Programme Structure

Sharda School of Engineering & Technology

Department of Biotechnology

B.Tech. Food Process Technology

Programme code: SET0211
Batch: 2023-2027

The components of the Curriculum

Course Component	Curriculum Content (% of total number of credits of the Programme)	Total number of contact hours	Total number of credits
Basic Sciences	11.88%	22	19
Engineering Sciences	15.63%	35	25
Humanities and Social sciences	5.63%	17	9
Technical and communications skills	8.13%	24	13
Programme Core	35.00%	77	56
Programme Electives	12.50%	20	20
Open Electives	6.25%	10	10
Project(s)	5.00%	16	8
Total number of Credits			160

Credit Distribution B. Tech.

Discipline	SC	PC	PE	OE	Credits	%
Engineering	36	56	20	3	115	71.9%
Science	21	0	0	2	23	14.4%
Humanities	12	0	0	3	15	9.4%
Management	5	0	0	2	7	4.4%
	74	56	20	10	160	100.0%

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023-2027
Term: 01

S.No.	Course Type (Code)	Course Code	Course Title	L	T	P	C	Category of Course
1	SC	FPE101	Introduction to Food Process Engineering	0	0	2	1	Engineering
2	SC	CSE113	Programing for Problem Solving	3	0	0	3	Engineering
3	SC	CSP113	Programing for Problem Solving lab	0	0	2	1	Engineering
4	SC	CVL103	Environmental Science	2	0	0	0	Science
5	SC	MTH114	Math I(Bucket based)	3	1	0	4	Science
6	SC	PHY126	Thermodynamics	2	0	0	2	Science
7	SC	CHY213	Organic Chemistry	3	0	0	3	Engineering
8	SC	MEP106	Computer Aided Design & Drafting	0	0	3	1.5	Engineering
9	SC	ARP101	Soft Skill - 1 (Communicative English-I)	1	0	2	2	Humanities
TOTAL							**17.5**	

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023 -2027; Term: 02

S.No.	Course Type (Code)	Course Code	Course Title	L	T	P	C	Category of Course
1	SC	CSE114	Application based Programming in Python	3	0	0	3	Engineering
2	SC	CSP114	Application based Programming in Python Lab	0	0	2	1	Engineering
3	SC	MTH215	Maths II (Bucket based)	3	1	0	4	Science
4	SC	EEE112	Principles of Electrical and Electronics Engineering	2	1	0	3	Engineering
5	SC	EEP112	Principles of Electrical and Electronics Engineering Lab	0	0	2	1	Engineering
6	SC	MEP105	Mechanical Workshop	0	0	3	1.5	Engineering
7	SC	HMM111	Human Values and Ethics	2	0	0	2	Management
8	SC	ARP102	Soft Skill - 2 (Communicative English-2)	1	0	2	2	Humanities
9	SC	BTY118	Design/Creativity course based on requirement	1	0	2	2	Engineering
10	PC	FPE201	Food Chemistry	3	0	0	3	Science
11	PC	FPP201	Food Chemistry Lab	0	0	2	1	Science
			TOTAL				**23.5**	

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023 -2027
Term: 03

S.No.	Course Type (Code)	Course Code	Course Title	L	T	P	C	Category of Course
1	SC	BDA212	Maths III (from basket-Statistics-II)	4	0	0	4	Science
2	PC	FPE301	Instrumentation for Food Quality Analysis	3	0	0	3	Engineering
3	PC	FPP301	Instrumentation for Food Quality Analysis Lab	0	0	2	1	Engineering
4	PC	FPE202	Food Microbiology	3	0	0	3	Science
5	PC	FPP202	Food Microbiology Lab	0	0	2	1	Science
6	PC	IED001	Introduction to entrepreneurship development	0	1	2	2	Engineering
7	SC	FPP254	Project Based Learning 1	0	0	4	2	Engineering
8	PC	FPE213	Unit operation in Food Processing	4	0	0	4	Engineering
9	SC	FPT291	Industrial Internship I	0	0	4	2	Engineering
			TOTAL				**24**	

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023 -2027
Term: 04

S.No.	Course Type (Code)	Course Code	Course Title	L	T	P	C	Category of Course
1	SC	ARP208	Quantitative and Qualitative aptitude skill building	1	0	2	2	Humanities
2	PC	FPE205	Dairy Engineering	3	0	0	3	Engineering
3	PC	FPE206	Food preservation	3	0	0	3	Engineering
4	PC	FPE203	Heat and Mass Transfer	3	1	0	4	Engineering
5	PE	FPT	Programme Elective-1	3	0	0	3	Engineering
6	OE	OPE	Open elective 1	2	0	0	2	Management
7	PC	BTY246	Bioethics and IPR	2	0	0	2	Science
8	PC	FPP253	Project based learning 2	0	0	4	2	
9	PC	FPP205	Dairy Engineering Lab	0	0	2	1	Engineering
10	PC	FPP206	Food Preservation Lab	0	0	2	1	Engineering
			TOTAL				**23**	

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023 -2027
Term 05

S.No.	Course Type (Code)	Course Code	Course Title	L	T	P	C	Category of Course
1	SC	ARP305	Personality development and decision-making skills	1	0	2	2	Humanities
2	PC	FPE312	Food Safety	3	0	0	3	Engineering
3	PC	FPE302	Technology of Meat, Marine and Poultry Products	3	0	0	3	Engineering
4	PC	ECC 301	Community Connect	0	0	4	2	Engineering
5	PE	FPT	Programme Elective-2	3	0	0	3	Engineering
6	PC	BTY316	Research Methodology	2	0	0	2	Engineering
7	PC	FPP353	Project Based Learning (PBL) -3	0	0	4	2	Engineering
8	OE	NFT001	Open Elective - 2	2	0	0	2	Engineering
9	PC	FPP393	Industrial Internship	0	0	4	2	Engineering
10	PC	FPP303	Technical skill enhancement course 1(New Product Development lab)	0	0	2	1	Engineering
11	PC	FPP302	Technology of Meat, Marine and Poultry Products Lab	0	0	2	1	Science
12	OE2	FPP	Food Safety Lab	0	0	2	1	Engineering
			TOTAL				**24**	

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023 -2027
Term: 06

S.No.	Course Type (Code)	Course Code	Course Title	L	T	P	C	Category of Course
1	SC	ARP306	Campus to Corporate	0	0	4	2	Humanities
2	PE	FPT	Programme Elective 3	3	0	0	3	Engineering
3	PE	FPT	Programme Elective-4	3	0	0	3	Engineering
4	PE	FPT	Programme Elective-5	3	0	0	3	Engineering
5	PE	FPT	Programme Elective-6	3	0	0	3	Engineering
6	PC	FPE306	Advance Food Process Engineering	3	1	0	4	Engineering
7	PC	FPP354	Project based learning 4	0	0	4	2	Engineering
8	OE	OPE	Open Elective 3	3	0	0	3	
9	OE	FPP308	Technical Skill Enhancement Course-2 (Technology of cereals, pulses and oilseeds lab)	0	0	2	1	Engineering
			Total				**24**	

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023 -2027
Term: 07

S. No.	**Course Type (Code)**	**Course Code**	**Course Title**	L	T	P	C	Category of Course
1	PC	FPE401	Food Packaging Technology	3	0	0	3	Engineering
2	SC	HMM	Management course from the basket	3	0	0	3	Engineering
3	PE	FPT	Programme Elective-7	2	0	0	2	Engineering
4	PE	FPP451	Major Project- 1	0	0	4	2	Engineering
5	PC	FPP593	Summer/industrial Internship III	0	0	4	2	Engineering
6	OE	OE	Open Elective - 4	3	0	0	3	
7	OE	FPP401	Food Packaging Technology Lab	0	0	2	1	Engineering
			TOTAL				**16**	

Programme Structure
Sharda School of Engineering & Technology
B.Tech.-Food Process Technology
Batch: 2023 -2027
Term: 08

S. No.	**Course Type (Code)**	**Course Code**	**Course Title**	L	T	P	C	Category ofCourse
1	PC	FPP452	Major Project - 2	0	0	16	8	Engineering
			TOTAL				**8**	

Total Credits all Semesters	**160**

Course Modules

(B.Tech. Food Process Technology)

FPE101 Introduction to Food Process Engineering

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: I**	
1	Course Code	FPE101	
2	Course Title	**Introduction to Food Process Engineering**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The 'Introduction to **Food Process Engineering**' course aimed to provide theories and principles of equipment used in various unit operations of food industry.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Analyze, identify, characterize, and classify the need of different unit operations at different times. CO2: Classify and build knowledge for different high temperature food Preservation operations and their machines/equipment's. CO3: Discuss the concepts of food preservation. CO4: Assess and build knowledge for dehydration in food processing operations and their machines/equipment's. CO5: Elaborate concept of refrigeration and freezing. CO6: Estimate the impact of these operations in food industry.	
7	Course Description	This course covers basic introductory concepts of food engineering with emphasis on their working principles and its application. Topics include thermal and non-thermal methods and the various equipment's used in between.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Food Process Engineering	**CO1, CO6**
	A	Units and Dimensions	
	B	Scope and importance of Food Process Engineering- preliminary operations –cleaning, grading, sorting, washing, cutting – equipment used.	

	C	Unit operations involved in Food processing (Food Preparation)			
	Unit 2	**Processing Methods**			**CO2, CO6**
	A	Concepts and equipment used in Blanching, pasteurization , sterilization.			
	B	Extrusion			
	C	Microwave processing of foods			
	Unit 3	**Principles of Food Process Engineering**			**CO3, CO6**
	A	Thermal and electrical properties of foods			
	B	Rheological Properties of food			
	C	Food preservation by Radiation			
	Unit 4	**Drying and Dehydration of foods**			**CO4, CO6**
	A	Cereals			
	B	Fruits and Vegetables			
	C	Freeze drying			
	Unit 5	**Refrigeration and Freezing**			**CO5, CO6**
	A	Principles of refrigeration; second law of thermodynamics applied to refrigeration			
	B	Freezing: Plank's law and estimation of freezing time of foods; equipment, freeze concentration of liquid food. Rate of freezing.			
	C	Refrigeration and freezing in food industry; types of refrigeration system			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Brennan, J.G., Butters, J.R., Cowell, N.D. and Lilly			

		AEI. (Eds.). (1990). *Food Engineering Operations*. Elsevier. ISBN: 978-1851664443	
	Other References	1.Fellows P. (Eds.). (2022). *Food Processing Technology: Principle and Practice*. 5th edition. Woodhead publishing. ISBN: 9780323857376.	

FPE201 Food Chemistry

School: SSET		**Batch: 2023-2027**
Programme: B. Tech		**Current Academic Year:2023-2024**
Branch: FPT		**Semester: II**
1	Course Code	FPE201
2	Course Title	Food Chemistry
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Compulsory
5	Course Objective	The course is designed to acquire knowledge of principle and techniques involved in food chemistry along with analysis of carbohydrates, lipids, fats and minerals and its relation with human nutrition.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Analyze depth and breadth of knowledge in food chemistry by demonstrating knowledge of, and applying, the principles and concepts of chemistry as they apply to food systems. CO2: Develop an understanding of the principles of carbohydrates whereby food molecules can be selected for use as ingredients in food formulations. and the related factors that might be controlled during to enhance product quality. CO3: Inspect the physico-chemical and functional properties of proteins. CO4: Evaluate the importance of fats in food processing. CO5: Discuss the various aspects of minerals and vitamins. CO6: Investigate and solve qualitative and quantitative problems in food chemistry, both individually and in teams, by synthesizing and evaluating information from a range of sources, including traditional and emerging technologies.
7	Course Description	The course will deal with the chemistry of the principal components of foods, their properties and interactions, and the changes that occur during processing, storage, and utilization. Emphasis will be on evidence derived from original research literature, interpretation of research findings, and problem solving based on the scientific principles of food chemistry.
8	Outline syllabus	CO Mapping

	Unit 1	**Introduction**			
	A	Introduction to different food groups and importance of food chemistry			CO1, CO6
	B	Water in foods and its properties			
	C	Proximate analysis in foods			
	Unit 2	**Carbohydrates**			
	A	Carbohydrate: Sources of food carbohydrates			CO2, CO6
	B	Physico-chemical and functional properties			
	C	Chemistry and structure of homosaccharide and heterosachharide.			
	Unit 3	**Proteins**			
	A	Proteins: Sources and physico-chemical and functional properties; Purification of proteins			CO3,CO6
	B	Changes in protein during processing, protein determination methods.			
	C	Proteins from plant and animal sources.			
	Unit 4	**Fats**			
	A	Fats: Sources and physico chemical and functional properties; PUFA [Poly-unsaturated Fatty Acids] hydrogenation and rancidity;			CO4, CO5
	B	Saponification number, iodine value, Reichert-Meissl number, Polenske value;			
	C	Lipids of biological importance like cholesterol and phospholipids. Changes during food processing.			
	Unit 5	**Minerals and Vitamins**			
	A	Minerals and Vitamins: Sources and structures of minerals & vitamins;			CO5, CO6
	B	Effect of processing and storage of vitamins, Pro vitamins A & D; Vitamins as antioxidants;			
	C	Food Pigments & Flavoring Agents: Importance, types and sources of pigments - their changes during processing and storages.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Swaminathan, M., (Ed.). (1973). *Advanced text book on Food and Nutrition* Vol. 1 & 2. The Bangalore Press. ASIN: B078T9R2YJ			

	Other References	2. Muyer, L.H., (Ed.). (2006). *Food Chemistry*. CBS Publishers & Distributors. ISBN: 9788123911496.	

FPP201: Food Chemistry Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: II**
1	Course Code	FPP201
2	Course Title	Food Chemistry Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The course is designed to acquaint the students with basic techniques of Food Chemistry. To make students familiar with the different approaches of slide preparation. To make students learn concept of cell identification, cell division, chromosome study etc. through hands-on experiments.
6	Course Outcomes	After finishing the course, the students will be able to CO1: Examine basic set up and working of food chemistry lab CO2: Analyze the techniques of lipid estimation CO3: Inspect techniques for protein estimation CO4: Estimate adulterants used in foods. CO5: Discuss methods for proximate analysis in foods CO6: Elaborate concepts for chemical composition estimation in food systems
7	Course Description	Food Chemistry Lab course is designed to make students learn the basic techniques of proximate analysis. The students also learn basic composition of food and their role in quality analysis.

List of Practicals:

S. No.	Experiment	CO Mapping
1.	Introduction safety measures in Food Chemistry Lab	CO1, CO6
2.	Effect of heat and Ph on color and texture of green vegetables.	CO2, CO6
3.	Determination of ash content in given food samples	CO2, CO6
4.	Determination of carbohydrates in samples	CO2, CO6
5.	Determination of fat in food sample	CO3, CO6
6.	Oxidative Rancidity in Potato Chips	CO3, CO6
7.	Determination of moisture in a given food sample	CO4, CO6
8.	To find gluten content present in different food samples	CO4, CO6
9.	Identification of pigments in given food samples	CO5, CO6
10.	To perform the isoelectric precipitation of casein present in milk.	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1. Miller, D.D. (Eds.). (2022). *Food Chemistry: A laboratory manual*. 2nd edition.Wiley. ISBN 978-0-470-639-931-3			
Other References	2.Weaver, M.C. and Daniel, J.R. (Eds.). (2023). *The Food Chemistry Laboratory.* CRC Press ISBN: 9780470631232.			

FPE301 Instrumentation for Food Quality Analysis

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: 03**	
1	Course Code	FPE301	
2	Course Title	Instrumentation for Food Quality Analysis	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	The course is designed to introduce and describe instruments for analyzing rheological properties of food, spectroscopic instruments used for analysis of foods and their scope. The course will also describe chromatographical techniques used in sensory analysis of foods.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Appraise the basic concept of food quality assessment and the requirements necessary for its application. CO2: Develop an idea for the appropriate methodologies' types of techniques for food quality evaluation purpose. CO3: Describe instruments to find thermodynamic and thermal properties of food. CO4: Elaborate about various chromatographic techniques used in food analysis. CO5: Demonstrate experimentally among various scales used for sensory evaluation. CO6: Analyze the difference between various instruments used in quality analysis and their applications.	
7	Course Description	The '**Instrumentation for food quality analysis**' course outlines the different instrumental techniques for food analysis, forthermodynamic, thermal, rheological, textural and sensory properties and to use chromatographic and spectroscopic techniques.	
8	Outline syllabus		CO Mapping
	Unit 1	**Food rheology analysis**	CO1, CO6
	A	Viscometers	
	B	Powder Rheometers	
	C	Rheometers	
	Unit 2	**Spectroscopic instruments**	

	A	UV visible spectroscopy			
	B	Atomic absorption Spectroscopy			
	C	FT-IR, NMR and ICPi			CO2, CO6
	Unit 3	**Thermal methods of analysis**			
	A	Thermogravimetry			
	B	Differential thermal analysis			
	C	Scanning Electron microscope			CO3, CO6
	Unit 4	**Chromatographic techniques**			
	A	Gas chromatography			
	B	Liquid chromatography			
	C	High performance thin layer chromatography			CO4, CO6
	Unit 5	**Sensory analysis**			
	A	Electronic nose			
	B	Colorimeter			
	C	Texture analyzer			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Ibtisam, E.T. (Ed.). (2003). *Rapid and on-line instrumentation for food quality assurance*. Woodhead Publishing Limited. ISBN: 9780429134951.			
	Other References	1.Kilcast, D., (Ed.). (2013). *Instrumental Assessment of food sensory quality*. Woodhead Publishing Limited, ISBN: 9780429234951.			

FPE202 Food Microbiology

School: SSET		**Batch: 2023-2027 onwards**
Programme:B.Tech		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: III**
1	Course Code	FPE202
2	Course Title	Food Microbiology
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	**Compulsory**
5	Course Objective	The course is designed to prepare students with a basic understanding of the microbes involved in biological processes such as fermentation and spoilage. The course provides a foundation for careers in microbiology, food engineering, or research in all branches of food sciences and technology.
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Determine the role and significance of intrinsic (i.e. aw, pH, etc.) and extrinsic (gases in the environment, etc.), factors in the growth and response of microorganisms. CO2: Develop knowledge of important pathogens and spoilage mechanisms in foods to control food contamination of food. CO3: Discuss the principles of food preservations and to describe the different food preservation methods. CO4: Evaluate the process of fermented food products and their preservation. CO5: Elaborate the issues of food borne diseases and preventive practices in food processing operations. CO6: Compile the principles and current practices of processing techniques and how they can impact food safety and food quality.
7	Course Description	This course covers the characteristic of microbial growth, intrinsic and extrinsic factors and their relationship to microbial growth; the principles of food fermentation and the role of beneficial microbes; the role of

		microorganisms and food spoilage; pathogenic microorganisms, infection and intoxication, mycotoxin, viruses and parasites; the principles to control microbial growth; as well as qualitative and quantitative microbiological analysis.	
8	Outline syllabus		CO Mapping
	Unit 1	**Microorganisms in food**	
	A	Importance of microorganisms in food, History of Microorganisms in Food Developments	CO1, CO6
	B	Intrinsic and extrinsic parameters of food affecting microbial growth	
	C	Types of microorganisms in foods like meats, poultry, seafood, vegetables, dairy products, fruits and vegetables.	
	Unit 2	**Microbial spoilage**	
	A	Principles and types of spoilage, Microbial spoilage of spoilage of fruits and vegetables, fresh and processed meats.	CO2, CO6
	B	Microbial spoilage of poultry, sea foods, cereals, flour, dough, bakery products, dairy products and canned foods.	
	C	Assessing microbial load in foods – microscopic, cultural, physical, chemical and immunological methods.	
	Unit 3	**Preservation of foods**	
	A	Food preservation principles, Factors affecting preservation	CO3, CO6
	B	Food preservation using temperature low temperature food preservation high temperature food preservation	
	C	Preservation of foods by drying, chemicals and radiation with limitations and commercial applications.	
	Unit 4	**Fermented and microbial foods**	
	A	Fermented foods-vegetables, fruits ,dairy products.	CO4, CO6
	B.	Fermented meat and fish products, alcoholic and non alchoholic fermented drinks. Oriental Foods, Probiotics and Prebiotic	
	C	Tempeh, Soy sauce, Sauerkraut, Yoghurt, Kefir, Kumis, Acidophilus milk, Bulgaricus milk, Baker's yeast, Beer, Cider Vinegar, Indigenous food products; Nutritional and therapeutic values of fermented foods	

	Unit 5	**Food borne diseases and safety**			
	A	Food borne infections and intoxications– food poisoning-botulism – salmonellosis – gastroenteritis, food borne pathogens – *Clostridium, Bacillus ceres, Staphylococcus aureus, Vibrio, Campylobacter,Yersinia* .			CO5 and CO6
	B	Prevention of food-borne diseases; Food Hazards. HACCP			
	C	Indicators of food safety food processing plant sanitation. Microbiological standards and guidelines			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Jay, J.M., Loessner, M.J. and Golden, D.A. (Eds.). (2006). *Modern food microbiology*. 7th edition. Springer. ISBN 0-387-23180-3.			
	Other References	1. Frazier, W.C. and Westhoff, D.C. (Eds.). (2013).*Food microbiology*. 5th edition. Tata McGraw Hill Publishing Co. ISBN 9781259062513, 9781259062513			

FPE213 Unit Operations in Food Processing

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: 03**	
1	Course Code	FPE213	
2	Course Title	Unit Operations in Food Processing	
3	Credits	4	
4	Contact Hours (L-T-P)	4-0-0	
	Course Status	Compulsory	
5	Course Objective	The '**Unit Operation in Food Processing**' course will provide knowledge of unit operations and processes like size reduction, mixing, distillation, filtration, extraction, adsorption, separation, crystallization, evaporation, drying, heat exchange, cooling/ freezing, etc.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Utilize basics of transport phenomena, unit operations, and unit food processes. CO2. Explain the size reduction, mixing, and emulsification in relation to food processing. CO3: Discuss the principles of separation, filtration, distillation, and extraction in food processing applications. CO4: Interpret absorption/adsorption, crystallization, and dryingfor food processing CO5: Conclude concept heat exchangers, evaporation/ concentration, cooling, and freezing processes for food processes. CO6: Elaborate unit operations which are used in food processing like size reduction, mixing, separation, filtration, evaporation, absorption, extraction, distillation, freezing, cooling and dehydration.	
7	Course Description	This course is related to basics as well as applications of different unit operations in food processing. Generally, in all food processing operations size reduction, mixing, heat exchange, distillation absorption, cooling/ freezing, etc. are used.	
8	Outline syllabus		CO Mapping
	Unit 1	**Basics of unit operations**	
	A	Unit operations classifications, unit processes	CO1, CO6
	B	Material and energy balance	
	C	Fluid flow theory and applications	
	Unit 2	**Size reduction, mixing and emulsification**	

	A	Size reduction- Grinding/cutting, Energy used, Performance evaluation, Equipment			CO2, CO6
	B	Mixing-Measurement, Energy used, Mixing equipment			
	C	Emulsification-dispersion/continuous phase, emulsifying agents, homogenization,			
	Unit 3	**Separation, filtration, distillation, condensation, and extraction**			
	A	Mechanical Separation, Filtrations-rates and resistance of cake filters, filtration equipment			CO3, CO6
	B	Contact phase equilibrium, Distillation, Condensation, types and equipment			
	C	Extractions -extraction and washing equipment, Rate, stage and equipment, Critical Fluid extraction			
	Unit 4	**Absorption/Adsorption, crystallization, and drying**			
	A	Absorptions-gas absorption, rate, stage and equipment of absorption			CO4, CO6
	B	Crystallization –principles, equipment and applications			
	C	Psychrometry, Mass transfer, Drying and dehydration-basic theory, dryer efficiencies, and equipment			
	Unit 5	**Heat exchangers, Evaporation/ Concentration, Cooling, and Freezing**			
	A	Types of heat exchangers, materials of construction, fouling, heat transfer coefficients, analysis and performance evaluation of heat exchangers, design of heat exchangers			CO5, CO6
	B	Evaporations and concentration-single effect and multiple effect evaporators, evaporation equipment, and concentrators			
	C	Food freezing and cooling-Freezing and cooling temperature, thermal properties, freezing/cooling time, design of systems and equipment			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ibarz, A. and Canovas, G.V.B. (Eds.). (2003). *Unit operations in Food Engineering*. 1st edition. CRC Press. ISBN: 9780429134951.			
	Other References	1.Varzakas, T. and Tzia, C. (Eds.). (2014). *Food Engineering Handbook*. 1st edition. CRC Press. ISBN:9781482261660.			

FPP202 Food Microbiology Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch:FPT		**Semester:03**
1	Course Code	FPP202
2	Course Title	Food Microbiology Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The course is designed to acquaint the students with basic techniques of Food Microbiology and to make students familiar with the different approaches of microbe identification and plating techniques.
6	Course Outcomes	After completion of the course the students will be able to: CO1: Examine common aseptic techniques used in the microbiology laboratory. CO2: Discuss technique of media preparation. CO3: Elaborate method for isolation of microorganism. CO4: Classify basic techniques used in the observation and identification of microorganisms. CO5: Justify various biotechniques in enumeration of different compounds. CO6 : Appraise concept of food microbiology in the food systems.
7	Course Description	The course will introduce students to methods used in microbiological examination of foods. Students will be exposed to practical training on isolating, purifying and identification of microorganisms in different foods.

List of Practical's:

S. No.	Experiment	CO Mapping
11.	Introduction of safety measures in Food Microbiology Lab	CO1, CO6
12.	To learn the importance of cleaning and sterilization of lab wares used in microbiology	CO2, CO6
13.	Preparation of nutrient agar media.	CO2, CO6
14.	Preparation of potato dextrose agar.	CO2, CO6
15.	To plate the milk samples by spread and pour plate technique	CO3, CO6
16.	To determine the Aerobic Mesophilic Plate count in food sample.	CO3, CO6
17.	To obtain isolated microbial colonies from an inoculum by creating areas of increasing dilution on an agar petri plate.	CO3, CO6
18.	To study different various phases of bacterial growth	CO4, CO6
19.	To study methylene blue reductase test for given milk samples	CO5, CO6
20.	Fermenter design and requirements of the microbial systems	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1.Nollet, L.M.L. (Eds.). (2006). *Handbook of Water Analysis*. 2nd edition. Taylor and Francis Group. ISBN9780429123597.			
Other References	1. Downes, F.P. and Ito, K. (Eds.). (2001). *Compendium of Methods for the Microbiological Examination of Foods.* American Public Health Association.			

FPE205 Dairy Engineering

School: SSET		**Batch: 2023-2027 onwards**
Programme: B. Tech		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: IV**
1	Course Code	FPE205
2	Course Title	Dairy Engineering
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	**Compulsory**
5	Course Objective	To introduce students to an understanding of milk constituents with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporation, freezing and drying of milk.
6	Course Outcomes	By the end of this course, students should be able to: CO1: Classify the composition of milk, identify the approximate content of individual types present, and describe physicochemical characteristics of the main components. CO2: Justify the importance of processes like sterilization, homogenization and aseptic packaging. CO3: List potential applications and efficiency of various equipment used in dairy products processing. CO4: Analyze the production of milk products substitutes. CO5: Assess key functions in production steps, standards and defects of various dairy products. CO6: Elaborate their knowledge of food chemistry/engineering/microbiology and physical properties of foods to understand the processing of dairy products.
7	Course Description	Dairy Engineering deals with the processing of milk and its products. This field involves the use of "Technology and Engineering" to make the dairy products and processing more advanced and useful.

8	Outline syllabus	CO Mapping

	Unit 1	**Pasteurization**	
	A	Milk-physical, chemical and functional properties-composition -reception and storage-testing—milk grading and defects-cooling of milk.	CO1, CO6
	B	Pasteurization – principles, objectives and methods. LTLT/holding pasteurization-types, advantages and disadvantages. HTST pasteurization- functions of HTST pasteurizer, advantages and disadvantages	
	C	Clean- in- Place process	
	Unit 2	**Sterilization and Homogenization**	
	A	Sterilization-In bottle sterilization, UHT processing-advantages-difficulties, Indirect heating systems using plate heat exchangers, Direct heating-Fouling of heat exchangers. -	CO2, CO6
	B	Homogenization theory, mechanism, factors influencing homogenization , merits and demerits.	
	C	Aseptic filling systems : cartons, plastic pouches, plastic bottles	
	Unit 3	**Centrifugation, Bactofugation and Membrane separation**	
	A	Principles of Centrifugation, clarification, standardisation.Components of cream separators, factors affecting fat percentage in cream ,fat loss in skim milk.	CO3, CO6
	B	Membrane processing-principles of -Reverse osmosis - Ultra filtration and Electro dialysis.	
	C	Bactofuge treatment, Factors affecting bactofugation and its application.	
	Unit 4	**Manufacturing of milk products and substitutes**	CO4, CO6
	A	Technology of condensed and evaporated milk	
	B	Casein, Lactose, Whey protein concentrates and isolates	
	C	Milk powder – Whole Milk Powder and Skim Milk Powder ,Spray dryer construction and powder recovery system.	
	Unit 5	**Manufacturing of dairy based products**	
	A	Yogurt,Butter, Buttermilk and Ice cream manufacturing	CO5, CO6
	B	Cream ,Cheese, Khoa and gulabjam, barfi, kalakand	

	C	Rosogolla, srikhand,channa and paneer with their defects, standards and packaging.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Sukumar, D., (Ed.). (2019). *Outline of Dairy Technology*, Oxford University Press. ISBN: 9780195611946.			
	Other References	1. Farrall, A.W., (Ed.). (2018). *Dairy and food products for Engineering*. 2nd edition. Medtech. ISBN:9386800713.			

FPE206 Food Preservation

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: IV**	
1	Course Code	FPE206	
2	Course Title	Food Preservation	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	**Compulsory**	
5	Course Objective	The aim of 'Food Preservation' course is to provide knowledge about different food processing methods of preservation like low processing techniques, high temperature processing, hurdle technology, novel thermal and non-thermal techniques of processing. It will also impart indirect preservation techniques like packaging, GMP and GHP.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Classify the low temperature processing techniques CO2. List high temperature processing techniques. CO3: Discuss different methods of hurdle technologies to preserve the food. CO4: Categorize novel thermal and non-thermal processing techniques. CO5: Discover indirect preservation techniques like packaging, GMP and GHP. CO6: Elaborate all the techniques for food preservation.	
7	Course Description	This course is related to basic and advance techniques of food preservation so that the shelf life of the product can be enhanced. Low temperature and high temperature processing methods are well known to preserve the foods but novel food preservation methods and hurdle and indirect techniques are equally important for food preservation. This course will give details of such techniques.	
8	Outline syllabus		CO Mapping
	Unit 1	**Low Temperature Preservation**	
	A	Adiabatic cooling, Cold storage	CO1, CO6
	B	Controlled atmospheric storage	
	C	Chilling, Refrigeration, Freezing	
	Unit 2	**High Temperature Preservation**	
	A	Pasteurization	CO2, CO6
	B	Canning & Sterilization	
	C	Ultrahigh temp preservation	
	Unit 3	**Hurdle technology**	
	A	Moisture & pH control	CO3, CO6

	B	MAP, CAP and surface treatments			
	C	Using antioxidants, nitrites, antimicrobials, coatings			
	Unit 4	**Novel preservation methods**			
	A	Ohmic, Radio frequency and microwave			CO4, CO6
	B	High hydrostatic pressure, irradiation			
	C	PEF, PL, ultrasound and, ozonation			
	Unit 5	**Indirect food preservation**			
	A	Packaging			CO5, CO6
	B	Good Hygiene Practices			
	C	Good Manufacturing Practices			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Rahman, M.S. (Ed). (2013). *Handbook of food preservation*. 2nd edition. CRC Press Taylor & Francis Group. ISBN9780429191084.			
	Other References	1.Sivasankar, B. (Ed). (2002). *Food processing and preservation*. Prentice hall India. ISBN: 978-8120320864.			

FPE203 : Heat and Mass Transfer

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: IV**	
1	Course Code	**FPE203**	
2	Course Title	**Heat and Mass Transfer**	
3	Credits	4	
4	Contact Hours (L-T-P)	3-1-0	
	Course Status	**Compulsory**	
5	Course Objective	This course covers the information on mechanism of conductive/convective heat transfer, including heat transfer with heat exchangers. It will impart the knowledge of mass transfer. Thermal conductivity and mass diffusivity in food processing operations will also be discussed.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Discuss conductive heat transfer, conductivity and types of heat transfer and conduction through pipes. CO2: Illustrate convective heat transfer with dimensional analysis CO3: Outline radiation heat transfer with heat exchangers CO4: Calculate mass transfer equilibria. CO5: Elaborate role of mass transfer in food and handling equipment. CO6: Recall concepts related to heat and mass transfer and its applications in food industry.	
7	Course Description	The '**Heat and Mass Transfer'** course outlines the different methods of heat and mass transfer in foods, like heat transfer through conductive, convective and radiation and mass transfer by different ways and to discuss heat and mass transfer diffusivity.	
8	Outline syllabus		Outline syllabus
	Unit 1	**Conductive heat transfer**	
	A	General equations, thermal conductivity,	CO1, CO6
	B	Steady and unsteady state heat transfer	
	C	Conduction through pipes	
	Unit 2	**Convective transfer**	
	A	Dimensionless analysis	CO2, CO6
	B	Free and force convection heat transfer coeff.,	
	C	Condensation: Condensation heat transfer, film condensation on vertical plates, boiling and Evaporation-Types,capacity,Single and multiple effect	

	Unit 3	**Radiation heat transfer and heat exchangers**			
	A	Black and grey body radiation			CO3, CO6
B		Heat exchangers types, heat transfer coeff.,, heat exchanger mean temperature difference, effectiveness and numbers of units			
C		Radiative exchanges between bodies			
Unit 4		**Equilibrium mass transfer**			
A		Phase equilibria, diffusion			CO4, CO6
B		Diffusivity in solids			
C		Interphase mass transfer			
Unit 5		**Mass Transfer**			
A		Moisture transport			CO5, CO6
B		Diffusion Steady and unsteady state			
C		Convective mass transfer, Simultaneous heat and mass transfer			
Mode of examination		Theory			
Weightage Distribution		CA	MTE	ETE	
		25%	25%	50%	
Text book/s*		1.Datta, H.K. (Eds.). (2002). *Biological and bioenvironmental Heat and mass transfer*. Taylor and Francis. ISBN9780429222337.			
Other References		2.Fellows P. (Eds.). (2022). *Food Processing Technology: Principle and Practice*. 5th edition. Woodhead publishing. ISBN: 9780323857376.			

FPP205 Dairy Engineering Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester:IV**
1	Course Code	FPP205
2	Course Title	Dairy Engineering Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The objective of the course is to identify the basic instruments used in dairy technology and their importance along with isolation and characterization of microorganisms. The student will also become familiar with presence of foreign adulterants in milk samples.
6	Course Outcomes	After completion of the course the students will be able to: CO1: Discuss common aseptic techniques used in the dairy technology. CO2: Examine the importance of milk sample preparation. CO3: Design experiments used for adulterants in milk and products. CO4: Discuss basic techniques used in the estimation of platform tests. CO5: Justify adulterants and their effects on human wellbeing. CO6: Elaborate various techniques for preparation of different milk products.
7	Course Description	The course will introduce students to methods used in chemical examination of milk products. Students will be exposed to practical training on chemical testing of milk based products.

List of Practical's:

S. No.	Experiment	CO Mapping
21.	To prepare sample of milk and milk products for testing.	CO1, CO6
22.	To perform platform tests in milk.(Acidity, COB, MBRT, Specific Gravity, SNF)	CO2, CO6
23.	To estimate milk fat by Gerber method.	CO2, CO6
24.	Preparation of flavored milk	CO2, CO6
25.	To prepare casein and calculate its yield.	CO3, CO6
26.	Estimation of different adulterants in milk.	CO3, CO6
27.	Detection of starch or cereals in milk.	CO4, CO6
28.	Determination of cane sugar in milk	CO4, CO6
29.	To estimate milk protein concentration of given sample.	CO5, CO6
30.	Development of different types of khoa	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1.FSSAI manual for Dairy products.			
Other References	1. Downes, F.P. and Ito, K. (Eds.). (2001). *Compendium of Methods for the Microbiological Examination of Foods.* American Public Health Association.			

FPP206: Food Preservation Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: 4**
1	Course Code	FPP206
2	Course Title	Food Preservation Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Compulsory
5	Course Objective	The course is designed to acquaint the students with basic knowledge about need of food preservation and learn various preservation techniques used in preservation of foods.
6	Course Outcomes	After finishing the course the students will be able to CO1: Examine major food preservation techniques and underlying principles. CO2: Analyze the preservation skills of different food products CO3: Examine the importance and basic principles of food preservation CO4: Examine different preparatory unit operation for food processing CO5: Design and develop different preserved food products CO6: Originate concepts to process and preserve the shelf life of food products.
7	Course Description	Food Preservation Lab course is designed to provide the information about different preservation techniques that influence the quality of food materials during processing. Students will also get knowledge about handling of these food items on scientific lines and will get information about the production of quality products. These different techniques will be helpful to process and preserve the shelf-life offoodproducts

List of Practical's:

S. No.	Experiment	CO Mapping
31.	To study the changes in fruits/vegetables during storage	CO1, CO6
32.	To study the TSS and preparation of Brine and syrup	CO2, CO6
33.	To study blanching of seasoned fruits and vegetables	CO2, CO6
34.	Preparation of Jam	CO2, CO6
35.	Preparation of Jelly	CO3, CO6
36.	Preparation of Squash	CO3, CO6

37.	Pickel preparation	CO4, CO6
38.	Preparation of fruit bars.	CO4, CO6
39.	Preparation of sauerkraut	CO5, CO6
40.	To study dehydration of fruits and vegetables.	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1.Rahman, M. S. (Ed.). (2007). Handbook of food preservation. CRC press. ISBN eBook ISBN9780429191084			
Other References	2.Fellows P. (Eds.). (2022). *Food Processing Technology: Principle and Practice*. 5th edition. Woodhead publishing. ISBN: 9780323857376.			

FPE 302 Technology of Meat, Marine and Poultry Products

School: SSET		**Batch : 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: V**
1	Course Code	FPE302
2	Course Title	Technology of Meat, Marine and Poultry Products
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	**Compulsory**
5	Course Objective	The course is designed to prepare students with a basic understanding of the steps involved in processing of meat, marine and poultry products. . The course provides a foundation for careers in poultry and meat industry.
6	Course Outcomes	CO1: Determine the current market scenario of meat, marine and poultry industry. CO2: Analyze the role of pre and post handling systems for better meat quality. CO3: Examine important techniques and processes in shelf life extension of meat and meat based products. CO4: Discuss the composition and quality parameters of egg and poultry products. CO5: Elaborate the basic handling practices and processing of marine products. CO6: Describe the principles and current practices of processing techniques and how they can impact food safety and food quality in meat industry.
7	Course Description	In this course, students will acquire a survey of knowledge of processing of slaughter animals, their quality classification and handling of animal. This course deals with the processing of marine and poultry products.
8	Outline syllabus		CO Mapping
	Unit 1	**Pre treatment of meat**	
	A	Status of meat poultry and fish industry in India; Sources and importance of meat, poultry and fish.	CO1, CO6
	B	Structure and composition of muscle, types, classification and composition of fish. Pre-slaughter operations and slaughtering operations for animals and poultry.	
	C	Abattoir design and layout	
	Unit 2	**Post slaughter treatment**	

	A	Post slaughter care,post mortem and rigour mortis .			CO2, CO6
	B	Biochemical changes in meat.			
	C	Tenderization of meat by natural or artificial enzymes.			
	Unit 3	**Meat preservation**			
	A	Traditional methods for meat preservation			CO3, CO6
	B	Novel methods for meat preservation (Low dose irradiation, hurdle concept and high pressure treatment)			
	C	Preparation, preservation and equipment for manufacture of meat sausages and dehydrated meat products.			
	Unit 4	**Egg and Poultry Processing**			
	A	Eggs: Structure, composition, quality characteristics, processing, preservation of eggs.			CO4, CO6
	B	Manufacturing of egg powder, frozen egg.			
	C	Dressing , grading, laughtering ,scalding, Mechanical defeathering ,eviscerating, preservation, Quality control and standardization of poultry meat.			
	Unit 5	**Marine Processing**			
	A	Sea food nutritional composition, fishing resources transportation of fish, grading			CO5, CO6
	B	sea food products and processing , preservation methods			
	C	Surumi process, Quality control in fish processing.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Vikas Nanda. (Ed). 2014. *Meat, Egg and Poultry Science & Technology*. I.K. International Publishing House Pvt. Ltd.			
	Other References	1.B.D. Sharma and Kinshuki Sharma. (Eds.). (2011). *Outlines of Meat Science and Technology*. Jaypee Brothers Medical Publishers Pvt. Ltd.			

FPE312 Food Safety

School: SSET		**Batch: 2023-2027**	
Programme : B.Tech.		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: V**	
1	Course Code	FPE312	
2	Course Title	Food Safety	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	**Compulsory**	
5	Course Objective	The course is designed to prepare students with a basic understanding and importance of food safety involved in food processing and spoilage. The course provides a foundation for careers in total quality managementand national and international food regulations.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Classify and identify the food contaminants influencing the safety of agricultural and processed products. CO2: Assess the responsibilities of food handlers regarding food safety including their legal responsibilities. CO3: Analyze the importance of food safety management systems and different regulatory frameworks across the globe. CO4: List requirements for completing documentation for implementing a prerequisite Programme. CO5: Discuss and apply the national and international legislation/ regulation. CO6: Elaborate the principles and current practices of processing techniques and how they can impact food safety and food quality.	
7	Course Description	To provide the students with an understanding of food contaminants and how to control the factors influencing the safety of agricultural products, and also to implement management system to ensure the safety of agricultural products.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Food Safety**	

	A	Definitions - food safety and quality, General principles of food safety and quality.	CO1, CO6

		Hazards - physical, chemical and biological, Role of Cross contamination.			
	B	Limits for pesticide residues in foods			
	C	Metal contamination of food			
	Unit 2	**Management of hazards**			
	A	Need of controlling of critical parameters, Design of food plant, Temperature Danger Zone and Storage of Food.			CO2, CO6
	B	Role of Handler, Personal Hygiene of Handler, Quality of Water and its analysis, Hygiene and Sanitation in Food Service Establishments. CIP/ COP; Methods of Rodent Control.			
	C	SOP, Seamless abd integrated cold chain, HACCP			
	Unit 3	**Role of Quality Assurance and Control**			
	A	Quality Control, Quality Assurance, Concepts of quality control and quality assurance functions in food industries. Safety and quality nexus			CO3, CO6
	B	Quality Improvement Total Quality management: Quality evolution, defining TQM, principals of TQM, stages in implementation, TQM road map.			
	C	Quality improvement tools, customer focus, cost of quality. GAP, GMP, GHP, etc.			
	Unit 4	**International standards and organizations**			
	A	Food and Drug Administration Act (FDA),International Organization for Standards (ISO) and its implication, European Council (EU) .			CO4, CO6
	B	Codex *Alimentarius* Commission (CAC), Total Quality Management (TQM), Good Manufacturing Practices (GMP).			
	C	Good Agricultural Practices (GAP), Good Hygienic Practices (GHP), Good Manufacturing Practices			
	Unit 5	**Indian laws and Standards**			
	A	National Food Regulation-FSSA and important regulatory Agencies (FSSAI), Prevention of Food Adulteration Act (PFA) and Food safety standards bill, Fruit Products Order (FPO).			CO5 and CO6
	B	Bureau of Indian Standards (BIS), Agricultural Grading and Marketing (AGMARK).			
	C	The Agricultural and Processed Food Product Export Development Authority (APEDA).			
	Mode of examination	Theory			
	Weightage	CA	MTE	ETE	

	Distribution	25%	25%	50%	
	Text book/s*	1.Lawley, R., Curtis L. and Davis,J. (Eds.). (2012). *The Food Safety Hazard Guidebook*. 2nd edition. RSC Publishing. ISBN: 978-1-84973-381-6.			
	Other References	1. Vries, J. D. (Eds.). (2021). *Food Safety and Toxicity*.1st edition. CRC Press. e Book ISBN: 9780367803049.			

\

FPE306 Advanced Food Process Engineering

School: SSET		**Batch : 2023-27**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VI**	
1	Course Code	FPE306	
2	Course Title	**Advanced Food Process Engineering**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	The '**Food Process Engineering**' is aimed to provide theories and principles of high and low thermal processing techniques like drying and dehydration, chilling and freezing, frying, baking and roasting.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Develop the concept for role of temperature in inactivation of microorganisms. CO2: Appraise drying and dehydration theory and their efficiencies . CO3: Apply theory of refrigeration, chilling and freezing of foods in industry. CO4: Assess freeze drying theory and equipment used along with the applications. CO5: Justify principles of frying, baking and roasting of foods. CO6: Elaborate working principles and theory of different thermal processes used in food processing.	
7	Course Description	The '**Food Process Engineering'** course outlines the theories and working principle in different food processing operations like drying and dehydration, Chilling and freezing, freeze drying, frying, baking and roasting.	
8	Outline syllabus		CO Mapping
	Unit 1	**Thermal processing**	
	A	Kinetics of thermal inactivation of microorganism	CO1, CO6
	B	Lethality in thermal processes, heat transfer	
	C	Methods and equipment	
	Unit 2	**Drying and dehydration**	
	A	Basic drying theory,	CO2, CO6
	B	calculation of drying times, dryer efficiencies	
	C	classification and selection of dryers	
	Unit 3	**Refrigeration, chilling and freezing**	
	A	Effect of temperature	CO3, CO6
	B	Freezing, freezing kinetics	
	C	Effect of freezing on product quality	
	Unit 4	**Freeze drying**	
	A	Sublimation of water, heat and mass transfer	

	B	Freeze drying in practice			CO4, CO6
	C	Freeze concentration			
	Unit 5	**Frying baking and roasting**			
	A	Frying kinetics			CO5, CO6
	B	Baking			
	C	Roasting			
	Mode of examination	**Theory**			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1.Brennan, J.G., Butters, J.R., Cowell, N.D. and Lilly AEI. (Eds.). (1990). *Food Engineering Operations*. Elsevier. ISBN: 978-1851664443			
	Other References	1.Fellows P. (Eds.). (2022). *Food ProcessingTechnology: Principle and Practice*. 5th edition. Woodhead publishing. ISBN: 9780323857376.			

FPP302: Technology of Meat, Marine and Poultry Products Lab

School: SSET		**Batch: 2023-27**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester:**	
1	Course Code	FPP302	
2	Course Title	Technology of Meat, Marine and Poultry Products Lab	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	This course will develop the importance of meat and poultry industry in nation's economy. The students shall gain knowledge of the processing and preservation of meat, poultry and seafoods.	
6	Course Outcomes	After successfully completion of this course students will be able to: CO1 : Learn safety measures required in modern abattoir. CO2 : Understand various techniques for meat handling to work in contamination free environment. CO3 : Prepare media for culturing spoiling microorganism prevalent in meat supply chain. CO4 : Demonstrate preservation techniques for meat preservation. CO5 : Develop meat and marine based new product with extended shelf life. CO6 : Learn various methods to isolate, handle, store and work with various micro-organisms under aseptic conditions	
7	Course Description	This course is been designed to make student understand the processing and preservation technologies for meat, poultry and marine foods.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on safety measures in modern and traditional abattoir.**	CO1,CO6
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 2	**Practical related to Meat handling**	CO2, CO6
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 3	**Practical related to culturing media for spoilage causing micro organisms**	CO3, CO6
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 4	**Practical related to meat preservation**	CO4, CO6
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 5	**Practical related to shelf life extension in novel meat products**	CO5,CO6
		Sub unit - a, b and c detailed in Instructional Plan	
	Mode of	Practical	

	examination				
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	Practical Manual of Meat and Meat Products by FSSAI.			

FPP308: Technology of Cereals, Pulses and Oilseeds Lab

School: SSET		**Batch: 2023-27**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VI**	
1	Course Code	FPP308	
2	Course Title	**Technology of cereals, pulses and oilseeds lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Compulsory	
5	Course Objective	The objective of the course is to bridge the gap between theoretical concepts and practical aspects in industrial settings and in-depth knowledge of laboratory/industrial skills required for employment or for creation of employment in cereal processing.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Explain the concept of baking. CO2: Understand the different types of oilseeds and their advantages and disadvantages. CO3: Understand the use of chemical preservative permissible limit in bakery and pulse industry. CO4: Estimate the carbohydrate, lipids, proteins and enzyme activity in baked goods. CO5: Apply protocols for testing rheological properties of dough. CO6: Discuss the on-field application of cereal, pulses and oilseed industry.	
7	Course Description	This course deals with the design and development of baking processes and SOPs for the manufacturing of novel food products with pulses and cereal grains.	
8	Outline syllabus		CO Mapping
	Unit 1	**Baking concept**	
		Demonstration of working of baking unit	**CO1, CO6**
		Time and temperature combinations and their roles in baking	
	Unit 2	**Oilseeds**	
		Oilseed extraction	**CO2, CO6**
		Concept of purification	
	Unit 3	**Chemical preservation in baking**	
		Leaveners	**CO3, CO6**
		Permissible limits of Preservatives	
	Unit 4	**Analytical techniques**	
		Estimation of carbohydrates, fats and lipids.	**CO4, CO6**

	Unit 5	**Rheological properties of dough**			
		Different instruments			**CO5, CO6**
		Demonstrations			
	Mode of examination	Practical/Viva			
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	**1.Sergio- O. Saldivar (Ed). (2012).** *Cereal Grains: Laboratory Reference and Procedures Manual*. CRC Press. ISBN 143985565X			

FPE401 Food Packaging Technology

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VII**	
1	Course Code	**FPE401**	
2	Course Title	**Food Packaging Technology**	
3	Credits	3	
4	Contact hours (L-T-P)	3-0-0	
	Course Status	Compulsory	
5	Course Objective	The aim of 'Food Packaging Technology' course is to describe packaging materials and their properties including shelf life of packaging materials. The course is also intended for importance of labelling in packaging and regularity aspects also.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: List the packaging materials and their properties. CO2: Discuss shelf life of the food with different packaging techniques. CO3: Apply the concept of high moisture foods and their packaging techniques to enhance their shelf life. CO4: List packaging materials for low moisture foods like cereals and pulses, oils and fats. CO5: Analyze importance of labeling in packaging and regulatory aspects. CO6: Elaborate suitability of packaging materials with respect to perishable and non-perishable food products, different techniques for enhancing shelf life of products, precautions for high moisture foods, labelling on packaging and regulations.	
7	Course Description	The 'Food Packaging Technology' course outlines the different packaging materials of foods and their properties, packaging of high and low moisture foods and finally importance of labelling in packaging and regularity aspects.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Food packaging**	
	A	Food packaging materials	CO1, CO6
	B	Properties of Food packaging materials	
	C	Packaging selection criteria	
	Unit 2	**Food packaging and shelf life**	

	A	Active and intelligent packaging			CO2, CO3
	B	Smart packaging, MAP, CAP, Aseptic packaging			
	C	Shelf life testing methods			
	Unit 3	**Packaging of high moisture food products**			
	A	Packaging of dairy products			CO3, CO6
	B	Packaging of meat and Fish			
	C	Packaging of fruit, vegetables, and herbs			
	Unit 4	**Packaging of low moisture food product**			
	A	Packaging food grains and oilseeds			CO4, CO6
	B	Packaging of oils and fats			
	C	Packaging of spices, snacks, etc.			
	Unit 5	**Food labelling and Regulations**			
	A	Food Packaging and labelling Regulatory Issues			CO5, CO6
	B	Food packaging and Food safety			
	C	Disposal of used packaging materials			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Coles, R., Mcdowell, D., and Kirwan, M.J., (Eds.). (2009). *Food Packaging Technology*. 1st edition. Blackwell Publishing. ISBN: 978-1-405-14771-2.			
	Other References	1. Robertson, G.L. (Ed.). (2012). *Food Packaging: Principles and Practice*. 3rd edition.CRC Press Taylor& Francis Group. ISBN:978-1439862414.			

FPP401 Food Packaging Technology Lab

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year:2023-2024**	
Branch: FPT		**Semester:VII**	
1	Course Code	**FPP401**	
2	Course Title	**Food Packaging Technology Lab**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	**Compulsory**	
5	Course Objective	To introduce the technicalities of food packaging and its industrial application. To develop the ability and knowledge for selecting appropriate packaging materials of different foods.	
6	Course Outcomes	After successful completion of the course the students will be able to : CO1: Comprehend the basic concept of packaging materials and the requirements necessary for its application. CO2. Illustrate the idea for selecting packaging materials for industries. CO3. Review new and exciting developments that have taken place in the field of packaging materials like MAP and CAP. CO4. Describe the role of strength of materials in packaging. CO5. Analyze recently developed packaging techniques. CO6. Demonstrate various packaging material applications.	
7	Course Description	The course will provide an overview of food packaging material with focus on industrial applications.	
8	Outline syllabus		CO Mapping
	Unit 1	**Practical based on different packaging materials**	CO1,CO6
		Sub unit - a, b and c detailed in Instructional Plan	CO2, CO6
	Unit 2	**Practical related to dairy industry packaging materials**	
		Sub unit - a, b and c detailed in Instructional Plan	CO3, CO6
	Unit 3	**Practical related to CAP and MAP**	
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 4	**Practical related to strength of materials used in food packets**	CO4, CO6
		Sub unit - a, b and c detailed in Instructional Plan	
	Unit 5	**Practical related to recently developed packaging techniques.**	CO5, CO6
		Sub unit - a, b and c detailed in Instructional Plan	
	Mode of	Practical	

	examination				
	Weightage Distribution	CA	CE	ETE	
		25%	25%	50%	
	Text book/s*	1.Robertson, G.L. (Ed.). (2012). *Food Packaging: Principles and Practice Laboratory*. 3rd edition. CRC Press Taylor& Francis Group. ISBN:978-1439862414.			

ELECTIVE

FPT403: Applied Nutrition and Biochemistry

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VI**	
1	Course Code	**FPT403**	
2	Course Title	**Applied Nutrition and Biochemistry**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	To provide knowledge of nutrition and energy from macronutrients and micronutrients, dietary nutrition, physiological biochemistry and metabolism and clinical biochemistry	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Demonstrate basics of nutrition and energy metabolism. CO2: Develop an understanding of the major macro and micronutrients relevant to human health. CO3: Outline the importance of food composition and food regulatory issues CO4: Evaluate the scientific rationale for defining nutritional requirements in healthy individuals and populations, with reference to biochemistry and metabolism. CO5: Discuss the role of hormones in clinical biochemistry. CO6: Investigate and solve the role of nutritional elements, dietary standards, biochemistry and nutritional related regulations.	
7	Course Description	The course outlines introduction to nutrition, energy from foods, balance diet, nutrition and metabolism, physiological and clinical biochemistry	
8	**Outline syllabus**		CO Mapping
	Unit 1	**Introduction to Nutrition**	
	A	Global perspective on food and nutrition	CO1, CO6
	B	Human Nutrition	
	C	Energy from foods	

	Unit 2	**Nutrition and metabolism**			
	A	Protein and amino acids			
	B	Carbohydrates, lipids			
	C	Vitamins minerals and trace materials			CO2, CO6
	Unit 3	**Dietary Nutrition**			
	A	Dietary standard, Food Composition			
	B	Food safety and public health Issues			
	C	Regularity issues			CO3, CO6
	Unit 4	**Physiological biochemistry**			
	A	Digestion and absorption			
	B	Biological oxidation			
	C	Metabolism of biomolecules			CO4, CO6
	Unit 5	**Clinical biochemistry**			
	A	Hormones and organ function test and Nutrition			
	B	Tissue protein and body fluid			
	C	Water electrolytes and acid base balance			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Gibney, M. J., Lanham-New, S. A., Cassidy, A., & Vorster, H. H. (2013). *Introduction to Human Nutrition*, 2nd edition. Wiley Blackwell publication. ISBN:978-1439862454.			
	Other References	1. Thompson, J. L. & Manore, M. (2012) *Nutrition an applied approach*., 5th edition. Pearson Education, Inc. ISBN 978-0134516233.			

FPE208: Engineering properties of food materials

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year:**	
Branch: FPT		**Semester:VI**	
1	Course Code	**FPE208**	
2	Course Title	**Engineering properties of food materials**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The aim of 'Engineering properties of food materials' course is to introduce and explain different properties of food like surface thermodynamic and thermal properties of foods.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Demonstrate properties of food materials. CO2: Develop an understanding of surface properties of foods like surface tension, foaming, wet ability and solubility CO3: Outline the thermodynamic and thermal properties of foods. CO4: Evaluate the importance of rheology and texture properties of foods which play a very important role. CO5: Discuss electrical properties like dielectric properties. CO6: Investigate and solve engineering properties of food materials	
7	Course Description	The 'Engineering properties of food materials' course outlines the different properties of foods, like physio-chemical, surface properties, thermodynamic and thermal, rheological, textural and electrical properties and study of energy and mass balance, surface tension, foaming, thermal conductivity and diffusivity, viscoelastic behavior.	
8	Outline syllabus		CO Mapping
	Unit 1	**Properties of food materials**	
	A	Energy and mass balances in operations	CO1, CO6
	B	Physico-chemical properties of foods	
	C	Other properties of foods	
	Unit 2	**Surface Properties of Food**	
	A	Surface tension, temperature effects	CO2, CO6
	B	Emulsions	
	C	Foaming, wettability and solubility	
	Unit 3	**Thermodynamic and thermal properties of foods**	
	A	Thermal properties of foods	CO3, CO6
	B	Thermal conductivity and diffusivity	
	C	Thermodynamic properties	
	Unit 4	**Food Rheology and Texture**	

	A	Fundamental deformation and flow properties			
	B	Viscosity and viscoelastic behaviour			
	C	Gelation and food texture			CO4, CO6
	Unit 5	**Electrical properties**			
	A	Electrical properties			
	B	Dielectric properties			
	C	Microwave related properties			CO5, CO6
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Rao, M.A. & Rizvi, S.S.H. (Eds). (1986). *Engineering properties of foods*. CRC Press Taylor & Francis Group. ISBN 97802753283			
	Other References	1. Fellows, P. (Eds.). (2022). *Food Processing Technology: Principle and Practice*. 5th edition. Woodhead publishing. ISBN: 9780323857376.			

FPE307: Enzymes in Food Processing

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-24**	
Branch: FPT		**Semester: VI**	
1	Course Code	FPE307	
2	Course Title	Enzymes in Food Processing	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of the course is to develop knowledge and industrial processing, application and chemistry of enzymes.	
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Demonstrate the basic chemistry concept of enzymes and their role. CO2: Develop an understanding of the role of enzymes in baking industry . CO3: Outline the different parameters use to evaluate enzyme activity in carbohydrates, proteins and fat. CO4: Evaluate the importance of enzymes and their role in food flavors. CO5: Discuss the importance of regulation in synthesis of new enzymes. CO6: Investigate and solve the concepts of food enzymology.	
7	Course Description	Food Enzymology is an application of various enzymes found in food and their end use in new product development. The types of molecules from plant after fermentation introduce beneficial as additives in food preservation. In the future Food Enzymology offer foods with higher vitamin levels, longer shelf lives or the ability to retain as fresh even in the face of climate change. In this course, students will learn about the different bimolecular and techniques/ methods used as ingredients/ materialand their use.	
8	Outline syllabus		CO Mapping
	Unit 1	**Enzymes**	
	A	Introduction, Definition and functions	CO1, CO6
	B	characterization, kinetics and immobilization; fermentative production of enzymes (amylases, proteases, cellulases, pectinases, xylanases, lipases)	
	C	Enzymes used in food industry and their downstream processing.	

	Unit 2	**Enzymes in processing of food**			
	A	Role of enzymes in baking (fungal α-amylase for bread making; maltogenic α-amylases for anti-staling; xylanses and pentosanes as dough conditioners			CO2, CO6
	B	Lipases or dough conditioning; oxidases as replacers of chemical oxidants; synergistic effect of enzymes);			
	C	Enzymes in meat processing (meat tenderization) and egg processing.			
	Unit 3	**Role of enzymes in fruit juices**			
	A	Liquefaction, clarification, peeling, de bittering, decolourization			CO3, CO6
	B	Enzymes in brewing: Enzymes in malting and mashing, Enzymes for process improvement, starch- haze removal			
	C	Applications of enzymes: protein cross-linking and oil degumming enzymatic approach to tailor- made fats.			
	Unit 4	**Enzyme processing for flavours**			
	A	Enzyme-aided extraction of plant materials for production of flavours			CO4, CO6
	B	Production of flavour enhancers such as nucleotides; flavours from hydrolyzed animal/vegetable protein			
	C	Role of enzymes in cheese making, whey processing.			
	Unit 5	**Other applications**			
	A	Enzymes for production of protein hydrolysates and bioactive peptides			CO5, CO6
	B	Enzyme safety and regulations			
	C	Regulations of enzyme products			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Kruger, J.E. et al. (1987) (Eds). *Enzymes and their Role in Cereal Technology*. American Association of Cereal Chemists Inc.			
	Other References	1. Whitehurst, R. & Law, B. (Eds). (2002). Enzymes in Food Technology. Blackwell Publishing. ISBN 9780275335.			

FPE405 Food Additives and Toxicology

School: SSET		**Batch: 2023-2027**
Programme: B. Tech		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: VII**
1	Course Code	FPE405
2	Course Title	Food Additives and Toxicology
3	Credits	2
4	Contact Hours (L-T-P)	2-0-0
	Course Status	Programme Elective
5	Course Objective	To provide an opportunity to introduce studnets to food safety and toxicology includes the understanding of the entire range of toxic compounds found in foods, naturally occurring or used by industry.
6	Course Outcomes	After completion of this course student will be able to: CO1: Examine fundamental knowledge of processes and endpoints in the human body associated with exposure to toxic agents in the human food chain. CO2: Analyze knowledge of sourcing and synthesizing information of flavorants. CO3: Examine the applications of natural and artificial colorants. CO4: Examine roles and permissible limits of different artificial additives in food industry. CO5: Design the importance of legislation and food laws governing food additives. CO6: Originate competency to critically evaluate toxicology of artificially synthesized flavors, colorants and additives in product formulation and processing.
7	Course Description	Food additives and toxicology is the study of the nature, properties, effects, and detection of toxic substances in food and food animal feed and their disease manifestation in humans. This course will provide a general review of toxicology related to food and the human food chain. The course will give an idea of chemicals of food interest, such as food additives, natural product and pesticides, and how they are tested and regulated.
8	Outline syllabus:	CO Mapping

	Unit 1	**Introduction**			
	A	Food Additives-definition, properties, functions and usage of food additives			CO1, CO6
	B	Intentional and non-intentional food additives.			
	C	Chemical Preservative, bio preservatives, nutritive additives.			
	Unit 2	**Flavourants**			
	A	Natural and synthetic Flavourants , solvents, enzymes, gases.			CO2, CO6
	B	Level of addition of individual falvour enhancers; their chemical properties			
	C	Sources of natural and synthetic flavourants; Application of flavourants in food products.			
	Unit 3	**Colourants**			
	A	Natural and synthetic colorants; types, sources, and chemical properties,			CO3, CO6
	B	Extraction and purification of colourants from natural sources.			
	C	Application of colournats in food products and the levels of usage			
	Unit 4	**Miscellaneous Food Additives**			
	A	Antioxidants, emulsifiers, pH control agents, acidulants, and texturizing agents.			CO4, CO6
	B	Artificial and natural sweeteners, chelating agents, anti - browning agents, humectants.			
	C	Usage of Natural and synthetic agents in food product industries.			
	Unit 5	**Legislation and Laws Governing Food Additives**			
	A	Methods to determine toxicity			CO5, CO6
	B	Toxicants formed during food processing; polycyclic aromatic hydrocarbons, nitrosamines, etc.			
	C	Laws and regulations for food additives and ingredients in processed foods.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Smith, J., & Hong-Shum, L. (Eds.). (2011). *Food additives data book*. 2nd Edition, John Wiley & Sons. ISBN. 978-1405195430			
	Other References	1. Brannen, A. L., Davidson, P. M., Salminen, S. & Thorngate, J.H. (Eds.). (2002) "*Food additives*". 2nd Edition, Revised and Expanded. Marcel Dekker Inc.			

		USA . ISBN 978-0824741709. 2. Smith, J., & Hong-Shum, L. (Eds.). (2011). Food additives data book. 2nd Edition, John Wiley & Sons. ISBN. 978-1405195430.	

FPE406 New Product Development

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VII**	
1	Course Code	FPE406	
2	Course Title	New Product Development	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Programme Elective	
5	Course Objective	The course objective is to gain an understanding of the stages involved in the invention process, formulation, and development of new food products.	
6	Course Outcomes	After completion of the course students will be able to: CO1:Examine food prototypes or food concepts. CO2:Analyze effective product development communication materials and planning of trials. CO3: Examine the use of statistical methods like ANOVA, RSS and SPSS in new product development. CO4: Examine formulations to meet cost targets, ingredient statement, nutrition profile and sensory attributes of desired product. CO5: Design and enhance team cooperation and communication skills. CO6: Originate the knowledge acquired from previous academic courses and apply it to the real-life project of developing a new food product.	
7	Course Description	This course is designed to provide students with a basic understanding of the product development process in the commercial food industry. Through lectures, and hands-on formulation activities, students will learn how to successfully initiate, organize, and carry out a product development project.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction of New Product Development**	
	A	Definition and importance of New Product Development	CO1, CO6
	B	Steps of Product Development	
	C	Product development tools and reasons for failure.	

	Unit 2	**Development process**			
	A	Development of process and planning for production trials. Planning the test market.			CO2, CO6
	B	Actual production trials and evaluation of test results.			
	C	Test marketing, Suggestions for improving success.			
	Unit 3	**Statistical methods in Food Product Development**			
	A	Consumer Survey, market Survey.			CO3, CO6
	B	Development of New Product by Using Statistical Software likes Design Matrix, Full.			
	C	Factorial Design, RSM, SPSS, ANOVA			
	Unit 4	**Market Survey**			
	A	Market and literature survey to identify new products based on special dietary requirements, functionality, convenience and improvisation of existing traditional Indian foods.			CO4, CO6
	B	Screening of product concept on the basis of techno-economic feasibility.			
	C	Development of prototype product and Standardization of formulation process.			
	Unit 5	**Case Studies**			
	A	Nutritional profile of the new product			CO5, CO6
	B	Packaging, labelling and shelf-life studies			
	C	Cost analysis and Final Project Report Each team/group of students would develop a food product on the basis of the above-mentioned protocol and submit a project report.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Fuller, G. W. (Ed.). (2016). *New food product development: from concept to marketplace.* CRC Press. ISBN. 978-1439818657			
	Other References	1. Kumar, S. A. (Ed.). (2008). *Entrepreneurship development.* New Age International. ISBN.978-8122414349.			

FPE407 Technology of Spices

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VII**	
1	Course Code	FPT	
2	Course Title	Technology of Spices	
3	Credits	2	
4	Contact Hours (L-T-P)	2-0-0	
	Course Status	Programme Elective	
5	Course Objective	The course will cover study of the types of spices, their origin , functions and processing techniques . Introduction to medicinal foods and their extraction procedures.	
6	Course Outcomes	Upon completion of this course, students are expected to be able to: CO1:Examine and describe the processing conditions of major spices. CO2:Analyze understanding of the role and significance of minor spices. CO3: Examine the processing of medicinal crops. CO4: Examine the the role of essential oils and manufacturing of oleo resin. CO5: Design the scope of legal standards in spices. CO6: Originate and apply the theories of spices in practical, real-world situations and problems.	
7	Course Description	This course has been designed to make student understand the processing technology used for manufacturing of Spices and Plantation crops and the role of them in nutraceuticals.	
8	Outline syllabus		CO Mapping
	Unit 1	**Major spices**	
	A	Production and Post harvest technology of major spices and their scope	CO1, CO6
	B	Composition and processing of major spices	
	C	Processed products of major spices: Ginger, chilli, onion and garlic, pepper.	
	Unit 2	**Minor spices**	
	A	Production and Post harvest technology of minor spices and their utilization;	CO2, CO6
	B	Composition and processing of minor spices	
	C	Processing of saffron, cinnamon, clove, vanilla and annatto	
	Unit 3	**Processing of medicinal crops**	

	A	Importance of medicinal crops, production and export			CO3, CO6
	B	Principles of processing of medicinal crops			
	C	Equipment for processing of medicinal plants and their operations			
	Unit 4				
	A	Essential oils and oleoresins from spices			CO4, CO6
	B	Extraction techniques			
	C	Super critical fluid extraction for spices			
	Unit 5	**Legal standards for spices**			
	A	Standard specification of spices, eg., ESA, ASTA, FSSAI and maintenance of quality by fumigation, CAS and ETO sterilization			CO5,CO6
	B	Functional packaging of spices and spice products			
	C	By-products of plantation crops and spices			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Pandey, P. H. (Ed.). (2002). P*ost Harvest Engineering of Horticultural Crops through Objectives*. Saroj Prakasam, Allahabad. ISBN. 932- 7263294			
	Other References	1. Purseglove, J.W., Brown, E.G., Green, G. L. & Robbins, S. R. J. (Eds.). (1981). *Cardamom – Chemistry. Spices*, Vol. I, Tropical Agricultural Series, Longman, London, 1: 605. 2. Pruthi, J.S. (Ed.). (1980). *Spices and Condiments: Chemistry, Microbiology and Technology*. First Edition. Academic Press Inc., New York, USA. pp. 1-450. ISBN. 9780120164646			

FPE406: Functional food and Nutraceutical

School: SSET		**Batch :2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: Food Process Technology		**Semester: V**	
1	Course Code	FPE406	
2	Course Title	**Functional food and Nutraceutical**	
3	Credits	3	
4	Contact Hours(L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The objective of the course is to provide awareness about bioactive carbohydrates, bioactive lipids like medium and long chain fatty acids and bioactive peptides.	
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Demonstrate the role of bioactives compounds CO2: Develop an understanding of bioactive lipids like medium and long chain fatty acids CO3: Outline the importance of bioactive peptides CO4: Evaluate the importance of bioactive polyphenol and carotenoids. CO5: Discuss the role of functional foods and their derivation from foods CO6: Investigate and solve the role of functional foods and nutraceuticals.	
7	Course Description	This course is related to basics functional foods and nutraceutical, in which different bioactive compounds like lipids, peptides, polyphenols and carotenoids and functional components of foods..	
8	Outline syllabus		CO Mapping
	Unit 1	**Bioactive carbohydrates**	
	A	Soluble and insoluble fibre	CO1, CO6
	B	Resistant Starch and slow digestible starch	
	C	Prebiotic foods	
	Unit 2	**Bioactive lipids**	
	A	Introduction	
	B	Medium chain fatty acids	

	C	Long chain fatty acids			CO2, CO6
	Unit 3	**Bioactive peptide**			
	A	Production of bioactive peptides			CO3, CO6
	B	Hydrolysis of protein			
	C	Protein derived bioactives			
	Unit 4	**Bioactive polyphenol and carotenoids**			
	A	Structure function considerations			CO4, CO6
	B	Bioactive Polyphenol			
	C				
	Unit 5	**Functional Foods components**			
	A	Cereals grains			CO5, CO6
	B	Fruits and vegetables			
	C	Animal products			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Aluko, R. E. (Ed.). (2 0 1 2) *FunctionalFoods and Nutraceuticals*. Springer Dordrecht Heidelberg London.			
	Other References	1. Glenn, R. G. & Williams, C. M. (Eds.). (2000) *Functional foods concept to product*. Wood head Publishing Limited.			

FPE304: Food Fermentation Technology

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VI**	
1	Course Code	FPE304	
2	Course Title	Food Fermentation Technology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The objective of the course is to impart knowledge about biological and biochemical technology, with a focus on biological products, the design and operation of industrial practices.	
6	Course Outcomes	By the end of this course, students should be able to: CO1: Demonstrate the characteristics of conditions required for fermentation processes. CO2: Develop an understanding of kinetics of cell and product formation in batch, continuous and fed-batch cultures. CO3: Outline the knowledge of sterilization techniques CO4: Evaluate the importance of various parts of fermentor and their operation. CO5: Discuss the importance of traditional and modern fermented foods. CO6: Investigate and apprehend technical skills in the area of fermentation to face the modern challenges in biotechnological industry.	
7	Course Description	It covers basic principles of fermentation and technologies of fermented food products. These are microbial growth kinetics, fermentation types, selection of microorganisms used in industry and production of different types of fermented food products(wine, beer, vinegar etc)	
8	Outline syllabus		CO Mapping
	Unit 1	**Fermentation –Introduction**	CO1, CO6
	A	Introduction to fermentation ,benefit and nutrition value of fermentation	
	B	Microbial changes in fermented foods	
	C	Proteolytic, liploytic and fermentative bacteria.	

	Unit 2	**Fermentation Types**			CO2, CO6
	A	Selection of industrial importance microorganisms , production of single cell protein.			
	B	Microbial Growth Kinetics: Growth, substrate utilization and product formation. Media for industrial fermentation :Medium Composition , Energy, CO2, nitrogen and other growth factors, buffering and foam agents.			
	C	Types of fermentation Ethanolic fermentation mixed alcoholic and acidic fermentation Lactic acid fermentation.			
	Unit 3	**Sterilization**			CO3 and CO6
	A	Sterilization - Principles, sterilization of fermentation media, -			
	B	Development of inoculum for industrial fermentation			
	C	Criteria for transfer of inoculums ,Aseptic inoculation			
	Unit 4	**Fermentor**			CO4 and CO6
	A	Basic functions of fermentor , Design of fermentor			
	B	Types of fermentor ,working and construction			
	C	Recovery and purifications of food products , Fermentor Accessories			
	Unit 5	**Technology of Fermented Food Products**			CO5 and CO6
	A	Traditional fermented foods - Curd, yoghurt, dhokla, miso, shrikand, cheese, butter milk, dosa.			
	B	Modern fermented products -, vinegar, baker's yeast, sauerkrauts, sausages, fermentation of milk, meat, fruits and vegetables			
	C	Wine, beer, brandy, Distilled beverages			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Stanbury, P.F., Whitaker, A. & Hall, S. J. (Eds.).(2000). *Principles of Fermentation Technology*.Aditya books private Ltd. ISBN 9780120164646.			
	Other References	1. Pederson, C.S. (Ed.). (1971). *Microbiology of food fermentations*, AVI Publishing company. 2. Joshi, V.K. & Pandey, A. (Eds.). (2005). Biotechnology: Food Fermentation, Asiatech Publisher.			

FPE: Bakery, Confectionery and Snack products

School: SSET		**Batch :2023-2027**
Program me: B.Tech.		**Current Academic Year: 2 0 2 3 - 2 0 2 4**
Branch: FPT		**Semester: V**
1	Course Code	FPE
2	Course Title	Bakery, Confectionery and Snack products
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Programme Elective
5	Course Objectives	To develop industrial approach in students for bakery, chocolate and confectionary industry
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Demonstrate the functions of bakery ingredients, machineries and various rheological testing of dough. CO2: Develop an understanding of technology and manufacture of bakery products and losses in bakery. CO3: Outline the analysis of bakery ingredients and manufacture various bakery products and chocolate with maintaining safety and hygiene of bakery plants. CO4: Evaluate the technology and manufacture process of confectionery. Products with standards and regulations for confectionary CO5: Discuss about extrusion cooking, machineries and products. CO6: Investigate and solve the processing technology of bakery, confectionery and extruded products.

7	Course Description	This course demonstrates broad knowledge about bakery, confectionary and extruded products development and machineries related to the products. Hygiene is also important factor for the same and this course provides the knowledge about bakery plant safety with hygiene. Thiscourse will be helpful for joining industry as well as setting up one's own industry.	
8	Outline syllabus		
	Unit 1	**Introduction to baking**	
	A	Introduction to baking; Bakery ingredients and their functions; Machines and equipment for batch and continuous processing of bakery products	
B		Dough development; methods of dough mixing; dough chemistry	CO1, CO6
C		Rheological testing of dough-Farinograph, Mixograph, Extensograph, Amylograph / Rapid ViscoAnalyzer, Falling number, Hosney's dough stickiness tester	CO1, CO6
Unit 2		**Manufacturing of bakery products**	
A		Technology for the manufacture of bakery products-bread, biscuits, cakes	**CO2, CO6**
B		Effect of variations in formulation and process parameters on the quality of the finished product	
C		Quality consideration and parameters; Staling and losses in baking	
Unit 3		**Analysis of bakery products**	
A		Testing of flour; Cake icing techniques, wafer manufacture, cookies, crackers, dusting or breading	**CO3, CO6**
B		Manufacture of bread rolls, sweet yeast dough products, cake specialties, pies and pastries, doughnuts, chocolates and candies	
C		Coating or enrobing of chocolate (including pan-coating); Maintenance, safety and hygiene of bakery plants.	
Unit 4		**Quality characteristics of confectionery ingredients**	

A	Quality characteristics of confectionery ingredients; technology for manufacture of flour, fruit, milk, sugar, chocolate, and special confectionery products			**CO4, CO6**
B	Colour, flavour and texture of confectionery; standards and regulations			
C	Machineries used in confectionery industry			
Unit 5	**Extrusion**			
A	Importance and applications of extrusion in food processing; Pre and post extrusion treatments			**CO5, CO6**
B	Manufacturing process of extruded products			
C	Change of functional properties of food components during extrusion.			
Mode of examination	Theory			
Weightage Distribution	CA	MTE	ETE	
	25%	25%	50%	
Text book/s*	1. Harper, J.M. (1981) *Extrusion of Food* (2nd ed.), CRC Press.			
Other References	1. Matz, S. A. (1992). *Bakery technology and engineering* (3rd ed.), AVI Publisher. 2. Fance, W.J. & Wrogg, B.H. (1968) *Up to-date Bread Making* Maclasen & Sons Ltd.			

FPE 417: Food industry waste management

School: SSET		**Batch :2023-2027**
Programme : B.Tech		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: VI**
1	Course Code	FPE417
2	Course Title	Food industry waste management
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Programme Elective
5	Course Objective	The objective of the course is to understand the importance, need and management of different food industry waste.

6	Course Outcomes	After successfully completion of this course students will be able to: CO1 Demonstrate the basic concept of waste and types. CO2: Develop an understanding of Waste Disposal method and utility of waste from food Industry CO3: Outline the treatment of plant waste by physical, chemical and biological methods including various hazards and their control measures. CO4: Evaluate the types, availability and utilization of by-products of cereals, legumes & oil seeds CO5: Discuss the status and utilization of dairy by-products. CO6: Investigate and solve different case study.	
7	Course Description	Food waste management is an application of utilization food waste. The types of treatment applied during processing identification are beneficial as by product recovery. In the future waste management could offer more depth knowledge with its applicable techniques. In this course, students will learn about the different treatments required in food manufacturing.	
8	Outline syllabus	The syllabi deals with the waste management and waste treatment of food industries.	
	Unit 1	**INTRODUCTION**	
	A	Waste and its consequences in pollution and global warming.	**CO1,CO6**
	B	Types of food processing wastes & their present disposal methods.	
	C	Identification of waste.	
	Unit 2	**Treatment methods for liquid wastes**	
	A	Treatment of plant waste by physical, chemical and biological methods.	**CO2, CO3**
	B	Solid and liquid waste.	
	C	Use of waste and waste water.	
	Unit 3	**Treatment methods of solid wastes**	
	A	Types, availability and utilization of by-products	**CO3,CO4**
	B	Vermin composting	

	C	Utilization of by-products from sugar and agro based industries, and brewery & distillery waste.			
	Unit 4	**Bio filters and bio clarifiers**			
	A	Type of Filters used in Waste Water Treatment.			**CO4, CO6**
	B	Drinking Water treatment			
	C	Recovery of useful materials from effluents by different methods.			
	Unit 5	**Case Studies**			
	A	Sugar Cane Industry			**CO5,CO6**
	B	Meat Industry			
	C	Milk Industry Case studies.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1) Beggs, C. (2000) Energy Management and Conservation. Elsevier Publisher.			
Other References		1. York, K. F. & Goswami, D.Y. (2008) *Energy Conservation through Waste Utilization.* American Society of Mechanical Engineers, CRC Press. 2) Murphy, W.R. & Mckay. G. (1982). *Energy Management*. BS Publisher.			

FPE305: Modeling and Simulation in Food Process Operations

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year:2023-2024**	
Branch: FPT		**Semester: VI**	
1	Course Code	FPE305	
2	Course Title	Modeling and Simulation in Food Process Operations	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The objective of the course is to make student understand the processing and preservation technology for meat, poultry and sea foods.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Demonstrate depth and breadth of knowledge in modeling and simulation in food processing CO2: Develop an understanding of the principles of modeling and simulation in heating process CO3: Outline the modeling of cooling processes in foods. CO4: Evaluate the importance of modeling and simulation of novel thermal food processes. CO5: Discuss modeling and simulation of novel non-thermal food processes. CO6: Investigate and apprehend applications of modelling and simulation in all food processing operations	
7	Course Description	The '**Modelling and simulation in food processing'** course outlines application of modelling and simulation techniques in different food processing operations whether thermal or non- thermal processing and novel processes. This will help in predictingfood processes.	
8	Outline syllabus		CO Mapping
	Unit 1	**Modelling /Simulation of food processes**	
	A	Introduction to modelling and numerical simulation	CO1, CO6
	B	Kinetic modelling of inactivation	
	C	Computer simulation approaches	
	Unit 2	**Modelling of heating processes**	
	A	Modelling of drying process	CO2, CO6

	B	Modelling of Pasteurization & Sterilization			
	C	Modelling of frying and baking			
	Unit 3	**Modelling of cooling processes**			
	A	Chilled and frozen food modelling			CO3, CO6
	B	Cold food chain modelling			
	C	Modelling food storage			
	Unit 4	**Modelling and simulation of novel thermal processes**			
	A	Ohmic heating and Radiofrequency processing			CO4, CO6
	B	Microwave and infrared processing			
	C	Pulse light processing			
	Unit 5	**Modelling and simulation of Non thermal processes**			
	A	Hydrostatic pressure processing			CO5, CO6
	B	Pulse electric field processing			
	C	Irradiation processing			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Soojin, J. (2009). *Food Processing operations modelling- designand analysis*. CRC Press Taylor & Francis Boca Raton.			
	Other References	1. Josheph I. (2002). *Food Processing operations modelling- Design and analysis*. Marcel Dekker AG, Inc. New York			

FPE209:Post Harvest and Storage Engineering

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech.		**Current Academic Year:2023-2024**	
Branch: FPT		**Semester: IV**	
1	Course Code	FPE209	
2	Course Title	**Post Harvest and Storage Engineering**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The objective of the course is to understand structure of grains, fruits and vegetable harvesting and processing. Another objective is ti understand different methods to collect and process milk, meat products and other post-harvest operations along with storage aspects for such foods.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: List the steps for successful grain harvesting and processing. CO2: Develop an understanding of fruits and vegetable harvesting and processing techniques CO3: Investigate the different methods to collect and process milk and meat products CO4: Evaluate the importance of safe storage of grain and oil seeds. CO5:Discuss storage of perishable products like meats, fresh fruits and vegetable in different storage conditions CO6:Elaborate and apprehend post-harvest techniques as storage conditions for different type of food products.	
7	Course Description	This course outlines the different Post harvest processing techniques for cereals, pulses, fruits, vegetables, milk and meat products along with the storage requirements of such products in different conditions.	
8	Outline syllabus		CO Mapping
	Unit 1	**Grain harvesting and processing**	

	A	Post- harvest technology overview	CO1, CO6
	B	Decorticating, Shelling and Milling	
	C	Material handling systems	
	Unit 2	**Fruit and vegetables Harvesting and processing**	
	A	Harvesting	CO2, CO6
	B	Processing of Fruits	
	C	Processing of vegetables	
	Unit 3	**Milk and Meat processing**	
	A	Milk collection and processing	CO3, CO6
	B	Meat and poultry processing	
	C	Fish processing	
	Unit 4	**Storage of grain and oil seeds**	
	A	Types of products and storage requirements	CO4, CO6
	B	Storage techniques and load calculations	
	C	Shelf life during storage and precautions	
	Unit 5	**Storage of perishable products**	
	A	Storage techniques for perishables	CO5, CO6
	B	Storage techniques and load calculations	
	C	Shelf life and economics	
	Mode of examination	Theory / CA / ETE	
		25% / 25% / 50%	
	Text book/s*	1. Amalendu, C. & Singh, R. P. (Eds.). (2014) *Postharvest Technology and Food Process Engineering*. CRC Press, ISBN 9781138198852.	
	Other References	2. Hui, Y. H. (Ed.). (2005). *Handbook of Food science, Technology, and Engineering.* CRC Press Taylor & Francis Group. ISBN 9780849398476.	

FPE309: Process and Equipment Design

School: SSET		**Batch :2023-2027**	
Programme : B.Tech.		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VI**	
1	Course Code	FPE309	
2	Course Title	**Process and Equipment Design**	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The objective of the course is to give detailed understanding for designing of different thermal, non-thermal processes and equipment along with mechanical transport and storage.	
6	Course Outcomes	By the end of this course students will be able to: CO1: Demonstrate designing of different thermal and packaging food processing equipments. CO2: Develop an understanding of designing food processing equipments for mechanical transport and storage CO3: Outline the designing of mechanical processing operations and equipments. CO4: Evaluate the importance of designing of food dehydrators, freezing and cooling equipments. CO5: Discuss the various aspects of food process and equipment. CO6: Investigate food processing equipments and storage equipments	
7	Course Description	This course is related to process equipment and plant design. In this course, equipment which are used for processing of food will be discussed and their in details with their working principles and their design parameters. This also includes designing food plant in which process and equipment designing will be discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Designing equipments**	
	A	Thermal processing equipments	CO1, CO6
	B	Heat and mass transfer equipments	

	C	Packaging equipments	
	Unit 2	**Mechanical transport and storage equipments**	
	A	Mechanical transport	CO2, CO6
	B	Conveyor, belts and fluid transport	
	C	Food storage equipment design	
	Unit 3	**Mechanical processing equipment**	
	A	Size reduction, mixing and Homogenization equipments	CO3, CO6
	B	Separation equipment	
	C	Evaporation equipment	
	Unit 4	**Other Food processing equipment**	
	A	Food dehydrator	CO4, CO6
	B	Freezing and cooling equipment design	
	C	Novel food processing equipment	
	Unit 5	**Food process plant**	
	A	Process design	CO5, CO6
	B	Plant layout and design equipment	
	C	Hygiene design	
	Mode of examination Weightage Distribution	Theory	
		CA: 25% / MTE: 25% / ETE: 50%	
	Text book/s*	1. Saravacos, G.E., Kostaropoulos, A.E., (2016). (Eds.). *Hand book of food processing Equipments*. Springer. ISBN 9781461507253978, 1461507251.	
	Other References	1. López-Gómez, A. & Barbosa-Cánovas, G.V. (2005). (Eds.). *Food Plant Design*. CRCPress Taylor & Francis Group. ISBN: 9780429118944.	

FPE404: Refrigeration and Cold Chain Management

School:		**Batch : 2023-2027**	
Programme : B.Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: VI**	
1	Course Code	FPE404	
2	Course Title	**Refrigeration and Cold Chain Management**	
3	Credits	3	
4	Contact Hours	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The objective of the course is to provide knowledge of refrigeration and cold chain management, cooling load calculations, design of cold storage plant and other food plants.	
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Demonstrate refrigeration and freezing principles. CO2: Develop an understanding of air conditioning requirements and principles for food processing operations. CO3: Outline the effect of cooling load in refrigeration operations. CO4: Evaluate the importance of designs of refrigerated plants. CO5: Discuss different strategies for ice manufacturing. CO6: Investigate the need for cold chain management and air conditioning.	
7	Course Description	This course is related to basic principles of refrigeration, air conditioning, cooling load calculations, refrigerated plant designs and refrigerated will be discussed.	
8	Outline syllabus		CO Mapping
	Unit 1	**Principle of refrigeration**	
	A	Second Law of thermodynamics, refrigeration	CO1, CO6
	B	Working of carnot cycle, vapour refrigeration	
	C	Refrigerants and their properties	
	Unit 2	**Air conditioning**	
	A	Classifications , sensible heat factor	

	B	Unitary air conditioning systems			CO2, CO6
	C	Design of complete air condition system			
	Unit 3	**Cooling load calculation**			
	A	Product load calculations			
	B	Other load calculations			
	C	Total load calculation			CO3, CO6
	Unit 4	**Refrigerated plant design**			
	A	Cold storages			CO4, CO6
	B	Ice manufacture plant			
	C	Freezer plant			
	Unit 5	**Refrigerated transport**			
	A	Handling and distribution,			CO5, CO6
	B	Refrigerated vans			
	C	Cold chain management			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. William, C., Whitman, W. M., Johnson, J. A. & Silberstein, E. (Eds). (2009). *Refrigeration & Air Conditioning Technology*, 6th edition.			
	Other References	2. Stoecker, W.F. & Jones, J.W. (Eds). (1982). *Refrigeration and Air Conditioning*, 2nd edition.			

\

FPE308: Technology of cereal, pulses and oilseeds

School: SSET		**Batch : 2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: 4**	
1	Course Code	FPE308	
2	Course Title	Technology of cereal, pulses and oilseeds	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	To provide the students an opportunity to gain knowledge about the storage procedure of different cereals, legumes, oilseeds and to help students to understanding the different procedure of production of various cereal based processed products.	
6	Course Outcomes	After completion of this course student will be able to: CO1: Demonstrate production trends, structure, composition, quality evaluation and processing. CO2: Develop an understanding of uniqueness of wheat as a cereal grain in the world food supply and the scientific nature of the functionality and inter-relationships of the key constituents in wheat for food utilization. CO3: Outline the problems associated with milling of paddy and their solution. CO4: Identify technologies for product development and value addition of various cereals, pulses and oilseeds. CO5: Discuss the various aspects of processing legumes and oilseeds. CO6: Investigate competency to critically evaluate quality of finished cereal, legume products in terms of underlying properties of flour, dough/batter, ingredient function, product formulation and processing.	
7	Course Description	This course deals with the structure, composition and utilization of rice, wheat and other cereal grains for the production of starches, flours, milling by-products, and cereal-based human food products; cereal processing technologies such as dry and wet milling, baking, extrusion cooking, breakfast cereals and noodle and pasta manufacturing.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to Food Grains**	
	A	Present status and future prospects of cereals and millets	CO1, CO6

	B	Structure and composition of common cereals, legumes and oilseeds.			
	C	Supply chain of food grains			
	Unit 2	**Processing of wheat**			
	A	Wheat: Types and physicochemical characteristics; wheat milling -products and by products; factors affecting quality parameters; physical, chemical and rheological tests on wheat flour.			CO2, CO6
	B	Manufacture of whole wheat atta, blended flour and fortified flour.			
	C	Pasta products and various processed cereal-based foods.			
	Unit 3	**Rice Processing**			
	A	Rice: Classification, physicochemical characteristics; cooking quality; rice milling technology; by products of rice milling and their utilization; Rice bran stabilization, oil extraction and refining.			CO3, CO6
	B	Parboiling methods of rice, criteria of quality of rice, aging of rice, quality changes.			
	C	Processed products based on rice			
	Unit 4	**Products and Byproduct processing of corn ,barley and oats.**			
	A	Corn: Types and nutritive value; dry and wet milling, processing of corn in breakfast cereals, snacks, tortilla .			CO4, CO6
	B	Barley: composition, milling, malting of barley, chemical and enzymatic changes during malting, uses of malt.			
	C	Oat: composition, processing of oat, byproducts of oatmeal milling.			
	Unit 5	**Legumes and Oilseeds**			
	A	Legumes and oilseeds: composition, anti-nutritional factors, processing and storage.			CO5, CO6
	B	Processing for production of edible oil, meal, flour, protein concentrates and isolates			
	C	Oil extraction process: Mechanism, solvent, SCE, oil refining, utilization of by products of oil milling.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Chakraverty, A. (Ed.). (2000). *Post Harvest Technology of cereals, pulses and oilseeds*. 3rd edition. Oxford & IBH publishing & Co. ISBN 9788120409699.			

	Other References	1. Champagne, E. T. (Ed.). (2004). *Rice: Chemistry and Technology*, 3rd Ed., AACC International. ISBN 1891127349.	

FPE409: Technology of Fruits, Vegetables and Plantation Crops

School:SET		**Batch :2023-2027**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: 4**	
1	Course Code	FPE409	
2	Course Title	Technology of Fruits, Vegetables and Plantation Crops	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The objective of the course is to introduce students to the science and technology associated with fruits and vegetables	
6	Course Outcomes	After completion of the course students will be able to: CO1: Demonstrate the structure and composition of fruits and vegetables and their role in nutrition. CO2: Develop an understanding of preservation and processing technologies applied to fruits and vegetables. CO3: Outline the physiological changes occurring to fruit and vegetables during harvesting and storage CO4: Evaluate the possible preventive measure to control or even enhance the stability and shelf life of the processed fruits and vegetables by dehydration process. CO5: Discuss the appropriate technological process for plantation crops, from the selection of raw materials to final product. CO6: Investigate the impact of certain technological operations and parameters on the success of fruit and vegetable processing and on certain properties of the final product.	
7	Course Description	The course consists of various processing techniques of fruits and vegetables and their related product technologies.	
8	Outline syllabus		CO Mapping
	Unit 1		
	A	Importance of fruits and vegetable ,history and need of preservation; Method of preservation	CO1, CO6
	B	Canning and bottling of fruits and vegetables ;process of canning; factors affecting the process- time and temperature; lacquering syrups and brines for canning	

	C	Spoilage in canned foods, containers of packing.	
	Unit 2	**Processing of fruits and related products**	
	A	Processing of fruit juices (selection, juice extraction, deaeration, straining, filtration and clarification), Preservation of fruit juices.	CO2, CO6
	B	Jam: Constituents, selection of fruits, processing & technology. Jelly, Constituents (Role of pectin ratio), Theory of jelly formation, Processing & technology, Defects in jelly.	
	C	Marmalade : Types, processing and defects. Processing of squashes, cordials, nectars, concentrates and powder.	
	Unit 3	**Processing of Vegetables**	
	A	Pickles: Types, Processing, Spoilage	CO3, CO6
	B	Processing of chutneys and sauces.	
	C	Processing of tomato juice, tomato puree, paste, ketchup, sauce and soup.	
	Unit 4	**Dehydration**	
	A	Sun drying: Working and construction of equipments with advantages and disadvantages.	CO4, CO6
	B	Mechanical dehydration: Types, Working and Construction of equipment.	
	C	Effects of processing on fruits and vegetables, Packing and Storage.	
	Unit 5	**Plantation Crops**	
	A	Introduction, principles and practices of post harvest technology of plantation crops.	CO5, CO6

	B	Processing of major produce from Tea, Cocoa, Rubber, Coffee and Coconut.			
	C	Value addition, grading, packing and storage of plantation crop			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Girdharilal, G.S. & Tandon, G.L., (Eds.). (2009) *Preservation of fruits & Vegetables*, ICAR, New Delhi, ISBN 9788171640904.			
	Other References	1. Arsdel, W.B., Copley, M.J. & Morgen, A.I. (1973) (Eds.). *Food Dehydration*, 2nd Edition.			

FPT Technology of Beverages

School: SSET		**Batch : 2023-2027**	
Programme : B.Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: 06**	
1	Course Code	FPT	
2	Course Title	Technology of beverages	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Elective	
5	Course Objective	The objective of the course is to provide the students with general scientific knowledge about processing of alcoholic and non- alcoholic beverages.	
6	Course Outcomes	By the end of this course, students should be able to: CO1: Review types of beverages, manufacturing technology of carbonated and non-carbonated beverages. CO2: Discuss the importance of beverages based on dairy, spices, tea and coffee. CO3: Describes types of tea and coffee. CO4: Assess key manufacturing steps in production of alcoholic beverages. CO5: Recall manufacturing aspects, quality measures and standards given by Bureau of Indian Standards. CO6: Integrate their knowledge of manufacturing of alcoholic and non-alcoholic beverages.	
7	Course Description	This course deals with various products related to alcoholic and non- alcoholic beverages their processing technology and technical aspects.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction**	

	A	Types of beverages and their importance, status of beverage industry in India,	CO1, CO6
	B	Manufacturing technology for juice-based beverages, synthetic beverages	
	C	Technology of still, carbonated, low-calorie and dry beverages, isotonic and sports drinks; role of various ingredients of soft drinks, carbonation of soft drinks.	
	Unit 2	**Manufacturing process of beverages**	
	A	Beverages based on tea, coffee, cocoa	CO2, CO6
	B	Beverages based on spices, plant extracts, herbs, nuts	
	C	Dairy-based beverages	
	Unit 3	**Types of Tea and Coffee**	
	A	Chemical composition and processing of tea and coffee and their quality assessment	CO3, CO6
	B	Types of tea: black tea, green tea, oolong tea. Types of coffee: Vacuum coffee, drip coffee, iced coffee. Espresso coffee, instant coffee	
	C	Decaffeination of Coffee types of decaffeination: Roselius method, Swiss water process, direct and indirect method, triglyceride method, carbon dioxide method	
	Unit 4	**Alcoholic beverages**	
	A	Types, manufacture and quality evaluation; the role of yeast in beer and other alcoholicbeverages	CO4, CO6
	B	Ale type beer, lager type beer, technology of brewing process	
	C	Equipment used for brewing and distillation, wine and related beverages, distilled spirits.	
	Unit 5	**Packaged drinking water**	
	A	Definition, types, manufacturing processes, quality evaluation and raw and processed water,	CO5, CO6
	B	Methods of water treatment	

	C	BIS quality standards of bottled water; mineral water, natural spring water, flavored water, carbonated water.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	Manay, N.S., & Shandaksharaswamy, M., (Eds.). (2004) *Foods- Facts andPrinciples,* New Age International Publishers. ISBN 9389802407.			
	Other References	Potter, N.N, & Hotchkiss, J.H. (2000) (Eds.). *Food Science.* CBS Publishers. ISBN 978-8123904726.			

FPT Food Rheology

School: SSET		**Batch : 2023-2027 onwards**	
Programme: B.Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: 6**	
1	Course Code	FPT	
2	Course Title	Food Rheology	
3	Credits	3	
4	Contact Hours (L-T-P)	3-0-0	
	Course Status	Programme Elective	
5	Course Objective	The course is designed to prepare students with a basic understanding of the food rheology and the relation with viscosity of semi-solid and liquid food. The course provides a foundation for careers in food engineering, food production technology or research in all branches of food sciences and technology.	
6	Course Outcomes	By the end of this course, students should be able to: CO1: Recall the role and significance of food rheology in food processing. CO2: Describe various rheological instruments and their applications in food industry. CO3: Discuss the role of texture analyzer in manufacturing. CO4: Demonstrate rheological properties of fluids and semi-solid processed products. CO5: Analyze the role of additives and emulsifies in food processing. CO6: Outline the concept of rheology and its application in development of modern processing equipment.	
7	Course Description	This course covers the concept of food rheology and the effect of processing parameters on rheological properties and quality of food.	
8	Outline syllabus		CO Mapping
	Unit 1	**Introduction to rheology of foods**	
	A	Introduction to rheology of foods: Definition of texture, rheology and psychophysics– their structural basis	CO1, CO6
	B	Physical considerations in study of foods	

	C	Salient definitions –Stress tensor and different kinds of stresses			
	Unit 2	**Concept of rheology**			
	A	Concept of rheology, Shear stress, rate, torque			CO2, CO6
	B	Newtonian and Non- Newtonian flow and types			
	C	Measurement of rheology, Viscosity: measurement of viscosity and consistency with Brookfield synchrolectric viscometer, Stormer viscometer, Ostwald viscometer, Bostwick consistometer.			
	Unit 3	**Texture Analysis**			
	A	Food texture, Physical characteristics of food			CO3, CO6
	B	Measurement of texture using different instruments and their working: Texture Analyser, Instron Universal Testing machine			
	C	Fruit pressure tester, puncture tester, succulometer, tenderometer, fibrometer.			
	Unit 4	**Rheological properties of foods**			
	A	Rheological properties of selected food products: Measurement modes and techniques			CO4, CO6
	B	Rheological behaviour of processed fluid and semisolid foods: fruit juice, milk and milk concentrates and structural analyses of food dispersions, structural components of yield stress.			
	C	Rheological behaviour of chocolate, mayonnaise and margarine			
	Unit 5	**Rheology of starch and stabilizers**			
	A	Rheology of food gum and starch dispersions: effect of heating, effect of sugar and protein, rheological behavior of starch			CO5, CO6
	B	Rheology of starch- gum dispersions.			
	C	Effect of processing and additives (stabilizers and emulsifiers) on food product rheology.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Steff, J. F. (1964). *Rheological Methods in Food ProcessEngineering*, Freeman Press.			
	Other References	2. Rao, M. A. (Ed.). (2007) *Rheology of Fluid and semisolid Foods: Principles and Application,* Springer.			

MINOR SUBJECTS FOR B.Tech. Students

Minors in B.Tech. Food Process Technology Programme for B.Tech.Students									
S.No.	Course Code	Course Name	L	T	P	C	Category	Prerequisite	Offered in Term
1	FPE102	Introduction to Food Technology	2	0	0	2	Engineering	Introduction	II
2	FPE215& FPP207	Basics of Food Microbiology	3	0	2	4	Engineering	Basic Course	III
3	FPE216	Fundamentals of Unit Operations	3	0	0	3	Engineering	Basic Course	IV
4	FPE310& FPP310	Dairy Technology	3	0	2	4	Engineering	Advance Course	V
5	FPE201& FPP201	Food Chemistry	3	0	2	4	Engineering	Advance Course	VI
6	FPP402	Preservation Technology	0	1	4	3	Engineering	Industrial Applications	VII
Total Credits						20			

Minor in B.Tech. Food Process Technology Programme For Non-B. Tech.Students									
S.No.	Course Code	Course Name	L	T	P	C	Category	Prerequisite	Offered in Term
1	FPE102	Introduction to Food Technology	2	0	0	2	Engineering	Introduction	II
2	FPE215& FPP207	Basics of Food Microbiology	3	0	2	4	Engineering	Basic Course	III
3	FPE216	Fundamentals Of Unit Operations	3	0	0	3	Engineering	Basic Course	IV
4	FPE310& FPP310	Dairy Technology	3	0	2	4	Engineering	Advance Course	V
5	FPE311& FPP311	Bakery, Confectionary and Snacks Products	3	0	2	4	Engineering	Advance Course	VI
6	FPP402	Preservation Technology	0	1	4	3	Engineering	Industrial Applications	VII
Total Credits							20		

FPE102 Introduction to Food Technology

School: SSET		**Batch : 2023-2027**	
Programme: B. Tech		**Current Academic Year:2023-2024**	
Branch: FPT		**Semester:1**	
1	Course Code	FPE102	
2	Course Title	**Introduction to Food Technology**	
3	Credits	1	
4	Contact Hours (L-T-P)	0-0-2	
	Course Status	Elective	
5	Course Objective	The 'Introduction to **Food Process Technology**' course aimed to provide theories and principles of equipment used in various unit operations of food industry.	
6	Course Outcomes	After successful completion of this course students will be able to: CO1: Analyze, identify, characterize, and classify the need of different unit operations at different times. CO2: Classify and build knowledge for different high temperature food Preservation operations and their machines/equipment's. CO3: Discuss the concepts of food preservation. CO4: Assess and build knowledge for dehydration in food processing operations and their machines/equipment's. CO5: Elaborate concept of refrigeration and freezing . CO6: Estimate the impact of these operations in food industry.	
7	Course Description	This course covers basic introductory concepts of food engineering with emphasis on their working principles and its application. Topics include thermal and non-thermal methods and the various equipment's used in between.	
8	Outline syllabus		CO Mapping
	Unit 1	Introduction to Food Process Engineering	**CO1, CO6**
	A	Units and Dimensions	
	B	Scope and importance of Food Process Engineering- preliminary operations –cleaning, grading, sorting, washing, cutting – equipment used.	
	C	Unit operations involved in Food processing (Food Preparation)	
	Unit 2	**Processing Methods**	

	A	Concepts and equipment used in Blanching, pasteurization, sterilization.			**CO2, CO6**
	B	Extrusion			
	C	Microwave processing of foods			
	Unit 3	**Principles of Food Process Engineering**			**CO3, CO6**
	A	Thermal and electrical properties of foods			
	B	Rheological Properties of food			
	C	Food preservation by Radiation			
	Unit 4	**Drying and Dehydration of foods**			**CO4, CO6**
	A	Cereals			
	B	Fruits and Vegetables			
	C	Freeze drying			
	Unit 5	**Refrigeration and Freezing**			**CO5, CO6**
	A	Principles of refrigeration; second law of thermodynamics applied to refrigeration			
	B	Freezing: Plank's law and estimation of freezing time of foods; equipment, freeze concentration of liquid food.Rate of freezing.			
	C	Refrigeration and freezing in food industry; types of refrigeration system			
	Mode of examination	Theory			
	Weightage	CA	MTE	ETE	

	Distribution	25%	25%	50%	
	Text book/s*	1.Brennan, J.G., Butters, J.R., Cowell, N.D. and LillyAEI. (Eds.). (1990). *Food Engineering Operations*. Elsevier. ISBN: 978-1851664443			
	Other References	1.Fellows P. (Eds.). (2022). *Food Processing Technology: Principle and Practice.* 5th edition. Woodhead publishing. ISBN: 9780323857376.			

FPE215 Basics of Food Microbiology

School: SSET		**Batch: 2023-2027 onwards**
Programme : B.Tech		**Current Academic Year:2023-2024**
Branch: FPT		**Semester: 03**
1	Course Code	FPE215
2	Course Title	Basics of Food Microbiology
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	The course is designed to prepare students with a basic understanding of the microbes involved in biological processes such as fermentation and spoilage. The course provides a foundation for careers in microbiology, food engineering, or research in all branches of food sciences and technology.
6	Course Outcomes	After the successful completion of this course students will be able to: CO1: Determine the role and significance of intrinsic (i.e. aw, pH, etc.) and extrinsic (gases in the environment, etc.), factors in the growth and response of microorganisms. CO2: Develop knowledge of important pathogens and spoilage mechanisms in foods to control food contamination of food. CO3: Discuss the principles of food preservations and to describe the different food preservation methods. CO4: Evaluate the process of fermented food products and their preservation. CO5: Elaborate the issues of food borne diseases and preventive practices in food processing operations. CO6: Compile the principles and current practices of processing techniques and how they can impact food safety and food quality.
7	Course Description	This course covers the characteristic of microbial growth, intrinsic and extrinsic factors and their relationship to microbial growth; the principles of food fermentation and the role of beneficial microbes; the role of

		microorganisms and food spoilage; pathogenic microorganisms, infection and intoxication, mycotoxin, viruses and parasites; the principles to control microbial growth; as well as qualitative and quantitative microbiological analysis.	
8	Outline syllabus		CO Mapping
	Unit 1	**Microorganisms in food**	CO1, CO6
	A	Importance of microorganisms in food, History of Microorganisms in Food Developments	
	B	Intrinsic and extrinsic parameters of food affecting microbial growth	
	C	Types of microorganisms in foods	
	Unit 2	**Microbial spoilage**	CO2, CO6
	A	Principles and types of spoilage, Microbial spoilage of spoilage of fruits and vegetables, fresh and processed meats.	
	B	Microbial spoilage of poultry, sea foods, cereals, flour, dough, bakery products, dairy products and canned foods.	
	C	Assessing microbial load in foods – microscopic, cultural, physical, chemical and immunological methods.	
	Unit 3	**Preservation of foods**	CO3, CO6
	A	Food preservation principles, Factors affecting preservation	
	B	Food preservation using temperature	
	C	Preservation of foods by drying, chemicals and radiation with limitations and commercial applications.	
	Unit 4	**Fermented and microbial foods**	CO4, CO6
	A	Fermented foods-vegetables, fruits ,dairy products.	
	B.	Fermented meat and fish products, alcoholic and non alchoholic fermented drinks.	
	C	Oriental Foods, Probiotics and Prebiotic	
	Unit 5	**Food borne diseases and safety**	CO5 and CO6
	A	Food borne infections and intoxications	
	B	Indicators of food safety food processing plant sanitation.	
	C	Food and plant microbiological standards and	

		guidelines			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Jay, J.M., Loessner, M.J. and Golden, D.A. (Eds.). (2006). *Modern food microbiology*. 7th edition. Springer. ISBN 0-387-23180-3.			
	Other References	1. Frazier, W.C. and Westhoff, D.C. (Eds.). (2013).*Food microbiology*. 5th edition. Tata McGraw Hill Publishing Co. ISBN 9781259062513, 9781259062513			

FPP207 Basics of Food Microbiology Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year:2023-2024**
Branch:FPT		**Semester:03**
1	Course Code	FPP207
2	Course Title	Basics of Food Microbiology Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Elective
5	Course Objective	The course is designed to acquaint the students with basic techniques of Food Microbiology. To make students familiar with the different approaches of microbe identification and plating techniques.
6	Course Outcomes	After completion of the course the students will be able to: CO1: Examine common aseptic techniques used in the microbiology laboratory. CO2: Discuss technique of media preparation. CO3: Elaborate method for isolation of microorganism. CO4: Classify basic techniques used in the observation and identification of microorganisms. CO5: Justify various biotechniques in enumeration of different compounds. CO6 : Appraise concept of food microbiology in the food systems.
7	Course Description	The course will introduce students to methods used in microbiological examination of foods. Students will be exposed to practical training on isolating, purifying and identification of microorganisms in different foods.

List of Practical's:

S. No.	Experiment	CO Mapping
1.	Introduction of safety measures in Food Microbiology Lab	CO1, CO6
2.	To learn the importance of cleaning and sterilization of lab wares used in microbiology	CO2, CO6
3.	Preparation of nutrient agar media.	CO2, CO6
4.	Preparation of potato dextrose agar.	CO2, CO6
5.	To plate the milk samples by spread and pour plate technique	CO3, CO6
6.	To determine the Aerobic Mesophilic Plate count in food sample.	CO3, CO6
7.	To obtain isolated microbial colonies from an inoculum by creating areas of increasing dilution on an agar petri plate.	CO3, CO6
8.	To study different various phases of bacterial growth	CO4, CO6
9.	To study methylene blue reductase test for given milk samples	CO5, CO6
10.	Fermenter design and requirements of the microbial systems	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1. Nollet, L.M.L. (Eds.). (2006). *Handbook of Water Analysis*. 2nd edition. Taylor and Francis Group. ISBN9780429123597.			
Other References	1. Downes, F.P. and Ito, K. (Eds.). (2001). *Compendium of Methods for the Microbiological Examination of Foods.* American Public Health Association.			

FPE216 Fundamentals of Unit Operations

School: SSET		**Batch: 2023-2027**
Programme: B. Tech		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: 03**
1	Course Code	FPE216
2	Course Title	Fundamentals of Unit Operations
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
	Course Objective	The '**Unit Operation in Food Processing**' course will provide knowledge of unit operations and processes like size reduction, mixing, distillation, filtration, extraction, adsorption, separation, crystallization, evaporation, drying, heat exchange, cooling/ freezing, etc.

		absorption, extraction, distillation, freezing, cooling and dehydration.	
7	Course Description	This course is related to basics as well as applications of different unit operations in food processing. Generally, in all food processing operations size reduction, mixing, heat exchange, distillation absorption, cooling/ freezing, etc. are used. T	
8	Outline syllabus		CO Mapping
	Unit 1	**Basics of unit operations**	CO1, CO6
	A	Unit operations classifications, unit processes	

	B	Material and energy balance	
	C	Fluid flow theory and applications	
	Unit 2	**Size reduction, mixing and emulsification**	CO2, CO6
	A	Size reduction- Grinding/cutting, Energy used, Performance evaluation, Equipment	
	B	Mixing-Measurement, Energy used, Mixing equipment	
	C	Emulsification-dispersion/continuous phase, emulsifying agents, homogenization,	
	Unit 3	**Distillation, Filtration and extraction**	CO3, CO6
	A	Distillation Equilibrium relationships, types and equipment	
	B	Filtrations-rates and resistance of cake filters, filtration equipment	
	C	Extractions -extraction and washing equipment, Rate, stage and equipment	
	Unit 4	**Absorption/Adsorption, crystallization, and drying**	CO4, CO6
	A	Absorptions-gas absorption, rate, stage and equipment of absorption	

	B	Separations – Sedimentation, flotation, types of separations and equipment's of absorption and applications			
	C	Crystallizations-geometry, principles, equipment's and application.			
	Unit 5	**Evaporation, drying and cooling**			CO5, CO6
	A	Evaporations and concentration-single effect evaporator, Multiple effect and evaporation equipment's and concentrators			
	B	Drying and dehydration-basic theory, heat requirements, dryer efficiencies, Mass transfer, psychrometry and equipment's			
	C	Food freezing and cooling-Freezing and cooling temperature, thermal properties, freezing/cooling time, design of systems and equipment's			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Ibarz, A. and Canovas, G.V.B. (Eds.). (2003). *Unit operations in Food Engineering*. 1st edition. CRC Press. ISBN: 9780429134951.			
	Other References	1.Varzakas, T. and Tzia, C. (Eds.). (2014). *Food Engineering Handbook*. 1st edition. CRC Press. ISBN:9781482261660.			

FPE310 Dairy Technology

School: SSET		**Batch: 2023-2027**	
Programme: B. Tech		**Current Academic Year: 2023-2024**	
Branch: FPT		**Semester: 04**	
1	Course Code	FPE310	
2	Course Title	Dairy Technology	
3	Credits	3	
4	Contact Hours	3-0-0	
	Course Status	Elective	
5	Course Objective	To introduce students to an understanding of milk constituents with various dairy engineering operations such as homogenization, pasteurization, thermal processing, evaporation, freezing and drying of milk.	
6	Course Outcomes	By the end of this course, students should be able to: CO1: Classify the composition of milk, identify the approximate content of individual types present, and describe physicochemical characteristics of the main components. CO2: Justify the importance of processes like sterilization, homogenization and aseptic packaging. CO3: List potential applications and efficiency of various equipment used in dairy products processing. CO4: Analyse the production of milk products substitutes. CO5: Assess key functions in production steps, standards and defects of various dairy products. CO6: Elaborate their knowledge of food chemistry/engineering/microbiology and physical properties of foods to understand the processing of dairy products.	
7	Course Description	Dairy Engineering deals with the processing of milk and its products. This field involves the use of "Technology and Engineering" to make the dairy products and processing more advanced and useful.	
8	Outline syllabus		CO Mapping
	Unit 1	**Pasteurization**	CO1, CO6

	A	Milk-physical, chemical and functional properties-composition -reception and storage-testing—milk grading and defects-cooling of milk.			
	B	Pasteurization – principles, objectives and methods			
	C	Clean- in- Place process			
	Unit 2	**Sterilization and Homogenization**			CO2, CO6
	A	Sterilization-In bottle sterilization, UHT processing-advantages-difficulties			
	B	Homogenization theory, mechanism, factors influencing homogenization , merits and demerits.			
	C	Aseptic filling systems : cartons, plastic pouches, plastic bottles			
	Unit 3	**Centrifugation, Bactofugation and Membrane separation**			CO3 and CO6
	A	Principles of Centrifugation, clarification,standardisation. Components of cream separators, factors affecting fat percentage in cream ,fat loss in skim milk.			
	B	Membrane processing-principles of -Reverse osmosis -Ultra filtration and Electro dialysis.			
	C	Bactofuge treatment, Factors affecting bactofugation and its application.			
	Unit 4	**Manufacturing of milk products and substitutes**			CO4 and CO6
	A	Technology of condensed and evaporated milk			
	B	Casein, Lactose, Whey protein concentrates and isolates			
	C	Milk powder – Whole Milk Powder and Skim Milk Powder ,Spray dryer construction.			
	Unit 5	**Manufacturing of dairy based products**			CO5 and CO6
	A	Yogurt,Butter, Buttermilk and Ice cream manufacturing			
	B	Cream ,Cheese, Khoa and gulabjam, barfi, kalakand			
	C	Rosogolla, srikhand,channa and paneer with their defects, standards and packaging.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	

	Text book/s*	Sukumar, D., (Ed.). (2019). *Outline of Dairy Technology*, Oxford University Press. ISBN: 9780195611946.	
	Other References	1. Farrall, A.W., (Ed.). (2018). *Dairy and food products for Engineering*. 2nd edition. Medtech. ISBN:9386800713.	

FPP310 Dairy Technology Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester:04**
1	Course Code	FPP310
2	Course Title	Dairy Technology Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Elective
5	Course Objective	bjective of the course is to identify the basic instruments used in dairy technology and their importance along with isolation and characterization of microorganisms. The student will also become familiar with presence of foreign adulterants in milk samples.
6	Course Outcomes	After completion of the course the students will be able to: CO1: Discuss common aseptic techniques used in the dairy technology. CO2: Examine the importance of milk sample preparation. CO3: Design experiments used for adulterants in milk and products. CO4: Discuss basic techniques used in the estimation of platform tests. CO5: Justify adulterants and their effects on human wellbeing. CO6: Elaborate various techniques for preparation of different milk products.
7	Course Description	The course will introduce students to methods used in chemical examination of milk products. Students will be exposed to practical training on chemical testing of milk based products.

List of Practical's:

S. No.	**Experiment**	**CO Mapping**
1.	To prepare sample of milk and milk products for testing.	CO1, CO6
2.	To perform platform tests in milk.(Acidity, COB, MBRT, Specific Gravity, SNF)	CO2, CO6
3.	To estimate milk fat by Gerber method.	CO2, CO6
4.	Preparation of flavored milk	CO2, CO6
5.	To prepare casein and calculate its yield.	CO3, CO6
6.	Estimation of different adulterants in milk.	CO3, CO6
7.	Detection of starch or cereals in milk.	CO4, CO6

8.	Determination of cane sugar in milk	CO4, CO6
9.	To estimate milk protein concentration of given sample.	CO5, CO6
10.	Development of different types of khoa	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1. FSSAI manual for Dairy products.			
Other References	1. Downes, F.P. and Ito, K. (Eds.). (2001). *Compendium of Methods for the Microbiological Examination of Foods.* American Public Health Association.			

FPE201 Food Chemistry

School: SSET		**Batch : 2023-2027**
Programme: B. Tech		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: VI**
1	Course Code	FPE201
2	Course Title	Food Chemistry
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Elective
5	Course Objective	The course is designed to acquire knowledge of principle and techniques involved in food chemistry along with analysis of carbohydrates, lipids, fats and minerals and its relation with human nutrition.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Analyze depth and breadth of knowledge in food chemistry by demonstrating knowledge of, and applying, the principles and concepts of chemistry as they apply to food systems. CO2: Develop an understanding of the principles of carbohydrates whereby food molecules can be selected for use as ingredients in food formulations and the related factors that might be controlled during to enhance product quality. CO3: Inspect the physico-chemical and functional properties of proteins. CO4: Evaluate the importance of fats in food processing. CO5: Discuss the various aspects of minerals and vitamins. CO6: Investigate and solve qualitative and quantitative problems in food chemistry, both individually and in teams, by synthesising and evaluating information from a range of sources, including traditional and emerging technologies.
7	Course Description	The course will deal with the chemistry of the principal components of foods, their properties and interactions, and the changes that occur during processing, storage, and utilization. Emphasis will be on evidence derived from original research literature, interpretation of research findings, and problem solving based on the scientific principles of food chemistry.
8	Outline syllabus	CO Mapping

	Unit 1	**Introduction**			CO1, CO6
	A	Introduction to different food groups and importance of food chemistry			
	B	Water in foods and its properties			
	C	Proximate analysis in foods			
	Unit 2	**Carbohydrates**			
	A	Carbohydrate: Sources of food carbohydrates			CO2, CO6
	B	Physico-chemical and functional properties			
	C	Chemistry and structure of homosachharides and heterosachharides.			
	Unit 3	**Proteins**			CO3,CO6
	A	Proteins: Sources and physico-chemical and functional properties; Purification of proteins			
	B	Changes in protein during processing, protein determination methods.			
	C	Proteins from plant and animal sources.			
	Unit 4	**Fats**			CO4, CO5
	A	Fats: Sources and physico chemical and functional properties; PUFA [Poly-unsaturated Fatty Acids] hydrogenation and rancidity;			
	B	Saponification number, iodine value, Reichert-Meissl number, Polenske value;			
	C	Lipids of biological importance like cholesterol and phospholipids. Changes during food processing.			
	Unit 5	**Minerals and Vitamins**			CO5, CO6
	A	Minerals and Vitamins: Sources and structures of minerals & vitamins;			
	B	Effect of processing and storage of vitamins, Pro vitamins A & D; Vitamins as antioxidants;			
	C	Food Pigments & Flavouring Agents: Importance, types and sources of pigments - their changes during processing and storages.			
	Mode of examination	Theory			
	Weightage Distribution	CA	MTE	ETE	
		25%	25%	50%	
	Text book/s*	1. Swaminathan, M., (Ed.). (1973). *Advanced text book on Food and Nutrition* Vol. 1 & 2. The Bangalore Press. ASIN: B078T9R2YJ			

	Other References	2. Muyer, L.H., (Ed.). (2006). *Food Chemistry*. CBS Publishers & Distributors. ISBN: 9788123911496.	

FPP201: Food Chemistry Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch:FPT		**Semester: VI**
1	Course Code	FPP201
2	Course Title	Food Chemistry Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Elective
5	Course Objective	The course is designed to acquaint the students with basic techniques of Food Chemistry. To make students familiar with the different approaches of slide preparation. To make students learn concept of cell identification, cell division, chromosome study etc. through hands-on experiments.
6	Course Outcomes	After finishing the course the students will be able to CO1: Examine basic set up and working of food chemistry lab CO2: Analyse the techniques of lipid estimation CO3: Inspect techniques for protein estimation CO4: Estimate adulterants used in foods. CO5: Discuss methods for proximate analysis in foods CO6: Elaborate concepts for chemical composition estimation in food systems
7	Course Description	Food Chemistry Lab course is designed to make students learn the basic techniques of proximate analysis. The students also learn basic composition of food and their role in quality analysis.

List of Practical's:

S. No.	Experiment	CO Mapping
	Introduction safety measures in Food Chemistry Lab	CO1, CO6
1.	Effect of heat and Ph on color and texture of green vegetables.	CO2, CO6
2.	Determination of ash content in given food samples	CO2, CO6
3.	Determination of carbohydrates in samples	CO2, CO6
4.	Determination of fat in food sample	CO3, CO6
5.	Oxidative Rancidity in Potato Chips	CO3, CO6
6.	Determination of moisture in a given food sample	CO4, CO6
7.	To find gluten content present in different food samples	CO4, CO6
8.	Identification of pigments in given food samples	CO5, CO6
9.	To perform the isoelectric precipitation of casein present in milk.	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	2. Miller, D.D. (Eds.). (2022). *Food Chemistry: A laboratory manual*. 2nd edition.Wiley. ISBN 978-0-470-639-931-3			
Other References	2.Weaver, M.C. and Daniel, J.R. (Eds.). (2023). *The Food Chemistry Laboratory*.CRC Press ISBN: 9780470631232.			

FPE311 Bakery, Confectionery and Snack Products

School: SSET		**Batch : 2023-2024**
Programme: BTech		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester:VII**
1	Course Code	FPE311
2	Course Title	Bakery, Confectionery and Snack products
3	Credits	3
4	Contact Hours (L-T-P)	3-0-0
	Course Status	Minor
5	Course Objectives	The objective of the course is to develop industrial approach in students for bakery, chocolateand confectionary industry.
6	Course Outcomes	After successfully completion of this course students will be able to: CO1: Examine the functions of bakery ingredients, machineries and various rheological testing of dough. CO2: Analyze the technology and manufacture of bakery products and losses in bakery. CO3:Examine the analysis of bakery ingredients and manufacture various bakery products and chocolate with maintaining safety and hygiene of bakery plants. CO4: Examine the technology and manufacture of confectionery. Products with standards and regulations for confectionary CO5: Design and develop extrusion cooking, machineries and products. CO6: Originate concepts to processing technology of bakery, confectionery and extruded products.
7	Course Description	This course demonstrates broad knowledge about bakery, confectionary and extruded products development and machineries related to the products. Hygiene is also important factor for the same and this course provides the knowledge about bakery plant safety with hygiene. This course will be helpful for joining industry as well as setting up one's own industry.
8	Outline syllabus	
	Unit 1	**Introduction to baking**
	A	Introduction to baking; Bakery ingredients and their functions; Machines and equipment for batch and continuous processing of bakery products
B		Dough development; methods of dough mixing; doughchemistry — CO1, CO6
C		Rheological testing of dough-Farinograph, Mixograph, Extensograph, Amylograph / Rapid ViscoAnalyzer,Falling number, Hosney's dough stickiness tester
Unit 2		**Manufacturing of bakery products**
A		Technology for the manufacture of bakery products-bread, biscuits, cakes — **CO2, CO6**
B		Effect of variations in formulation and process

	on the quality of the finished product	
C	Quality consideration and parameters; Staling and losses in baking	CO2, CO6
Unit 3	**Analysis of bakery products**	
A	Testing of flour; Cake icing techniques, wafer manufacture, cookies, crackers, dusting or breading	CO3, CO6
B	Manufacture of bread rolls, sweet yeast dough products, cake specialties, pies and pastries, doughnuts, chocolates and candies	
C	Coating or enrobing of chocolate (including pan-coating); Maintenance, safety and hygiene of bakery plants.	
Unit 4	**Quality characteristics of confectionery ingredients**	
A	Quality characteristics of confectionery ingredients; technology for manufacture of flour, fruit, milk, sugar, chocolate, and special confectionery products	CO4, CO6
B	Colour, flavour and texture of confectionery; standards and regulations	
C	Machineries used in confectionery industry	
Unit 5	**Extrusion**	
A	Importance and applications of extrusion in food processing; Pre and post extrusion treatments	CO5, CO6
B	Manufacturing process of extruded products	
C	Change of functional properties of food components during extrusion.	

Mode of examination	Theory		
Weightage Distribution	CA	MTE	ETE
	25%	25%	50%

Text book/s*	1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press. 2. Kingslee, J. (2006). A Professional Text to Bakery and Confectionary. New Age International. 3. Mudgil, D., Barak, S., & Khatkar, B. S. (2017). Cookie texture, spread ratio and sensory acceptability of cookies as a function of soluble dietary fiber, baking time and different water levels. LWT, 80, 537- 542.
Other References	1. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub. 2. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen& Sons Ltd. 3. Khatkar, B. S. (Ed.). (2007). Food Science and Technology. Daya Books.

FPP311:Bakery, Confectionary and Snack products Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch:FPT		**Semester:VII**
1	Course Code	FPP311
2	Course Title	Bakery, Confectionary and Snack products Lab
3	Credits	1
4	Contact Hours (L-T-P)	0-0-2
	Course Status	Minor
5	Course Objective	The objective of the course is to develop industrial approach in students for bakery, chocolate and confectionary industry.
6	Course Outcomes	After finishing the course the students will be able to CO1: Examine the functions of bakery ingredients, machineries and various rheological testing of dough. CO2: Analyze the technology and manufacture of bakery products and losses in bakery. CO3:Examine the analysis of bakery ingredients and manufacture various bakery products and chocolate with maintaining safety and hygieneof bakery plants. CO4: Examine the technology and manufacture of confectionery. Products with standards and regulations for confectionary CO5: Design and develop extrusion cooking, machineries and products. CO6: Originate concepts to processing technology of bakery, confectionery and extruded products.
7	Course Description	Bakery, Confectionary and Snack products Lab course is designed to provide the information about bakery, confectionary and extruded products development and machineries related to the products. Hygieneis also important factor for the same and this course provides the knowledge about bakery plant safety with hygiene. This course will behelpful for joining industry as well as setting up one's own industry.

List of Practical's:

S.No.	Experiment	CO Mapping
1	Determination of Effect of Ingredients - Yeast, Fat and Sugar	CO1, CO6
2	Determination of Gluten Content in Wheat	CO2, CO6
3	Determination of Falling Number	CO2, CO6
4	Determination of Dough Raising Capacity	CO2, CO6
5	Preparation of Bread and Its Evaluation	CO3, CO6
6	Different Bread Making Methods-Straight Dough, Sponge and Dough, Activated Dough Development	CO3, CO6
7	Preparation of Variety Bakery Products-Buns, Rusk, Rolls, Doughnuts, Pizza, Puff Pastry	CO4, CO6
8	Baking of Biscuits	CO4, CO6
9	Baking of Cakes-Sponge Cake and Decoration	CO5, CO6
10	Effect of Additives on baking quality of bread	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1. Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press. 2. Kingslee, J. (2006). A Professional Text to Bakery and Confectionary. New Age International. 3. Mudgil, D., Barak, S., & Khatkar, B. S. (2017). Cookie texture, spread ratio and sensory acceptability of cookies as a function of soluble dietary fiber, baking time and different water levels. LWT, 80, 537-542.			
Other References	1. Bakery Technology & Engineering; Matz SA; 1960; AVI Pub. 2. Up to-date Bread Making; Fance WJ &Wrogg BH; 1968, Maclasen& Sons Ltd. 3. Khatkar, B. S. (Ed.). (2007). Food Science and Technology. Daya Books.			

FPP402: Preservation Technology Lab

School: SSET		**Batch: 2023-2027**
Programme: B.Tech.		**Current Academic Year: 2023-2024**
Branch: FPT		**Semester: 7**
1	Course Code	FPP402
2	Course Title	Preservation Technology Lab
3	Credits	3
4	Contact Hours (L-T-P)	0-1-4
	Course Status	Minor
5	Course Objective	The course is designed to acquaint the students with basic knowledge about need of food preservation and learn various preservation techniques used in preservation of foods.
6	Course Outcomes	After finishing the course the students will be able to CO1: Examine major food preservation techniques and underlying principles. CO2: Analyze the preservation skills of different food products CO3: Examine the importance and basic principles of food preservation CO4: Examine different preparatory unit operation for food processing CO5: Design and develop different preserved food products CO6: Originate concepts to process and preserve the shelf life of food products.
7	Course Description	Food Preservation Lab course is designed to provide the information about different preservation techniques that influence the quality of food materials during processing. Students will also get knowledge about handling of these food items on scientific lines and will get information about the production of quality products. These different techniques will be helpful to process and preserve the shelf-life of foodproducts

List of Practical's:

S. No.	Experiment	CO Mapping
41.	To study the changes in fruits/vegetables during storage	CO1, CO6
42.	To study the TSS and preparation of Brine and syrup	CO2, CO6
43.	To study blanching of seasoned fruits and vegetables	CO2, CO6
44.	Preparation of Jam	CO2, CO6
45.	Preparation of Jelly	CO3, CO6
46.	Preparation of Squash	CO3, CO6

47.	Pickel preparation	CO4, CO6

48.	Preparation of fruit bars.	CO4, CO6
49.	Preparation of sauerkraut	CO5, CO6
50.	To study dehydration of fruits and vegetables.	CO5, CO6

Mode of examination	Practical/Viva			
Weightage Distribution	CA	CE	ETE	
	25%	25%	50%	
Text book/s*	1Rahman, M. S. (Ed.). (2007). Handbook of food preservation. CRC press. 2Fellows, P. J. (2022). Food processing technology: principles and practice. Woodhead publishing.			
Other References	Zeuthen, P., & Bogh-Sørensen, L. (Eds.). (2003). Food preservation techniques. Elsevier.			