aspects	Applying
CO5	Understand the marketing and regulatory issues of nutraceuticals and functional foods	Applying

COa	POs											PSOs		
COS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	-	-	-	-	1	-	-	-	-	1	2	2
CO2	3	2	1	1	-	-	1	-	-	-	-	1	3	3
CO3	3	-	-	-	-	2	2	-	-	-	-	1	2	2
CO4	3	1	-	-	-	1	2	-	-	-	-	1	3	2
CO5	3	1	1	-	-		-	-	-	-	-	1	2	2
Average	3	1	1	1	2	2	2	1	2	NA	NA	1	3	2
CO5 Average	3 3 ow) 2: M	1 1 Ioderate (N	1 1 fedium)	- 1 3: \$	- 2 Substantia	2 l (High)	- 2	- 1 If there	- 2 is no cor	- NA relation, 1	- NA	1 1		2 3

#### **Course Outcome 1 (CO1)**

- Aspects of nutraceuticals and functional foods
- Classifications of nutraceuticals and functional foods
- Biochemical properties and health benefits of nutraceuticals

## **Course Outcome 2 (CO2)**

- Metabolic disorders and disturbances
- Recommended foods in different disorders
- Nutraceutical approach and prevention of metabolic disorders

## **Course Outcome 3 (CO3)**

- Functional role of nutraceuticals
- Dietary fibers and complex carbohydrates as functional food ingredients
- Probiotic foods and their functional role

## **Course Outcome 4 (CO4)**

- Health promoting activity of common herbs
- Functional vegetable products, oil seeds and sea foods
- Functional beverages and health benefits

# **Course Outcome 5 (CO5)**

- Marketing and regulatory issues of Nutraceuticals and functional foods
- Effects of processing and storage of nutraceuticals
- Recent developments and advances in the area of Nutraceuticals and functional foods

## Syllabus:

## Module-I: Technological Aspects of Nutraceuticals and functional Foods

Defining nutraceuticals and functional foods, nature, type and scope. Nutraceuticals and functional foods applications and their health benefits, classification based on chemical and biochemical nature with suitable and relevant descriptions.

## Module-II: Nutraceuticals for Specific Diseases

Food recommended and restricted in metabolic disorders and disturbances, gastrointestinal disorders; fever and infection; liver, gall, bladder and pancreatic disturbances; blood, circulatory and cardiac diseases; urinary and musculoskeletal diseases; allergies.

## Module-III: Functional Role of Food Components

Antioxidants, phytochemicals, isoflavones, lycopene, their role in Nutraceutical and functional foods, dietary fibers and complex carbohydrates as functional food ingredients. Proteins as a functional food ingredient, probiotic foods and their functional role.

#### Module-IV: Role of Specific Food Products as a Functional Food

Herbs as functional foods, health promoting activity of common herbs. Cereal products as functional foods- Oats, Wheat bran, rice bran etc. Functional vegetable products, oil seeds and sea foods. Coffee, tea and other beverages as functional foods/ drinks and their protective effects

#### **Module-V: Legal Aspects of Nutraceuticals**

Effects of processing and storage, interaction of various environmental factors on the potentials of such foods. Marketing and regulatory issues of Nutraceuticals and functional foods and. Recent developments and advances in the area of Nutraceuticals and functional foods.

#### **Reference Books and Suggested Readings**

Title	Author
Handbook of Nutraceutical and Functional Foods	Wildman REC
Anti-angiogenic Functional and Medicinal Foods	Losso JN
Handbook of Nutraceuticals	Pathak YV
Innovations in Healthy and Functional Foods	Ghosh D et al
Nutrition and Dietetics	Joshi SA

#### **Course Contents and Lecture Schedule**

Module No.	Topic of Content						
1.	Technological Aspects of Nutraceuticals and functional Foods	06					
1.1	Defining nutraceuticals and functional foods, nature, type and scope	02					
1.2	Nutraceuticals and functional foods applications and their health benefits	02					
1.3	classification based on chemical and biochemical nature with suitable and relevant descriptions	02					
2.	Nutraceuticals for Specific Diseases	08					
2.1	Food recommended and restricted in metabolic disorders and disturbances	02					
2.2	Gastrointestinal disorders; fever and infection; liver, gall, bladder and pancreatic disturbances	02					
2.3	Blood, circulatory and cardiac diseases	02					
2.4	Urinary and musculoskeletal diseases; allergies	02					
3.	Functional Role of Food Components	06					

2.1	Antioxidants, phytochemicals, isoflavones, lycopene, their role	02								
5.1	in Nutraceutical and functional foods									
2.2	Dietary fibers and complex carbohydrates as functional food									
5.2	ingredients.									
3.3	Proteins as a functional food ingredient									
3.4	Probiotic foods and their functional role	01								
4.	Role of Specific Food Products as a Functional Food	06								
4.1	Herbs as functional foods, health promoting activity of	01								
4.1	common herbs.									
4.2	Cereal products as functional foods- Oats, Wheat bran, rice									
4.2	bran etc.	02								
4.3	Functional vegetable products, oil seeds and sea foods.	01								
4.4	Coffee, tea and other beverages as functional foods/ drinks and their protective offects	02								
5	their protective effects									
5.		04								
5.1	Effects of processing and storage, interaction of various	02								
	Modulating and regulatory issues of Nutraceuticals and									
5.2	functional foods and.	01								
5.2	Recent developments and advances in the area of	01								
5.3	Nutraceuticals and functional foods	01								
	Total Hours	30								

# TFT 415: NUTRITIONAL ASPECTS OF NATURAL AND PROCESSED FOODS

L	Т	Р	С
3	0	3	4

**Course objectives:** The objective of this course is to impart

- Knowledge about the nutritional importance of the different constituents of the foods and their digestion and absorption in human body
- Nutrient's role in controlling the physiological processed foods and development of different diets.
- Balance & therapeutic diet for different individuals and groups and Assessment of calorific value and nutritional quality of natural and processed foods.

## **Course Outcomes**

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

CO1	Understand the basic concepts of food nutrition and RDI	Understanding
CO2	Understand the digestion of nutrients in the human body	Understanding
CO3	Formulate different diets	Applying
CO4	Calculate calorific value of food	Analyzing
CO5	Perform sensory analysis of food	Applying

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

## **Course Outcome 1 (CO1)**

- Knowledge about the function of food and diet
- Nutrients and its role in human diet
- Recommended Dietary Intakes (RDI) and its significance

# **Course Outcome 2 (CO2)**

- Different categories of foods and its sources
- Nutritional changes during processing & storage of foods
- Restoration, Enrichment, Fortification and Supplementation of foods

# **Course Outcome 3 (CO3)**

- Digestion, Absorption and Metabolism of food nutrients
- Protein & lipid digestion in human body

# **Course Outcome 4 (CO4)**

- Balanced diets for different groups
- Therapeutic diets for people in various ailments and disorders
- Functional foods and nutraceuticals

## **Course Outcome 5 (CO5)**

- Assessment of calorific value of foods
- Nutritional quality of natural and processed foods by different means
- Sensory qualities and acceptability of foods

# Syllabus

# Module-I: Basic concept of nutrients of food & RDI

Food and its functions, Role of nutrients, Effects of deficient or excess intake of the individual essential nutrients. Recommended Dietary Intakes (RDI) and its uses. Factors affecting nutritional requirement of an individual.

# **Module-II: Composition of Foods**

General and Specific for different foods of plant and animal origin. General causes of loss of nutrients. Nutritional changes during processing & storage and their implications. Potentially undesirable constituents in foods. Restoration, Enrichment, Fortification and Supplementation of foods.

# Module -III: Fate of Food in human body
Digestion, Absorption and Metabolism of Carbohydrate: Glycolytic pathway, TCA cycle, ETP, PPP. Protein & lipid digestion, absorption and metabolism. Digestion, absorption and metabolism of Vitamins and Minerals.

## Module-IV: Therapeutic diet and its role

Balanced diets for normal individuals, Therapeutic diets for people suffering from various ailments and disorders, Functional foods.

#### Module-V: Nutritional and Sensory qualities of Food

Assessment of calorific value and nutritional quality of natural and processed foods by chemical and biological means. Sensory qualities and acceptability of foods.

#### **Reference Books and Suggested Readings:**

Title	Author
Nutrition and Dietetics	Shubhangini A.Joshi
Nutritive Value of Indian Foods	Gopalan C and others
Food Chemistry'	Fennema O. R
Basic Nutrition in Health & Disease	P.S. Howe & W.B. Saunders
Food and Nutrition	Swaminathan M

#### **Course contents and Lecture schedule**

Module No.	Topic of Content	No. of Lectures
1.	Basic concept of nutrients of food & RDI	06
1.1	Food and its functions, Role of nutrients	01
1.2	Effects of deficient or excess intake of the individual essential nutrients.	01
1.3	Recommended Dietary Intakes (RDI) and its uses	02
1.4	Factors affecting nutritional requirement of an individual	02
2.	Composition of Foods	08
2.1	General and Specific for different foods of plant and animal origin.	02
2.2	General causes of loss of nutrients	01
2.3	Nutritional changes during processing & storage and their implications.	02
2.4	Potentially undesirable constituents in foods.	01
2.5	Restoration, Enrichment, Fortification and Supplementation of foods.	02

3.	Fate of Food in human body	06
3.1	Digestion, Absorption and Metabolism of Carbohydrate	02
3.2	Glycolytic pathway, TCA cycle, ETP, PPP	01
3.3	Protein & lipid digestion, absorption and metabolism.	01
3.4	Digestion, absorption and metabolism of Vitamins and Minerals	02
4.	Therapeutic diet and its role	06
4.1	Balanced diets for normal individuals	02
4.2	Therapeutic diets for people suffering from various ailments and disorders	02
4.3	Functional foods and Nutraceuticals	02
5.	Nutritional and Sensory qualities of Food	06
5.1	Assessment of calorific value	02
5.2	Nutritional quality of natural and processed foods by chemical and biological means	02
5.3	Sensory qualities and acceptability of foods	02
	Total Hours	32

# **TFT-461: Industrial Training Presentation**

L	Т	Р	С
0	0	4	2

The students offer summer internship of 6 to 8 weeks would be giving presentation on the work they performed or learned during training

**OBJECTIVE:** The objectives of this course is to enable the students

- To expose to industrial environment •
- To acquaint with the various machines for the manufacturing of food products •
- For testing of raw materials and finished products •
- Handle the research project •
- To improve professional attitude •

#### **Course Outcome**

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

CO1	Understand the plant layout, work culture and human relationship.	Understand
CO2	Apply the theoretical knowledge in understanding the working of various machines and manufacturing processes	Apply
CO3	Understand the process sequence and optimization of process parameters.	Apply, Analyze
CO4	To get exposure to various conventional and modern tools and equipment for testing of raw materials and finished products	Apply
CO5	To analyze the research problem and devise methodology/ steps to solve it and development of products	Analyze, Create

COs						POs							PSOs	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	3	2	-	-	2	1	3	3	2	3	3	2	2
CO2	3	2	2	1	2	2	-	1	2	-	2	3	2	2
CO3	3	3	3	2	3	2	1	2	2	2	2	3	2	2
CO4	3	3	2	3	3	-	-	-	-	-	1	3	2	2
CO5	3	3	3	3	3	3	2	1	3	2	3	3	2	2
Average	3	3	2	2	3	2	1	2	3	2	2	3	2	2
1: Slight (L	ow) 2: N	Ioderate (N	(Iedium)	3: S	ubstantia	l (High)		If there	is no cor	relation, 1	out "-"			

3: Substantial (High)

If there is no correlation, put "-

# TFT-471: Seminar

L	Т	Р	С
0	0	4	2

**OBJECTIVE:** The objectives of this course is to enable the students

- Study a topic of latest developments/innovative technology on their own and to prepare a dissertation report on this topic.
- Present a lecture on the topic on power point format.
- Improve the communication skill of the students.

## **Course Outcome**

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

CO1	Review, collect and study literature on a topic of interest	Understand
CO2	Apply the knowledge to prepare a report on this topic.	Apply
CO3	Deliver a lecture on the topic on power point format and answer questions from audience, if any	Apply
CO4	While being in the audience listen to the lectures delivered by other participants evaluate the same and comment on the same	Evaluate
CO5	Analyze own shortcomings as well as that of other participants and improve upon the same	Analyze, Evaluate

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

1: Slight (Low)

2: Moderate (Medium) 3: Substantial (High)

If there is no correlation, put "-

# TFT-497: PROJECT 1

L	Τ	Р	С
0	0	8	4

**OBJECTIVE:** The objectives of this course is to enable the students

□ To identify a food product that can be manufactured in India or a research problem and conduct experiment.

- □ To prepare a report for a project based on manufacturing of product/ development of technology
- $\hfill\square$  To present a lecture on the topic on power point format.
- $\hfill\square$  To improve the communication skill of the students.

#### **Course Outcome**

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

CO1	Review, collect and study literature on a topic of interest	Understand
CO2	Apply the knowledge to prepare a report on the same	Apply
CO3	Evaluate the collected literature and formulate a project	Apply, Evaluate
<b>CO4</b>	Define a process/method for completion of the same	Apply
CO5	Analyze sustainability of the technology	Analyze

COa						POs	5						PSOs	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	3	-	2	1	-	1	-	2	3	2	2
CO2	3	2	2	2	1	2	3	-	2	3	3	2	2	2
CO3	3	3	3	2	3	2	2	2	3	3	3	3	2	2
CO4	3	2	2	-	2	1	2	3	3	3	3	3	2	2
CO5	3	3	3	-	1	2	3	3	2	1	2	3	2	2
Average	3	3	3	2	2	2	2	3	2	3	3	2	2	2
1: Slight (L	.ow) 2: N	Ioderate (N	ledium)	3: 5	ubstantia	ıl (High)		If there	is no cor	relation, p	out "-"			

## **TFT-402: INNOVATIVE TECHNIQUES IN FOOD PROCESSING**

L	Т	Р	С
3	0	3	4

**Course Objective:** The objective of the course is to impart

- Knowledge about working principles of various innovative techniques in food processing
- Knowledge about the advantage & disadvantage of innovative techniques to improve quality and yield of production.

## **Course outcomes:**

On the successful completion of the course the student will be able to

CO1	Understand the membrane technology: MF, UF, NF & RO and Super critical fluid extraction process in food industry	Understanding
CO2	Understand the application of microwave and radio frequency wave technology in food processing	Understanding
CO3	Understand the working principle and advantage of High pressure processing in food preservation	Understanding
CO4	Understand the working principle and advantage of Ohmic and Radiation heating process in food processing	Understanding
CO5	Understand the Hurdle Technology and apply it to extend the shelf-life of food products	Applying

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

1: Slight (Low) 2: Moderate (Medium)

3: Substantial (High) If there is no correlation, put "-"

## **Course Level Assessment Questions3**

#### **Course Outcome 1 (CO1)**

- Principle and technology of membrane processing
- Working and application of microfiltration, UF, NF and RO
- Supercritical fluid extraction concept

#### **Course Outcome 2 (CO2)**

- Mechanism of heat generation.
- Working of Microwave and Radio frequency processing
- Application of Microwave and Radio Frequency Processing in sterilization and finish drying.

## **Course Outcome 3 (CO3)**

- Principle and Technological aspect of High pressure processing (HPP).
- Mechanism of Microbial inactivation in food during HPP.
- Principle, Technology and application of ultrasonic processing in food industry.

## **Course Outcome 4 (CO4)**

- Principle, Technology and application of Ohmic heating in food processing and preservation
- Principle and Technology of IR heating, inductive heating and X-rays.
- Application of IR heating, inductive heating and X-rays in food processing and preservation.

## **Course Outcome 5 (CO5)**

- Concept of physical and chemical hurdles.
- Principle and application of Hurdle Technology.
- Design hurdles for a given process.

# Syllabus Module-I: Membrane technology

Introduction to pressure activated membrane processes: microfiltration, UF, NF and RO and their industrial application, Supercritical fluid extraction concept, property of near critical fluids NCF, extraction methods.

## Module-II: Microwave and Radio Frequency Processing

Definition, Advantages, mechanism of heat generation, application in food processing: microwave blanching, sterilization and finish drying.

## Module-III: High Pressure Processing,

Concept, equipments for HPP treatment, mechanism of microbial inactivation and its application in food processing, Ultrasonic processing: Properties of ultrasonic, application of ultrasonic as processing techniques.

## **Module-IV: Ohmic and Radiation heating**

Concept and technology of ohmic heating, IR heating, inductive heating and X-rays in food processing and preservation,

## Module-V: Hurdle technology

Concept of physical and chemical hurdles, Principle of hurdle technology and its application in food preservation, Shelf-stable food products

## **Reference Books and Suggested Readings**

Title	Author					
Emerging Technologies for Food Processing.	Da-Wen Sun					
Novel Food Processing Technologies	M. P. Cano, M. S. Tapia, and G. V.					
Innovation in Food Engineering: New Techniques and Products,	Maria Laura Passos, Claudio P. Ribeiro					
Nonthermal Processing Technologies for Food	Howard Q. Zhang. et al., 2000					
Non-thermal Food Engineering Operations Food Processing Technologies: Impact on Product Attributes	Enrique Ortega-Rivas Amit K. Jaiswal					

Module	Module Course contents and Lecture schedule					
No.		Lectures				
1	Membrane Technology					
1.1	Principle of Membrane processing theory of Microfiltration	01				
1.2	Depth and cross flow filtration, materials and design for membrane	01				
1.3	Performance, membrane fouling, back flushing, Uniform trans	01				
1.4	Theory working and application of Ultra filtration	01				
1.4	Theory, working and application of Nano filtration	01				
1.5	Theory, working and application of Reverse osmosis	01				
1.0	Principle of Supercritical fluid extraction process. Properties of	01				
1.7	super critical fluid and near critical fluid	01				
1.8	Application and working of supercritical fluid extraction process	01				
2.	Microwave and Radio Frequency Processing	01				
2.1	Theory of Microwave processing: Mechanism of Heat generation	01				
2.2	Application of Microwave in food processing and preservation.	01				
2.3	Principle and working of Radio Frequency processing	01				
2.4	Application of Radio Frequency in food processing and	01				
2.4	preservation.	01				
	Advantage and disadvantage of Microwave and Radio frequency					
2.5	Processing in food industry, Highlight on some recent research	01				
	work related to the Microwave and Radio frequency processing.					
3.	High Pressure Processing,					
3.1	Principle and Working of High pressure Processing (HPP).	01				
3.2	Mechanism of microbial inactivation in food processing.	01				
3.3	Advantages, disadvantages and application of HPP in food processing.	01				
3.4	Ultrasonic processing and its properties	01				
3.5	Application of Ultrasonic as processing techniques in food processing	01				
3.6	Working mechanism of ultrasonic processing for various food materials	01				
3.7	Advantages and limitations of ultrasonic processing and its scope	01				
4.	Ohmic and Radiation heating					
4.1	Principle and working of ohmic heating	01				
4.2	Application of ohmic heating in food processing and preservation.	01				
1.0	Principle and technology of IR heating, inductive heating and X-					
4.3	rays in food processing and preservation.	02				
4.4	Application of IR heating, inductive heating and X-rays in food	02				
	Highlight on recent research work on Ohmic heating. IR heating.					
4.5	inductive heating and X-rays in food processing	02				
4.6	Advantages and limitations of ohmic heating, IR heating, inductive heating and X-rays	01				
5.	Hurdle Technology					

5.1	Concept of physical and chemical hurdles.	01
	Principle of hurdle technology	01
5.2	Application of hurdle technology in food preservation.	01
5.3	Design Hurdle for juice manufacturing process.	01
5.4	Design Hurdle for milk processing.	01
Total Hours		

## **TFT-404: COMPUTER APPLICATION IN FOOD PROCESSING**

L	Т	Р	С
3	1	0	4

Course objectives: The objective of the course is to impart the

- Basic knowledge about the different parts of the computers and their functions •
- The knowledge of computer based instrumentation and process control •
- Basic knowledge of modeling and simulation •

#### **Course outcomes**

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

CO1	Understand the basic components of the computer and their functions	Understanding
CO2	Analyze the data using the simple softwares	Analyzing
CO3	Perform the linear regression of a given data	Applying
CO4	Understand the concepts of modeling and simulation	Understanding
CO5	Understand the importance of new techniques in problem solving	Understanding

COs	POs									PS	PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	2	1	1	3	-	-	-	-	-	-	1	3	1
CO3	3	3	1	1	2	-	-	-	-	-	-	1	3	1
CO4	3	1	1	1	1	-	-	-	-	-	-	1	1	1
CO5	3	2	1	1	-	1	-	-	-	-	-	1	1	1
Average	3	2	1	1	2	1	-	-	-	-	-	1	2	1
1: Slight (Lo	w) 2: M	oderate (M	edium)		3: Substar	tial (High	i)	If the	ere is no	correlatio	n, put "-'	,	•	•

1: Slight (Low)

## **Course Level Assessment Questions**

## **Course Outcome 1 (CO1)**

- Different components of a computer
- Functions of CPU
- Different storage devices and their functions
- Different input and output devices
- Features of operating systems

## **Course Outcome 2 (CO2)**

- Importance of data analysis
- Types of data
- Statistical analysis,
- Hypothesis testing, ANOVA

#### **Course Outcome 3 (CO3)**

- Determination of regression coefficients
- Linear regression in EXCEL
- Non-linear regression using MATLAB

#### **Course Outcome 4 (CO4)**

- What is modelling?
- Types of modelling
- Characteristics of different models
- Kinetic modelling

#### **Course Outcome 5 (CO5)**

- Application of RSM in process optimization
- Application of RSM in Product development
- Application of fuzzy logics in sensory analysis
- Application of Numerical methods in food process modelling

#### **Syllabus**

#### Module-I: Basics of Computer software and Hardware

Introduction to computer hardware and operations, CPU, input and output devises, memory, secondary storage, operating system, spreadsheet fundamentals, data base management, graphics application.

#### Module-II: Data analysis

Classical and recently developed statistical procedures, basic principles of statistical inference, Problems of estimation, hypothesis testing, large sample theory, probability, regression-linear and nonlinear.

#### Module-III: Instrumentation and process control

Computer based instrumentation for data acquisition and their control, virtual instruments, reliability and fault finding, concept of process control -first order, second order, and third order processes

#### **Module-IV: Modelling and simulation**

Concept, advantages and limitations of dimensional analysis, Models - Types of models and modelling approaches, features of models, Curve fitting method of least squares, estimation of coefficients of simple determination and simple correlation, properties of least square residuals. Simulation and simulation language.

#### Module-V: New techniques of computation

Response surface methodology, artificial neural network, fuzzy logic, genetic algorithm, finite difference, finite element, computational fluid dynamics: concepts and their application in food processing with examples.

Reference Books and Suggested Readings:	
Title	Author
Elements of Practical Statistics	Kapur, K.
Basic Statistics	Simpson, O.J.
Computer Applications in Food Technology	Paul Singh R
PC based Instrumentation and control	Mike Tooley
Design and analysis of experiments	Douglas C. Montgomery

Module		No. of
No.		Lectures
1.	<b>Basics of Computer software and Hardware</b>	
1.1	Introduction to computer hardware and different parts of a computer	01
1.2	CPU, Input, output and storage devices	01
1.3	Operating systems	01
1.4	Fundamentals of spread sheet and data base management	03
1.5	Graphics	01
2.	Data analysis	
2.1	Introduction to data analysis, types of data and importance of data analysis	01
2.2	Recently developed statistical techniques in data analysis	01

#### **Course contents and Lecture schedule**

	Total Hours	43
5.4	Introduction to Numerical modelling: FDE, FEM, CFD	04
5.3	Introduction to fuzzy logic	03
5.2	Introduction to Response surface methodology	03
5.1	Introduction and importance of computation	01
5.	New techniques of computation	
4.7	Introduction to simulation and simulation language	02
4.6	Properties of least square residuals	01
4.5	Determination of regression coefficients	01
4.4	Curve fitting, Least square method	01
4.3	Types of models: Physical and empirical, their characteristics	02
4.2	Concept of dimensional analysis, advantages and limitations	01
4.1	Introduction to process modeling and simulation	01
4.	Modelling and simulation	
3.6	Process control of second order processes	02
3.5	Process control of second order processes	02
3.4	Introduction to process control, first-order processes	01
3.3	Determination of reliability, fault finding	01
3.2	Virtual instruments, Characteristics of instruments	01
3.1	computer based instrumentation and control	01
5.	Introduction to Instrumentation and process control importance of	
2.0	Instrumentation and process control	02
2.5	Non linear regression	02
2.4	Lincor regression	01
2.5	Turnes of hymothesis and Hymothesis testing	01
23	Basic principles of statistical interference	01

## **TFT-406: FOOD PACKAGING AND STORAGE ENGINEERING**

L	Т	Р	С		
3	1	0	4		

**OBJECTIVE:** The objectives of this course is to enable the students

- Knowledge of packaging, package developments and packaging laws and regulations in food ٠ industries
- Knowledge of different types of packaging materials and their forms used in food packaging ٠
- Knowledge about package performance and various testing of packaging materials •
- Knowledge about storage of food and food products •

## **Course Outcome**

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 and their properties and apply the knowledge in packaging various food commodities	Applying
CO3	Understand the selection of packages for specific food & agricultural commodities and advancement in food packaging	Understanding
CO4	Analyze the performance and quality of packaging materials	Analyzing
CO5	Understand the designing of storage structures for food commodities	Understanding

COa	POs												PSOs	
COS	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	2	-	-	-	-	2	2	2
CO2	3	1	1	-	-	-	1	-	-	-	-	1	2	2
CO3	3	-	-	-	-	-	1	-	-	-	-	1	2	2
CO4	3	2	-	-	-	-	1	-	-	-	-	1	2	2
CO5	3	1	1	-	-	-	1	-	-	-	-	1	2	2
Average	3	1	1	NA	NA	NA	1	NA	NA	NA	NA	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 (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-I: Introduction of Packaging**

Concept of packaging, Important functions of package, Packaging laws and regulations: Printing techniques; Package labeling: functions and regulations; Environmental aspect of food packaging

## **MODULE-II: Packaging Materials and Forms**

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 plastics containers and films and their mechanical sealing and barrier properties.

## **MODULE-III: Advances in Food Packaging**

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 oil

seeds 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: Testing of Packaging Material**

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: Storage of Foods**

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(s)
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

Module No.	Topic of Content	No. of Lectures
1.	Introduction of Packaging	06
1.1	Concept of packaging, Important functions of package	01
1.2	Packaging laws and regulations: Printing techniques	02
1.3	Package labeling functions and regulations	02
1.4	Environmental aspect of food packaging	01
2.	Packaging Materials and Forms	08
2.1	Glass containers and closures	02
2.2	Metal Containers: tin-plate containers, tin free steel containers, aluminum and other metal containers	02

#### **Course contents and Lecture schedule**

2.3	Protective lacquers and coatings for metal containers	01
2.4	Wooden crates, plywood, cellulosic papers, pouches, bags and card board/corrugated paper boxes	01
2.5	Rigid and flexible plastics containers and films and their mechanical sealing and barrier properties	02
3.	Advances in Food Packaging	08
3.1	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 oil seeds products, confectionery etc.	02
3.2	Evaluation of quality, safety and interaction with foods of various types of packaging materials	01
3.3	Gas, vacuum, CAP, MAP and aseptic packaging, Tetra packing	02
3.4	Smart packaging, Intelligent Packaging, Active Packaging and Antimicrobial packaging	02
3.5	Retortable pouches, biodegradable and edibles packaging materials and films	01
4.	Testing of Packaging Material	08
4.1	Destructive & Non-destructive test of rigid, semi rigid and flexible packaging material	01
4.2	Tensile strength, compression, bursting, tear and impact test for packages, integrity testing	02
4.3	Cushioning effect on packaged foods, deterioration of packaged foods	02
4.4	Shelf life study for packaged foods	02
4.5	Corrosion and toxicity of packaging material	01
5.	Storage of Foods	08
5.1	Design parameter for different storage bins for different grains, Milk silo	02
5.2	Design parameter, selection of parameter for designing cold storage for foods different storage	02
5.3	Spoilage of fruits & vegetables during transportation & storage and its prevention	01
5.4	Factors affecting quality of grain during storage	02
5.5	Causes and prevention of spoilage of grain during storage	01
	Total Hours	38

L	Τ	Р	С
3	1	0	4

Course objective: The objective of the course is to impart

- Knowledge to students on principles and techniques of food analysis by using physical, chemical, biological and instrumental methods
- To apply their knowledge and skills acquired to solve real-world problems associated with food analysis.

#### **Course Outcomes:**

On the successful completion of the course the student will be able to

CO1	Understand the regulations and standards of food analysis and concept of sampling	Understanding
CO2	Understand and apply the methods for compositional analysis of food	Applying
CO3	Explain the methods for chemical properties and characterization of food	Understanding
CO4	Understand the working principle of instrument used in food analysis: Spectroscopy and chromatography	Understanding
CO5	Understand color analysis and the rheological methods in food analysis	Understanding
CO6	Selection and apply the appropriate method and instrument to perform particular analysis	Applying

COs	POs											PS	Os	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	1	-	-	-	-	1	1	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1	2	1
CO3	3	2	-	-								1	2	1
CO4	3	2	-	-	-	-	-					1		
CO5	3	2	1	-	-	-	-	-				1	2	2
CO6														
Total														
1: 5	Slight (Low)	2: Mode	rate (Mec	lium)	3: S	ubstantia	l (High)		If there	is no corr	elation, pı	ıt"-"		

#### **Course Level Assessment Questions3**

#### **Course Outcome 1 (CO1)**

- United States Government Regulations and International Standards Related to Food analysis
- Nutritional Labelling
- Sampling methods and sample preparation.

#### **Course Outcome 2 (CO2)**

- Different methods of moisture content, fat content, protein content and ash content in food.
- Analysis of micronutrients.
- Traditional methods for mineral analysis.

#### Course Outcome 3 (CO3)

- Analysis of chemical properties of food.
- Characterization of food.
- Application of enzyme in food analysis.

#### **Course Outcome 4 (CO4)**

- Principle of spectroscopy and its application in food analysis.
- Basic principle of chromatography and its application in food analysis.
- Limitations Basic of spectroscopy and chromatography in food analysis.

#### **Course Outcome 5 (CO5)**

- Rheological principles of food analysis.
- Thermal analysis of food: DSC, TGA, modulated DSS etc.
- Color analysis

#### **Syllabus**

#### **MODULE-I:** General information

Introduction to Food Analysis, United States Government Regulations and International Standards Related to Food Analysis, Nutrition Labeling, Evaluation of Analytical Data, Sampling and Sample Preparation.

#### **MODULE-II: Compositional Analysis of Foods**

Determination of moisture in foods by different methods, ash content of foods, wet, dry ashing, microwave ashing methods, significance of sulphated ash, water soluble ash and acid insoluble ash in food, Determination of total fat in foods by different methods Moisture and Total Solids Analysis, Ash Analysis, Protein Analysis, Carbohydrate Analysis, Vitamin Analysis, Traditional Methods for Mineral Analysis.

#### **MODULE-III: Chemical Properties and Characteristics of Foods**

pH and titrable acidity, fat characterization, protein separation and characterization procedures, application of enzymes in food analysis, immunoassays, analysis of food contaminants, residues and chemical constituents of concern, analysis for extraneous matter, determination of oxygen demand

## **MODULE-IV: Spectroscopy & Chromatography**

Basic principles of spectroscopy, ultraviolet, visible and fluorescence spectroscopy, infrared spectroscopy, atomic absorption and emission spectroscopy, mass spectrometry, nuclear magnetic resonance and electron spin resonance, Basic principles of chromatography, chromatographic techniques: paper, thin-layer and column chromatography. High performance liquid chromatography (HPLC) and gas chromatography (GC).

## **MODULE-V: Physical Properties of Foods**

Rheological principle for food analysis, thermal analysis: Differential Scanning Calorimetry Modulated DSC, color analysis.

#### **References:**

Title	Author
Food Analysis, 3rd Edition	Nielson, S. Suzanne
Food Analysis : Theory and Practice 3rd Edition	Pomeranz, Yeshajahu and Clifton E. Meloan
Chemical Analysis of Food and Food Products	Jacobs, Morris B
Handbook of Food Analysis, 2nd edition	Nollet, Leo M.L.
Food Analysis by HPLC. 2nd Edition Methods of Analysis for Functional Foods and Nutraceuticals	Nollet, Leo M.L Hurst, Jeffrey W

Module							
No.							
1.	General information						
1.1	Introduction to Food Analysis	01					
1.2	United States Government Regulations and International Standards Related to Food Analysis	01					
1.2	Nutrition Labeling	01					
1.3	Sampling and Sample Preparation	01					
2.	Compositional Analysis of Foods						
2.1	Overview of low temperature processing: refrigeration, chilling and freezing. Effect of low temperature (refrigeration) on food spoilage	01					
2.2	Applications and procedures, Controlled and Modified atmosphere storage of foods, Post storage handling of foods	02					
2.3	Freezing curve of water and real solution, colligative properties in freezing	01					
2.4	Slow and fast freezing of foods and its consequence other occurrences associated with freezing of foods.	01					
2.5	Calculation of freezing rate and freezing time.	01					
2.6	Principles of Vapour Compression Refrigeration	01					
2.7	Freezing equipment's and thawing.	02					
3.	Chemical Properties and Characteristics of Foods						
3.1	Basic concepts. Lethality requirement and assessing the adequacy of a thermal process: D value, Z value, F value etc.	01					
3.2	Calculation of thermal process time and probability of spoilage.	02					
3.3	Commercial sterilization, concept of 12D and 5D	01					
3.4	Consequences of thermal processing on food quality and safety.	01					
3.5	Canning process	01					
3.6	Spoilage in canned food	01					
3.7	Retorting, batch and continuous retorts and aseptic processing	02					
4.	Physical Properties of Foods						
4.1	Principles & Technological aspects and application of evaporative concentration process;	01					
4.2	Principle and Technological aspects of drying and dehydration, drying curve.	01					
4.3	Drying time calculation – constant rate drying, falling rate drying, Constant rate of drying including conduction and convection both, constant rate of drying including convection only.	02					
4.4	Sorption Isotherm and Gab model	01					
4.5	Freeze concentration and membrane process for food concentrations.	01					
4.6	Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized-bed and freeze drying of foods.	02					
5.	Preservation by Non-thermal methods						
5.1	Principles, Technological aspects and application of sugar and salt,	01					

	Natural food preservation system, Fermentation, pickling, curing, smoking	02	
5.2	Antimicrobial agents (Nitrates, Benzoates, Propionates, Sorbates etc.), Mechanism of actions of different preservatives,	01	
5.3	Nonionizing and ionizing radiations in preservation of foods	02	
5.4	Hurdle technology	02	
Total Hours			

## **TFT-498: PROJECT**

L	Τ	Р	С
0	0	16	8

**OBJECTIVE:** The objectives of this course is to enable the students

- To articulate a clear research question or problem and formulate a hypothesis
- To identify and practice research ethics and responsible conduct in research
- To communicate confidently and constructively with fellow students and faculty as mentors
- explain their research to others in the field and to broader audiences through research presentation

#### **Course Outcome**

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

CO1	Identify and utilize relevant previous work that supports their research	Understand	
CO2	Identify and apply appropriate methodologies to address the research question or creative objective	Apply	
CO3	Work collaboratively with other members, demonstrating effective communication and problem-solving skills	Apply	
<b>CO4</b>	Present the research work effectively in a conference	Apply	
CO5	Analyze the sustainability of related technology	Analyze	

COs	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	3	-	2	1	-	1	-	2	3	2	2
CO2	3	2	2	2	1	2	3	-	2	3	3	2	2	2
CO3	3	3	3	2	3	2	2	2	3	3	3	3	2	2
CO4	3	2	2	-	2	1	2	3	3	3	3	3	2	2
CO5	3	3	3	I	1	2	3	3	2	1	2	3	2	2
Average	3	3	3	2	2	2	2	3	2	3	3	2	2	2
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) If there is no c					orrelation	ı, put "-"								