

ACADEMIC CURRICULA
POST GRADUATE DEGREE
PROGRAMMES

Master of Technology

(Choice Based Flexible Credit System)

Regulations 2021

Volume – 22

Syllabi for School of Bioengineering Programme

Professional Core and Elective Courses



SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

**Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India**

ACADEMIC CURRICULA

Food Safety and Quality Management

Professional Core Courses

Regulations 2021

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India

Course Code	21FPC511T	Course Name	FOOD TOXICOLOGY	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards			Nil

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>gaining the knowledge about Principles of toxicology</i>
CLR-2:	<i>know the information about food allergy and food toxicants</i>
CLR-3:	<i>obtain information about food safety of GMO</i>
CLR-4:	<i>know the impact of environmental toxicology</i>
CLR-5:	<i>attain information relevant to mycotoxins and food safety implications</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	obtain the knowledge of carcinogens in food			√
CO-2:	create aware about food allergy and natural toxins		√	
CO-3:	analyses food safety regulations of GMO		√	
CO-4:	understand impact environmental toxicology in food			√
CO-5:	analyses concept of mycotoxin and mycotoxin control strategies			√

Module-1 Toxicology 12 Hour

Principles of toxicology - Principles of toxicology - Absorption - Distribution - Metabolism - Excretion of toxic chemicals - General mechanisms by which toxic chemicals cause disease in humans - General mechanisms by which toxic chemicals cause disease in humans - Molecular mechanisms behind chemical-induced toxicities - Carcinogens in Food - Common carcinogens found in food - Effect on health - Effect on health - Sources and levels of exposure - Approaches to minimize carcinogens in food - Approaches to minimize carcinogens in food - Assessment of carcinogenic safety of food - Assessment of carcinogenic safety of food.

Module-2 Food Allergy and Food Toxicants 12 Hour

Food Allergy and Food Toxicants - Food allergy - Hypersensitivity - Introduction to the immune system - Introduction to the immune system - Mechanisms of allergic Type reactions - Allergenic components in foods - Allergenic components in foods - Natural toxins in food - Natural plant toxins - Natural plant toxins - Natural plant toxins effects in humans - Natural plant toxins effects in humans - Natural toxins in mushrooms - Toxicity of poisonous mushrooms in humans - Methods to reduce food contamination with pesticides - Methods to reduce food contamination with pesticides - Contaminant interaction - Drug - Pesticide - Heavy metal. Toxic environmental inorganic food contaminants - Toxic environmental organometallic food contaminants - Sources and their impact on human health

Module-3 Genetically Modified Organisms 10 Hour

Food safety of GMO - Definition of GMOs - Definition of LMO - Safety of genetically modified organisms (GMOs) - Safety of genetically modified organisms (GMOs) - Food safety regulations of GMOs - Food safety regulations of GMOs - GM Foods - Experiments on detection of pesticide residue - GM Foods - RCGM - GEAC - GMO applications in food and agriculture - GMO applications in food and agriculture - Environmental release of GMOs - Environmental release of GMOs - International rules and regulations in export and import of GMOs - Lab 6: Experiments on detection of antibiotic residues - International rules and regulations in export and import of GMOs.

Module-4 HACCP, GMP, GLP 11 Hour

Mycotoxins - Mycotoxins impacting food production and manufacturing - Patulin, Ochratoxin, Zearalenone, Aflatoxins, Trichothecenes, and Fumonisin - Guidance and regulations on mycotoxins in food and feed - Mycotoxin control strategies - Good agricultural practices (GAPs)/Good manufacturing practices (GMPs) - HACCP - VACCP - TACCP - Biological control measures - Transgenic approaches - Bioterrorism - Risk Assessment - Food safety implications - Statistical methods used in toxicological studies - Toxicological testing: LD50 and LC50 oral dermal and inhaled, feeding trials - In vitro tests for toxicology - Analysis of food toxins by gas chromatography and HPLC - Analysis of food toxins by mass spectrometry.

Learning Resources	1. Shibamoto, T. and Bjeldanes, L. 2016. <i>Introduction to Food Toxicology</i> , 2nd Ed. Elsevier Inc., Burlington, MA. -- (SB).	4. <i>A Textbook of Modern Toxicology</i> (3rd Ed 2004). Ernest Hodgson (Ed.), USA, Wiley & Sons. ISBN 0-471-26508-X.
	2. Stine, K. and Brown, T. 1996. <i>Principles of Toxicology</i> . CRC Press, Inc. Boca Raton, FL. 3. <i>Essentials of Environmental Toxicology</i> . W. William Hughes. Taylor & Francis, Philadelphia, PA. ISBN 1-56032-470-4.	5. <i>Food Toxicology</i> . W. Helferich and C. K. Winter (Ed.), CRC Press, London. ISBN 0-8493-2760-1. 20. 6. Klaassen, Curtis (Ed.). 2008. <i>Casarett and Doull's Toxicology</i> , 7th Edition. McGraw-Hill. New York, NY.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr R Preetha, SRM IST

Course Code	21FPC512J	Course Name	FOOD PROCESSING AND PRESERVATION TECHNIQUES	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes/Standards			

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	know about properties of raw materials used in food processing
CLR-2 :	know different processing and preservation techniques.
CLR-3 :	drying techniques of food material
CLR-4 :	low temperature and high temperature of preservation of foods
CLR-5 :	preservation by fermentation
CLR-6 :	modern food preservation techniques

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the basic concepts of physical, chemical and biological properties of preservatives.	√		
CO-2:	theories involved in various processing and preservation techniques.		√	
CO-3:	understand the concepts and theory behind the preservation mechanisms.			√
CO-4:	the concept of traditional processing and preservation methods.		√	
CO-5:	know the application of radiation in preservation methods.			√

Module-1: Food Preservation and Preservatives	12 Hour
Scope and importance of food processing - Food Preservation mechanisms and types - Properties of food preservatives - Physical properties of preservatives - Thermal properties - Mechanical properties - Biological properties - Mechanism of preservation - Sensory evaluation pattern - Raw material – preparation Grading, Sorting, Cleaning, Profiling, Peeling, Selection - Regulations for food preservatives - Usage of common food preservatives - Usage of Natural Food preservatives - Usage Synthetic food preservatives - Specification and regulatory guidelines - Health implications	
Module-2: Thermal Processing and Preservation	12 Hour
Preservation by altering the temperature - Low temperature preservation - Method of freezing - Effect of low temperature preservation - High temperature preservation - Concepts of thermal preservation - Thermal destruction of microbes - Microbes vs high & low temperature - D, Z, F, values - Blanching - Pasteurization techniques - Sterilization techniques - ETO - Canning - Aseptic processing - Evaporation - Modern preservation techniques-ETO - Regulations of usage of sterilizing agents - Country wise specifications - Mechanism and theory - Salmonella issue - Rapid detections techniques - Modern analytical techniques	
Module-3: Fermentation and Bio Preservation	12 Hour
Preservation by fermentation - Fermentation techniques - Mechanisms - Technology of fermentation - Application in food processing sector - Type of fermented food products - Yogurt - Pickling - Curing - Usages of probiotics - Types of probiotics - Characterization of probiotics - Sources of probiotic microbes - Role and Application of probiotics - Evaluation of probiotics foods - Health and food safety of probiotics - International norms - Concept of symbiotics - Studies on probiotic microbes - Dehydration - Evaporation - Sorption isotherm studies - Water activity and shelf life	
Module-4: Non- Thermal Preservation	12 Hour
Radiation – as a preservation method - Concepts of radiation techniques - Sources of radiation - Application in food industries - Mode of action - Effect on microorganisms and nutrients - Dose and duration of radio preservation techniques - Detection of radiated foods - Measurement of radiation dose - Safety measures of radiation technique - Safety of irradiated foods - Gamma irradiation - IR – Irradiation - Concepts and industrial set up - Evaluation of radiation efficiency - Effect of irradiation on nutritional and bioactive profile - Regulatory requirement on irradiation - Country wise specification on food irradiation - Advantages and limitations of modern preservation techniques - Pulsed electric field - PEF technology and application - Dose and duration of exposure - Industrial safety and set up - Evaluation of pattern	
Module-5: Advanced Preservation Technology and Regulations	12 Hour
Modern / advanced preservation techniques - Principles and theories behind the techniques - Edible coating - FSSAI norms of edible coating - High pressure processing - Principles and basic concepts - Microwave processing - Ultrasonic processing - Principles and application in food systems - Ultrasound mediated processing - Ohmic heating - Principles of ohmic heating - Electrical conductivity - Generic configuration -	

Application in food systems - INS numbering - Efficiency of preservation - Preservatives as per FSSAI - Specifications of preservatives - FSSAI norms - GMP concept

Learning Resources	1. Sivasankar, B. 2011. Food Processing and preservation, Eastern Economy Edition, BHI Publishers, New Delhi.	3. NeelamKhetarpaul, 2005. Food Processing and Preservation, Daya Publication House, New Delhi.
	2. Shafiur Rahman, M. 2007. Handbook of Food Preservation, Second Edition, CRC Press, Muscat, Sultanate of Oman.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (45%)		Life Long Learning CLA-2- Practice (15%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	-	15%	15%	-
Level 2	Understand	25%	-	-	20%	25%	-
Level 3	Apply	30%	-	-	25%	30%	-
Level 4	Analyze	30%	-	-	25%	30%	-
Level 5	Evaluate	-	-	-	10%	-	-
Level 6	Create	-	-	-	5%	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. G. Nagamianiammai, SRM IST

Course Code	21FPC513J	Course Name	ADVANCED FOOD MICROBIOLOGY	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	attain information about substrate for microbes
CLR-2:	know the factors affecting the microbial growth and metabolism
CLR-3:	gain the information about spoilage and preservation of different kinds of food products
CLR-4:	obtain knowledge about beneficial and harmful effect of microbes
CLR-5:	attain the advance techniques for the detection of specific toxin and microbes

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	enrich the technical association substrate and microbes	√		
CO-2:	control the microbes based on factors		√	
CO-3:	prevent food spoilage by using different control methods		√	
CO-4:	employ the fermentation techniques with specific skill			√
CO-5:	Technical knowledge for identifying the toxin and microbes through advance techniques			√

Module-1 Food as a Substrate for Microorganisms	10 Hour
Food as a substrate for microorganisms - Hydrogen ion concentration, water activity, oxidation reduction potential of food, nutritional content	
Module-2 - Factors Affecting the Growth of Microorganisms	12 Hour
Extrinsic factors, intrinsic factors, beneficial effect of microbes in food, pathogenic effect of microbes in food, microbial growth kinetics and log reduction, microbial metabolism of food components.	
Module-3 – Fermentation	13 Hour
Single cell protein - Advantages and disadvantages of single cell protein, probiotic microbes, fermented products, sauerkraut fermentation, vinegar fermentation, lactic acid fermentation	
Module-4 - Food Borne Diseases, Food Spoilage and Preservation	12 Hour
Food borne diseases - Food infection, food intoxication, spoilage and preservation of different kinds of food products, fruits and vegetable products, meat and poultry products, dairy products	
Module-5 - Methods for the Microbial Examinations of Foods	13 Hour
Methods for the microbial examinations of foods - Direct examinations, cultural techniques, enumeration techniques, rapid methods for the detection of specific organisms and toxins.	

Learning Resources	1. Frazier W.C., Westhoff D.C. and Vanitha N.M., (2014). Food Microbiology, 5 th Edition, Tata McGraw Hill Publishing Company.	4. Foster, W. (2016). Food Microbiology. New Delhi: CBS Publishers and Distributors. 5. Doyle, M.P., Diez-Gonzalez, F. and Hill, C. (2019). Food Microbiology: Fundamentals and Frontiers. Washington, DC: ASM Press.
	2. Adams, M.R., Moss, M.O., McClure, P.J. and Society, R. (2016). Food Microbiology. 4 th Edition. Cambridge, UK: Royal Society of Chemistry. 3. Erkmén, O., (2021). Microbiological Analysis of Foods and Food Processing Environments. Academic Press.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (45%)		Life Long Learning CLA-2- Practice (15%)			
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Level 1	Remember	15%	-	-	15%	15%	-
Level 2	Understand	25%	-	-	20%	25%	-
Level 3	Apply	30%	-	-	25%	30%	-
Level 4	Analyze	30%	-	-	25%	30%	-
Level 5	Evaluate	-	-	-	10%	-	-
Level 6	Create	-	-	-	5%	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. S. Periyar Selvam, SRMIST

Course Code	21FPC514J	Course Name	FOOD LAWS AND REGULATIONS	Course Category		PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand applicable food safety laws in India and international
CLR-2:	know the concept of food safety laws and its implications
CLR-3:	enhance and create awareness on health and hygiene
CLR-4:	know more about food safety systems
CLR-5:	understand food regulations in neighborhood countries

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand our country food laws and regulations	√		
CO-2:	know more about on food safety specifications	√		
CO-3:	apply knowledge on food safety regulations in food industries		√	
CO-4:	implement food safety and quality in industries			√
CO-5:	country wise specification on standards		√	

Module-1 - National Food Safety Regulations: Background Food Law	10 Hour
FSSAI scenario, Multiplicity of laws and regulations. Prevention of Food Adulteration Act, FPO, milk and milk product order. Agmark, Case studies on Food Adulteration. Common Food Adulterants.	
Module-2 – Genesis of Food Safety and Standard Authority of India:	10 Hours
Licensing and registration regulation Food Safety and Standards (Food Products Standards and Food Additives) Regulation, Food Safety and Standards (Prohibition and Restriction of Sales) Regulation; Food Safety and Standards (Contaminants, Toxins and Residues) Regulation; Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, Functional Food and Novel Food) Regulations; Food Safety and Standards (Organic Food) Regulation; Food Safety and Standards (Fortification of Food) Regulation. Case Study: Food Product Standards and Specifications; Food: Labelling	
Module-3 - Food Safety and Standards (Advertising and Claims) Regulation	10 Hour
Food Safety and Standards (Advertising and Claims) Regulation; Food Safety and Standards (Packaging) Regulation; Food Safety and Standards (Recovery and Distribution of Surplus food) Regulation; Food Safety and Standards (Safe food and balanced diets for children in school) Regulations; Food Safety and Standards (Foods for Infant Nutrition) Regulations; Food Safety and Standards (Labelling and Display) Regulations; Food Safety and Standards (Ayurveda Aahara) Regulations; Food Safety and Standards (Vegan Foods) Regulations. Case Studies on Food Safety Specification and standards of different products.	
Module-4 – Recent FSSAI Initiatives	20 Hour
Food Safety Compliance System (FoSCOS); Food Import Clearance System (FICS); Eat Right India, FoSTAC, Food Safety Mithra Case Study: Attending training program on FoSTAC. (Two Day Training).	
Module-5 – Brief Introduction about Other National Regulatory Bodies	10 Hour
Bureau of Indian Standards (BIS) in water licensing and product certification, Export regulations of Food, Role of Export Inspection council, Role of Agricultural and Processed Food Export Development Authority (APEDA), marine Product Export Development Authority, Other Boards in regulations: Spices Board, Coffee board, Tea board; Indian Oil Seeds And Produce Export Promotion Council (IOPEPC); Cashew Export Promotion Council of India(CEPC). International Food Law; Consumer Protection Act, 1986 and International Organization and Agreements in the Area of Food Standardization and Quality Control	

Learning Resources	1. T. Tamil Selvan, FSSAI: Food Safety Handbook Paperback: 2023	3. Naomi Rees, David Watson. 2000. International Standard for Food safety. An Aspen Publications
	2. Neal D. Fortin. 2009. Food Regulations, Wiley Publications	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
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		Theory	Practice	Theory	Practice	Theory	Practice
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Level 3	Apply	30%	-	-	25%	30%	-
Level 4	Analyze	30%	-	-	25%	30%	-
Level 5	Evaluate	-	-	-	10%	-	-
Level 6	Create	-	-	-	5%	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. P. Gurumoorthi, SRM IST

Course Code	21FPC515J	Course Name	FOOD SAFETY AND QUALITY AUDITING	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes/Standards			Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	impart knowledge on food safety and quality
CLR-2 :	create and enhance awareness on food safety issues and its monitoring activities
CLR-3 :	know and implement good manufacturing practices in industries
CLR-4 :	implement good health and hygiene practices
CLR-5 :	understand the regulatory requirement on food safety

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the basic principles and concepts of food safety and Quality.		√	
CO-2:	understand the concept on monitoring and implementing FSSAI regulations.			√
CO-3:	implement risk assessment and risk management.		√	
CO-4:	understand and implement food safety systems in industries			√
CO-5:	enhance knowledge in quality tools and its monitoring activities			√

Module-1: Food Plant Layout and Design	12 Hour
Food plant safety - Food Plant layout - Requirements – Plant facilities - Construction - Management - Maintenance - Equipment - Storage and maintenance - Transportation - FSSAI requirements. Case Studies.	
Module-2: Quality Management System and Environment Management System	12 Hour
GMP; GHP; GAP; ISO 9001 - Clause-wise discussion; OHSAS - Clause-wise discussion; Environmental management – 14000; Interpretation of ISO 9001 - EIC requirements - BRC, IMS – Studies - FSSAI checklist - Case studies - Interpretation of OHSAS 45001; Implementation model - Importance of the tool - Statistical Process Control - Statistical Quality Control - Quality management system - Bar Chart - Pareto analysis - Fishbone model - Run charts - Scatter plots - Control charts.	
Module-3: Implementation of HACCP, ISO/FSSC 22000 and BRC GS	12 Hour
HACCP - Principles - Implementation and maintenance; Hazard identification - CCP - OPRP - PRP - HACCP worksheet - HACCP case studies – Practice - HACCP case studies - - FSSAI – HACCP Checklist HACCP – Case studies. FSSC/ ISO 22000 - Context of the organization - Leadership - Planning - Support - Resources - Infrastructure - Operation - Pre-Requisite Program - Hazard control & Plan - Control of monitoring and measures - Verification and validation - Control of product and process Non-conformities - Correction - Corrective action - Root Cause Analysis - Performance evaluation - Internal audit - Management review - Improvement; Food Fraud and Traceability and authentication - Food product recall- VACCP- TACCP. BRC-GC –Sections. Practice – Clause wise - Identification of NC's – Practice with Case Studies.	
Module-4: Documentation and Auditing	12 Hour
Documentation: Standard operating procedure - Quality policy - Quality objectives - Quality manual - SOP for procurement - SOP for verification of procurement - SOP for storage - Personal hygiene - Resources management - Product management - Process management - Developing SOP and implementation. Auditing: Attributes of Auditor; Preparation of audit checklist – QMS, EMS and FSMS; Conducting audit - Opening meeting - Day briefing - Closing meeting - Preparation of audit report - NC statement - Case studies - Internal audit – Trial	
Module-5: Risk Assessment and Management	12 Hour
Food quality evaluation - Methods of quality evaluation - Quality management principles - Risk classification - Risk identification - Risk evaluation - Risk mitigation - Risk management - Risk Management worksheet – Practice - Risk assessment - Risk-based auditing - Microbial risk assessment. Contaminants - Naturally occurring toxic substances - Specification of NOTS - Pesticide residue - Analysis of pesticide residue. Risk management worksheet – practice	

Learning Resources	1. ISO 22000	4. Inteaz Ali. 2004. Food Quality Assurance – Principles and Practice, CRC press 5. Sara Mortimore and Carol Wallace. 2013. HACCP practical approach. 3 rd edition. Chapman and Hall London.
	2. FSSAI Food safety Inspection Checklist https://archive.fssai.gov.in/home/compliance/FOOD-SAFETY-INSPECTION-C FSSAI	
	3. Andres, V.J. 2005. Quality Assurance for Food Industries – A practical approach CRC press.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (45%)		Life Long Learning CLA-2- Practice (15%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	-	15%	15%	-
Level 2	Understand	25%	-	-	20%	25%	-
Level 3	Apply	30%	-	-	25%	30%	-
Level 4	Analyze	30%	-	-	25%	30%	-
Level 5	Evaluate	-	-	-	10%	-	-
Level 6	Create	-	-	-	5%	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. G.Nagamaniammai, SRM IST

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Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India

Course Code	21FPE551T	Course Name	ADVANCED FOOD CHEMISTRY	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	provide an understanding of the chemical function and properties of major food components.
CLR-2:	provide an understanding of the chemical interactions of food components and their effects on sensory and nutritional quality, functional properties, and safety of foods.
CLR-3:	provide an understanding of the chemical basis of food preservation and the effects of processing and storage on food quality.
CLR-4:	provide an understanding of Biochemical Changes During Processing of Food and Biochemical Reactions
CLR-5:	provide an understanding of nutritional properties of food

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	apply the knowledge on water and water quality standards			√
CO-2:	gain familiarity in protein chemistry and enzymes in food		√	
CO-3:	gain familiarity in fat/oil chemistry for food application		√	
CO-4:	gain the knowledge about Carbohydrate chemistry			√
CO-5:	gain the knowledge on processing induced changes in food			√

Module-1 Introduction About Physical and Chemical Properties of Food Components	15 Hour
Physical and Chemical Properties of Water - Water activity: principles, measurement, control, effects. Acid-base chemistry of foods and common additives. Composition of food and nutritional value. Moisture in foods. Biological oxidation, electron transport chain; oxidative phosphorylation. Assessment of quality of food by instrumental and chemical methods. Nutritive value of foods. Energy value and energy requirements and their estimation. Water, electrolytic and acid-base balance. Nutritive value of proteins PER, BV digestibility coefficient, NPU values, pepsin digestibility. Role of fibre in human nutrition.	
Module-2 Proteins, Carbohydrates and Lipids	15 Hour
Proteins - Physical properties of proteins in relation to protein structure, Analytical methods for estimation of protein, Characterization, Functional properties. Proteins: metabolism, deamination, decarboxylation, metabolic fate of amino acids, nitrogen balance. Deamination reactions and nitrogen excretion with special reference to fish. Fish muscle proteins, chemical changes in muscle during contraction. Proteins in foods, role in hydration- native and denatured proteins, gel formation, functional properties of proteins, changes during heat treatment and processing, texturized proteins. Carbohydrates: Naturally occurring polysaccharides in foods. Seaweed polysaccharides – sources and uses. Basic structures and properties: starches, celluloses, gums, modification techniques Browning reactions – enzymatic and non-enzymatic Basic chemistry - Simple sugars, sugar derivatives and oligosaccharides, sweetness, Sugar derivatives: sugar alcohols, glycosides, etc. Dietary fiber: components, properties, analysis. Lipids - Content and role in foods, Analytical methods Chemical, nutritional and physical properties, Processing of fats and oils. Lipids: metabolism of lipids, oxidation of fatty acids, lipoproteins; VLDL and HDL and their importance	
Module-3 Biochemical Changes During Processing of Food and Biochemical Reactions	15 Hour
Effects of food processing: changes occurring in chemical, functional and nutritional properties of proteins, Lipids and carbohydrates. Changes occurred in food during preservation and storage. Enzymatic reactions in food during storage Browning and related reactions, Case studies - acryl amide and furan formation in foods.	

Learning Resources	1. Srinivasan Damodaran, Kirk L. Parkin, Owen R. Fennema. 2007. Food Chemistry, 4 th Edition (Food Science and Technology). CRC Press, New York.	3. Connie M. Weaver, James R. Daniel. 2003. The Food Chemistry Laboratory: A Manual for Experimental Foods, Dietetics, and Food Scientists, Second Edition, CRC Press. London.
	2. H.-D. Belitz, Werner Grosch, Peter Schieberle. Food Chemistry 4 th Revised and extended Edition, 2009. Springer Publications. The Netherlands.	4. John, M. de Man. 2009. Principles of Food Chemistry, Third edition. Aspen Publishers.

Learning Assessment							
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Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr R Preetha, SRM IST

Course Code	21FPE552T	Course Name	FOOD ADDITIVES AND INGREDIENTS	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	gaining the knowledge about food additives
CLR-2:	know the information about types of food additives
CLR-3:	obtain information about pesticides and toxicants
CLR-4:	understand about various safety and standards for food additives
CLR-5:	attain information about common adulterants in food

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	gain the information about Classification and terminology of food additives		√	
CO-2:	obtain the knowledge of types of food additives			√
CO-3:	understand the possible of pesticides and toxicants residues in food		√	
CO-4:	know various specifications for food additives		√	
CO-5:	identify the common possible food adulterants		√	

Module-1 Food Additives and Preservatives	15 Hours
Introduction to food additives - Classification/Terminology - Stabilizers of physical characteristics - Inhibitors of chemical and biological alterations - Modifiers of organoleptic characters - Improvers and correctors - Purity and specifications of a food additive - Setting the Acceptable Daily Intake - Need - Properties - Properties - Functions - Functions - Usage of food additives - Usage of food additives - Toxicological evaluation of food additives - Toxicological evaluation of food additives. Chemical preservatives - Biopreservatives - Fortification - Antioxidants - Emulsifiers - pH control agents - Acidulants - Texturizing agents - Flavor enhancers - Enzymes - Gases - Honey and its adulteration - Honey adulteration detection and regulations - Ingredient - Colouring Agents - Sweeteners - Flavoring agents - Food processing aids.	
Module-2 Food Additives Standards	15 Hours
Safety and standards for food additives - Food additives and food labeling - European Union - European Union - FDA - FDA - FPO - FPO - FSSA specifications for food additives - FSSA specifications for food additives - Revised FSS Additives Regulations - Revised FSS Additives Regulations - Regulations related to sweeteners - Regulations related to food colors - Regulations related to flavors - Laws for food additives and ingredients in processed foods - Laws for food additives and ingredients in processed foods - Regulations for food additives and ingredients in processed foods - Regulations for food additives and ingredients in processed foods.	
Module-3 Adulterants, Pesticides and Toxicants	15 hours
Common adulterants in food - Milk and milk products - Milk and milk products - Atta - Edible oils - Cereals - Condiments - Whole and ground pulses - Coffee - Tea - Confectionery - Baking powder - Non-alcoholic beverages - Vinegar - Besan and curry powder - Types of adulterants - Intentional and incidental adulterants - Metallic contaminants. Pesticides and Toxicants - Pesticide residues in food - Chlorpyrifos and DDTs - Food contaminants from industrial wastes - Heavy metals - Lead - Cadmium - Arsenic - Nickel - Mercury - Polychlorinated polyphenols - Dioxins - Polycyclic aromatic hydrocarbons - Toxicants formed during food processing polycyclic aromatic hydrocarbons - Nitrosamines - Veterinary drug residues - Melamine contaminations.	

Learning Resources	1. Jim Smith and Hong Shum (2011). Food Additives data book. Second edition, Wiley- Blackwell publishers (e-Book). http://www.taylorandfrancis.com/books/textbooks/SCFS10	3. World Health Organization (WHO), 1995. Guidelines for Risk Assessment; Application of Risk Analysis to Food Standards Issues, a Joint FAO/WHO Expert Consultation, Geneva, Switzerland, 13–17 March 1995. http://www.who.int/foodsafety/publications/micro/march1995/en/index.html
	2. D Baines. Natural food additives, ingredients and flavourings. Woodhead Publishing website. http://www.woodheadpublishing.com/en/book.aspx/bookID=2063 .	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr R Preetha, SRM IST

Course Code	21FPE553T	Course Name	INSTRUMENTATION AND DATA ACQUISITION FOR FOOD INDUSTRIES	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1 :	<i>explain virtual instrument concepts.</i>
CLR-2 :	<i>select proper data acquisition hardware.</i>
CLR-3 :	<i>configure data acquisition hardware in LabVIEW.</i>
CLR-4 :	<i>use LabVIEW and configure the related hardware like DAQ and transducers.</i>
CLR-5 :	<i>create virtual instruments for practical works.</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>understand the principles of operation and limitations of common measuring instruments.</i>		√	
CO-2:	<i>model instruments and their operating conditions to use the instruments correctly</i>			√
CO-3:	<i>design and use signal conditioning devices</i>		√	
CO-4:	<i>program computers to automate the acquisition and processing of data</i>		√	
CO-5:	<i>design systems for the acquisition, analysis, and communication of data</i>		√	

Module-1 Measurement Systems	9 Hour
<i>Introduction, Temperature; Pressure, Motion and displacement, flow, force- static and dynamic characteristics.</i>	
Module-2 Data Acquisition - Fundamentals	12 Hour
<i>PC-Based DAQ System: PC, transducers and signal conditioners, DAQ hardware. Data acquisition specifications: Analog input: sampling rate, multiplexing, resolution, relative accuracy, noise, Analog output, Triggers, Real-Time system integration, Digital I/O. Timing I/O, Software, Multichannel analog DAQ system, Set up for data acquisition universal DAQ card, Use of timer-counter and analog outputs on the universal DAQ card.</i>	
Module-3 Data Acquisition – Signal Processing	12 Hour
<i>Environmental measurement- Signal Transmission, Signal Conditioning, Signal sampling, and Signal Acquisition. Resistive sensor, reactance variation and electromagnetic sensors, self-generating sensors, remote sensing, Wireless transmission, diagnosing sensor system.</i>	
Module-4 Data Processing	12 Hour
<i>Data bases and Management in Food Processing, Data storage and distribution by using various information technology tools and methods, Computer vision for food detection, Segmentation and recognition.</i>	

Learning Resources	1. Doebelin, E., <i>Measurement Systems</i> , 5th ed., McGraw-Hill, New York, 2004.	4. Fraden, J., <i>Handbook of Modern Sensors: Physics, Designs and Applications</i> , 3rd. ed., AIP Press and Springer, New York, 2004.
	2. Rizzoni, G., <i>Principles and Applications of Electrical Engineering</i> , 5th Ed. McGraw-Hill, New York, 2005.	5. Lancaster, D., <i>Active Filter Cookbook</i> , 2nd ed., Newnes, New York, 2003.
	3. Webster, J. G. (editor), <i>The Measurement, Instrumentation, and Sensors Handbook</i> , CRC Press and IEEE Press, 1999.	6. Various instruments catalogs
		7. Gupta S. and Gupta J.P, <i>PC Interfacing for Data Acquisition and Process Control</i> . Instrument society of America, 1994
		8. Paton Barry E., <i>Sensor, transducer and labview</i> , Tata McGraw Hill, New Delhi 2012

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr G. Nagamaniammai, SRM IST

Course Code	21FPE554T	Course Name	HYGIENE, PUBLIC HEALTH AND INDUSTRY SAFETY	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Department of Food Process Engineering	Data Book / Codes / Standards			

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>explain the meaning of health and hygiene.</i>
CLR-2:	<i>understand the indigenous health system in India</i>
CLR-3:	<i>indicate the various health and hygiene problems in India</i>
CLR-4:	<i>describe the health care delivery system in India</i>
CLR-5:	<i>understand the role of social-workers in prevention</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	know about public health and hygiene	√		
CO-2:	industrial safety requirements		√	
CO-3:	implementation challenges for industrial safety		√	
CO-4:	health care delivery			√
CO-5:	social responsibility			√

Module-1 – Introduction	9 Hour
<i>Introduction: Health Vs Hygiene; Definition of Health; Definition of Hygiene; Dimensions of Health; Factors Influencing Health.</i>	
Module-2 - Personal Hygiene	9 Hour
<i>Personal Hygiene; Washing Hands; Genital Hygiene; Keeping the Community Healthy; Immunization: An Introduction; National Immunization Schedule; Environmental Hygiene; Keeping Environment Healthy</i>	
Module-3 – Development of the Safety and Health Functions	9 Hour
<i>Development of the safety and health functions: Workers' compensations; record keeping; accident / incident cause analysis; organization of committees; safety and health economics; training.</i>	
Module-4 – Concepts of Hazards	9 Hour
<i>concepts of hazard avoidance: process safety and disaster management; process information; process analysis; building and facilities; ergonomics; health and toxic substances; personal protection and first aid; material handling and storage</i>	
Module-5 – International Requirements for Safety Health and Requirements	9 Hour
<i>OSHA permissible exposure limits; Safety Management; standard industrial classification; Factories Act and Case Law; Safety in food processing Industry</i>	

Learning Resources	1. Dr. K.U. Mistry, Fundamentals of Industrial Safety and Health; Siddharth Prakash an, 2008	2. C. Ray Asfahl David W. Rieske, Industrial Safety and Health Management, 6 th Edn. Printice Hall Publishers, 2010.
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Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. P. Gurumoorthi, SRM IST

Course Code	21FPE555T	Course Name	FOOD SAFETY SYSTEMS IN DAIRY INDUSTRIES	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	gaining the knowledge about milk composition, nutritional value and milk reception dock
CLR-2:	know the thermal processing techniques employed in milk
CLR-3:	know the sanitization and CIP process in dairy industries
CLR-4:	attain information relevant to possible adulterants, preservatives and naturalizer in milk
CLR-5:	provide fundamental theoretical concepts on food safety systems; technical knowledge for identifying food safety problems.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	gain the knowledge of milk composition and process in the milk reception	√		
CO-2:	implement strong control systems through different techniques			√
CO-3:	improve the best sanitization and CIP process in dairy industries			√
CO-4:	identify food safety problems		√	
CO-5:	gain more exposure and awareness on food safety systems in dairy industries		√	

Module-1 Milk Composition, Reception Operation and Raw Milk Examination	9 Hour
Milk composition, Nutritional importance, Milk reception operations, Layout of reception dock, Equipment unloading, Conveying, Examination of raw milk, Organoleptic tests, Preliminary tests, Laboratory testing of milk samples, Chemical analysis, Microbiological analysis.	
Module 2 – Thermal and Freeze Processing	9 Hour
Thermal processing of milk - Pasteurization, Batch, Holding process, Continuous process, Vaccination, Stassanization, Uperization, Heat processing of milk - Effect of heat on milk, salt system and acidity, milk proteins, Destabilization of caseinate system, Browning of milk. Factors affecting browning of milk. Freeze processing of milk - Effect of freezing on lactose and caseinate system.	
Module 3 - Ultra-High-Temperature Processing	9 Hour
Ultra-high-temperature processing - Types of sterilization plants - Direct and indirect type heating system, Advantages and Disadvantages of direct and indirect heating system, Changes in milk during processing and storage.	
Module-4 - Cleaning In Place Process	9 Hour
Centralized CIP system, Standalone type cleaning-in-place system, Sanitization in CIP process, Important Instructions and precautions for CIP system, Cleaning and sanitization methods and consideration, Cleaning and sanitization effectiveness factors, Assessment of effectiveness of cleaning and sanitizations.	
Module 5 – Preservatives, Neutralizers and Adulterants	9 Hour
Common preservatives added to milk and detection methods, Neutralizers in milk and detection methods, Adulterants in milk and detection methods. Dairy product certification and licensing.	

Learning Resources	1. Chandan, R.C., Arun Kilara and Shah, N.P. (2016). <i>Dairy Processing and Quality Assurance</i> . Chichester, West Sussex; Hoboken, Nj Wiley Blackwell.	3. Chavan, R.S. and Goyal, M.R. (2018). <i>Technological Interventions in Dairy Science: innovative approaches in processing, preservation, and analysis of milk products</i> . Oakville, ON: Apple Academic Press Inc.
	2. Webb, B.H., Johnson, A.H. and Alford, J.A. (2005). <i>Fundamentals of Dairy Chemistry</i> . New Delhi: CBS Publishers and Distributors.	4. Photis Papademas (2015). <i>Dairy microbiology a practical approach</i> . Boca Raton, Fla. CRC Press.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. S. Periyar Selvam, SRMIST

Course Code	21FPE556T	Course Name	FOOD SAFETY SYSTEMS IN FRUITS AND VEGETABLES	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>understand the importance of food safety in fruits and vegetables</i>
CLR-2:	<i>realize the concept of gap and implementation</i>
CLR-3:	<i>know the different preservation and storage methods</i>
CLR-4:	<i>understand the food safety regulations</i>
CLR-5:	<i>learn the risk and quality assessment methods</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>gain the knowledge of fruits and vegetables classification</i>	√		
CO-2:	<i>apply the knowledge on harvest and storage practices</i>		√	
CO-3:	<i>employ specific preservation techniques based on the types of fruits and vegetables and reduce the postharvest losses</i>		√	
CO-4:	<i>quality and risk assessment methods for fruits and vegetables</i>			√
CO-5:	<i>know the rapid method and consumer awareness, compliance and regulation</i>		√	

Module-1 - Overview of Food Safety	9 Hour
Overview of Food Safety - Importance in the context of fruits and vegetables, Historical perspectives and evolution of food safety standards, Pre-harvest Food Safety Practices, Pre-harvest Risk Assessment, Importance of Good Agricultural Practices.	
Module-2 Classification and Post - Harvest Physiology	9 Hour
Fruit and vegetable production in India, Classification of fruit and vegetables, Cellular components of plant cell, Importance of post-harvest physiology, Harvesting Practices.	
Module-3 - Types of Post-Harvest	9 Hour
Types of post-harvest losses - Mechanical injury types, Respiration and Transpiration losses, Technologies to control post-harvest losses, Spoilage of fruits and vegetables, Methods for the preservation of fruits and vegetables. Roles of regulatory agencies in ensuring fruits and vegetables safety.	
Module-4 – Post Harvest Handling and Quality Assessment	9 Hour
Post-harvest handling, transportation, precooling after Harvest, Cleaning or Disinfecting, Grading, Sorting, Washing, Curing, Blanching, Peeling, Trimming methods, storage methods for fruits and vegetables, Safe processing methods for fruits and vegetables, Quality assurance in the production of value-added products, Assessment of safety and quality of value-added products.	
Module-5 - Common Contaminants Detection Methods	9 Hour
Common Contaminants in Fruits and Vegetables - Pesticide residues, Heavy metals, other contaminants. Monitoring and control strategies for various contaminants, Rapid Detection Methods - contaminants. Consumer Awareness- Educating consumers about food safety for fruits and vegetables. Future Trends in Produce Safety- Emerging technologies and trends in ensuring produce safety. Anticipating and preparing for future challenges.	

Learning Resources	1. Verma L.R and V.K. Joshi, "Post-Harvest Technology of Fruits and vegetables". Volume 1 and 2. Indus Publishing Company, New Delhi. 2006.	4. Wills R, Golding W, Graham D and B. McGlasson. 2016 "Postharvest: An Introduction to the Physiology and Handling of Fruit and Vegetables". 293.
	2. Siddiqui, M.W., & Ali, A. (Eds.). (2016). Postharvest Management of Horticultural Crops: Practices for Quality Preservation (1 st Edition). Apple Academic Press. https://doi.org/10.1201/b19992 .	5. Florkowski, W.J., Shewfelt, R.L., Prussia, S.E. and Banks, N. (2014). Postharvest Handling A Systems Approach. San Diego Elsevier Science and Technology Ann Arbor, Michigan Proquest.
	3. Joshi, V.K. (2021). Postharvest Management Of Fruits And Vegetables. New India Publishing Agency.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. S. Periyar Selvam, SRMIST

Course Code	21FPE557T	Course Name	FOOD PROCESSING PLANT DESIGN	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes/Standards			Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	identify plant location food industry
CLR-2:	understand the construction requirement for food plant
CLR-3:	prepare processing plant design
CLR-4:	apply designing skills on equipment fabrication and arrangements
CLR-5:	find suitable process flow and layout for processed foods

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	outline the food plant design		√	
CO-2:	design floor, drain and ventilation for food processing plant	√		
CO-3:	design pipes, fittings and equipment as per process flow			√
CO-4:	evaluate the layout for equipment installation			√
CO-5:	construct food plant design for different categories of foods		√	

Module-1: Plant Layout	9 Hour
Introduction - Processing plant design – Definition - Scope and importance - Classification of food plants - Based on process - Based on product - Location selection for food plant - Site selection for food plant - General points of considerations for designing food plant - Types of layouts - Demo - Principles of food layout - Consideration for building layout - Consideration for building materials - Food building layout - Legal approval for layout - Outline for area planning - Plant design - Design approval - Practice - Layout for building and floor	
Module-2: General Construction Requirements	9 Hour
Considerations for construction - Selection of construction materials - Materials for different food processing areas - Floor design - Floor material selection - Floors for different sections of food processing areas - Ventilation design - Case study - Illumination system for food plants - Selection of light intensity for processing areas - Wall and ceiling design - Personal hygiene practices in food plant design - Pest, Rodent Fly / insect control prevention - Microbial contamination prevention in processing plants - Drains and drain layout for fruits and vegetables - Drains and drain layout for animal foods - Drains and drain layout for dairy plants - Practice – Layout for Ventilation, fly control, mold control, and drains	
Module-3: Process Flowchart	9 Hour
Introduction - Definition and role in plant design - Types of Process Design - Materials for the food equipment - Material balance in food processing plant - Energy balance in food processing plant - Equipment design - Selection of materials and construction of equipment - Demo - Role and types of pipes and tubes - Materials selection for food processing pipes and tubes - Sanitary pipes and fittings - Selection of materials for sanitary pipes and fittings - Standard - glass piping, plastic tubing - Standard - fittings and gaskets - Installation of pipes, tubes, fittings, valves, and gaskets in food processing plants - Repair and replacement of pipes and fittings - Maintenance of pipes and fittings - Video presentation for different pipes, fittings, and sanitary pipes in food processing plants	
Module-4: Layout Plan for Equipment	9 Hour
Arrangement of equipment - Material selection for food processing equipment - Fabrication of equipment - Welding and fittings - Installation of process equipment - Material handling in dairies - Layout for preprocessing area - Video presentation for food processing equipment fabrication and erecting - Layout for processing area - Layout for laboratory - Layout for warehouse - Layout for office - Layout for effluent treatment plant boiler - Benefits of individual layout design - Common problems in processing area - Flexibility - Practice – Designing Food Processing plant	

Module-5: Identification of New Product	9 Hour
Product selection criteria - Product development - Stages of product development - Development of Process flow chart for new product - Introduction of new product from pilot plant - New food processing plant layout and design - Selection of equipment, fitting, and other accessories - 3D processing plant design development - Layout design – Fruits based products - Layout design – Vegetables based products - Layout design – Beverages - Layout design – Meat and poultry - Layout design – Fish - Layout design – Cereal mills - Layout design – Extrusion and Expanded foods - Layout design – Plantation foods - Food processing plant design Model	

Learning Resources	1. Tufail Ahmed. "Dairy Plant Engineering and Management", CBS Publishers and Distributors, New Delhi, 2001. 2. Ananthakrishnan.C.P. and M.N.Sinha. "Technology and Engineering of Dairy Plant Operations", Laxmi Publications, New Delhi, 1997. 3. Groff, Gane K. and Muthu, John F., "Operations Management Selected Readings", D.B.Taraporevala Sons and Co, Bombay, 1975. 4. Thuesen, H.G., Febyrcky, W.J. and Thuesen, G.J., "Engineering Economy", Prentice –Hall Inc, New Jersey, 1978.
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Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. G. Nagamaniammai, SRM IST

Course Code	21FPE558T	Course Name	SENSORS FOR FOOD SAFETY AND QUALITY	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	comprehending sensor principles is fundamental for effective utilization in food analysis.
CLR-2:	familiarity with sensor classification aids in selecting suitable technologies for specific applications.
CLR-3:	understanding sensor instrumentation enhances the ability to interpret data accurately.
CLR-4:	proficiency in sensor applications enables addressing real-world challenges in food safety and quality assurance.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	analyze the classification of sensors based on proximity and working principles.		√	
CO-2:	evaluate the instrumentation and working principles of e-nose and e-tongue.		√	
CO-3:	assess the effectiveness of time-temperature indicators and non-invasive analysis methods.			√
CO-4:	apply sensor technologies in real-world scenarios such as pesticide detection, bioprocess monitoring, and smart packaging in the logistic supply chain.			√

Module 1 Classification of Sensors	15 Hour
Sensors: their classification based on Proximity, working principle; examples of applications in process control – Calorimetric biosensors, Optical biosensors, Piezoelectric biosensors, electrochemical sensors, colorimetric biosensors, Nano biosensor. Requirements of on-line sensors: Construction, types, working principles, applications, merits and limitations	
Module 2 E Sensors	15 Hour
e nose and e tongue - instrumentation, application and working principles. Time-temperature indicators – partial-history and full-history indicators; Commercial devices; Applications and limitations. Non- invasive non-destructive methods of analysis- MS- FTIR analysis in food. ICPMS, HRMS, AAS. Principles and applications of NIR, NMR, X-ray diffraction analysis in food systems.	
Module 3 Application of Sensors	15 Hour
Pesticide and insecticide in food, Bioprocess monitoring and control- enzymes, culture and fermentation process for food and ingredients, Smart Packaging – perishable food –Logistic supply chain.	

Learning Resources	1. Nielsen, S.S. Introduction to the chemical analysis of foods. Jones and Bartlett Publishers, Boston , London. 2004.	3. Pearson, D. The Chemical Analysis of Foods. Churchill Livingstone, New York. 2002.
	2. Mahindru, S.N. Food additives. Characteristics, detection and estimation. Tata McGrawHill Publishing Company Limited, New Delhi. 2000	4. Sharma, B.K. Instrumental Methods of Chemical Analysis. Goel Publishing House, New Delhi. 2004.
		5. Poonam Mishra and Partha Pratim Saha, Biosensors in Food Safety and Quality: Fundamentals and Applications. CRC Press, Taylor and Francis group, UK. 2022.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. G. Nagamaniammai, SRM IST

Course Code	21FPE651T	Course Name	FOOD SAFETY AND QUALITY ASSURANCE FOR MEAT, POULTRY AND SEA FOOD INDUSTRIES.	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the meat processing concepts
CLR-2:	know the changes in the quality of poultry and egg
CLR-3:	conceptualize quality of sea foods
CLR-4:	demonstrate check list for risk management
CLR-5:	illustrate HACCP principles for animal foods

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	construct contamination free meat processing plant	√		
CO-2:	plan poultry and egg processing as per quality standards		√	
CO-3:	outline the quality of sea food on processing		√	
CO-4:	assess the risk management system for animal foods		√	
CO-5:	evaluate critical control point in animal processing plant			√

Module-1 - Sources of Meat and Meat Products in India	9 Hour
Sources of meat and meat products in India, its importance in national economy. Chemical composition and microscopic structure of meat. Effect of feed, breed and management on meat production and quality, Slaughtering of animals and poultry, inspection and grading of meat, Factors affecting post-mortem changes, properties and shelf-life of meat	
Module-2 - Meat Quality Evaluation	9 Hour
Meat quality evaluation. Mechanical deboning, meat tenderization. Aging, pickling and smoking of meat. Meat plant sanitation and safety, Byproduct utilization., tenderization of meat, HACCP implementation in meat processing plant, quality assurance	
Module-3 – Poultry Processing	9 Hour
poultry processing, defeathering, evisceration, byproduct utilization, different types of poultry, spoilage and preservation technique, quality assurance system by APEDA, HACCP implementation in poultry plant	
Module-4 -. Structure, Composition, Nutritive Value and Functional Properties	9 Hour
Structure, composition, nutritive value and functional properties of eggs and its preservation by different methods. Factor affecting egg quality and measures of egg quality, preservation of eggs, quality control	
Module-5 - Types of Fish	9 Hour
Types of fish, composition, structure, post-mortem changes in fish. Handling of freshwater fish. Canning, smoking, freezing and dehydration of fish. Fish sausage and home making. MMPO, MFPO, radiation processing meat safety, HACCP implementation in fish processing Module, quality assurance system by MPEDA	

Learning Resources	1. Pearson, A.M and Dutson, T.R. 1995. HACCP in meat, poultry and fish processing, Advances in meat research series, Volume 10, Chapman & Hall Publisher, New York.	4. Huss, H.H, Ababouch, L and Gram, L. 2003. Assessment and Management of Seafood Safety and Quality, FAO fisheries technical paper 444, Food and Agriculture Organization of the Moduled Nations Rome.
	2. ShaiBarbut. 2002. Poultry Products Processing An industry Guide, CRC Press, Florida.	5. William J. Stadelman, Owen J Cotterill. 2002. Egg science and Technology. Fourth edition, CBS Publishers & Distributors, New Delhi.
	3. Gunter Heinz and Peter Hautzinger, 2007. Meat processing technology for small- to medium scale producers, Food and Agriculture Organization of the Moduled nations regional office for Asia and the Pacific Bangkok, RAP publication.	6. Laboratory Manual for FSQM system for meat, poultry and sea foods

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Module test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr P Gurumoorthi, SRM IST

Course Code	21FPE652T	Course Name	FOOD SAFETY AND QUALITY ASSURANCE FOR BAKERY AND CONFECTIONERY INDUSTRIES	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards			

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>explain about overview of bakery and confectionary industry safety regulations.</i>
CLR-2:	<i>describe about types of ingredients used in baking industry and quality evaluation.</i>
CLR-3:	<i>analyze about the quality parameter of confectionery products and its spoilages due to contamination.</i>
CLR-4:	<i>describe about inspection procedure in bakery and confectionery industry.</i>
CLR-5:	<i>discuss about HACCP implementation on various bakery and confectionary product processing.</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>understand the basic concepts and functions of Safety aspects of bakery product based on FSSAI standards.</i>	√		
CO-2:	<i>learn function of bakery product formulation and quality evaluation.</i>	√		
CO-3:	<i>analyze about the baking quality, equipment used in bakery industry and preservation of baked products.</i>		√	
CO-4:	<i>understood the preparation of confectionary products, monitoring process control and inspection procedures.</i>			√
CO-5:	<i>described about role of HACCP in bakery and confectionery industries on various product productions, CCP.</i>			√

Module – 1: Bakery and Confectionery Industries Statuts in India	9 Hour
<i>Types of Ingredients in Bakery products; Essential Ingredients; Optional Ingredients; FSSAI regulation in bakery and confectionery products; Product specifications; Lab: Preparation of Bread and check quality parameter; Labeling procedures; Packaging regulation of bakery products; Food Safety and Management systems; Guideline implementation by FSMS; Bakery design and facility; Bakery personal hygienic; Bakery industrial hygienic; Basic cleaning and sanitation process in Bakery; Code of hygiene condition in bakery and confectionary; Preparation of Chocolate and evaluate its quality parameters; Preparation of Caramel</i>	
Module – 2: Bakery Products Technology; Baking Process	9 Hour
<i>Yeast made products; Cake preparation; Cake preparation; Biscuits; Cookies Doughnuts, Pastry and its types; Bagels; Muffins; Quality evaluation of finished bakery products, internal evaluation; external characteristic evaluation, baking quality in yeast and chemical leavening products. Preparation and quality assessment</i>	
Module – 3: Bakery Equipment for Preservation of Bakery Products	9 Hour
<i>Spoilage of Bakery products; Bread disease; Fault occur during processing of bakery products; Confectionary product technology; Sugar and Chocolate confectionery; Marshmallow; Production of types of chocolate; Ice creams and its types; List of confectionery equipment; Quality evaluation of confectionery products; Development of Toffee, Candy and evaluate its quality.</i>	
Module – 4: Bakery Product Quality and Safety	9 Hour
<i>Quality of Raw materials; Quality check on flours; Building inspection and routine; Monitoring process control Ingredient inspection and assessing; Bakery quality assurance.; HACCP implementation in bread industry; Food microbial testing on bakery and confectionery products</i>	
Module – 5: Monitor the Control Points for a Range Confectionery Products	9 Hour
<i>Bakery auditing procedure; Types of audit in bakery and confectionery industry; Scope of auditing; health and Safety standards in bakery and confectionery products; Cross contamination and how to control in Bakery Product; GMP in Bakery industry; ole of metal detector and X-ray scanners used in bakery industry</i>	

Learning Resources	1. Theodorasvarzakas, ConstantinaTzia, "Handbook of Food Processing, quality and manufacturing processes", CRC press, ISBN: 9781498721776, 2015.	3. Assuring food safety and quality, 2012. FAO Food and Nutrition Manual, FAO Publication, Rome.
	2. FSMS Manual for Bakery and Confectionary Industry, 2014.	4. Yogambal Ashokkumar, "Textbook of Bakery and Confectionery Products", second edition (Revised), Published by PHI Learning Private Limited, New Delhi, ISBN: 978-81-203-4603-1, 2012.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. P. Gurumoorthi, SRM IST

Course Code	21FPE653T	Course Name	FOOD SAFETY SYSTEMS IN BEVERAGE		Course Category	E	PROFESSIONAL ELECTIVE			L	T	P	C	
							3	0	0	3				
Pre-requisite Courses		Nil		Co- requisite Courses		Nil		Progressive Courses		Nil				
Course Offering Department		Food Process Engineering		Data Book / Codes / Standards		Nil								
Course Learning Rationale (CLR):														
The purpose of learning this course is to:														
CLR-1:		understand the importance of raw material and risk assessment in beverages production												
CLR-2:		realize the concept of quality control in soft drink industries												
CLR-3:		know the advantage and disadvantages of alcoholic beverages												
CLR-4:		create awareness on functional beverages												
CLR-5:		understand the beverages standards and regulation												
Course Outcomes (CO):														
		At the end of this course, learners will be able to:										Programme Outcomes (PO)		
												1	2	3
CO-1:		enhance the knowledge on types of beverages										√		
CO-2:		gain the knowledge of risk assessment in beverage production										√		
CO-3:		apply the knowledge on quality control in soft drink industries												√
CO-4:		gain the knowledge on quality control in alcoholic beverages												√
CO-5:		know the implementation of GMP and HACCP in beverage industry											√	
Module-1 – Types of Beverages and Regulatory Frame Works														
Current status of the beverage industry in India, Types of beverages, Nutritional and therapeutic benefits, Regulatory Framework, National and Global regulations in the beverage industry.														
Module-2 - Non-Alcoholic Beverages														
Non-Alcoholic Beverages, Natural Fruit based beverages, Synthetic/Artificial beverages, Carbonated beverages, Dairy-based beverages, Whey based beverages, Flavored milk, Advantages and disadvantages of soft drinks, Quality control in soft drink industries.														
Module-3 - Alcoholic Beverages														
Alcoholic Beverages, Types of wine, Types of beer, Distilled beverages - Brandy, Whiskey, Rum, Gin, Advantages and disadvantages of alcoholic beverages, Quality control in alcoholic beverages														
Module-4 - Specialty Beverages														
Specialty Beverages - Coffee, Tea, Probiotics as ingredient in functional beverage, Probiotics health benefits, Fortification of beverages, Sport beverages. Quality control in functional beverages - Probiotics, fortified drinks, sport beverages.														
Module-5 – Safety and Quality Control in Beverages														
Foodborne Pathogens in Beverages, Sanitation and Hygiene in Beverage industries, GMP in the Beverage Industry, Hazard Analysis and Critical Control Points (HACCP) in the Beverage Industry. Standards and regulation in India.														
Learning Resources		1. Grumezescu, A.M. and Holban, A.M. (2020). Safety issues in beverage production. Duxford, United Kingdom: Woodhead Publishing, an imprint of Elsevier. 2. Alexandru Mihai Grumezescu and Alina Maria Holban (2019). Production and Management of Beverages. Volume 1. The Science of Beverages. Cambridge, Ma: Woodhead Publishing. 3. Wilson, T. and Temple, N.J. (2016). Beverage Impacts on Health and Nutrition Second Edition. Cham Springer International Publishing, Imprint: Humana Press. 4. Paquin, P. (2009). Functional and Specialty Beverage Technology. Elsevier.												

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	30%	-	30%	-	30%	-
Level 4	Analyze	30%	-	30%	-	30%	-
Level 5	Evaluate	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. S. Periyar Selvam, SRMIST

Course Code	21FPE654T	Course Name	FOOD SAFETY AND QUALITY ASSURANCE FOR NUTRACEUTICAL AND FUNCTIONAL FOOD PRODUCTS	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	explain about linking between nutrition and medicine.
CLR-2:	describe about flavonoids and its health benefits.
CLR-3:	analyze about the bioactive compounds from plant sources used as health supplements.
CLR-4:	describe phytoestrogen and its role in health benefits as supplementary products.
CLR-5:	discuss about nutraceuticals, efficacy, safety and toxicity

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the basic concepts of nutraceutical and its classification used as health supplements.		√	
CO-2:	learn function of flavonoids health benefits for cardiovascular disease and bone health.	√		
CO-3:	analyze about the important of plant derived bioactive compounds potential to control the risk of diseases.			√
CO-4:	understand the vital role of phytosterol derived from plants source used to prevent cancer and other diseases.			√
CO-5:	describe about role of Bioactive compound used for reducing the risk of CVD, Diabetics, CNS disorders and Respiratory disorder.		√	

Module-1 Concepts of Nutraceutical	9 Hour
Concepts of Nutraceutical: Introduction- Classification of Nutraceutical; Definition, History, Classification of Functional Foods: Nutrient vs. Non-nutrient; Prebiotics - Chemistry, Sources and Bioavailability, Effect of Processing, Effects on Human Health and Potential Applications in Risk Reduction of Diseases, Perspective for Food Applications for the Following: Non-Digestible Carbohydrates/Oligosaccharides: Dietary Fibre; Resistant Starch, Gums.	
Module-2 – Quality Assurance Aspects of Nutraceutical Industries and International Requirements	9 Hour
Quality Assurance of Nutraceuticals and Their Approval, Registration, Marketing; Nutraceutical Regulations; European Regulations (EFSA) (EC) No 1924/2006; USA Regulations (DSHEA and FDA).	
Module-3 – Regulatory Aspects of Nutraceutical Industries	9 Hour
Manufacturer Responsibility & Quality Control; Ingredients; Formula; Manufacturing; End-products Testing. Major contamination risks of nutraceuticals; detection of microbial contamination in nutraceuticals;	
Module-4 FSSAI Regulation for Nutraceutical Industry	9 Hour
Food Safety and Standards (Health Supplements, Nutraceuticals, Food for Special Dietary Use, Food for Special Medical Purpose, and Prebiotic and Probiotic Food) Regulations, 2022. [FSSAI (Nutra) Regulations, 2022]; FSSAI guidance and notification on nutraceuticals.	
Module-5 – Food Safety and Quality Guidelines for Nutraceutical and Functional Food Industry	9 Hour
Guidelines on FOOD SAFETY MANAGEMENT SYSTEMs for nutraceuticals and Food Supplements industries: Establishment – Design and Facilities; Control of Operation; Establishment – Maintenance & Sanitation; Establishment – Personal Hygiene; Establishment-Product information and consumer awareness.	

Learning Resources	1. Vatter, Dhiraj A. and Vatsala Maitin. 2016. <i>Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications</i> . USA: DEStech Publications, Inc.	4. Cho, S. S. and M. L. Dreher. 2001. <i>Handbook of Dietary Fiber</i> . New York: Marcel Dekker Inc.
	2. Boye, Joyce I. 2015. <i>Nutraceutical and Functional Food Processing Technology</i> . New Jersey: Wiley-Blackwell.	5. Wildman, R. E. C. 2000. <i>Handbook of Nutraceuticals and Functional Foods</i> . Boca Raton: CRC Press.
	3. Iwu, Maurice M. 2017. <i>Food as Medicine: Functional Food Plants of Africa</i> . US: CRC Press.	6. Aluko, Rotimi E. 2012. <i>Functional Foods and Nutraceuticals</i> . Germany: Springer

Learning Assessment

Learning Assessment	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr. P. Gurumoorthi, SRM IST

Course Code	21FPE655T	Course Name	AI AND ML BASED FOOD QUALITY MONITORING SYSTEM	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	explain Foundation in AI Concepts and Techniques.
CLR-2:	configure Problem Solving with AI.
CLR-3:	learn Introduction to Machine Learning.
CLR-4:	design Application of AI in the Food Industry.
CLR-5:	learn Food Quality Monitoring and Safety.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand and apply fundamental AI techniques such as expert systems, neural networks, and fuzzy logic.		√	
CO-2:	systematically approach and solve complex problems using AI methodologies and models.		√	
CO-3:	implement and evaluate machine learning algorithms including PCA, KNN, and various classifiers.			√
CO-4:	utilize AI technologies in automating and optimizing production processes in the food industry.			√

Module-1 AI Techniques	12 Hour
Problem solving with AI, AI Models, Data acquisition and learning aspects in AI, Problem solving- Problem solving process, formulating problems, Problem types and characteristics. AI Techniques- Expert system, Artificial Neural Network, Fuzzy logic, Adaptive neuro- fuzzy interspace system and machine learning.	
Module-2 ML Tools and Processes	15 Hour
PCA and Dimensionality Reduction, Nearest Neighbors and KNN. Linear Regression. Decision Tree, Classifiers, Notion of Generalization and concern of Over fitting, Notion of Training, Validation and Testing, Connect to generalization and over fitting. Ensembling and RF, Linear SVM, K Means, Logistic Regression, Naive Bayes. Role of Loss Functions and Optimization, Gradient Descent and Perceptron/Delta Learning, MLP, Back propagation, MLP for Classification and Regression, Regularization, Early Stopping, Introduction to Deep Learning, CNNs, Kernels (with SVM), Bayesian Methods, Generative Methods, HMM, EM, PAC learning.	
Module-3 IoT Based Process Control and AUTOMATION	9 Hour
Automation of the Control of Production Processes, Evaluation the Capability of Production Process and Machine. Interfacing data through Internet of Things (IoT), Sensors, RFID, QR codes, pesticides, food additives, Analytical instruments, Sensory parameter, material /physical parameters, biological parameters, packing materials, Label declaration, Logistics and Supply chain, Product development and formulation, Shelf life studies.	
Module-4 Application of IoT, AI and ML in Food Quality Monitoring Systems	9 Hour
Real time monitoring, Food sampling and testing, Risk assessment, Food fraud, Food defense, Food threat.	

Learning Resources	1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.	4. Ian Goodfellow, Yoshoua Bengio, and Aaron Courville Deep Learning MIT Press Ltd, Illustrated edition
	2. Deepak Kemhani, First course in Artificial Intelligence, McGraw Hill Pvt Ltd, 2013	5. Christopher M. Bishop Pattern Recognition and Machine Learning - Springer, 2nd edition
	3. Tom M. Mitchell- Machine Learning - McGraw Hill Education, International Edition	6. Rodriguez MEP. 2018. Process Monitoring and Improvement Handbook, Second Edition 2018 by ISBN: 978-0-87389-974-1 Food Process Monitoring Systems 1993, Springer.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		Dr G Nagamaniammai, SRM IST

Course Code	21FPE656T	Course Name	LOGISTICS AND SUPPLY CHAIN MANAGEMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Food Process Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	explain about overview of logistics and supply chain management.
CLR-2 :	describe about inventory management and customer service and order processing.
CLR-3 :	analyze about the demand forecasting techniques in logistics and supply chain management.
CLR-4 :	describe warehousing, Transportation in LSCM and Protective Packaging.
CLR-5 :	discuss about Logistics Administration and Logistics Information systems.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the basic concepts and functions of LSCM.		√	
CO-2:	learned function of order processing cost, Inventory cost and types, and Customer service strategic Management.	√		
CO-3:	analyze about the effective forecasting Process and principle of demand forecasting.			√
CO-4:	understood the Warehousing strategy and warehouse design, Multi-modal transportation and Logistics packaging.			√
CO-5:	described about role of organization principles, Trends in LSCM organizations, and Logistics information systems.		√	

Module 1: Introduction to Logistics	9 Hour
Nature and concepts - Logistics mission and Strategic Issues - International Logistics System - Growing Importance of Logistics Management - Operational objectives - Components of Logistics Management - Functions of Logistics Management - Integrated Logistics system - Total cost analysis and Trade-off - Function of Supply Chain Management - Supply chain and competitive performance - The changing competitive environment - The impact of out-of-stock - Introduction about Inventory Management - Concept and types of Inventory management - Functions of Inventory in LSCM - Elements of Inventory cost	
Module 2: Logistics in India	9 Hour
ABC Analysis - ABC-VED Matrix - Distribution Requirement Planning (DRP) - Material Requirement Planning Equation (MRP) - Just-in-Time system - Prerequisites of JIT System - Nature and Concept of customer service - Components of customer service - Customer Service Costs - Gap analysis for Customer Service Management - Customer Service Strategic Management - Marketing Strategy - Order Processing in LSCM - Major function in order processing - Elements of order processing cost - Zero defect delivery system - Customer relationship with supply chain manager - Role of Supply chain management in order processing	
Module 3: Flow Chart of Order Processing	9 Hour
Logistics and shareholder value - Direct product profitability - Customer Profitability analysis - Logistics and the bottom line - International supply chain strategies - Warehousing and distribution centers - Concept of Warehousing - Types of Warehousing - Function of Warehousing - Warehousing strategy - Warehouse design - Operational Mechanism of Warehouse - Element of Transportation in LSCM - Transportation cost - Modes of Transportation - Multi-Modal Transport	
Module 4: Cold Storage Facilities	9 Hour
Selection of Transportation Mode - Indian Transport infrastructure - Transportation decision in LSCM - Protective packaging - Forms of protective packaging - Protective packaging problems - Packaging policy - Types of Packaging materials - Primary and Secondary Packaging - Labeling procedure in Logistics - Logistics organizations - Trends of Logistics and Supply Chain Organization - Basic organization principles - Organizing for global logistics - Collaborative planning - Factors influencing organization structure - Internal and External Performance measurement	
Module 5: Outline of Logistics Functioning	9 Hour
Role of information in Logistics and Supply chain management - Value flow of information in LSCM - Operational flow of information - Logistics Information System (LIS) - Operational Logistics information system	

- Electronic Data Interchange (EDI) - Components of EDI - Bar code system (BCS) in Logistics and Supply Chain Management - Enterprise Resource Planning (ERP) - Supply chain relationship - Harmonious Relationship Marketing - The lead-time gap - Thinking global and acting local - Role of supply chain management in demand forecasting - Case studies in LSCM - Cutting-edge customer service - Challenges facing in customer satisfaction

Learning Resources	1. Martin Christopher, "Logistics and Supply Chain Management" Fourth edition, Pearson education limited, ISBN: 978-0-273-73112-2, 2011.	3. Michael Hugos, "Essentials of Supply chain Management" Fourth edition, John Wiley & Sons, Inc, ISBN: 9781119461104 (paper back), 2018.
	2. D.K. Agarwal, "Textbook of Logistics and Supply Chain Management", revised edition, Trinity press, ISBN: 978-93-85750-04-5, 2016.	4. Cecil B. Bozarth, Robert B. Handfield, "Introduction to operations and supply chain management", Fourth edition, Pearson publication, ISBN-13: 9780133871777, 2016.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of Unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	25%	-	20%	-	25%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	30%	-	25%	-	30%	-
Level 5	Evaluate	-	-	10%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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(Deemed to be University u/s 3 of UGC Act, 1956)

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