M. Tech.

in

Food Engineering & Technology

Department of Food Engineering and Technology
Sant Longowal Institute of Engineering & Technology
(Deemed to be University, Estb. By: Govt. of India)
Longowal-148106 (Punjab)

2018

Semester I

S. No.	Subject Code	Subject Name		L	T	P	Credits
1	1FT01	Engineering Properties of Biomaterials and Applications	Core Course -1	3	0	0	3
2	1FT02	Food Rheology and Microstructure	Core Course - 2	3	0	0	3
3	1FT03A	Flavor Technology	Core Elective -1	3	0	0	3
	1FT03B	Advances in Dairy Engineering and Technology	Core Elective -1				
4	1FT04A	Food Quality and Plant Management	Core Elective - 2	3	0	0	3
	1FT04B	Advances in Fruits and Vegetable Processing Technology	Core Elective - 2				
5	1AXXX		Research Methodology and IPR	2	0	0	2
6	1AXXX		Audit Course -1	2	0	0	S/US
7	1FT05	Lab -1	Core Course Lab	0	0	4	2
8	1FT06	Lab -2	Core Elective Lab	0	0	4	2
							18

Semester II

S. No.	Subject Code	Subject Name		L	T	P	Credits
1	2FT07	Food Process Equipment and Plant Design	Core Course -3	3	1	0	4
2	2FT08	Novel Techniques in Food Packaging	Core Course - 4	3	0	0	3
3	2FT09A	Technology of Frozen Foods	Core Elective -3	3	0	0	3
	2FT09B	Advances in Meat, Fish and Poultry Technology	Core Elective -3				
4	2FT10A	Nutraceuticals and Functional Foods	Core Elective - 4	3	0	0	3
	2FT10B	Advances in Cereal and Pulse Processing Technology	Core Elective - 4				
5	2AXXX		Audit Course - 2	2	0	0	S/US
6	2FT11	Lab - 3	Core Course Lab	0	0	4	2
7	2FT12	Lab - 4	Core Elective Lab	0	0	4	2
8	2FT13		Seminar	0	0	2	1
							18

Students are to be encouraged to go to industrial training / Internship during summer break

Semester III

S. No.	Subject Code	Subject Name		L	T	P	Credits
1	3FT14A	Advanced Food Process Engineering	Core Elective -5	3	0	0	3
	3FT14B	Biotechnological Tools in Food Analysis	Core Elective -5				
2	3XXXX	Open Elective	Open Elective	3	0	0	3
3	3FT16	Dissertation (Part-1)		0	0	20	10
							16

Open Elective
3FT15: Advances in Food Process Technology

Semester IV

S. No.	Subject Code	Subject Name	L	T	P	Credits
1	4FT17	Dissertation (Part-2)	0	0	32	16
						16

- **Audit courses may be selected from AICTE PG model curriculum**

SEMESTER I

Subject Name : Engineering Properties of Biomaterials and Applications
Subject Code : 1FT 01
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To make aware on knowledge related to the various engineering properties of biomaterials.
2. To make aware on knowledge related to the measuring /determination of the various engineering properties of biomaterials.
3. To make aware on the application of engineering properties in designing process equipment.

Course Outcomes:

1. Student will acquire knowledge on various engineering properties of biomaterial/food materials
2. Student will acquire knowledge on techniques of measurement/determination of engineering properties.
3. Student will acquire knowledge on engineering properties of biomaterials and its application in designing of process equipments and storage structures.
4. Student will acquire knowledge on engineering properties of biomaterials and its application in the development of novel food processing techniques.
5. Student will acquire knowledge on engineering properties of biomaterials and its application in the quality control of processed food products.

Unit – I

Introduction

Biomaterials and their properties in relation to processing, their role in the development of new products and processes 04

Physico-Chemical Characteristics

Physico-chemical characteristics: Definition, concept and understanding of shape, sphericity, size, volume, density, porosity, surface area, coefficients of friction, and angle of repose of food materials. Various techniques used in the measurement/determination of engineering properties. Influence of proximate composition/ chemical constituents on physical properties of food materials and its influence in processing and design of process equipments. 08

Mechanical and Rheological Properties

Flow behavior properties of food materials: definition and concept in general and detailed understanding on granular and powdered food materials.

Textural profile analysis and interpretation of data of food products using various types of food texture analyzer and interpretation of data.
Mechanical damage on food its significance in causing biological and chemical reactions. Mechanical damage: detection and interpretation of data. Static and dynamic resistance to mechanical damage: comparison and evaluation. Impact damage: damage under dead load, vibration damage-stress cracking. 06

Aero and hydrodynamic characteristics
Drag coefficients, terminal velocity in agricultural materials: definition, concepts understanding. Determination/measurement of aero and hydrodynamic properties.
Application of aero and hydrodynamic properties: processing, handling of agricultural produce and designing of process equipments. 06

Unit – II
Thermal, Electrical and Optical Properties
Specific heat, thermal conductivity, thermal diffusivity, electrical resistance and conductance, dielectric constant, reflectivity, transmitivity and absorbtivity of incident rays: definition, concepts understanding.
Determination/measurement of thermal, electrical and optical properties of agricultural materials/biomaterials.
Application of thermal, electrical and optical properties: processing, handling of agricultural produce and designing of process equipments. 12

Applications
Application of engineering properties in process development as well as design and operation of equipment and structures associated with handling, processing and storage of raw as well as processed food products and applications in the development of novel processing techniques. 12

Recommended Books

Author	**Title**
M.A. Rao and S.S. H. Rizvi	Engineering Properties of Foods
J. M. Aguilera & D. W. Stanley	Microstructural principles of food processing and Engineering
N. N. Mohsenin	Physical properties of plant and animal materials

References

1. Singhal, OP and Samuel, DVK. Engineering properties of biological materials , Saroj Prakasan, Allahabad, 2003
2. Peleg, M and Bagelay, E.B. Physical properties of foods. AVI publishing Co.,USA, 1983

Mapping of Course Outcome and Program Outcomes

CO/PO Mapping: Engineering Properties of Biomaterials and Applications (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S											
	CO 2	S											
	CO 3	S		M									
	CO 4	S											
	CO 5	S											

Subject Name	**:**	**Engineering Properties of Biomaterials and Applications Lab**
Subject Code	**:**	**1FT 05**
L T P	**:**	**0 0 4**
Credits	**:**	**2**

Course Objectives:

1. To develop the skill in determining various engineering properties of biomaterials.
2. To make student aware on the application of engineering properties in designing process equipment.
3. To make student aware about novel food processing techniques by considering engineering properties of the biomaterials.

Course Outcomes:

1. Student will acquire knowledge in determining various engineering properties of biomaterial/food materials
2. Student will acquire skill on techniques of measurement/determination of engineering properties.
3. Student will acquire knowledge on engineering properties of biomaterials and its application in designing of process equipments and storage structures.
4. Student will acquire knowledge on engineering properties of biomaterials and its application in the development of novel food processing techniques.
5. Student will acquire knowledge on engineering properties of biomaterials and its application in the quality control of processed food products.

List of Practicals:

1. Determination of dimensional and gravimetric characteristics of food.
2. Determination of angle of repose and coefficient of friction of food.
3. Determination of drag coefficients and terminal velocity of food.
4. Determination of thermal conductivity, thermal diffusivity, electrical resistance and conductance of food.
5. Determination of dielectric constant and loss of food.
6. Determination of optical characteristics of food.
7. Calculation of various forces applied by the food material in storage structure.

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Engineering Properties of Biomaterials and Applications Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S											
	CO 2	S											
	CO 3	S		M									
	CO 4	S											
	CO 5	S											

Subject Name : Food Rheology and Microstructure
Subject Code : 1FT 02
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To provide basic understanding of food microstructure.
2. To make student aware on various types of spectroscopy methods.
3. To make student aware on various food structures at macro and molecular level.
4. To make students able to implement their knowledge about detailed rheology of foods.

Course Outcomes:

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

1. Get exposure about texture and rheology of foods.
2. Get insight about the processing effect on food microstructure.
3. Identify suitable equipments/techniques for examining microstructure of foods.
4. Apply the knowledge of various aspects of food processing mechanisms based on microstructure.
5. Correlate the quality and structure of foods.

Unit	Main topics	Detailed contents	Lectures
I	**Examining Food Microstructures**	History of Food Microstructure Studies, Light Microscopy, Transmission Electron Microscopy, Scanning Electron Microscopy	**8**
	Image Analysis	Image Acquisition, Image Processing, Measurement Analysis	**6**
	Fundamentals of Structuring	Food Polymers, Polymer Solutions, Phase Transitions, Mechanical and Rheological Properties, Rheology of Foods, Mechanical Properties of Food Solids, Food Structure in the Mouth and Beyond	**8**
II	**Food Structuring**	Traditional Food Structuring, Extrusion and Spinning, Structuring Fat Products, Structure and Stability, Gels, The Microstructure of Gels	**8**
	Food Microstructure and Quality	Measurement of Texture, Structural Aspects of Food Texture, Quality and Structure	**8**

	Effect of Food Processing on Microstructure	Extraction, Freezing, Dehydration, Drying, Frying	**6**

Books Recommended:

Sl. No.	**Author (s)**	**Title**
1	José Miguel Aguilera	Microstructural Principles of Food Processing Engineering
2	Moskowitz	Food Texture
3	Donald B. Bechtel	New Frontiers in Food Microstructure
4	C. A. Glasbey	Image Analysis for the Biological Sciences
5	H.A. Barnes	An Introduction to Rheology
6	S.D. Holdsworth	Thermal Processing of Packaged Foods
7	D. Leo Pyle	Chemical Engineering for the Food Industry

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Food Rheology and Microstructure (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
		Program Outcome (PO)											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**											
	CO 2			**S**									**S**
	CO 3					**S**							**S**
	CO 4				**S**								**S**
	CO 5				**S**								

Subject Name : Food Rheology and Microstructure Lab
Subject Code : 1FT05
L T P : 0 0 4
Credits : 2

Course Objectives:

1. To familiarize the students with various flow and viscosity measuring devices.
2. To familiarize the students to the applications related to behavior of fluids and rheology with respect to foods.
3. Students will be able to understand the textural characteristics of food materials
4. To familiarize the students with the application of rheology in food processing

Course Outcomes:

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

1. Judge the behavior of food materials using dynamic testing
2. Measure various textural parameters of various foods
3. Handle various viscometers and measure the viscosity of unknown fluids.
4. Understand the foods on the basis of their viscoelastic behaviour.
5. Apply the rheology in the processing of various food materials.

List of Practicals:

1. Determination of viscosity by rotational viscometer
2. Effect of temperature on the viscosity of a fluid food.
3. Textural Profile Analysis of dough with varying water content.
4. To determine stress relaxation of dough
5. To determine creep (retarded deformation) recovery in the bread dough
6. Dynamic (varying stress or strain) testing of viscoelastic food material
7. To determine staleness of bread
8. To determine puncture strength of fruits and vegetables
9. To determine tensile strength of a packaging film
10. To determine stickiness of dough
11. To determine firmness of gel
12. To determine firmness of extruded foods

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Fluid Rheology and Microstructure Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S	M				S			W	W		
	CO 2	M				M				W	W		
	CO 3	M	W					M		W	W		
	CO 4	M	M		W		S			W	W		
	CO 5	M	M			M				W	W		

Subject Name : Flavour technology
Subject Code : 1FT 03A
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To enable the student to understand the basics of foods flavours.
2. To enable the student to learn the biosynthesis of natural flavours.
3. To enable the students to learn the isolation of flavouring compounds from different food materials.
4. To enable the students to learn the identification and quantification of flavouring compounds by different techniques.

Course Outcomes:

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

1. To develop methods for stabilization of natural flavours.
2. To develop aroma chemicals.
3. To attain knowledge about isolation techniques for analysis of aroma chemicals
4. To attain knowledge about the chromatography and mass spectrometry techniques to identify and quantify the flavouring compounds.
5. The students acquire knowledge about importance of flavours in maintaining or improving food quality

Unit – I

Introduction

Definition of flavor, classification of food flavor, chemical compounds responsible for flavours, difficulties of flavor chemistry research. Anatomy of chemical senses. Chemical compounds classes and their flavor response 10

Flavour Extraction

Methods of flavour extraction, isolation, separation and equipment 04

Flavor development during biogenesis

Flavor Compounds from Carbohydrates and Proteins, Lipid oxidation 03

Flavouring compounds during food processing

Volatile and non volatile flavouring compounds, non enzymatic browning reactions 03

Unit – II

Flavour analysis

Sensory evaluation, discrimination analysis, descriptive analysis, Instrumental analysis (Absorption Spectroscopy (W/VIS), chromatography, mass spectrometry) 06

Food Flavours in different food products

Principal components and properties, baked products, cheese, milk, meat, fish, wine, coffee, tea, chocolate. 08

Flavour encapsulation and stabilization

Principles and techniques of flavour encapsulation, types of encapsulation, factors affecting stabilization of encapsulated flavour and their applications in food industry, Packaging and flavor compounds interaction, packaging and storage 12

Recommended Books

Author	**Title**
Reineccius, G.	Source Book of Flavors
Heath, H. B.	Flavour chemistry and technology
Piggott, J. R., Paterson, A.	Understanding Natural Flavors.
Morton, I. D., Macleod A. J.	Food Flavor:
Yamanishi, T.	Recent advances in flavour researches
Gabelman, A.	Bioprocess Production of Flavor, Fragrance, and Color Ingredients
Ashurst P. R.	Food Flavorings.

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Flavour Technology
(S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak

		Program Outcome (PO)											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**											
	CO 2	**S**											
	CO 3		**S**	**M**		**W**							
	CO 4	**S**					**S**						**M**
	CO 5	**S**		**S**			**S**	**M**					

Subject Name : Flavor Technology Lab
Subject Code : 1FT06
L T P : 0 0 4
Credits : 2

Course Objectives:

1. Describe the chemical constituents of flavours.
2. Describe the various methods of isolation and detection of flavouring compounds.
3. Explain importance of different types of flavours.
4. To learn technological advancements in food flavoring technology

Course Outcomes:

On successful completion of the subject,

1. The students will understand the fundamentals of food components that are responsible for taste and smell.
2. The students will understand various methodologies for food flavoring.
3. The students will learn the diverse chemistry of food flavors.
4. The students will learn the recent technological advances and their implications in food flavor technology

List of Practicals:

1 Training of sensory panel.
2 Odour recognition and thresholds tests.
3 To perform recognition and sensitivity tests for four basic tastes.
4 To perform analytical tests of sensory evaluation.
5 Analysis of different types of flavours such as whole and powdered spices, essential oils, oleoresins, synthetic flavors.
6 Recognition tests for various food flavours,
7 Sensory evaluation of milk and milk products.
8 Preparation of flavour emulsions and their stability
9 Correlation of subjective and objective methods.
10 Separation, purification and identification of some flavouring compounds by GC/MS.
11 Formulation of food flavorings.
12 Flavor defects indifferent food materials.
13 Visit to the industry

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Flavour Technology Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak												
	Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1		S										
	CO 2			S									
	CO 3	S											
	CO 4			S									
	CO 5			S									

Subject Name : Advances in Dairy Engineering and Technology
Subject Code : 1FT 03B
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To understand different physico-thermal properties and their applications
2. To understand homogenizations of milk and its applications and tanks, pumps and stirrers in dairy industry.
3. To understand thermal processing of milk and quality changes therein.
4. To understand concentration of milk and drying of the milk solids.
5. To understand technology of the different milk and by products.

Course Outcomes:

1. The students will be able to understand different properties of dairy products.
2. Students will understand homogenization and its applications in dairy industry
3. Students will understand designing aspects of tanks and stirrer in dairy industry and thermal processing of milk
4. Students will understand different types of evaporators, heat & mass balance
5. Students will have knowledge to produce different dairy products and drying techniques.

Unit – I

Introduction

Physico-chemical and thermal properties of milk and its application in processing and equipment design (03)

Homogenization of milk

Principle of homogenization, single and double stage homogenizers, care and maintenance of homogenizers, design principles of homogenizers, application of homogenization in dairy industry. (05)

Tanks, Pumps and Stirrer

Designs of tank, types of tanks, pumps in dairy industry, Agitation and mixing, construction of agitators, patterns of flow & power consumption. (05)

Thermal processing of milk

Pasteurization of milk; batch, flash and continuous pasteurizer, HTST pasteurizer and design principle and thermal death kinetics, UHT processing of milk, quality changes during processing of milk. (8)

Non-thermal processing of milk

Microwave, high pressure, pulsed electric field and ultrasound processing of milk and changes in its quality (4)

Unit – II

Concentration of milk

Construction and operation, types of evaporators, heat and mass balance in single and multiple effect evaporator, Operations and various feeding systems, Economy of operation, Thermo processor and MVR system, steam economy. (8)

Spray and drum drying

Theory of drying, estimation of drying rates and drying time, drying equipments, particle size calculation, design of spray and drum dryer. air heating systems, atomization and feeding systems and separation and recovery of dried product (8)

Dairy products

Frozen dairy products; Cheese, Casein and its derivatives, Lactose: manufacturing, process control and quality control parameters. (8)

Recommended Books

Author	**Title**
Lampart, Lincoln M.	Dairy products
Eckles, Comb and Macy	Milk and Milk Products
Arbuckle	Ice Cream
John T Bowen	Dairy Engineering

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Advances in Dairy Engineering and Technology (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**											
	CO 2	**S**											
	CO 3	**S**											
	CO 4	**S**											
	CO 5	**S**											

Subject Name	**:**	**Advances in Dairy Engineering and Technology Lab**
Subject Code	**:**	**1FT06**
L T P	**:**	**0 0 4**
Credit	**:**	**2**

Course Objectives:

1. To understand construction and working principles of homogenizer
2. To understand construction and working principles of multiple effect evaporator.
3. To understand icecream premix production.
4. To understand concentration of milk and drying of the milk solids.
5. To understand technology of byproducts production.

Course Outcomes:

1. The students will be able to understand construction of homogenizer.
2. Students will understand evaporator in dairy industry
3. Students will understand designing aspects of tanks and stirrer in dairy industry and thermal processing of milk
4. Students will understand spray dryer and powder properties
5. Students will have knowledge to produce different dairy products byproducts.

List of Practicals:

1. Study of construction and operation of Homogenizer
2. Study of construction and operation of triple effect evaporator,
3. Study of construction and operation of Spray dryer,
4. Study and operation of Icecream and cheese making equipments,
5. Particle size analysis of milk powder
6. Manufacture of edible casein from cow and buffalo milk
7. Visit to a milk product plant.

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Advances in Dairy Engineering and Technology Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S											
	CO 2		S										
	CO 3		S										
	CO 4		S										
	CO 5		S										

Subject Name : Food Quality and Plant Management
Subject Code : 1 FT04 A
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To understand different food laws and standards and their importance in controlling the quality
2. To provide basic knowledge about the food quality, being affected from the adulterants, hazards etc and its safety.
3. To understand different food safety regulations and their implementation in food industry to ensure the quality and safety of the foods.
4. To understand different analytical techniques in controlling the quality of foods.
5. To understand statistical techniques in production planning and control and issues related WTO, IPR and industrial legislations and different forms of business organizations.

Course Outcomes:

1. The students will be able to know different food laws and their importance
2. Students will also know different adulterants and hazards and their safety measures
3. Student shall be able to implement different safety tools and regulation in food industry to produce safe products
4. Students will know different statistical techniques and their implementation in production planning and control
5. Students will have knowledge of different forms of organizations and structure

Unit – I

Food laws, regulation, standards and specifications 12

Food Safety and Standards Act - 2006, Agmark- 1937, Consumer Protection Act –1986, Export quality control and inspection act- 196. Requirement of good manufacturing practices (GMP), good hygienic practices (GHP), .BIS –1952, ISO–9001, HACCP and ISO 22000: fundamentals and implementations.

Quality Control, Production planning and Network analysis 12

Introduction, Evaluation of food quality; Statistical approaches in quality control and quality assurance; objectives of production planning and concept of total quality control (TQM). Procedure of production control, Plant Layout / PERT and CPM network.

Unit – II

Analytical Techniques in Foods

Application and operating parameters of Spectrophotometry, AAS, GC, HPLC. 08

Industrial Legislation, Disputes and trade Unions

Industrial legislation and laws, acts and disputes. Industrial disputes act –1947, WTO, GATT, CAC, Patent Laws and IPR

08

Industrial Organization structure 08

Types of organization structure, Principles of development of organization structure, forms of business organization, Division of industries, industrial sectors (private and public), Problems associated to public sector industries, social obligations of industries towards society.

Recommended Books

Author	**Title**
Kramer and Twigg	Quality control in food industry (Vol. I and II)
Ranganna	Hand book of analysis Fruits and Vegetables Pdts.
Stewart and Whittaker	Modern method of analysis
M.A. Amerian	Sensory quality control
Pomeranz and Meloan	Food analysis theory and practices
M.Jocob	Food analysis and quality control
J.R. Piggot	Sensory analysis of food
Dieter W. Geuwedit and Whitaker	Food analysis Principle and technique

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Food Quality and Plant Management
(S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak

		Program Outcome (PO)											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**M**		**S**									
	CO 2					**S**							**S**
	CO 3		**M**				**S**						**S**
	CO 4	**S**	**M**			**S**							**S**
	CO 5	**S**					**S**						

Subject Name : Food Quality and Plant Management Lab
Subject Code : 1FT06
L T P : 0 0 4
Credits : 2

Course Objectives:

1. To train the student to analyze food components
2. To aware of the standards of food quality and its control, safety aspects in transportation of raw material and finished products.
3. To understand the principle involved in food quality assurance and quality management.
4. To enable the students to provide knowledge of principle and working of various processing equipments.
5. To make aware the students about plant management and handling techniques with respect to processing and quality control, food plant safety, physical hazards in various

Course Outcomes:

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

1. Understand about quality of the food and its controland safety aspects during emergency
2. Learn about newer methods of food analysis.
3. Attain knowledge about isolation and analysis techniques for analysis of volatile chemicals
4. Apply their knowledge of study of use of enzymes in foods processing and product development
5. To enable the use of technical skill in plant management and raw material control and finished product storage and distribution, fire safety aspects in food industry

List of Practicals:

1. Study and comparison of Stereo zoom and Compound microscope.
2. Chromatographic analysis of protein in food samples
3. Determination of antioxidant activity of given food sample.
4. SDS-PAGE electrophoresis of food samples
5. Mineral profile analysis of food samples by Atomic Absorption Spectroscopy.
6. Estimation of Capsaicinoids (peppers)
7. Isolation and determination of lycopene from tomato products.
8. Quantitative analysis of water samples as per carbonated beverage requirements
9. Qualitative /Quantitative analysis of chemical additives (sodium benzoate/KMS) in food samples
10. Extraction and estimation of spice oleoresins
11. Qualitative/Quantitative estimation of added starch in food samples

12. Determination of artificial un-permitted colours in spices (chilli, turmeric, sweets)
13. Analysis of marketed samples for nutraceutical ingredients and permitted additives
14. Estimation of pesticides in food products , beverages
15. Develop/learn about Plant Layout / PERT and CPM network models and their practical applications

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Food Quality and Plant Management Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
		Program Outcome (PO)											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**											
	CO 2		**S**		**M**			**S**					**S**
	CO 3				**M**							**M**	
	CO 4	**S**											**S**
	CO 5	**M**	**M**					**M**				**M**	

Subject Name : Advances in Fruits and Vegetable Processing Technology
Subject Code : 1FT04B
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To make aware a student with knowledge and understanding of Indian economy with respect to the fresh and processed fruits and vegetables.
2. To make aware a student with knowledge and understanding in the basic of preprocessing operations involved in thermal processing, aseptic processing with respect to the microbial quality.
3. To make aware a student with knowledge and understanding in the basic steps, operations involved and product quality in dehydration of fruits and vegetables.
4. To make aware a student with knowledge and understanding of process like high frequency heating, microwave heating and ohmic heating fruits and vegetables used for minimal processing of fruits and vegetables.

Course Outcomes:

On successful completion of the subject

1. Student will acquire knowledge on post harvest losses and its impact on the Indian economy.
2. Student will acquire knowledge on different operations like cleaning, grading, peeling, blanching etc involved in processing fruits and vegetables.
3. Student will acquire knowledge on basic physiological, metabolic processes and various nutritional changes in fruits and vegetables.
4. Student will acquire knowledge on thermal processing which include types of cans, can formation, various operation involved in process and calculation of process time.
5. Student will acquire knowledge on process like dehydration, minimally processing, Ohmic heating, microwave heating and high frequency heating of fruits and vegetable products.

Unit	Main topics	Detailed contents	Lectures
I	**Introduction**	Importance of fruits and vegetable processing, impact on Indian economy, processing concept.	**04**
	Processing characteristics	Advances in fruits and vegetable selection, grading, sorting, blanching and other pre processing steps in automation of processing line, kinetics of quality changes: physical, chemical, sensory and nutritional changes during processing.	**08**
	Thermal processing	Influence of elevated temperature on microbial population, product quality, process time calculation, blanching techniques	**10**

		and purpose of blanching, determination of blanching processes, concept of commercial sterilization, heating and cooling of food in container, influence of commercial sterilization on product quality.	
	Aseptic processing	Concept of aseptic processing and packaging, quality assurance, machineries and their maintenance, package characteristics.	**06**
II	**Drying and Dehydration**	Concept of drying and drying curves, state of water in fruits and vegetables, drying effect on product quality and nutritive value. Advances in drying of fruits and vegetables.	**08**
	Minimally processed fruits and vegetables	Concept of hurdle technology, thermal heating approach to minimal processing, high frequency heating, microwave heating and ohmic heating.	**12**

Recommended Books

Author	**Title**
Woodruf and Luh	Commercial Fruit Processing
W.V. Cruess	Commercial Fruits and Vegetable Products
Stumbo C.R.	Thermobacterology in Food Process
D.K. salunkhe and S.S. Kadam	Handbook of Fruit science and Technology: Production, Composition, storage and processing
Lester E. Jeremiah	Freezing Effects on Food Quality
Leo M.L. Nollet	Handbook of Food Analysis
J. Weichmann	Postharvest Physiology of Vegetables

Mapping of Course Outcome and the Program Outcome:

CO/PO Mapping: Advances in Fruits and Vegetable Processing Technology (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
		Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S			M								
	CO 2	S											
	CO 3	S						M					
	CO 4	S	M										W
	CO 5	S											W

Subject Name : Advances in Fruits and Vegetable Processing Technology Lab
Subject Code : 1FT06
L T P : 0 0 4
Credits : 2

Course Objectives:

1. To make aware a student with knowledge and understanding of the basic of pre process of handling of fruits and vegetables.
2. To make aware a student with knowledge and understanding of internal and external quality fruits and vegetables.
3. To make aware a student with knowledge and understanding in the basic steps involved in thermal processing of Fruits and vegetables.
4. To make aware a student with knowledge and understanding the dehydration, freezing and minimal processing of fruits and vegetables.

Course Outcomes:

On successful completion of the practicals

1. Student will acquire knowledge on quality evaluation of fruits and vegetables.
2. Students acquire insight into specific process like peeling and blanching and learn about quality, safety, authenticity, etc. of raw materials and products.
3. Student will acquire knowledge on Different operations like cleaning, grading, peeling pulping, juice extraction fruit juices, concentration and different aroma recovery systems.etc involved in processing fruits and vegetables
4. Student will acquire knowledge on thermal processing and dehydration and freezing fruit and vegetable.5.
5. Student will acquire knowledge on processes employed in the minimally processing of fruit and vegetable based products.

List of Practicals:

1. Evaluation of quality parameters for different fruits and vegetables
2. Effects of pre-treatment on quality of cut fruits and vegetables
3. Study the effect of various processing on the nutritional quality of Fruits and Vegetables.
4. Canning and cut out analysis of canned fruit and vegetable
5. Calculation of process time in canning of Fruits and vegetables.
6. Dehydration rate and rehydration of common available vegetable
7. Study the osmotic dehydration of different Fruits and vegetables
8. Comparison of juice/pulp extraction methods on quality and yield of tomato pulp
9. Estimation of various kind of pigments present in the fruits and vegetables.
10. Determination of Vitamin C content in the given samples.

11. Estimation of textural properties of fruits and vegetables by using the texture analyzers.
12. To study the viscosity profile during concentration of fruits juices.
13. Visit to fruit and vegetable processing Industry

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Advances in Fruits and Vegetable Processing Technology Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
		Program Outcome (PO)											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**		**M**		**W**							**M**
	CO 2					**S**							
	CO 3	**S**											
	CO 4	**S**	**M**										**W**
	CO 5	**S**											

SEMESTER II

Subject Name : Food Process Equipment and Plant Design
Subject Code : 2FT07
L T P : 3 1 0
Credits : 4

Course Objectives:

1. To familiarize the students to the various mechanical properties of the different materials required for fabrication of equipments.
2. To study the various types of stress produced in various equipments and selection of materials for fabrication of equipments.
3. To impart knowledge of basic principles required for the design and fabrication of processing equipments like storage tanks, pressure vessels, heat exchangers, piping system etc.
4. To impart the knowledge regarding destructive and non destructive testing of equipment materials.

Course Outcomes:

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

1. Demonstrate strong basics in selection and design of various processing equipments required in the food processing, transportation and storage operations.
2. Solve the numerical problems related to heat exchangers, pressure vessels, storage tanks, etc. used in the food processing industry.
3. Critically evaluate the design choices in the field of heat transfer apparatuses design like heat exchangers, evaporators etc.
4. Design the various process equipments storage tanks, pressure vessels, fluid flow operation system etc.
5. Understand the technical competence or knowledge of fluid flow system, piping fabrication and colour codes for various types of fluids flowing through pipes.

UNIT	MAIN TOPIC	DETAILED CONTENTS	Lectures
I	**Introduction to Machine Design**	Introduction to equipment or machine design, Basic requirements for machine elements and machines, classification of engineering materials, selection of materials for engineering purposes, mechanical properties of metals, Manufacturing considerations in machine design; introduction to load, stress, strain, Young Modulus of Elasticity or Stress modulus or Modulus of rigidity, Stress strain diagram, Factor of safety, Theories of failure under static load.	**04**
	Corrosion mechanism	Theories of corrosion, types of corrosions, factors influencing corrosion, prevention of corrosion	**04**

	Riveted and Welded Joints	Introduction Riveted points, kinds of riveted joints, failures of riveted joints, strength of riveted joint, Riveted value, efficiency of riveted joint, Design of riveted joint Introduction to welding, advantages of welded joints over riveted joints, disadvantages of welding joints, classification of welding processes, types of welded joints, strength of welded joints.	**06**
	Pressure Vessels	Codes and regulations, Basic data for design of pressure vessels, classification of pressure vessels, stresses in thin cylindrical shell, circumferential (hoop) stresses and longitudinal stresses, design of thick pressure vessels Design of cylinder heads and cover plates, optimum proportions of a vessel, determination of optimum vessel size, Purging of vessels. Stresses induced in vessels; Reinforcement of cylinder for high pressure vessels.	**8**
II	**Storage Tanks**	Loss mechanism in storage tanks, optimum proportions of a storage tank, spherical storage tanks, design of rectangular storage tanks, different types of roofs of tanks, nozzles and mountings in storage tanks, estimation of nozzle diameter for drain and vent in a storage tank.	**04**
	Heat Exchangers	Theoretical concept of LMTD and NTU, general design considerations, design of double pipe heat exchanger, design of shell and tube heat exchanger; Design of plate heat exchanger, construction codes	**06**
	Plant Piping	Different types of pipes, Stresses in Pipes, Design of Pipes fabrication method of different types of pipes, testing of piping material, colour codes, different types of piping joints.	**06**
	Plant Design	Plant design concepts and general design considerations, Feasibility analysis and preparation of feasibility report: plant size, factors affecting plant size and their interactions, estimation of break-even and economic plant size; Product and process design, process selection, process flow charts, Hygienic design aspects and worker's safety, functional design of plant building and selection of building materials, management techniques in plant design including applications of network analysis, preparation of project report and its appraisal.	**08**

Books Recommended:

	Author (s)	Title
1.	M. V. Joshi	Process equipment design
2.	R.T. Toledo	Fundamentals of food process Engg.
3.	Brennan, J.G. and J.R. Cowell	Food Engg. Operations
4.	Heldman, D.R. and R.P.Singh	Food Process Engg.
5.	R.C. Sachdeva	Fundamentals of Engg. Heat andMass Transfer
6.	Slade FH.	Food Processing Plant

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Food Process Equipment and Plant Design (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak												
	Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S	S	S	S		M	M	M				S
	CO 2	S	S	S	M		M	M	M			M	M
	CO 3	S	S	M	M		M	M	M				M
	CO 4	S	S	M	M		M		M				M
	CO 5		S		S		S	M	M				M

Title of the course : Food Process Equipment and Plant Design Lab
Subject Code : 2FT11
L T P : 0 0 4
Credit : 2

Course Objectives:

1. To familiarize the students with the various design codes and regulations.
2. To impart knowledge of basic principles required for the design and fabrication of processing equipment's like storage tanks, pressure vessels, heat exchangers, piping system etc.
3. To impart the knowledge regarding design concepts of food processing plant.

Course Outcomes:

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

1. Understand basics in selection and design of various processing/storage equipment
2. Design the pressure vessels and storage tanks used in food industries.
3. Design heat exchangers for capacity
4. Apply hygienic design concepts for a Food processing plant.

List of Practicals:

1. Design of thin cylindrical pressure vessels.
2. Design of thick cylindrical pressure vessels.
3. Design of spherical vessels,
4. Design of jacketed vessel.
5. Design of shell and tube heat exchanger.
6. Design of double pipe heat exchanger
7. Design of food processing plant

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Food Process Equipment and Plant Design Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak												
	Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S	S	W	M	W	W	W	M	W	W	M	M
	CO 2	S	S	W	M	W	W	W	M	W	W	M	M
	CO 3	S	S	W	M	W	W	W	M	W	W	M	M
	CO 4	S	S	S	M	W	M	W	M	W	M	M	M

Subject Name : Novel Techniques in Food Packaging
Subject Code : 2FT08
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To impart advance knowledge related to the various packaging technology systems.
2. To make aware on different packaging systems which improves safety and shelf life of food products
3. To acquaint about food-package interaction and their effect on food quality.
4. To make student aware on the recycling of packaging materials, biodegradable packaging materials and safety and legislative aspects.

Course Outcomes:

1. Student will acquire advance knowledge on various packaging technology systems
2. Students will learn about various type of scavengers and emitters for improving the food quality
3. Student will acquire advance knowledge on the properties and production of various packaging materials and effect of various indicators used in supply chain management to indicate the food quality
4. Student will acquire knowledge about interaction between package-flavour, gas storage systems for food storage, recycling and use of green plastics for reducing the pollution.
5. Students will learn about consumer response about new packaging systems and safety and legislative requirements

Unit	MAIN TOPICS	DETAILED CONTENTS	LECTURES
I	Active and intelligent packaging	Active Packaging Techniques and intelligent Packaging Techniques, current use of novel Packaging Techniques, consumers and novel Packaging	04
	Oxygen, ethylene and other scavengers	Oxygen scavenging technology, selecting right types of oxygen scavenger, ethylene scavenging technology, carbon dioxide and other scavengers	04
	Antimicrobial food packaging	Antimicrobial agents, constructing antimicrobial packaging systems, factors affecting the effectiveness of antimicrobial packaging	04
	Non-migratory bioactive polymers	Advantages of NMBP, Inherently bioactive synthetic polymers: types and application,	04

	(NMBP) in food packaging	Polymers with immobilized bioactive compounds and their applications	
	Time Temperature indicators (TTIs)	Defining and classifying TTIs, Requirements for TTIs, development of TTIs, Maximizing the effectiveness of TTIs, Using TTIs to monitor shelf life during distribution	04
	The use of freshness indicator in packaging	Compounds indicating the quality of packaged food products, freshness indicators, pathogen indicators, other methods for spoilage detection	04
	Nanotechnologies in Food Packaging		01
II	Packaging-flavour interaction	Factors affecting flavour absorpstion, role of food matrix, role of differing packaging materials, flavour modification and sensory quality	03
	Moisture regulation	Silica gel, clay, molecular sieve, humectants, salts, irreversible adsorption	03
	Developments in modified atmosphere packaging (MAP)	Novel MAP gas, testing novel MAP applications, applying high oxygen MAP	03
	Recycling packaging materials	Recyclability of packaging plastics, improving the recyclability of plastics packaging, testing safety and quality of recycled materials, using recycled plastics in packaging	03
	Green plastics for food packaging	Problems of plastic packaging wastes, range of biopolymers, developing novel biodegradable materials	02
	Integrating intelligent packaging, storage and distribution	Supply chain for perishable foods, role of packaging in the supply chain, creating integrated packaging, storage and distribution: alarm systems and TTIs	03
	Testing consumer responses to new packaging concepts	New packaging techniques and the consumers, methods for testing consumer responses, consumer attitudes towards active and intelligent packaging	03
	Safety and legislative aspects of packaging	Regulatory considerations, plastic, metal, paper and glass packaging	02

Recommended Books

Author	**Title**
Ahvenainen	Novel Food Packaging Techniques
Robertson	Food Packaging
Hanlon, Kelsey & Forcinio	Handbook of Package Engineering
Paine and Paine	A Handbook of Food Packaging

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Novel Techniques in Food Packaging (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**											
	CO 2	**S**											
	CO 3	**S**											
	CO 4	**S**											**W**
	CO 5	**S**											**W**

Subject Name	**:**	**Novel Techniques in Food Packaging Lab**
Subject Code	**:**	**2FT11**
L T P	**:**	**0 0 4**
Credits	**:**	**2**

Course Objectives:

1. To impart advance knowledge related to the types of packaging materials
2. To make aware about different packaging materials which improves safety and shelf life of food products.
3. To acquaint about different food packages.
4. To acquaint the student about the different types of packaging machinery.

Course Outcomes:

1. Student will acquire advance knowledge on the properties and production of various packaging materials.
2. Students will learn about various types of packages and their production used for different foods.
3. Students will get aquainted about the packaging machinery.
4. Student will acquire knowledge about water and gas transmission rate of plastic packaging materials.
5. Students will learn about the package selection process.

List of Practicals:

1. Vacuum packaging of different foods and study their shelf life.
2. To carry out accelerated shelf life study of foods.
3. Estimation of shelf life of different foods under different packaging materials.
4. Study the water vapor transmission rate (WVTR) of different packaging materials.
5. Study various physical and mechanical properties of packaging materials.
6. Determination of optical properties of different packaging materials.
7. Study of sorption isotherm for food package design.
8. Determination of properties of foods packed in seal and shrink packaging machine.
9. Study the thermal resistance of different glass containers.
10. To carry out seal and shrink packaging of food products and determine their shelf life.

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Novel Techniques in Food Packaging Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S	S	S			M						M
	CO 2	S	M	M			M						M
	CO 3	S	S	S	M						M		
	CO 4	S											W
	CO 5	S		M									W

Subject Name : Technology of Frozen Foods
Subject Code : 2FT09A
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To understand important aspects of freezing such as Thermo physical properties, Glass transition temperature, Microbiology, freezing loads and freezing time calculations.
2. To understand cold chain facility for the frozen foods and innovations in the freezing processes.
3. To understand quality and safety of different frozen foods.
4. To understand different techniques to measure and control the quality of frozen foods.
5. To understand suitability of different packaging materials for the frozen foods.

Course Outcomes:

1. The students will be able to understand different properties and microbiology of frozen foods.
2. Students will understand calculations of freezing load and freezing time calculations for different foods.
3. Student will understand glass transition temperature phenomenon in frozen foods and its manipulation
4. Students will know different freezing methods and equipments and transportation of frozen foods
5. Students will have knowledge to control quality and safety of different frozen foods

Unit – I

Fundamentals of Freezing

Glass transitions in frozen foods and biomaterials, Microbiology of frozen foods, Thermo-physical properties of frozen foods, Freezing loads and Freezing time calculation, Innovations in freezing process (12)

Facilities for the Cold Chain

Freezing methods and equipment, Cold store design and maintenance, Transportation of frozen foods, Retail display equipment and management, Household refrigerators and freezers, Monitoring and control of the cold chain. (10)

Unit – II

Quality and Safety of Frozen Foods

Quality and safety of frozen meat and meat product, Quality and safety of frozen poultry and poultry products, Safety and quality of frozen fish, Shellfish, and related products, Quality and

safety of frozen vegetables, Quality and safety of frozen fruits, Quality and safety of frozen dairy products, Quality and safety of frozen ready meads, Quality and safety of frozen bakery products, Quality and safety of frozen eggs and egg products. (14)

Monitoring and Measuring Techniques for Quality and Safety

Chemical Measurements, Sensory analysis of frozen foods, Foodborne illnesses and detection of pathogenic microorganisms, Shelf-life prediction of frozen foods. (08)

Packaging of Frozen Foods

Introduction to frozen food packaging, Plastic packaging of frozen foods, Paper and card packaging of frozen foods, Packaging of frozen foods with other materials, Packaging machinery. (10)

Recommended Books

Author	**Title**
Marilyn C. Erickson,Yen-Con Hung	Quality in Frozen Foods
Isabel Guerrero Legaretta	Handbook of Frozen Foods
Kennedy Chris J	Managing Frozen Foods

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Technology of Frozen Foods (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**				**M**							
	CO 2	**S**				**M**							
	CO 3	**S**				**M**							
	CO 4	**S**				**M**							
	CO 5	**S**											

Subject Name	**:**	**Technology of Frozen Foods Lab**
Subject Code	**:**	**2FT12**
L T P	**:**	**0 0 4**
Credits	**:**	**2**

Course Objectives:

1. To understand thermo-physical properties of freezing process.
2. To acquaint the students about the microbiology of frozen foods.
3. To give knowledge about equipments for freezing of foods.
4. To impart knowledge about different techniques to control the quality of frozen foods.
5. To acquaint the students about different packaging materials for the frozen foods.

Course Outcomes:

1. The students will be able to understand different properties of frozen foods.
2. The students will understand about microbiology of frozen foods.
3. The student will get knowledge about different equipments involved in freezing of foods.
4. The students will know about different freezing methods of frozen foods.
5. The students will have knowledge to control quality and safety of different frozen foods.

List of Practicals:

1. Study the construction of freeze drier and carry out freeze drying of different food samples.
2. To carry out the storage study of different frozen foods and determine their different properties during storage.
3. To carry out the standard plate count (SPC) of frozen food samples.
4. Study the effect of different packaging materials on frozen foods.
5. Study the changes during thawing of frozen foods.
6. To carry out osmodehdrofreezing and study its different properties.
7. Study the effect of different cryoprotectants on freezing.
8. Determination of different stabilizers on the ice crystal size of frozen dessert.

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Technology of Frozen Foods Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak												
	Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S						M					
	CO 2	S				M	M						
	CO 3	S	S			S			M			M	
	CO 4	S		S				S					
	CO 5	S			S				M				

Subject Name : Advances in Meat, Fish and Poultry Technology
Subject Code : 2FT09B
L T P : 3 0 0
Credits : 3

Course Objectives:
1. To understand about the composition, nutritive value of meat, poultry and fish
2. To understand the various post-mortem changes related to muscle and various other tissues.
3. To know about processing technology of meat, poultry and fish.
4. To know the value addition and packaging of meat, fish and poultry products

Course Outcomes:
On successful completion of the subject, the students will be able to
1. The student will be able to understand to process meat, poultry and fish.
2. The students will be able to learn hygienic and mechanised processing.
3. The students will be able to prepare various value added products.
4. The student will be able to understand raw material characteristics, formulations, handling and processing procedures with quality, yield and cost of product produced.
5. The students will be able to learn about the Food Standards in relation to these food commodities.

Unit – I

Meat Industry

Meat and meat products in India-an Industrial profile. Meat production and trade practices. Prospects and problems in production of fresh meat in India, Research and Development activities on meat, fish and poultry products. 06

Gross and microstructure of muscle. Mechanism of muscle contraction and relaxation

Organization of skeletal muscle from gross structure to molecular level. Muscle Communication (sarcolemma, sarcoplasmic reticulum, Innervation). Muscle metabolism. Different types of connective tissues and their relevance to properties of meat. Myofilament proteins and their major functions. Nervous tissue, nerves and the nature of stimuli, membrane potential in nerve and muscle, Events that occur during relaxation and contraction. 10

Cattle and beef, sheep and mutton, pig and pork and their fabrication

Breeds, pre slaughter care, ante and post mortem, slaughter, handling of offal (edible and inedible). Cuts of beef, pork and mutton. 06

Meat inspection and grading

Application and Enforcement of inspection laws, elements of inspection (sanitation, ante-mortem inspection, postmortem inspection, condemnation, product inspection, laboratory inspection, labeling). Identification of inspected products, product inspection, types of grades, factors used

to establish quality grades, conformation, fleshing and finish.

06

Unit – II

Properties of fresh meat

Perception of tenderness, Factors effecting tenderness, connective tissue, collagen, sarcomere contractile state, Myofibrillar tenderness, marbling. Methods to improve tenderness (Electrical stimulation, aging, Meat color, Pigments associated with color, Chemical state of pigments, methods to improve meat color. Water holding capacity (Net charge effect and stearic effect)

08

Poultry meat

Kind of poultry, processing of poultry. Special poultry products, Breaded poultry, Smoked turkey, Packaged pre cooked chicken, Freeze dried poultry meat. 04

Meat analogues and restructured meat products

Textured plant proteins, processes for preparation of meat analogues and restructured meat products. 04

Fish processing and fish products

Selection of raw material for processing of streaking and filleting of fish; production of fish paste, fish oils, sauce, fish protein concentrates 04

Recommended Books

Author	**Title**
Henricksons	Meat poultry and Sea Food Technology
G.J. Mountney	Poultry product Technology
Albert Levie	Meat Hand Book
G Mead	Poultry meat processing and quality

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Advances in Meat, Fish and Poultry Technology (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S											
	CO 2		S	S									
	CO 3			S									
	CO 4			S									
	CO 5						S						

Subject Name	**:**	**Advances in Meat, Fish and Poultry Technology Lab**
Subject Code	**:**	**2FT12**
L T P	**:**	**0 0 4**
Credit	**:**	**2**

Course Objectives:

1. Describe the structure of and composition of meat
2. Describe the processes that should be followed to obtain quality meat from animals.
3. Develop skills in processing and preservation of meat, fish and poultry products
4. Develop value added meat products of meat, fish and poultry.

Course Outcomes:

On successful completion of the subject,

1. The student will able to understand biological principles that influence composition, processing, preservation and quality of meat and meat products.
2. The students will able to learn concept of meat quality, the principle factors influencing it and its biochemical basis.
3. The students will able to understand Knowledge of manufacturing practices, product formulation, and quality control of fresh, frozen, and cured meats and fish.
4. The students will able to understand Quality control functions performed in meat and poultry processing.
5. The students will able to characteristics associated with the value of carcasses, primal and retail cuts from meat animals.

List of Practicals:

1. To study the effect of low and high oxygen atmosphere on meat colour.
2. To study the chemistry of myoglobin as it relates to the color of the molecule.
3. To study the structure of the muscle under compound microscope.
4. To perform the slaughtering of the poultry birds.
5. Identification of different internal organs of poultry birds and their utilization for product preparation.
6. Determination of lipids in meat.
7. Qualitative bacteriological examination of animal products.
8. To study the internal and external quality of an egg.
9. To perform the Steaking and filleting of Fish.
10. Determination of total volatile acids in fish,
11. Determination of buffering capacity of fish muscle.
12. Rapid estimation of hypoxanthine concentration in chill stored fish.
13. Determination of glycine in fish muscle.
14. Determination of protein fractions in fresh fish.

15. Cut out test for canned fishery products.
16. Determination of glycogen in fish muscle.
17. Industrial visit to meat industry.

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Advances in Meat, Fish and Poultry Technology Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak												
	Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1		S										
	CO 2			S									
	CO 3	S											
	CO 4			S									
	CO 5			S									

Subject Name : Nutraceuticals and Functional Foods
Subject Code : 2FT10A
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To provide advance knowledge on various biomolecules showing health benefits
2. To make aware on various sources and characterization of biomolecules showing health benefits
3. To make student aware on use biomolecules exhibiting nutraceutical and functional food in alleviating above mentioned disease.

Course Outcomes:

1. Student will acquire advance knowledge on various biomolecules showing health benefits
2. Student will acquire advance knowledge on various physiological and biochemical aspects of life threatening and chronic diseases
3. Student will acquire advance knowledge on effect of various biomolecules on life threatening and chronic diseases
4. Student will acquire knowledge on isolation, characterization and application of biomolecules.
5. Student will acquire knowledge on food safety, quality control, toxicology aspect of food products including, nutraceutical and functional foods.

Unit – I

Defining nutraceuticals and functional foods. Nature, type and scope of nutraceutical and functional foods. 04

Nutraceutical and functional food applications and their health benefits. Nutraceutical compounds and their classification based on chemical and biochemical nature with suitable and relevant descriptions. 06

Functional foods and nutraceuticals and as anti-cancer, hypo-lipidemic, anti-stress, osteoarthritis,hypotensive, hypoglycemic, hypoallergenic food, neuro-protective food. 08

Antioxidants and other phytochemicals as anti aging, Dietary fibers and complex carbohydrates from oats, wheat bran, rice bran as functional food. 06

Unit – II

Whey proteins, soya proteins as nutraceuticals, probiotic and prebiotic and their functional role. 03

Nutraceuticals from fruits and vegetables products, oil seeds and sea foods. 04

Coffee, tea and other beverages as functional foods/drinks and their protective effects. 04
Effects of processing and storage on the potentials of such foods. 04
Food Toxicology aspect of food including functional nutraceutical foods, Safety, Marketing and regulatory issues for functional foods and nutraceuticals. 06
Future of nutraceuticals and functional foods, recent development and advances in the areas of nutraceutical and functional foods and their role in nutrigenomics. 04

Recommended Books

Author	**Title**
R. Chadwick,S. Henson,B. Moseley,G.	Functional Foods
W. Jeffrey Hurst	Methods of Analysis for Functional Foods and Nutraceuticals
Mazza	Functional Foods
Robert E.C. Wildman	Handbook of Nutraceuticals and Functional Foods

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Nutraceuticals and Functional Foods (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**											
	CO 2	**S**											
	CO 3	**S**											
	CO 4	**M**											
	CO 5	**S**											

Subject Name	**:**	**Nutraceuticals and Functional Foods Lab**
Subject Code	**:**	**2FT12**
L T P	**:**	**0 0 4**
Credits	**:**	**2**

Course Objectives:

1. To develop comprehensive understanding of different nutraceuticals and functional foods.
2. To gain knowledge about the nutraceutical constituents present in various food products.
3. To understand the extraction techniques of plant based nutraceuticals.
4. To acquire knowledge on estimation and identification of nutraceutical and functional food compounds by various advanced analytical techniques.

Course Outcomes:

On successful completion of the subject, the students will be

1. Acquire knowledge on various nutraceutical components and their health benefits.
2. Get knowledge about the techniques for the determination of the constituents present in food such as pigment, pectin etc.
3. Gain their practical knowledge regarding extraction, isolation, characterization and application of nutraceuticals in food industries.
4. Acquire knowledge about the probiotic as well as prebiotic components in food.
5. Capable to develop and characterize the functional food.

List of Practicals:

1. Identification of various nutraceuticals and functional foods available in the market
2. Estimation of pigments of fruits and vegetables.
3. Determination of total pectin in plant material.
4. Estimation of crude fibre/dietary fibre content in cereals.
5. Extraction and quantification of polyphenols.
6. Phyto-chemical analysis of plant sample and extract.
7. Extraction and isolation of protein from different sources.
8. Preparation and evaluation of probiotic/ prebiotic foods.
9. Formulation of a health drink.
10. Industrial visit to a food processing and nutraceutical unit.

Mapping of Course Outcome versus Program Outcome

CO/PO Mapping: Nutraceuticals and Functional Foods Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak												
	Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S	M		W		S						S
	CO 2	S	S	S	S	S		S			M	S	
	CO 3	S	S	M	S	S	M	S	S		S		S
	CO 4	S	S	W	S	S	S	S	M	W			M
	CO 5	S	S	S	S	S	M	S	S		M		S

Subject Name : Advances in Cereal and Pulse Processing Technology
Subject Code : 2FT10B
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To provide knowledge of various cereal grains and pulses after harvesting.
2. To make student aware on various types of modern processing methods of cereals and pulses
3. To make student aware on various storage techniques of cereals and pulses
4. To make students able to implement their knowledge about advanced manufacturing technologies of cereals and pulses consumed
5. The students can learn about techniques of reducing losses of foods grain during handling and storage

Course Outcomes:

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

1. Get exposure about rice, maize and pulses w.r.t. their modern milling methods
2. Develop technical know-how for the preparation of secondary products from cereals and pulses
3. Identify suitable technology for cereals and pulses processing
4. Apply the advanced knowledge of processing methods of cereals and pulses in food industries.
5. Develop knowledge about the storage of cereals and pulses using modern techniques

UNIT - I

Paddy Processing 12

Paddy varieties, their composition and quality characteristics. curing of paddy. Parboiling processes, cold water soaking and hot water soaking processes, paddy dryer-LSU dryer. by products of paddy processing - paddy husk and its uses - as boiler fuel, husk ash, activated carbon, furfural and other by products. Production of flattened rice and puffed rice from paddy. Rice Milling: Paddy dehusking processes: rice mill flow chart, Engelberg huller mills, modern rice mills. Components of modern rice mill, pre cleaners, shellers, under runner shellers and centrifugal shellers, paddy separators – Satake and Schule designs, Polishers-cone polishers and other types, bran and brokens separators. Rice mill yields and loss due to brokens at different stages of milling. Rice mill machinery handling. Methods of rice
bran oil extraction.

Milling of Pulses: 10

Major Pulses grown in the country and their application, Status of Pulse milling industry in India, need for modernization, Traditional milling process, merits and demerits, Drying of

legumes, Sun drying, Traditional Processing steps – Pre-cleaning, Pitting, Oil application, conditioning, Dehusking and splitting, Machinery and equipment employed, mass balance, losses during milling; Modern milling process, Mechanical hot air drying and conditioning, merits and demerits, Dehusking in Pulse Pearler, Water conditioning, splitting of pulses in Pulse splitter, process flow chart, Merits and demerits, Mini dal mill, working principle, advantages and disadvantages, Grinding of split pulses, pulse flour products, their applications, equipment used.

UNIT - II

Milling and Processing of Maize 08

Dry milling of maize: Storage and drying, Pre-cleaning, cleaning equipment, De-germination and Dehusking, Roller milling, Sifting, Purifying, Aspiration, Pneumatics in a maize mill. Products of milling-Flour, Semolina, Brewers' grits etc. and their applications. Wet milling of Maize and corn: Modern methods of processing, Cleaning, Steeping, Degermination, Bran and Fibre separation, Gluten and Starch Separation, extraction process; Equipment needed for Degermination, Debranning and starch separation, Starch conversion into other value added products, Acid Hydrolysis, Enzyme Hydrolysis, Isomerization processes, Processing for Dextrose, Malto Dextrin and other products. Extraction and refining of Corn oil in brief.

Storage and Handling 08

Bag Storage, Bag Storage structure design, Parameters of good storage structure, Cover Plinth Storage Structures, CAP storage (Ceiliny outs, Dunnage, Materials for Dunnage, Pallets, Protection against Rodents, Fungi, Pests and Mites, Fumigation Processes for bag storage piles, Bulk Storage in silos and large Bins; Problems of Silo storage, Construction of Silos, Physical load and mechanical strength of Silos, concrete and Metal Silos, Silo flow problems, Relative merits and demerits of Silo storage to Bag Storage, Relative Costs of Silo and Bag Storage, Conveyors and Elevators for feeding and discharging into Silos. In silo Aeration and Drying, Problems of Dust Explosion in Grain Storages, Quality Changes of Grains during storages and remedial measures to prevent unwanted quality changes.

Recommended Books

Author Title

1. Chakraverty, A Post Harvest Technology of Cereals, Pulses and Oilseeds
2. Samuel Matz The Chemistry and Technology of Cereals as Food and Feed
3. N. L. Kent and A. D. Evans Technology of Cereals
4. George E Inglett Maize-Recent Progress in Chemistry and Technology
5. Ruth H. Matthews Pulses – Chemistry, Technology and Nutrition
6. Y. Pomeranz Modern Cereal Science and Technology
7. Cryde M. Christensen Storage of Cereal Grains and their Products
8. Karel Kulp and Joseph P Pante, Hand Book Of Cereal Science and Technology

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Advances in Cereal and Pulse Processing Technology (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S								M			M
	CO 2	S	M										
	CO 3	S		M									S
	CO 4	S	M							S			
	CO 5	M											S

Subject Name	**:**	**Advances in Cereal and Pulse Processing Technology Lab**
Subject Code	**:**	**2FT12**
L T P	**:**	**0 0 4**
Credits	**:**	**2**

Course Objectives:

1. To train the student to analyze food components
2. To make the students aware of the standards of food quality
3. To understand the principle involved in food processing and technology.
4. To enable the students to learn the principle and working of various processing equipments.
5. To make the students to equip with analytical and instrumental analysis techniques

Course Outcomes:

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

1. Assess the quality of the food
2. Develop newer methods of food analysis.
3. Attain knowledge about isolation and analysis techniques for analysis of volatile chemicals
4. Apply their knowledge of incorporating enzymes in foods and their actions in foods
5. Get understanding of various ingredients needed for preparations of food products

List of Practicals:

1. Texture profile analysis of foods samples.
2. Chromatographic analysis of protein in food samples
3. Analysis of powder characteristics using powder flow analyzer.
4. Identification of unknown compounds using FTIR.
5. Determination of total phenolic content of given food sample.
6. Estimation of total sugars in the given food sampleby Dubois method.
7. SDS-PAGE electrophoresis of food samples
8. Determination of total flavonoid content of given food sample.
9. Determination of diastatic activity of given food sample.
10. Mineral profile analysis of food samples by Atomic Absorption Spectroscopy.
11. Determination of thermal properties of food starches using DSC.
12. Estimation of amino acid profile using amino acid analyzer.
13. Development of extruded products.
14. Estimation of β- glucan (cereals)
15. Estimation of Lecithins (legumes seeds)
16. Extraction and estimation phenolic compounds od cereal grain bran by colorimetric and spectrophotometric techniques.

Mapping of Course Outcome and Program Outcome

CO/PO Mapping: Advances in Cereal and Pulse Processing Technology Lab (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S											
	CO 2	S			M								S
	CO 3				M								
	CO 4	S											S
	CO 5	M	M		S			M				M	

SEMESTER III

Subject Name : Advanced Food Process Engineering
Subject Code : 3FT14A
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To familiar the students to the theory and application of different engineering operations.
2. To be able to apply the fluid flow, heat and mass transfer and separation principles to analyze and design food processes.
3. To understand engineering principles and practical applications of thermal processing for increasing shelf life of food products.
4. To be able to identify and apply the energy management strategies in food process industries.

Course Outcomes:

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

1. Understand and apply the engineering principles required for process design.
2. Understand the working and design features of various food process equipments.
3. Calculate the thermal process time, drying and freezing times of different food products.
4. Understand energy audit and apply energy management techniques in food process industries.

UNIT	MAIN TOPICS	DETAILED CONTENTS	*Lectures*
I	**Fluid Flow**	Material and energy balance problems, Flow of fluids foods, sanitary pipes and fittings, pumps, stirrers and mixers, Related numerical problems	**8**
	Mechanical Separation	Theory of centrifugal separation, cyclone separators, Theory of ultra-filtration and reverse osmosis, selection and types of membranes and properties, concentration polarization, mathematical description of flow through membrane, application and use in food industry.	**5**
	Thermal Processing	Factors affecting spoilage of different types of food products, Target microorganism for thermal processing, Concept of D, F and Z value, Microbial inactivation Method for thermal process evaluation - Commercial sterility, pasteurization and	8

		sterilization methods based on slowest heating region; process time evaluation for batch sterilization by graphical method; calculation of process time for continuous sterilization of liquid foods; factors affecting rate of heat penetration; effect of can size on sterility requirement; related numerical problems,	
II	**Drying and Evaporation**	Thermodynamic properties of moist air, kinetics of water absorption, mechanics of movement of air through stationary bed, thin layer and thick layer bed drying, simulation models for drying systems, Evaporation basics, design of single and multi-effect evaporators	**7**
	Refrigeration and Food Freezing	Refrigeration cycles, components of vapour compression refrigeration system, different refrigeration systems for ultra-low refrigeration. Freezing point depression, freezing point curves, phase diagrams, Ice crystal formation, Enthalpy change during freezing, Plank's equation and other modified equations for predicting rates of product freezing; Cryogenic freezing and IQF, and design concepts of freezing equipment, methods of freeze concentration and drying, Design calculations related to refrigeration load, and system capacity.	**10**
	Energy Management	Energy audit and management strategies in food process industries	**5**

Books Recommended:

Author (s)	**Title**
1. Brennan and Cowell	Food Engineering Operations
2. Charm, S.E	. Fundamentals of Food Process Engg
3. Geankoplis	Transport Process & Unit operations
4. Harper, J.C.	Elements of Food Engg
5. Heldman and Singh	Food Process Engineering
6. Smith, P G.	Introduction to Food Process Engineering
7. Stumbo C.R.	Thermobacteriology in Food Process
8. Toledo, R.T.	Fundamentals of food process Engineering

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Advanced Food Process Engineering (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
	Program Outcome (PO)												
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S	S	S	W	W							
	CO 2	S	S	S	W	W							
	CO 3	S	S	S	M	M							
	CO 4	S	S	W	W	W							

Subject Name : Biotechnological Tools in Food Analysis
Subject Code : 3FT14B
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To provide the basic knowledge about the concept and scope of biotechnology in food.
2. acquaint with new biotechnology (genetic engineering) and its applications
3. understand the principles of biotechnological tools and techniques (PCR, ELISA, Immunoassays, Biosensors, etc.).
4. To impart basic understanding about the utilization of biotechnological tools in food industry.

Course Outcomes:

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

1. Get exposure about the biotechnology and its multidisciplinary approach.
2. Get insight with various important terms and techniques such as gene cloning and DNA fingerprinting.
3. Identify, analyze, design biotechnological kits related to analysis of food component.
4. Acquaint themselves with the fundamentals of antigen, antibodies, immunoassays and their application in the food industry.
5. Get knowledge about the basic principles of biosensors and its application.

UNIT	MAIN TOPICS	DETAILED CONTENTS	LECTURES
I	**Introduction**	Introduction: Concept of Biotechnology, history, old vs new Biotechnology, Different food borne pathogens.	**4**
	Genetic Engineering	Concept, different vector systems used in gene cloning, gene cloning procedures: isolation of DNA fragment, joining to vector, expression & selector of recombinant with suitable example, DNA fingerprinting, Method of DNA fingerprinting, Identification techniques, Practical applications.	**12**
II	**Polymerase Chain Reaction (PCR)**	Polymerase Chain Reaction: Introduction and principle, process of PCR, Development of a PCR assay, PCR optimization, Practical modifications to the PCR technique, Advantages and disadvantages, Applications, Application of PCR in the detection of different pathogen species, MPCR analysis.	**10**

III	**ELISA**	ELISA: Concept of Antigen & Antibody, ELISA, Types of ELISA, Methods, ELISA kits, Applications in food and agriculture.	**6**
	Immunoassay Kits	Types of Immunoassays, Principle of detection of kits, Monoclonal Antibodies-antigen, antibody, Nomenclature, Production of monoclonal antibodies-in vitro and in -vivo, merits and demerits, application in food industries.	**8**
IV	**Biosensors**	Types of biosensor-Calorimetric, Potentiometric, Amperometric, Optical, Piezoelectric, Immunosensors, Principle of detection, Application, Biosensors in food analysis.	**8**

Books Recommended:

Author (s)	**Title**
PS Panesar, SS Marwaha	Biotechnology in Agriculture & Food Processing
P.K. Gupta	Biotechnology
P.S. Panesar, SS Marwaha, HK Chopra	Enzymes in Food Processing
S.S. Marwaha	Food Processing : Biotechnological Applications
Crueger and Crueger	Biotechnology

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Biotechnological Tools in Food Analysis (S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak													
		Program Outcome (PO)											
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Course Outcome (CO)	CO 1	S											S
	CO 2		S										
	CO 3			S	S	S							
	CO 4					S		S					
	CO 5					S							

Subject Name : Advances in Food Process Technology
Subject Code : 3FT15
L T P : 3 0 0
Credits : 3

Course Objectives:

1. To provide the understanding about growth dynamics and destruction mechanism of microbes with the associated models and applications.
2. To provide the concept of membrane technology, supercritical fluid extraction with their effective industrial applications.
3. To impart the theoretical background of hurdle concept of food preservation and upcoming food processing techniques such as microwave technology, high pressure processing with the newer novel techniques of food processing.
4. To provide the understanding about the principles, mechanism and application of nanotechnology in food.

Course Outcomes:

1. Students will acquire the concepts behind growth dynamics and destruction mechanism of microbes with the associated models and applications.
2. They can able to understand and solve the problems related to membrane technology and supercritical fluid extraction.
3. They can understand the concept behind the preservation of foods either using old or newer techniques.
4. They can get the idea and concept of quality assessment of food using ultrasonic techniques
5. They can understand the concept behind the principles, mechanism and application of nanotechnology in food.

Unit – I

Membrane technology:

Introduction to pressure activated membrane processes, performance of RO/UF and NF and industrial application. 06

Supercritical fluid extraction:

Property of near critical fluids (NCF), solubility and efficiency of NCF extraction, equipment and experimental techniques used in NCF extraction and industrial application. 06

Microwave energy in Foods:

Theory of microwave heating, dielectric properties of food materials, working principle of magnetron, microwave blanching, sterilization and finish drying. 06

Hurdle technology:

Types of preservation techniques and their principles, concept of hurdle technology and its application. 04

Unit – II

High Pressure processing of foods:

Concept of high pressure processing, quality changes, effects of pressure on microorganisms and its application in food processing. 04

Ultrasonic in food processing:

Properties and generation of ultrasonic, ultrasonic imaging, application of ultrasonics as an analytical tool and processing techniques 04

Newer techniques in food processing

Application of technologies of high intensity light, pulse electric field, ohmic heating, micronization in food processing and preservation 08

Nanotechnology:

Principles, mechanism and applications in foods 04

Recommended Books

Author	**Title**
G. W. Gould	New Methods of Food Preservation
R.P.Singh	Introduction to Food Engineering
Fellows, P. J.	Food processing technology

Mapping of Course Outcome and Program Outcome:

CO/PO Mapping: Advances in Food Process Technology
(S/M/W indicates strength of the correlation) S-Strong, M-Medium, W-Weak

		Program Outcome (PO)											
		PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
Course Outcome (CO)	**CO 1**	**S**	**S**	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**S**
	CO 2	**S**	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**S**
	CO 3	**S**	**S**	**S**	**S**	**S**	**M**	**M**	**M**	**S**	**M**	**M**	**S**
	CO 4	**S**	**S**	**M**	**S**	**M**	**M**	**M**	**M**	**S**	**M**	**M**	**S**
	CO 5	**S**	**S**	**S**	**S**	**M**	**S**	**S**	**M**	**M**	**M**	**M**	**S**