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SHIVAJI UNIVERSITY, KOLHAPUR
416 004, MAHARASHTRA

PHONE : EPABX - 2609000, BOS Section - 0231-2609094, 2609487

Web : www.unishivaji.ac.in Email: bos@unishivaji.ac.in

शिवाजी विद्यापीठ, कोल्हापूर ४१६ ००४, महाराष्ट्र

दूरध्वनी - इपीबीएक्स - २०६०९०००, अभ्यासमंडळे विभाग : ०२३१- २६०९०९४, २६०९४८७

वेबसाईट : www.unishivaji.ac.in ईमेल : bos@unishivaji.ac.in



SU/BOS/Sci & Tech/ 182

Date: 10/06/2026

The Director,
School of Engineering and Technology,
Shivaji University, Kolhapur.

Subject: Regarding revised syllabus of **B. Tech. Part - IV (Sem VII & VIII) degree Programme (Department of Technology)** under the Faculty of Science and Technology as per NEP 2020.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of B. Tech. Part - IV (Sem VII & VIII) degree Programme under the Faculty of Science & Technology as per National Education Policy 2020 (NEP 2020).

Sr. No.	Course Syllabus
1	Civil Engineering
2	Mechanical Engineering
3	Computer Science and Technology
4	Chemical Engineering
5	Electronics and Telecommunication Engineering
6	Food Technology

This Syllabus, nature of question and equivalence shall be implemented from the academic year **2026-27** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website www.unishivaji.ac.in > Syllabus > Syllabus as per NEP-2020.

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2026 & March / April 2027. These chances are available for repeater students, if any

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

Dy. Registrar

Copy to: for Information and necessary action

1	The I/c Dean, Faculty of Science & Technology	7	Appointment A & B Section
2	Director, Board of Examinations & Evaluation	8	Affiliation (T.1) (T.2) Section
3	The Chairperson, Respective Board of Studies	9	P.G.Admission Section,
4	Other Exam 4 Section,	10	P.G Seminar Section
5	Eligibility Section,	11	Computer Centre/ IT Cell
6	Internal Quality Assurance Cell (IQAC)		

Shivaji University, Kolhapur

Vidyanagar, Kolhapur-416004, Maharashtra.

School of Engineering and Technology

(Department of Technology)



As per NEP2020 guidelines

Final Year B.Tech (Food Technology),

Detailed Curriculum, 2026-27 onwards

Shivaji University, Kolhapur
School of Engineering and Technology (Department of Technology)
Final Year B. Tech. (Food Technology), Semester- VII

Teaching and Evaluation Scheme										
Sr. N.	Category	Code	Course Title	Hours per Week			Contact Hours	Credits	Evaluation Scheme	
				L	T	P			Theory	Practical
1	Program Core Course	PCC 411	Meat, Poultry and Fish Processing Technology	03	-	02	05	04	30:70	50:00
2	Program Core Course	PCC 412	Spices and Plantation Crops Processing	03	-	02	05	04	30:70	00:50
3	Program Core Course	PCC 413	Food Plant Design and Layout	03	-	-	03	03	30:70	00:00
4	Program Elective Course	PEC 411	Program Elective II	03	-	-	03	03	30:70	00:00
5	Open Elective Course	OEC 411	Open Elective II	03	-	-	03	03	30:70	00:00
6	Project Seminar Internship	PSI 411	Research Project Phase- II	-	-	04	04	02	00:00	50:100
7	Value Education Course	VEC 411	Green Technology and Sustainability	01	-	-	01	01	-	50:00
8	Project Seminar Internship	PSI 412	MDM based Internship *	One Month Duration *				03	-	50:50
								23	500	400
9	Project Based Learning	PBL 411	Major Project Lab- II	-	-	02	02	IE at Course in charge end		
			Total Hours	16	-	10	26	-	-	-

- The MDM based industry Internship to be completed during any winter/summer vacation slots 4th Semester onwards, before 7th Semester commencement.

Program Elective II: Flavour Technology, Process Instrumentation, Dynamics and Control, Beverages Technology

Open Elective II: Research Methodology and IPR, Business and Entrepreneurship Essentials, Data Science

Shivaji University, Kolhapur**School of Engineering and Technology (Department of Technology)****Final Year B. Tech. (Food Technology), Semester- VIII**

Teaching and Evaluation Scheme										
Sr. N.	Category	Code	Course Title	Hours per Week			Contact Hours	Credits	Evaluation Scheme	
				L	T	P			Theory	Practical
1	Project Seminar Internship	PSI 421	(Entire Semester) (Follow up by the Department)	The entire semester is to be spent in the industry				10	00:00	150:200
2	SWAYAM (NPTEL) or any other MOOCs	PEC 421	Program Elective – III (Through MOOC*)	03	-	-	03	03	30:70	00:00
3	Program Elective Course	PEC 422	Program Elective – IV (Through MOOC*)	03	-	-	03	03	30:70	00:00
4	Indian Knowledge Systems	IKS 421	Program Specific IKS : Indigenous Food Science	02	-	-	02	02	30:70	00:00
5	Project Seminar Internship	PSI 422	Case Study- Food Safety Management System (Online)*	01	-	-	01	01	-	50:50
6	Value Education Courses	VEC 421	Professional Ethics (Through MOOC)	01	-	-	01	01	-	50:00
7	Project Based Learning	PBL 421	MDM based Mini Project **	-	-	-	-	02	-	50:50
Total Hours								22	300	600
Total Hours (Other than Internship)				10	-	-	10	-		

*There is an option for End Semester Examination either on respective MOOC platform or at the course teacher's end through the University System.

** Though the course is to be completed online either through course coordinator or via suitable MOOC if any, the ISE will be coordinated by the course in charge and the ESE will be through University system.

*** MDM based Mini Project to be completed during 4th Semester to 8th Semester.

Program Elective –III: Novel technologies for food processing and shelf life extension, Process Equipment Design and Drawing, Sugar Technology

Program Elective –IV: Enzyme Science and Technology, Cooling Technology in Food Processing and Preservation, Food Laws and Regulations

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PCC 411				
Course Category	Professional Core Courses				
Course Title	Meat, Poultry and Fish Processing Technology				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	03	03
Evaluation Scheme	ISE:30			ESE: 70	Total = 100
Pre-requisite (if any)					
Course Rational	Animal-based foods such as meat, poultry, eggs, and fish play a significant role in human nutrition and the food processing sector. This course introduces students to the structure, composition, processing, preservation, and quality management of animal foods. Emphasis is given to sustainable processing, food safety, value addition, and industry-relevant practices in compliance with NEP-2020 goals of skill development, employability, and multidisciplinary learning.				
Course Objective	The course is designed to enable students to: 1. Understand the present status of livestock, poultry, and fishery industries and their contribution to the national economy. 2. Learn the nutritional importance, muscle structure, and physico-chemical properties of meat. 3. Gain knowledge of slaughtering, dressing, and hygienic handling of animals and poultry. 4. Understand various meat processing and preservation techniques. 5. Learn egg structure, quality characteristics, and egg processing technologies. 6. Acquire knowledge of fish types, handling, processing, preservation, and value-added fish products.				
Course Outcome	After successful completion of the course, students will be able to: CO1: Describe the current status of livestock, poultry, and fisheries industries and the nutritional profile of meat, poultry, eggs, and fish. CO2: Explain the muscle structure, chemical composition, and physico-chemical properties of meat muscle.				

	CO3: Apply slaughtering, dressing, and inspection techniques for animals and poultry. CO4: Analyse different meat processing and preservation methods. CO5: Evaluate egg quality, processing, and preservation techniques. CO6: Classify fish types and explain fish handling, processing, and preservation methods.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2				2	2			1		2
CO 2	3	3		2								2
CO 3	3	2	2	2	2	3	2	2	1	1		2
CO 4	3	3	2	2	2	2	2				1	2
CO 5	3	3	2	2	2	1	1					2
CO 6	3	3	2	2	2	2	2					2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Meat, Poultry and Fish Industry Overview - Sources and classification of meat, poultry, and fish, - Current status of meat, poultry, and fish processing industries - Importance of meat, poultry, and fish in human nutrition - Role of meat, poultry, and fish processing industries in national economy - Quick Service Restaurants (QSR)	5
2.	Meat Muscle Structure and Abattoir Design - Structure of skeletal muscle - Chemical composition of meat - Physico-chemical properties of meat muscle - Post-mortem changes in meat - Abattoir design, layout, and hygienic requirements	6

3.	Slaughtering and Dressing of Animals and Poultry • Pre-slaughter care and handling • Stunning methods • Slaughtering techniques for animals and poultry • Ante-mortem and post-mortem examination • Dressing, grading, and by-product utilization	7
4.	Meat Processing and Preservation • Mechanical deboning • Chilling and freezing of meat • Pickling and curing • Cooking and smoking • Frozen and value-added meat products	7
5.	Egg Processing and Preservation • Egg structure and composition • Egg quality characteristics • Egg grading and quality evaluation • Egg processing methods • Preservation techniques and egg-based products	7
6.	Fish Processing and Preservation • Classification and types of fish • Examination and quality assessment of fish • Handling, transportation, and storage • Fish processing techniques • Freezing, canning, salting, drying • Frozen and value-added fish products	7
Sr. No.	Text Books	
1.	Singh, R. A. (2013). <i>Poultry Production</i> .	
2.	Gerrard, F. (1951). <i>Meat Technology: A Practical Textbook for Students and Butchers</i> .	
Sr. No.	Reference Books	

1.	Lawrie, R. A. (1981). <i>Developments in Meat Science</i> , Volume 2.
2.	Aberle, E. D., Forrest, J. C., Gerrard, D. E., & Mills, E. W. (2012). <i>Principles of Meat Science</i> .
3.	Levie, A. (1967). <i>Meat Handbook</i> (3rd Revised Edition).

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII					
Course Code	PCC 412					
Course Category	Professional Core Courses					
Course Title	Spices and Plantation Crops Processing Technology					
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits	
	03	-	-	03	03	
Evaluation Scheme	ISE:30			ESE: 70		Total =100
Pre-requisite (if any)	A foundational knowledge of horticulture and agriculture, specifically related to crop production and post-harvest management.					
Course Rational	The course provides knowledge about the basic concepts of post-harvest management. It equips students with the skills for value addition to meet the demands of the food industry and enhance economic opportunities for farmers and entrepreneurs.					
Course Objective	The course teacher will ensure to: 1. Introduce basic food science knowledge in spices and plantation crops. 2. Introduce students to major and minor spice processing aspects. 3. Describe the post-harvest technology and processing of tea. 4. Explain the post-harvest technology and processing of coffee. 5. Illustrate the quality assessment of spices and herbs. 6. Demonstrate the different spices, herbs and its oleoresins.					
Course Outcome	After successful completion of the course, students will be able to: CO1: Know the scope and importance of spice processing. CO2: Describe the classification of the spices. CO3: Understand the different Techniques used for extraction of functional ingredients from spices.					

	CO4: Identify the major and minor constituents of food and the chemical reactions in which they participate. CO5: Describe the principle involved in the processing of the major types of food products. CO6: Extract the functional ingredients from spices.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1		1	1	1	2	1		1	3		
CO 2		2	1		3	1	2	2				
CO 3	2		1	2	2	2						
CO 4	2	1	3	1	2	1	1		3		1	
CO 5		2		1	1					1		
CO 6	1		2		1		1		1			1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction - Production and processing scenario of spice and plantation crops and its future scope - Importance and role of spices in food processing - Classification and properties of spices and herbs including medicinal properties	05
2.	Major spices Postharvest technology, composition, processing and value-added products of Ginger, chilli, turmeric, onion and garlic, pepper and cardamom	06
3.	Minor spices Postharvest technology, composition, processing and value-added products of Cinnamon, clove, coriander, cumin, all spice, sweet basil; caraway seed, cassia, nutmeg, mace, mint, saffron, ajowan and asafoetida	07
4.	Post-harvest technology and processing of Plantation Crops Post-harvest technology and processing aspects of cocoa, vanilla, annatto, herbs, seasoning and curry leaves	07

5.	Post-harvest technology and processing of tea and coffee • Post-harvest technology of tea and its types (Green tea, oolong and CTC) • Manufacturing process for green tea, black tea and instant tea. • Physiochemical and microbial quality evaluation of Tea • Post-harvest technology of Coffee and instant coffee • Fermentation of coffee beans and its manufacturing. • Physiochemical and microbial quality evaluation of coffee	07
6.	Extraction of functional ingredients from Spices • Techniques used for extraction of functional ingredients from minor and major spices. • Spice oil, oleoresins and Colouring pigment • Labelling and specification as per food laws and regulations.	07
Sr. No.	Text Books	
1.	J. S. Pruthi. 2001. Spices and Condiments Major Spices of India. National Book Trust, New Delhi.	
2.	S. Gupta. Handbook of Spices and Packaging with Formulae. Engineers India Research Institute, New Delhi	
3.	Handbook of Herbs and Spices (2012), 2 nd edition, edited by K. V. Peter, Wood head Publishing Ltd., 80 High Street, Sawston, Cambridge CB22 3HJ, UK. Volume 1	
Sr. No.	Reference Books	
1.	K. G. Shanmugavelu. Spices and Plantation Crops. Oxford and IBH Publishing Co., New Delhi	
2.	J.W. Pursegrove, E.G. Brown, C.L. Green and Robins. Spices, Vol. I and II. SRJ Academic Press, New Delhi.	
3.	Kenji Hirasa and MitsuoTakemasa. 1998. Spice Science and Technology. Marcel Dekker, NY, USA.	
4.	H. Panda. Handbook on Spices and Condiments (Cultivation, Processing and Extraction). Asia Pacific Business Press Inc., New Delhi.	
Sr. No.	Important web links	
1.	https://onlinecourses-archive.nptel.ac.in/	

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PCC413				
Course Category	Professional Core Courses				
Course Title	Food Plant Design and Layout				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE: 70	Total = 100
Pre-requisite (if any)	In order to complete the course successfully, it is important to have a good knowledge of basic food science and food engineering.				
Course Rational	The course provides knowledge about the basic concepts of food engineering and application of knowledge in any food industry.				
Course Objective	The course is designed to enable students to: 1. Help students to gain knowledge of basic concepts of plant layout and design with special reference to food process industries 2. Introduce students to the various factors affecting the plant location selection 3. Help student to learn about different plant layout and equipment layout 4. Describe the economics and cost analysis method for plant designing. 5. Illustrate to the students about factors consideration in new plant building 6. Elaborate to the students about how to initiate processing related to foods in a safe and creative manner.				
Course Outcome	After successful completion of the course, students will be able to: CO1: Understand about advanced unit operations specific to the food industry and of the criteria for the design of complex food plants CO2: Choose processing site, transportation mode, fuel, energy and their integration with the skills of food technology in the design of complex food plants CO3: Apply the knowledge of food manufacturing processes and their representation in a flow-sheet preparation of the plant. CO4: Evaluate the critical control points where product or process can be				

	compromised, draw, using standard symbols, and factory layouts. CO5: Design the plant layout and initiate processing related to foods in a safe and creative manner. CO6: Create layout of waste treatment plant and management of food plant.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1											
CO 2	1											
CO 3				1	1		1					
CO 4			1		2							
CO 5	1					1	1					
CO 6		1	1				2				1	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction: - Basic concepts of plant layout and design with special reference to food process industries. - Application of HACCP , ISO, Codex, BIS - FPO & MPO requirements in food plant layout and design.	7
2.	Plant Location - Influence of location on plant layout - Location factors - Location theory and models - Economic plant size - Types of manufacturing processes like continuous, repetitive and intermittent processes.	7
3.	Plant Layout	5

	• Preparation of a Plant Layout • Plant Layout problem, importance • Objectives • classical types of layout • Evaluation of layout. • Advantages of good layout	
4.	Plant Building • Considerations in building design, type of factory buildings, • Choice of building construction, material for floors, foundation, walls, doors, windows, drains etc, ventilation, fly control, mold prevention and illumination in food processing industries.	7
5.	Plant layout & Equipment Layout • Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages; milk and milk products; meat, poultry and fish processing industries. Equipment layout in Food Industries • Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.	8
6.	Cost Analysis • Fixed cost, variable cost, depreciation, method of economic analysis, profitability analysis of a plant	5

Sr. No.	Text Books
1.	Plant Layout and Design by James M. Moore (1962), Mac Millan, New York
2.	Plant Design for Chemical Engineering. By Peterse and Timmerhaus, McGraw Hil
3.	Textbook of Dairy Plant Layout and Design by Prof. Lalat Chander by ICAR, Pusa, Delhi Publication,2004
4.	Food Process Design by Zacharias B. Maroulis published by Marcel Dekker, Inc , Cimarron Road, Monticello, New York 12701, U S A
5.	Food plant engineering systems by Theunis C. Robberts, CRC Press, Washington

Sr. No.	Reference Books
1.	Facility Planning and Layout Design by Chandrasekhar Hiregoudar, Technical Publications, 2017
2.	Applied guide to process and plant design by Sean Moran Elsevier, 2015
3.	Project Engineering of process plants by Rase and Brrowt John Willey and Sons
4.	Chemical Engineering Plant Design by Vilbrant and Dryden, Tata McGraw Hill
5.	Plant Design and Economics for Chemical Engineering, by Peters and Timmerhaus, McGraw Hill

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PEC 411.1				
Course Category	Program Elective Course				
Course Title	Flavour Technology				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE: 70	Total = 100
Pre-requisite (if any)	Basic knowledge of food chemistry, food additives, and food safety is required. Familiarity with fundamental concepts of food processing and quality control is recommended.				
Course Rational	This course is designed to provide a systematic understanding of flavor science and technology based on the six units. It covers fundamentals of flavor perception, types and sources of flavors, flavor development during processing, extraction and analytical techniques, sensory evaluation, and industrial applications. The course integrates food chemistry, food additives, and food safety concepts to help students understand flavor formulation, quality control, and regulatory requirements, preparing them for professional roles in the food and flavor industry.				
Course Objective	The course teacher will ensure to- 1. Provide basic understanding of flavor science and perception. 2. Explain types, sources, and classification of flavors. 3. Introduce methods of flavor generation during processing.				

	4. Describe extraction and analysis of flavor compounds. 5. Explain sensory evaluation of flavors. 6. Introduce industrial applications and quality control of flavors.
Course Outcome	After completing this course, students will be able to: CO1: Understand basic concepts of flavor, taste, and aroma. CO2: Classify flavors based on source and method of formation. CO3: Explain flavor development in natural and processed foods. CO4: Apply extraction and analytical techniques for flavor compounds. CO5: Perform and interpret basic sensory evaluation tests. CO6: Evaluate flavour quality and stability in food products.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	1	1	1	1	–	–	–	2
CO 2	3	3	2	2	1	1	1	1	–	–	–	2
CO 3	3	3	2	2	1	1	1	1	–	–	–	2
CO 4	3	3	2	3	3	1	1	1	1	1	–	2
CO 5	2	2	1	3	2	1	1	1	2	2	–	2
CO 6	2	2	2	2	2	2	2	2	1	1	1	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Fundamentals of Flavour Science Definitions of flavour, taste, and aroma. Concept of flavour wheel. Classification of flavour compounds into volatile and non-volatile such as alcohols, aldehydes, ketones, esters, and terpenes. Gustation: structure of taste buds, signal transduction, and five basic tastes. Olfaction: olfactory epithelium and ortho-nasal and retro-nasal perception. Trigeminal nerve and chemesthesis such as menthol cooling and chili heat. Physiological basis of flavour perception. Global and Indian flavour industry scenario. Production trends, market demand, and natural versus synthetic flavour consumption.	07
2.	Types, Sources, and Generation of Flavours	06

	Classification into natural, semi-synthetic, and synthetic flavours. Nature-identical and artificial flavouring substances. Natural sources like herbs, spices, essential oils, oleoresins, and extracts. Processed flavours from cooking, roasting, and ripening. Biogenesis in fruits and vegetables. Fermentation-derived flavours. Flavour enhancers.	
3.	Flavour Development and Stabilization Maillard reaction and formation of aroma compounds. Lipid oxidation and off-flavours and fried aromas. Caramelization of sugars. Need for flavour stabilization. Encapsulation by spray drying. Wall materials like maltodextrin and gum arabic. Alternative methods such as freeze drying, coacervation, and cyclodextrins.	07
4.	Extraction and Analytical Techniques Extraction by steam distillation, solvent extraction, and cold pressing. Advanced extraction by supercritical CO ₂ , microwave, and ultrasound methods. Optimization using temperature, pressure, and solvents. Analysis by GC-MS and HPLC. SPME for volatiles. Electronic nose and tongue. Objective and subjective analysis.	07
5.	Sensory Evaluation and Regulatory Framework Panellist selection and training. Threshold testing. Difference tests like triangle and duo-trio. Descriptive analysis by QDA. FSSAI standards and labelling. Codex, FEMA, and IOFI guidelines. GRAS status and safety assessment.	06
6.	Industrial Applications and Quality Control Flavour formulation for food matrices. Beverage flavours, emulsions, and clouding agents. Bakery and confectionery flavours and heat stability. Fat-based and water-based flavours. Flavour-matrix interactions. Detection of adulteration like synthetic vanillin. Solvent residue detection. Shelf-life studies and quality standards.	06
Sr. No.	Reference Books	
1	Taylor, A. J., and Linforth, R. S. (Eds.). (2002). Food flavour technology (p. 302). Sheffield, UK: Sheffield Academic Press.	
2	Berger, R. G. (Ed.). (2007). Flavours and fragrances: chemistry, bioprocessing and sustainability. Springer Science & Business Media.	
3	Rowe, D. (Ed.). (2009). Chemistry and technology of flavours and fragrances. John Wiley and Sons.	

4	Fisher, C., and Scott, T. R. (2007). Food flavours: biology and chemistry. Royal Society of chemistry.
5	Parker, J. K., Elmore, S., and Methven, L. (Eds.). (2014). Flavour development, analysis and perception in food and beverages. Elsevier.
6	Ziegler, H. (Ed.). (2007). Flavourings: production, composition, applications, and regulations. John Wiley & Sons.
Sr. No.	Important web links
1.	https://www.youtube.com/watch?v=CqNXgOLkiZM

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PEC 411.2				
Course Category	Program Elective Course				
Course Title	Process Instrumentation, Dynamics and Control				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	Students are expected to have a background in mathematics through differential equations, Laplace transformation, material and energy balance concepts, and unit operations.				
Course Rational	The course provides knowledge about the basic concepts of process instrumentation, dynamics and control and their application				
Course Objective	The course teacher will ensure that students: 1. Understand the working principles of basic instruments used for measuring flow, pressure, level, and temperature. 2. Understand the dynamic behaviour and modelling of process systems and equipment. 3. Learn Laplace and Inverse Laplace Transforms to obtain transfer functions and analyse dynamic responses. 4. Understand and analyse the stability characteristics of dynamic systems.				

	5. Gain knowledge of P, PI, and PID controllers used in chemical and process industries. 6. Understand the frequency response of dynamic systems.
Course Outcome	After completing this course, students will be able to: CO1: The student will be able to understand working principles of basic instruments available for flow, pressure, level and temperature measurement CO2: The student will be able to learn model dynamical systems. CO3: The students will be able to understand the use and measurement of transfer Functions. CO4: The students will be able apply knowledge of mathematics [Laplace Transforms] to model and solve the models describing dynamics of chemical processes. CO5: The students will be able to evaluate stability of control loops. CO6: The students will be able to understand dynamic behavior and stability of chemical process control systems.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1						1					
CO 2		1										
CO 3	1				1							
CO 4					2				1			
CO 5	1					1	1					
CO 6	1	2				1						

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Measuring Instruments - Theory, practice and applications of measurements of temperature, mass and levels. - Measurement of pressure, vacuum, humidity and pH in process	05

2.	Flow measuring instruments: - Flow measuring devices for incompressible and compressible fluids. - Electro-hydraulic valves, hydraulic servomotors, electro-pneumatic valves. - Pneumatic actuators.	05
3.	Modelling Consideration - Process modelling - Stand variables and equations - Example of Modelling a Stirred Tank Heater - Linearization of nonlinear model	06
4.	Dynamic behaviour of chemical process - Laplace Transform - Laplace Transform of derivatives First Order Process; Significance of first order process; Second Order Process - Features of the process response; Poles and Zeros; Qualitative analysis of process response - Higher Order Systems; Frequency Response Analysis; Response of a First-Order System to a Sinusoidal Input; Bode Diagram; Bode Diagram of a first order process; Bode Diagram of pure time delay; Nyquist Plot	09
5.	Introduction to feedback control - Elements of Control loop - controller, measuring device, final control element, transmission lines, transducers, transmitters, development of block diagram. Concept of servo and regulatory problems. - Selection of measured, manipulated and controlled variables. Types of controller - on-off, P, PI, PID. Effects of proportional, integral and derivative actions.	08
6.	Other control strategies - Feed forward controller - design with steady state model, design with dynamic model, combination of feed forward-feedback structure, - Cascade control structure - analysis and design, Ratio control, split range control, Selective control, override control, auctioneering control.	06
Sr. No.	Text Books	

1	Rangan, C. S., Sarma, G. R., & Mani, V. S. V. (2003). <i>Instrumentation: Devices and systems</i> (2nd ed.). Tata McGraw-Hill.
2	Murthy, D. V. S. (2010). <i>Transducers and instrumentation</i> . Prentice Hall of India.
3	Hashemian, H. M. (2006). <i>Maintenance of process instrumentation in nuclear power plants</i> . Springer.
Sr. No.	Reference Books
1.	Stephanopoulos, G. (1984). <i>Chemical process control: An introduction to theory and practice</i> . Prentice-Hall.
2.	Coughanowr, D. R., and Koppel, L. B. (1991). <i>Process systems analysis and control</i> (2 nd ed.). McGraw-Hill.
3.	Luyben, W. L. (1990). <i>Process modelling, simulation, and control for chemical engineers</i> . McGraw-Hill.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII				
Course Code	PEC 411.3				
Course Category	Program Elective Course				
Course Title	Beverages Technology				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	-				
Course Rational	Beverage Technology will help students to develop their skills in the areas of beverage. The course will focus on making students understand the basics of beverages, get familiar with different types of beverages, the importance of beverages for Indian population. The course is completely Industry oriented which includes all the knowledge of processing and packaging technologies that is required in industries.				
Course Objective	The course aims to:				

	1. Enable students to understand the present status and future prospects of beverages in India and globally. 2. Explain the principles involved in beverage processing. 3. Familiarize students with equipment used in beverage manufacturing. 4. Apply fundamental food science knowledge to beverage technology. 5. Explain the role of various ingredients used in beverages. 6. Understand quality control and regulatory aspects of beverages.
Course Outcome	After completing this course, students will be able to: CO1: Describe the present status and future prospects of the beverage industry. CO2: Explain the role of various ingredients used in beverages. CO3: Describe the working principles of equipment used in beverage manufacturing. CO4: Formulate different alcoholic and non-alcoholic beverages. CO5: Analyse various quality parameters of different beverages. CO6: Select suitable packaging materials for different types of beverages.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1			2	2			1	1	2
CO 2	3	2	2	1			1					1
CO 3	3	2	2	2								1
CO 4	3	3	3	2	2	1	1		1		1	2
CO 5	3	3	2	3	2	1	2	1	1			2
CO 6	3	2	3	2	2	2	3	1	1		1	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Types of beverages, Present status of beverage industry in India and Globally, Scope and importance of Beverage Industry, Market trends	07

2.	Types of Bottled Water: Mineral Water, Spring Water, Flavoured Water, Carbonated Water, Manufacturing process of packaged drinking water, Water Treatments, Quality Standards of Bottled and Packaged Water	08
3.	Beverage Additives, FSSAI specification for beverages, Equipment's used for Beverages 6 manufacturing, Plant Layout	06
4.	Non Alcoholic Beverages: Tea, Coffee, Low-calorie beverages, Sports Drinks (Isotonic, Hypertonic, Hypotonic Drinks), Quality Control aspects	06
5.	Soft Drinks: History, Types, Role of various ingredients, manufacturing process; Quality Control in the Beverage, Packaging of Beverages	06
6.	Alcoholic Beverages: Classification; Fermented alcoholic beverage : Beer, types of beer, the role of yeast in beer, technology of brewing process, Wine; Distilled spirits: Whisky, Brandy, Vodka, Rum; Equipment used for brewing and distillation	06
Sr. No.	Text Books	
1	Hardwick, W. A. (1995). <i>Handbook of Brewing</i> . Marcel Dekker.	
2	Hui, Y. H., Meunier-Goddik, L., Josephsen, J., Nip, W. K., & Stanfield, P. S. (2004). <i>Handbook of Food and Beverage Fermentation Technology</i> (Vol. 134). CRC Press.	
3	Stewart, G. G., and Priest, F. G. (2006). <i>Handbook of Brewing</i> (2 nd ed.). CRC Press.	
4	Vine, R. P. (2012). <i>Commercial Winemaking: Processing and Controls</i> . Springer.	
Sr. No.	Reference Books	
1.	Varnam, A., and Sutherland, J. M. (1994). <i>Beverages: Technology, Chemistry and Microbiology</i> (Vol. 2). Springer.	
2.	Woodroof, J. G., & Phillips, G. F. (1981). <i>Beverages: Carbonated and Noncarbonated</i> . AVI Publishing.	
Sr. No.	Important web links	
1.	https://www.fssai.gov.in	

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII
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Course Code	OEC 411.1				
Course Category	Open Elective Course				
Course Title	Research Methodology and IPR				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	Foundational knowledge to identify gaps or problems worth researching.				
Course Rational	Research Methodology and IPR course has been meticulously designed to provide a comprehensive understanding of the essential aspects of research methodology and the critical realm of Intellectual Property Rights (IPR)				
Course Objective	The course teacher will ensure to- 1. Describe the basics of research, types of research and problem formulation. 2. Discuss the methods of conducting literature reviews, technical reading and use research databases. 3. Explain methods of data collection, analysis, and reporting. 4. Illustrate the nature and importance of Intellectual Property (IP) and IPR in innovation. 5. Elucidate about various IP types: Patents, Copyrights, Trademarks, and Designs. 6. Evaluate patent laws, drafting procedures, and the process of filing.				
Course Outcome	After completing this course, students will be able to: CO1: Analyze and evaluate the meaning, types (descriptive, analytical, applied, fundamental), and significance of engineering research. CO2: Interpret and analyze the procedures for literature review, technical reading, data collection, and analysis. CO3: Comprehend research ethics, avoid plagiarism, and understand proper attribution and citation CO4: Understand the nature and importance of intellectual property (patents, copyrights, designs, trademarks). CO5: Learn the process of patenting, from innovation to filing, including international procedures (PCT). CO6: Understand copyright laws, design rights, and legal compliances related				

	to IP.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		3	2	2	2	2						
CO 2	1		1	2	1	3	2	2				
CO 3	1	2		3	2	1	1	1				
CO 4	1	1	3	2	3	1	3					
CO 5	1		1		1	1	1					
CO 6	1	2	3	3		2						

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Research Design: - Overview of research process and design, - Use of Secondary and exploratory data to answer the research question - Qualitative research - Observation studies, Experiments and Surveys. – Case Studies	7
2.	Data Collection and Sources: - Measurements, Measurement Scales - Questionnaires and Instruments - Sampling and methods. - Data - Preparing - Exploring, examining and displaying.	8
3.	Data Analysis and Reporting: - Overview of Multivariate analysis, - Hypotheses testing and Measures of Association. - Presenting Insights and findings using written reports and oral presentation.	6
4.	Intellectual Property Rights: Intellectual Property – The concept of IPR	6

	• Evolution and development of concept of IPR • IPR development process • Trade secrets, utility Models • IPR & Bio diversity • Role of WIPO and WTO in IPR establishments • Right of Property • Common rules of IPR practices • Types and Features of IPR Agreement • Trademark and Functions of UNESCO in IPR maintenance.	
5.	Patents: • Patents – objectives and benefits of patent • Concept, features of patent • Inventive step • Specification	6
6.	Patent application: • Types of patent application, • process E-filing, • Examination of patent, Grant of patent, • Revocation, Equitable Assignments, • Licensing of related patents, • patent agents, • Registration of patent agents.	6
Sr. No.	Text Book	
1	Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar	
2	Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, John W. Creswell	
3	The Craft of Research, Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams	
Sr. No.	Reference Books	
1.	Intellectual Property: A Very Short Introduction, Siva Vaidhyanathan	

2.	Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets" Deborah E. Bouchoux
3.	Research methodology: an introduction for science & engineering students, Stuart Melville and Wayne Goddard,
4.	Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
Sr. No.	Important web links
1.	https://onlinecourses.swayam2.ac.in/ntr24_ed08/preview

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	OEC 411.2				
Course Category	Open Elective Course				
Course Title	Business and Entrepreneurship Essentials				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)					
Course Rational	The ‘Micro-MBA’ curriculum design provides a real-world and multi-disciplinary overview of successful companies. Students can learn diverse aspects of business, make better career choices, and be more ready to join the Industry. Working Professionals can develop the cross-functional knowledge to perform better in their current jobs and be prepared for a broader role. Faculty members can widen the scope of their Business and Entrepreneurship courses. Entrepreneurs and Small Business Owners can better prepare to start or scale their businesses to the next level. Participants will get access to customized AI Tools and be able to explore a wide range of Startup Business Ideas and Technology Concepts. This will help them augment their in-course learning with hands-on Simulation and Entrepreneurial Business Cases.				
Course Objective	The course teacher will ensure to-				

	1. Understand the structure, purpose, and DNA of businesses. 2. Analyze strategy, innovation, and operational excellence. 3. Interpret financial, marketing, and HR fundamentals. 4. Evaluate business risks and governance mechanisms. 5. Develop startup and social venture frameworks. 6. Build and present compelling business cases.
Course Outcome	After completing this course, students will be able to: CO1: Explain how businesses are structured and governed. CO2: Analyse strategy, innovation, and operational systems. CO3: Apply finance, marketing, sales, and HR concepts. CO4: Evaluate business models and risk frameworks. CO5: Develop start up and social venture plans. CO6: Present structured business cases confidently.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1	2	1	1		2		1		2	2	1
CO 2	2	3	2	2	1		1		1	1	2	1
CO 3	1	2	3	1	2	1		1	2	2	3	1
CO 4	1	2	2	2	1	2	3	3	1	1	2	1
CO 5	1	3	3	2	2	2	2	3	2	1	2	1
CO 6		2	2	1	1	1		1	3	3	2	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content
1.	Introductory Module: Course Structure and Overview Learning Objective: Understand the DNA of Business and Companies Module 1: Overview of a Business Module 2: Company and Structures Learning Objective: Understand Company Purpose. Vision, Strategy and Culture Module 3: Vision, Mission, Goals, Strategy and Culture

2.	Week 3 Learning Objective: Understand Innovation and Quality Manufacturing Processes Module 4: Innovation and Product Development Module 5: Manufacturing and Quality Learning Objective: Understand Leadership, People and Financial Management, ESG Module 6: Finance and Accounting Module 7: Leadership and Human Resources Module 8: Environment, Society and Governance
3.	Learning Objective: Understand Markets and Customers Module 9: Market Research Module 10: Customers and Segments Learning Objective: Understand Basics of Marketing Module 11: Values Based Marketing Module 12: Marketing Communication
4.	Learning Objective: Understand Basics of Sales Module 13: Sales Channels and Distribution Module 14: B2B and B2C Sales Learning Objective: Understand Basics of Customer Service and Supply Chain Module 15: Customer Service Management Module 16: Supply Chain and Logistics
5.	Learning Objective: Understand Business Information and Risk Management Module 17: Business Risk and Management Module 18: Business Information and Management Learning Objective: Understand Business Models and Social Business Module 19: Business Types and Models Module 20: Social Business Development
6.	Learning Objective: Understand How to Start New Tech & Social Ventures Module 21: Starting Up a New Technology Venture Module 22: Starting Up a New Social Venture Learning Objective: Understand How to Create and Present a Business Case Module 23: Business Case Discussion Module 24: Course Recap & Wrap up

Sr. No.	Books and references
1	Management by James A. F. Stoner, R. Edward Freeman, Amitabh Deo Kodwani Daniel R. Gilbert, Ranjeet Nambudiri Pearson Paperback - 19 January 2018
2	Principles of Corporate Finance Richard A Brealey, Stewart C Myers, Franklin Allen, Pitabas Mohanty McGraw Hill
3	Human Resource Management Gary Dessler & Biju Varkkey Pearson Paperback
4	Marketing Management Philip Kotler, Kevin Keller, Alexander Chernev, Jagdish Sheth, G Shainesh Pearson Paperback
5	Sales and Distribution Management Richard R. Still, Edward W. Cundiff, Norman A. P. Govoni, Sandeep Puri (Author) Pearson Paperback
6	Operations and Supply Chain Management Richard B. Chase, Ravi Shankar, F. Robert Jacobs McGraw Hill
Sr. No.	Mini Case-studies and Websites:
1.	Will be referred to and provided links as part of the course modules

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII					
Course Code	OEC 411.3					
Course Category	Open Elective Course					
Course Title	Data Science					
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits	
	3	-	-	3	3	
Evaluation Scheme	ISE:30			ESE: 70		Total = 100
Pre-requisite (if any)	-					
Course Rational	Data Science integrates statistics, computer science, and domain knowledge to derive actionable insights from data. Engineers in every discipline now leverage data-driven methods for optimization, forecasting, process monitoring, and decision-making. This course provides foundational knowledge in data					

	handling, analysis, visualization, and machine learning, preparing students to apply data science concepts in engineering, business, and research environments.
Course Objective	The course teacher will ensure to: 1. Understand fundamentals and workflow of data science. 2. Learn data collection, cleaning, and preprocessing methods. 3. Apply statistical and analytical techniques for data exploration. 4. Develop skills in visualization and interpretation. 5. Explore basics of predictive modelling and machine learning. 6. Evaluate applications and ethical aspects of data science.
Course Outcome	After completing this course, students will be able to: CO1: Explain data science concepts and workflow. CO2: Handle and preprocess structured data. CO3: Apply statistical tools for data analysis. CO4: Visualize and interpret data effectively. CO5: Build simple predictive models. CO6: Evaluate data-driven decisions and ethics.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	0	1	1	0	0	0	1	0	1
CO 2	3	3	2	1	2	0	0	0	0	0	0	1
CO 3	2	3	3	2	3	0	1	0	0	1	1	2
CO 4	1	2	3	3	3	1	1	1	0	1	2	2
CO 5	1	2	3	3	3	2	3	1	1	2	2	3
CO 6	0	1	1	0	1	3	3	3	1	3	1	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
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1.	Introduction to Data Science, Definition, scope, and importance of data science, Data-driven decision-making and applications in engineering, Role of statistics and computing in data analysis, Data science workflow: acquire, prepare, analyze, model, report	05
2.	Data Acquisition and Preprocessing, Data types and formats (structured, unstructured, time-series), Data collection from sensors, databases, and web sources, Data cleaning, normalization, missing data handling, Tools: Excel, Python (pandas)	08
3.	Exploratory Data Analysis, Descriptive statistics and data summarization, Measures of central tendency, variability, and correlation, Outlier detection and feature scaling, Case study: process data analytics	07
4.	Data Visualization and Interpretation: Principles of effective data visualization, Charts, plots, and dashboards (matplotlib, seaborn, Power BI), Communicating results through reports, Visual storytelling and decision insights	07
5.	Introduction to Machine Learning: Supervised vs. unsupervised learning, Regression, classification, clustering (basic algorithms), Model training, testing, and evaluation metrics, Practical examples using open datasets	06
6.	Applications and Ethical Considerations: Industrial and social applications of data science, AI bias, privacy, and data protection, Responsible use of data and sustainability in analytics, Case studies in manufacturing, healthcare, and finance, Focus: Evaluation and creation (L5–L6; SOLO – Extended Abstract)	06

Sr. No.	Text Books
1.	Aggarwal, C.C. (2018). Machine Learning for Data Science. Springer, Cham.
Sr. No.	Text Books
1.	Provost, F., & Fawcett, T. (2013). Data Science for Business. O'Reilly Media, California.
2.	James, G., Witten, D., Hastie, T. Tibshirani, R. (2021). An Introduction to Statistical Learning with Applications in R. 2nd ed., Springer, New York.
3	Nandakumar, K., & Kannan, R. (2020). Instrumentation and Process Control. PHI Learning, New Delhi.
4	Han, J., Kamber, M., & Pei, J. (2022). Data Mining: Concepts and Techniques. 4th ed., Elsevier, Amsterdam.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PSI 411				
Course Category	Project Seminar Internship				
Course Title	Research Project Phase- II				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	-	-	4	4	2
Evaluation Scheme	IPE:50			EPE: 100	Total = 150
Pre-requisite (if any)					
Course Rational	The Research Phase II course equips students with essential research skills in Food Science and Technology, focusing on problem identification, experimental design, data analysis, and scientific communication. It prepares students for innovation, industry applications, and advanced research in food processing, safety, and quality.				
Course Objective	The course teacher will ensure to- 1. Guide students in identifying research problems in food technology. 2. Facilitate literature review and benchmarking of existing solutions. 3. Assist in designing experiments and research methodologies. 4. Support data collection, analysis, and use of advanced tools. 5. Encourage optimization of findings for industrial applications. 6. Develop skills in technical writing and research presentation.				
Course Outcome	After successful completion of the course, students will be able to: CO1: Develop innovative research proposals addressing challenges in food technology. CO2: Design experiments and methodologies for investigating food processing and quality aspects. CO3: Conduct hands-on research and simulations using advanced tools in food engineering. CO4: Analyze, interpret, and optimize experimental results for real-world applications. CO5: Apply scientific writing and technical presentation skills to communicate				

	research effectively. CO6: Demonstrate an ability for independent research, problem-solving, and lifelong learning in food science and technology.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	2	1	2	2	1	1	2	2	2
CO 2	3	3	3	3	2	1	1	1	1	1	1	2
CO 3	3	2	2	3	3	1	1	1	2	1	1	2
CO 4	3	3	2	3	2	2	2	1	1	1	1	2
CO 5	2	2	1	2	2	1	1	1	1	3	2	2
CO 6	2	2	1	2	1	1	1	1	1	1	1	3

Level of Mapping as: Low 1, Moderate 2, High 3

Research Project Phase- II
In the second phase of the Project Work, all the project groups will carry out actual execution the work planned as stated as an outcome of the first phase in the 6th semester. They will submit the final project report in two hard bound copies along with soft copy to the guide. The guide will submit one copy to the Program office and the other copy will be owned by him/her. The report will be prepared in a standard format as provided by the Program Advisory Board. Generally, the report will consist of Introduction, Review of Literature, Materials and Methods, Result & Discussion, Summary and Conclusion and References. There may be little variation in project report writing depending on the nature of the respective project problem under investigation. The objective of the project is to make use of the knowledge gained by the students at various stages of the B. Tech. Food Technology Program. This helps to judge the level of proficiency, originality and capacity for application of the knowledge attained by the students at the end of the studies.

This particular activity will be for 100 marks as an Internal Practical Evaluation (IPE). The same research and review committee will carry out the assessment of the project groups.

For External Practical Examination (EPE) carrying 50 marks, there will be external examiner to assess the project work. The research and review committee along with the external examiner will examine each of the project groups through VIVA VOCE and physical verification of the project models if any. The students group will demonstrate their work to all the examiners.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	VEC 411				
Course Category	Value Education Course				
Course Title	Green Technology and Sustainability				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	-	-	-	1	1
Evaluation Scheme	IOE:50			ESE: 00	Total = 50
Pre-requisite (if any)	-				
Course Rational	This course introduces students of all engineering disciplines to the concepts and practices of sustainable development, emphasizing environmentally responsible engineering design and operation. It aims to develop awareness, critical understanding, and innovation for applying green technologies that minimize resource consumption, reduce pollution, and promote circular economy approaches. The course empowers engineers to integrate sustainability principles in diverse fields such as manufacturing, infrastructure, computing, food systems, and communication technologies.				
Course Objective	The course teacher will ensure to- 1. Understand the core principles of sustainability. 2. Explain green technology and eco-innovation concepts. 3. Assess environmental impacts of engineering systems. 4. Identify renewable and resource-efficient alternatives. 5. Integrate sustainable practices in design and operation.				

	6. Promote responsible and ethical engineering decisions.
Course Outcome	After completing this course, students will be able to: CO1: Explain the fundamental principles and concepts of sustainability in engineering practices. CO2: Describe and interpret green technology and eco-innovation strategies for sustainable development. CO3: Analyse the environmental impacts of engineering systems using appropriate assessment tools. CO4: Evaluate renewable energy sources and resource-efficient alternatives for sustainable solutions. CO5: Apply sustainable design principles in engineering system design and operational practices. CO6: Demonstrate ethical responsibility and promote sustainable decision-making in engineering projects.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	0	0	0	2	3	2	0	1	0	1
CO 2	2	2	0	1	0	2	3	0	0	0	0	1
CO 3	1	3	2	2	2	0	3	0	0	0	0	2
CO 4	1	2	3	2	2	1	3	1	0	1	0	2
CO 5	1	2	3	2	2	2	3	2	1	2	2	3
CO 6	0	0	1	0	1	0	2	2	2	3	1	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Sustainability Fundamentals - Definition and dimensions of sustainability (environmental, social, economic) - Sustainable Development Goals (SDGs) and their engineering relevance	2

	Principles of green engineering and sustainable innovation	
2.	Environmental Challenges and Resource Management - Global and local environmental issues - Energy, water, and material resource depletion - Waste generation and its impact across industries	2
3.	Green Technologies and Eco-Innovation - Concepts and case studies in clean and green technologies - Sustainable materials, cleaner manufacturing, digital sustainability (IoT, AI for energy management) - Smart cities, green buildings, and sustainable mobility	3
4.	Life Cycle Thinking and Environmental Assessment - Basics of Life Cycle Assessment - Carbon and water foot printing - Environmental performance indicators and sustainability metrics	3
5.	Renewable Energy and Sustainable Systems - Solar, wind, hydro, bioenergy, and hydrogen systems - Energy conservation and efficiency improvement - Integration of renewable technologies into engineering design	3
6.	Circular Economy and Sustainable Future - Waste-to-wealth concepts, product stewardship, recycling loops - Ethical, economic, and policy aspects of sustainability - Case studies and communication of sustainability projects	2

Sr. No.	Reference Books	
1	Allen, D.T., and Shonnard, D.R. (2001). Green Engineering: Environmentally Conscious Design of Chemical Processes. Prentice Hall, New Jersey.	
2	Anastas, P.T., and Zimmerman, J.B. (2018). The Twelve Principles of Green Chemistry and Engineering. Oxford University Press, Oxford.	
3	Graedel, T.E., and Allenby, B.R. (2010). Industrial Ecology and Sustainable Engineering. Pearson Education, New Jersey	
4	Rao, S.S., and Parulekar, A.H. (2022). Sustainable Engineering: Concepts, Design, and Case	

	Studies. McGraw-Hill Education, New Delhi.
5	Azapagic, A., Perdan, S., and Clift, R. (2004). Sustainable Development in Practice: Case Studies for Engineers and Scientists. John Wiley and Sons, Chichester.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PSI 411				
Course Category	Project Seminar Internship				
Course Title	MDM based Internship *				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	-	-	-	1 Month Duration*	3
Evaluation Scheme	IOE:50			EOE: 50	Total = 100
Pre-requisite (if any)	-				
Course Rational	The MDM-based Industry Internship provides final-year Food Technology students with real industrial exposure. It bridges the gap between theoretical knowledge and practical applications by allowing students to observe plant operations, safety systems, utilities, process equipment, and professional work culture. The course promotes experiential learning, interdisciplinary understanding, and industry readiness aligned with Outcome Based Education (OBE).				
Course Objective	The course teacher will ensure to- 1. Understand industrial organization structure and workflow. 2. Apply MDM course knowledge in real process environments. 3. Observe safety, health, and environmental practices in industries. 4. Develop teamwork and professional behavior. 5. Analyze process operations and equipment roles. 6. Develop technical reporting and presentation skills.				
Course Outcome	After successful completion of the course, students will be able to: CO1: Describe the structure and functioning of an industrial organization. CO2: Relate MDM course theory with industrial processes.				

	CO3: Identify major process equipment and utilities used in plants. CO4: Explain industrial safety and environmental practices. CO5: Demonstrate teamwork, ethics, and professional conduct. CO6: Prepare a structured internship report and deliver a presentation.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	0	0	0	2	1	1	1	1	1	2
CO 2	3	2	1	1	1	0	0	0	1	0	0	2
CO 3	3	2	0	1	2	0	0	0	0	0	0	1
CO 4	1	1	0	0	0	3	3	2	1	0	0	1
CO 5	0	0	0	0	0	1	0	3	3	2	1	2
CO 6	0	1	0	1	0	0	0	0	1	3	1	2

Level of Mapping as: Low 1, Moderate 2, High 3

	Course Content	Duration
	The course consists of a one-month internship in a relevant sector to undergo tasks with respect to the MDM course. Students will be placed in companies or organizations that align with their chosen MDM course. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

	Course Evaluation Method	
	This particular evaluation will be part of the structure of the 7th Semester. The evaluation for the Industrial Internship course will be conducted as follows: Internal Evaluation (50 marks): Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks. Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace. External Evaluation (50 marks): Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period. The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges. The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.	
Sr. No.	Reference Books	
1.	Chakrabarti, S., 2022. Project Engineering Primer for Chemical Engineers. Singapore: Springer.	
2.	Nicholas, J.M. and Steyn, H., 2025. Project Management for Engineering, Business and Technology. 7th ed. New York: Routledge.	
3.	Siegel, N.G., 2019. Engineering Project Management. Hoboken: John Wiley & Sons.	
4.	Munier, N., 2012. Project Management for Environmental, Construction and Manufacturing Engineers: A Manual for Putting Theory into Practice. Dordrecht: Springer.	
5.	Lessard, C. and Lessard, J., 2007. Project Management for Engineering Design. Springer.	

***Note:** MDM based Industry Internship: It should be done in the subject you have selected from the pool of MDM courses. You are required to visit and complete your internship in an industry relevant to your chosen subject area and carry out your training.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PBL 411				
Course Category	Project Based Learning				
Course Title	Major Project Lab- II				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	-	-	2	2	-
Evaluation Scheme	IE at Course in charge end				
Pre-requisite (if any)	-				
Course Rational	The Research Phase II course equips students with essential research skills in Food Technology, focusing on problem identification, experimental design, data analysis, and scientific communication. It prepares students for innovation, industry applications, and advanced research in food processing, safety, and quality. This course translates theory into practice through experimental work, pilot-scale studies, simulations, and prototype development. Anchored in global Project-Based Learning (PBL) models, the course develops higher-order problem-solving skills, experimental competence, data analysis ability, and innovation mind-set, ensuring graduates are industry-ready and practice-oriented.				
Course Objective	The course teacher will ensure that students: 1. Explain how a defined Food Technology problem can be translated into experimental or process-based tasks. 2. Develop students' ability to design and set up laboratory-scale experiments, simulations, or prototype systems. 3. Explain the safe operation of laboratory equipment and software tools, emphasizing standard operating procedures and safety practices. 4. Discuss methods for analysing experimental or simulation data using appropriate engineering and statistical techniques. 5. Discuss approaches for optimizing process parameters considering performance, safety, sustainability, and cost constraints. 6. Communicate best practices for presenting validated laboratory results through technical documentation and project demonstrations.				

Course Outcome	By the end of the course, the students will be able to- CO1: Implement a working laboratory or simulation model addressing the project problem. CO2: Conduct experiments or simulations adhering to engineering and safety standards. CO3: Analyze experimental data and identify key performance trends and limitations. CO4: Optimize and validate project outcomes using engineering judgment and evidence. CO5: Demonstrate hands-on competence, teamwork, and responsible lab practices. CO6: Prepare comprehensive laboratory reports and final project demonstrations.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	3	1	2	0	0	1	1	0	1	0
CO 2	2	2	2	0	1	1	1	2	1	0	1	0
CO 3	1	3	1	2	1	0	0	1	0	0	0	0
CO 4	1	2	2	3	1	1	2	2	0	0	1	0
CO 5	0	1	0	0	0	1	1	3	3	1	1	0
CO 6	0	0	0	0	1	0	0	1	2	3	0	1

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content
The students are required to carry out hands-on project-based laboratory work related to the field of food technology with emphasis on: • Translation of the selected project problem into experimental, computational, or process-based tasks • Design, setup, and execution of laboratory experiments, simulations, or prototype systems

Safe operation of equipment and adherence to standard operating procedures and laboratory safety practices ● Collection, analysis, and interpretation of experimental or simulated data ● Optimization and validation of project outcomes considering performance, safety, sustainability, and cost ● Documentation and demonstration of results through laboratory reports and final project presentations.
Course Assessment Process
The assessment of the Major Project Laboratory shall be carried out through continuous internal evaluation by the course in-charge / project supervisor, focusing on hands-on performance and project execution. Evaluation shall be entirely based on continuous assessment by the course in- charge. The internal assessment shall be based on: ● Laboratory work and experimental execution ● Proper use of equipment and adherence to safety practices ● Data collection, analysis, and interpretation ● Teamwork, regularity, and responsibility in laboratory work ● Laboratory records, interim reports, and final project demonstration
1. Kothari, C. R., & Garg, G. (2019). Research methodology: Methods and techniques (4 th ed.). New Age International, New Delhi.
2. Kerzner, H. (2017). Project management: A systems approach to planning, scheduling, and controlling (12th ed.). Wiley, Hoboken, NJ.
3. Booth, W. C., Colomb, G. G., Williams, J. M., Bizup, J., & Fitzgerald, W. T. (2016). The craft of research (4th ed.). University of Chicago Press, Chicago.
4. Beer, D. F., & McMurrey, D. A. (2014). A guide to writing as an engineer (4th ed.). Wiley, Hoboken, NJ.
5. Perry, R. H., Green, D. W., & Southard, M. Z. (2019). Perry's chemical engineers' handbook (9 th ed.). McGraw-Hill Education, New York.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PCC 411				
Course Category	Professional Core Courses				
Course Title	Meat, Poultry and Fish Processing Technology Lab				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	-	-	02	02	01
Evaluation Scheme	IOE:00			EOE: -50	Total = 50
Pre-requisite (if any)					
Course Rational	This laboratory course provides hands-on training in slaughtering, processing, preservation, quality evaluation, and value addition of meat, poultry, eggs, and fish. It complements the theory course by emphasizing skill development, food safety practices, sensory evaluation, and industry-oriented processing techniques, aligning with NEP-2020 goals of experiential learning and employability.				
Course Objective	The course is designed to enable students to: 1. Develop practical skills in pre-slaughter handling of poultry and livestock. 2. Gain hands-on experience in slaughtering and dressing operations. 3. Learn preservation techniques used for meat, poultry, and fish. 4. Understand egg grading, inspection, and processing methods. 5. Evaluate physico-chemical quality parameters of animal food products. 6. Develop value-added products from eggs, meat, and fish.				
Course Outcome	After successful completion of this laboratory course, students will be able to: CO1: Demonstrate skills required in pre-slaughter handling of poultry and livestock. CO2: Perform slaughtering and dressing operations following hygienic practices. CO3: Apply preservation techniques for meat, poultry, and fish products. CO4: Categorize, inspect, and grade eggs using standard methods. CO5: Analyze moisture, fat, and protein content of animal food products. CO6: Develop value-added products from eggs.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1			2	3	2	2	2	1		2
CO 2	2	2	2	1	2	3	2	3	2	1		2
CO 3	2	2	2	2	3	2	2		1			2
CO 4	2	3	1	2	2	1	1					2
CO 5	3	3		3	2							2
CO 6	2	2	3	2	2	1	1		2	1	1	2

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1	Candling and grading of eggs	2
2	Preparation of egg-based product	2
3	Preparation of chicken nuggets	2
4	Preservation of fish by drying	2
5	Preservation of fish by freezing	2
6	Preparation of fish product	2
7	Slaughtering and dressing of poultry bird	2
8	Preservation of meat/chicken/fish by curing and pickling	2
9	Sensory evaluation of processed non-veg product	2
10	Preparation of chicken burger	2
11	Quality evaluation of chicken sausage	2
12	Market analysis	2
Sr. No.	Text Books	
1.	Singh, R. A. (2013). <i>Poultry Production</i> .	
2.	Gerrard, F. (1951). <i>Meat Technology: A Practical Textbook for Students and Butchers</i> .	
Sr. No.	Reference Books	
1.	Lawrie, R. A. (1981). <i>Developments in Meat Science</i> , Volume 2.	

2.	Aberle, E. D., Forrest, J. C., Gerrard, D. E., & Mills, E. W. (2012). <i>Principles of Meat Science</i> .
3.	Levie, A. (1967). <i>Meat Handbook</i> (3rd Revised Edition).

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	PCC412				
Course Category	Professional Core Courses				
Course Title	Spices and Plantation Crops Processing Technology Lab				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	-	-	2	02	01
Evaluation Scheme	IOE:00			EOE: 50	Total =50
Pre-requisite (if any)	In order to complete the course successfully, it is important to have a good knowledge of basic food science, nutrition and food processing.				
Course Rational	The purpose of this course is to provide the students hands-on experience of quality assessment of spices and plantation crops.				
Course Objective	The course teacher will ensure to- 1. Explain basic varieties and morphological characteristics of spices and herbs. 2. Describe physicochemical qualities of spices and herbs. 3. Demonstrate extraction of spice and Herb oil. 4. Discuss about formulation of different spices premixes.				
Course Outcome	After successful completion of this laboratory course, students will be able to: CO1: Understand basic varieties and morphological characteristics of spices and herbs CO2: Know about physicochemical qualities of spices and herbs CO3: Learn to extract oleoresins from spice and Herb oil. CO4: Understand practical experience to develop different spice powders.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1		1	1	1	2	1		1		2	
CO 2		2	1		3				2			
CO 3	3		1	2		2		3		1	1	
CO 4	1	1		1	2	1			1		1	

Level of Mapping as: Low 1, Moderate 2, High 3

Experiment No.	Experiment Title/Objective	Hours
1	Physical analysis of different Spice Samples.	2
2	Chemical analysis of different Spice Samples.	2
3	Demonstration of process of oil extraction spices.	2
4	Demonstration of process of oleoresin extraction from different Spices.	2
5	Demonstration of Dehydration of ginger, process of turmeric.	2
6	Study of adulteration tests in spices.	2
7	Study of sensory characteristics of Spices and oleoresin.	2
8	Demonstration of Dehydration of ginger, process of turmeric.	2
9	Preparation of curry powder.	2
10	Preparation of Spice Album.	2
11	Practical about Blending Technology.	2
12	Visit to the Spice processing Plant.	2
Sr. No.	Suggested Text Books/ Reference Books/Manual	
1	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.	

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII					
Course Code	PSI 421					
Course Category	Project Seminar Internship					
Course Title	Industrial Internship (Entire Semester) (Follow up by the Department)					
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits	
	-	-	-	The entire semester is to be spent in the industry	10	
Evaluation Scheme	IOE:150			EOE: 200		Total = 350
Pre-requisite (if any)	Basic food technology courses					
Course Rational	This course provides full-semester industrial exposure to students, enabling them to gain real-time experience in professional work environments. It bridges theoretical knowledge with practical application, builds industry-relevant skills, and prepares students for employment through hands-on learning, teamwork, and professional ethics.					
Course Objective	The course teacher will ensure to- 1. Provide continuous industrial exposure for one full semester. 2. Develop technical and practical skills through real tasks. 3. Improve problem-solving using industry challenges. 4. Build professional behavior and ethics. 5. Enhance teamwork and communication skills. 6. Prepare students for career readiness and lifelong learning.					
Course Outcome	By the end of the course, the students will be able to- CO1: Understand industry structure, workflow, and standards. CO2: Identify and analyze real industrial problems. CO3: Apply academic knowledge in industrial projects. CO4: Use modern tools and technologies used in industry. CO5: Communicate work through reports and presentations. CO6: Demonstrate professionalism and independent learning					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	–	–	–	2	1	1	1	1	–	2
CO 2	3	3	2	2	1	1	1	1	1	1	–	2
CO 3	3	2	3	2	2	1	1	1	1	1	–	2
CO 4	3	3	2	3	3	1	1	1	1	1	–	2
CO 5	2	1	1	1	1	2	2	2	1	1	–	1
CO 6	1	1	1	1	1	2	2	2	1	1	1	3

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content
The Industrial Internship is a full-semester industry-oriented training program conducted in reputed industries, R&D organizations, start-ups, or government sectors related to Food Technology. Students work under the guidance of industry and faculty mentors on real engineering problems involving agriculture, food processing, pharmaceuticals, water treatment, and specialized manufacturing or allied areas. The internship emphasizes practical implementation, system understanding, professional ethics, teamwork, and documentation. Students are required to maintain a daily logbook, prepare periodic progress reports, and submit a final technical internship report. The course enhances employability, professional confidence, and industry readiness.
Guidelines, Rules and Regulations All the B. Tech. Food Technology students are required to complete an Industrial Internship during the eighth semester of the program. The internship is intended to provide extensive industrial exposure and practical learning experience. The internship shall be carried out for one full semester in an approved industry, R&D organization, start-ups, government organization, or reputed chemical sector relevant to the student's program. The internship organization must be recommended by the department and approved by the institute prior to commencement. Students must submit an official offer letter or confirmation letter from the organization to the department before joining the internship. Each student shall be assigned a faculty mentor from the respective program, who will monitor progress and provide academic guidance throughout the internship period.

Students are required to strictly follow the rules, regulations, safety policies, confidentiality agreements, and professional ethics of the internship organization. Any misconduct may lead to cancellation of the internship and disciplinary action as per institute norms.

Change of internship organization is not permitted without prior written approval from the Head of the Department and the institute authorities. At the end of the internship, students must submit a detailed internship report in the prescribed format along with an Internship Completion Certificate issued by the organization.

Failure to complete the internship satisfactorily or failure to submit the required documents within the stipulated time shall result in non-award of credits for the course.

Course Assessment

At the end of the internship, the student shall deliver a presentation before a departmental evaluation committee. The assessment shall be based on the internship report, presentation, technical competence, problem-solving ability, professional attitude, and overall performance during the internship. Internal Evaluation (IE) and End Examination (EE) marks shall be awarded, and grades shall be assigned in accordance with the institute's academic regulations.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII				
Course Code	PEC 421.1				
Course Category	Program Elective –III (Through MOOC)				
Course Title	Novel technologies for food processing and shelf life extension				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	Food Chemistry, Food Microbiology, Food Process Engineering, Food Preservation Technology				
Course Rational	The course focuses on advanced food processing technologies including non-thermal processing, oil extraction and stabilization, grain storage innovations, microencapsulation, and functional food development relevant to modern food industries				

Course Objective	The course teacher will ensure that students: 1. Gain an understanding of advanced food processing technologies. 2. Study the chemical and biochemical changes occurring during food processing. 3. Understand emerging non-thermal food processing techniques. 4. Develop knowledge of oil processing and grain storage technologies. 5. Explore functional foods and nutraceutical product development. 6. Enhance their ability to design innovative food products.
Course Outcome	After completing this course, students will be able to: CO1: Understand advanced food processing technologies. CO2: Analyse chemical changes during processing. CO3: Evaluate emerging non-thermal processing methods. CO4: Apply packaging and storage technologies. CO5: Design oil processing and stabilization systems. CO6: Develop functional and nutraceutical foods

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	2	-	-	-	-	-	-	-	-
CO 2	3	3	2	-	-	-	-	-	-	-	-	-
CO 3	2	3	3	2	-	-	-	-	-	-	-	-
CO 4	-	2	3	3	-	-	-	-	-	-	-	-
CO 5	2	3	3	-	-	-	-	-	-	-	-	-
CO 6	2	2	3	3	2	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction to food processing; water activity; structure-function relationship; enzymatic and non-enzymatic browning; protein and carbohydrate interactions.	07
2.	High Pressure Processing; Membrane technologies and applications.	08
3.	Food irradiation; RF and microwave heating; Supercritical CO ₂ extraction.	06

4.	Extrusion technology; RTE snacks; TVP; hurdle technology; controlled atmosphere storage.	06
5.	Modified atmosphere packaging; oil extraction; refining; hydrogenation; rancidity measurement; antioxidants.	06
6.	Microencapsulation; oil powder; functional foods; fortified bars; gluten-free products.	06
Sr. No.	Text Books	
1	Gould, G. W. (1995). New Methods of Food Preservation. Springer.	
2	Barbosa-Cánovas, G. V., Tapia, M. S., and Cano, M. P. (2005). Novel Food Processing Technologies. CRC Press	
3	Rahman, M. S. (2007). Handbook of Food Preservation (2nd Ed.). CRC Press.	
Sr. No.	Reference Books	
1.	Augustin, M. A., and Sanguansri, L. (2009). Microencapsulation in the Food Industry. Academic Press.	
2.	Brennan, J. G. (2006). Food Processing Handbook. Wiley-VCH.	
3.	Brennan, J. G., Butters, J. R., Cowell, N. D., & Lilly, A. E. V. (2012). Food Engineering Operations (4 th Ed.). Elsevier.	
4.	Singh, R. P., and Heldman, D. R. (2014). Introduction to Food Engineering (5th Ed.). Academic Press	
Sr. No.	Important web links	
1.	https://onlinecourses.nptel.ac.in/noc26_ag13/preview	

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII
Course Code	PEC 421.2
Course Category	SWAYAM (NPTEL) or any other MOOCs Program Elective Course
Course Title	Process Equipment Design and Drawing

Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	In order to complete the course studies successfully, it is important to have a good knowledge of Fundamental statistics of the design of equipment safely and economically efficient manner.				
Course Rational	The course provides knowledge about the basic concepts of equipment designing.				
Course Objective	The course teacher will ensure to- 1. Make students learn about the design procedures of process equipment's used in chemical and food process plants. 2. Make students learn the process and mechanical aspects of equipment design. 3. Help students understand various design codes and standards used in design of equipment. 4. Help students draw various process equipment's and mechanical components as per calculated design. 5. Help students to analyze design storage vessels and various parts of vessels 6. Make students understand various design procedure.				
Course Outcome	After completing this course, students will be able to: CO1: Understand the role of design engineer in designing procedure and knowledge of basics of process equipment design CO2: Understand the design of important components like flange, coupling and belt drive CO3: Understand key criteria involved in the design of internal pressure vessels as per IS Code. CO4: Able to design heat transfer equipment's used in food processing CO5: Ability to design storage vessels and various parts of vessels (e.g. heads, bottom plate) CO6: 6. Understand the relationship between process design, safety and environment.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2			1								
CO 2	1											
CO 3	1	1	1	1								
CO 4					1				1			
CO 5					1				2			
CO 6			2							1		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction: - Basic Design Parameters-1 - Basic Design Parameters-2	05
2.	Heat Exchangers: - Classification of exchangers-1 - Classification of exchangers-2 - Double Pipe Heat Exchanger - Type of shell and tube heat exchangers - Exchangers tube - Kerns Method - Bells method	06
3.	Design of condenser and reboiler - Design of condenser - Design of reboiler	05
4.	Design of evaporator and crystalliser - Design of evaporator - Design of crystalliser	06
5.	Crystalliser, packed column Design of crystalliser	09

	Design of packed column	
6.	Distillation column: - Distillation column mechanical design 1 - Distillation column mechanical design 2 - Distillation column mechanical design 3 - Distillation column mechanical design 4 - Distillation column mechanical design 5	08
Sr. No.	Text Books	
1	Joshi M. V., Mahajani V. V., 'Process Equipment Design', Macmillan, 2010.	
2	Bhattacharya B. C., 'Introduction to Chemical Equipment Design Mechanical Aspects', CBS Publishers, Delhi, 1991.	
3	E. Brownell and Edwin, H. Young, 'Process Equipment Design – Vessel Design ', John Wiley, New York 1963.	
Sr. No.	Reference Books	
1.	M. S. Peters and K. D. Timmerhaus, "Plant Design and economics for chemical engineers." Mc Graw Hill (2002).	
2.	Richard Turton, R.C. Bailie, W.B. Whiting, J.A. Shaeiwitz, "Analysis, Synthesis and Design of Chemical Processes, Prentice Hall	
3.	R.K Sinnott, Coulson and Richardson's Chemical Engineering- Chemical Engineering Design", Vol. 6, Butterworth-Heinemann	
4.	Kalyanmoy Deb, "Optimization For Engineering Design-Algorithms and Examples", PHI Learning Private Limited	
5.	S.S. Rao, "Engineering Optimization- Theory and Practice", New Age International	

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII				
Course Code	PEC 421.3				
Course Category	SWAYAM (NPTEL) or any other MOOCs Program Elective Course				
Course Title	Sugar Technology				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)					
Course Rational	The course provides knowledge about the processing of sugar from sugarcane, including manufacturing steps, equipment, by-products utilization, and quality control used in sugar industries.				
Course Objective	The course teacher will ensure to: 1. Make students understand the composition and properties of sugarcane. 2. Teach the process of sugar manufacturing from sugarcane. 3. Provide knowledge of equipment used in sugar industries. 4. Help students understand clarification, evaporation, crystallization, and centrifugation processes. 5. Make students aware of by-products utilization (molasses, bagasse, press mud). 6. Develop understanding of quality control and environmental aspects in sugar industry.				
Course Outcome	After completing this course, students will be able to: CO1: Understand the composition and properties of sugarcane and juice extraction process. CO2: Understand clarification and purification of sugarcane juice CO3: Understand evaporation and concentration processes in sugar manufacturing. CO4: Analyse crystallization and sugar recovery processes CO5: Understand by-product utilization and waste management in sugar industry.				

	CO6: Understand quality control, safety, and environmental aspects in sugar processing.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2			1								
CO 2	1											
CO 3	1	1	1	1				1				
CO 4				1				2				
CO 5				1								
CO 6			2						1			

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction to Sugar Industry - History and development of sugar industry - Types of sugar (raw, refined, plantation white) - Composition and properties of sugarcane - Factors affecting sugar recovery	05
2.	Juice Extraction and Preparation - Cane handling and preparation - Milling process - Diffusion process - Extraction efficiency - Equipment used in juice extraction	06
3.	Juice Clarification and Purification - Impurities in juice - Defecation process - Sulphitation and carbonation - Clarifiers and filtration equipment	05

4.	Evaporation and Concentration - Multiple effect evaporators - Heat economy - Syrup formation - Scale formation and control	06
5.	Crystallization and Centrifugation - Sugar crystallization principles - Vacuum pan operation - Masseccuite formation - Centrifugation process - Drying and cooling of sugar	09
6.	By-products, Quality Control and Environment - Utilization of bagasse, molasses, press mud - Alcohol production from molasses - Quality control of sugar - Pollution control and waste management - Environmental and safety aspects	08
Sr. No.	Text Books	
1	Hugot E., <i>Handbook of Cane Sugar Engineering</i>	
2	Chen J. C. P., <i>Manual of Cane Sugar Engineering</i>	
3	Meade G. P., <i>Cane Sugar Handbook</i>	
Sr. No.	Reference Books	
1.	Honig P., <i>Principles of Sugar Technology</i>	
2.	Mathur R. B. L., <i>Handbook of Cane Sugar Technology</i>	
3.	Rein P., <i>Cane Sugar Engineering</i>	
4.	Peter Rein, <i>Cane Sugar Engineering</i> (Modern reference)	

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, During VIII				
Course Code	PEC 422.1				
Course Category	Program Elective –IV (Through MOOC)				
Course Title	Enzyme Science and Technology				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	Strong foundations in biochemistry, understanding enzyme structure/function, kinetics, and basic molecular biology, with advanced knowledge in areas like enzyme engineering, metabolic pathways, genetics (for production), and industrial applications in fields such as bioenergy and medicine.				
Course Rational	An Enzyme Science and Technology course rationale emphasizes enzymes' critical roles in metabolism, industry, and medicine, explaining how this field uses enzyme structure, kinetics, and engineering (like directed evolution) to develop sustainable biocatalysts for pharmaceuticals, food, diagnostics, and bioremediation, bridging fundamental biochemistry with applied biotechnology for societal benefit				
Course Objective	The course teacher will ensure to- 1. Describe enzyme functions, its production through different types strategies and purification. 2. Discuss different approaches to study the interaction of substrate with enzymes, enzyme assay and kinetics. 3. Explain different approaches to design inhibitors against enzyme, understanding the enzyme-inhibitor kinetics and mode inhibition. 4. Illustrate the role of enzyme in cell metabolism, physiology and application of enzymes. 5. Elucidate enzyme structure (primary, secondary, tertiary) to catalytic activity. 6. Evaluate enzyme immobilization, molecular docking, and techniques for detecting biomolecules. .				
Course Outcome	After completing this course, students will be able to:				

	CO1: Analyze and evaluate the meaning and significance of enzyme functions. CO2: Interpret and analyze the procedures for substrate enzyme interactions. CO3: Comprehend to design inhibitors against enzymes. CO4: Understand the nature and importance of enzymes in cell metabolism and its application. CO5: Learn the structure of enzymes. CO6: Understand enzyme immobilization and techniques for biomolecules detection.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		3	2	2	2	2				1		
CO 2	1		1	2	3	3	2	2				
CO 3		2		2	2	1	1	1				
CO 4		2	3	3	3	1	3		1	1		
CO 5	2		1		1	1	1					
CO 6	1	1	1	3		2			1			

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction to Enzymes: - Basics of Enzyme, - Enzyme Classification - Enzyme Nomenclature - Structure of enzyme	07
2.	Enzyme Production: - Cloning of Enzyme - Over-expression in Host - Extraction of enzyme. - Purification Strategies - Enzyme Characterization Approaches	08

3.	Enzyme catalysed Biochemical reactions: - Enzyme catalysed reactions with respect to Carbohydrate, Protein and Lipid Metabolism - Enzyme-Substrate interaction	06
4.	Enzyme assay system and Kinetics: - Enzyme assay system - Enzyme Kinetics	06
5.	Enzyme Inhibitor Designing: - Inhibitor designing - Enzyme Inhibition kinetics	06
6.	Enzyme Applications: - Enzymes in Industrial setup - Enzymes in medical field - Enzymes in environment field - Enzymes in drug discovery - Enzymes in food processing.	06

Sr. No.	Text Books
1	Enzyme Kinetics: Behavior and analysis of rapid equilibria and steady state enzyme systems. Irwin H SEGEL. ISBN: 978-0-471-30309-1.
2	Biochemistry. 5 th edition, Berg JM, Tymoczko JL, Stryer L. publisher: W H Freeman
3	Biochemistry, 2 nd edition Reginald Garrett and Charles Grisham
Sr. No.	Reference Books
1.	Cornish-Bowden, A., Fundamentals of Enzyme Kinetics (revised ed.), Portland Press (1995).
2.	Nelson, David L. (David Lee), 1942-. Lehninger Principles of Biochemistry. New York : W. H. Freeman, 2005.
3.	Voet, D., Voet, J. G., and Pratt, C. W. (2008). Fundamentals of biochemistry: Life at the molecular level. Hoboken, NJ: Wiley.
4.	Enzyme: Catalysis, kinetics and mechanisms. N.S. Punekar. ISBN 978-981-13-0784-3.

Sr. No.	Important web links
1.	https://onlinecourses.nptel.ac.in/noc23_bt05/preview

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII				
Course Code	PEC 422.2				
Course Category	Program Elective –IV (Through MOOC)				
Course Title	Cooling Technology in Food Processing and Preservation				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	Heat Transfer, Thermodynamics, Food Process Engineering, Food Preservation Technology				
Course Rational	The course focuses on principles and applications of cooling technology in food processing and allied industries. It covers cooling load estimation, psychrometry, thermodynamic cycles, refrigeration systems, freezing and freeze drying operations, cold storage design and low temperature product manufacturing. The course emphasizes industrial applications and cold chain management relevant to modern food industries.				
Course Objective	The course teacher will ensure to: 1. Develop students’ understanding of the principles of cooling and their role in food preservation. 2. Provide knowledge of cooling load calculations and psychrometric analysis used in refrigeration systems. 3. Introduce the thermodynamic cycles involved in refrigeration processes. 4. Build understanding of the working principles and components of vapour compression refrigeration systems. 5. Explain the principles of freezing, freeze drying, and their effects on food quality.				

	6. Enhance students' knowledge of cold storage design and the processing of low-temperature food products.
Course Outcome	After completing this course, students will be able to: CO1: Understand fundamentals of cooling and its role in food preservation. CO2: Calculate cooling load and analyse psychrometric properties. CO3: Evaluate thermodynamic refrigeration cycles and COP. CO4: Analyse vapour compression refrigeration systems and components. CO5: Explain freezing, freeze drying and their impact on food quality.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	1	1	-	-	-	-	-	-
CO 2	3	2	2	2	1	1	-	-	-	-	-	-
CO 3	3	3	1	2	1	1	-	-	-	-	-	-
CO 4	2	2	2	3	1	1	-	-	-	-	-	-
CO 5	2	2	2	2	1	1	-	-	-	-	-	-
CO 6	2	1	2	2	1	1	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Fundamentals of food processing and preservation; role of temperature in microbial and enzymatic control; sensible and latent heat; product load; respiration heat; infiltration load; cooling load estimation.	07
2.	Psychrometry; properties of moist air; dry bulb and wet bulb temperature; relative humidity; dew point; psychrometric chart; air conditioning processes.	08
3.	Basics of thermodynamics; first and second laws; Carnot cycle; Carnot refrigeration cycle; reverse Carnot cycle; coefficient of performance (COP).	06
4.	Refrigeration and air conditioning; vapour compression refrigeration cycle; p-h diagram; compressors; condensers; expansion devices; evaporators; refrigerants; system performance..	06

5.	Freezing of foods; nucleation and crystal growth; freezing time estimation; Plank's equation; quality changes during freezing; freeze drying principles and applications.	06
6.	Cold storage design; controlled atmosphere storage; refrigerated transport; cold chain management; ice cream manufacture; freezing, hardening, overrun and defects.	06
Sr. No.	Text Books	
1	ASHRAE (Latest Edition). <i>ASHRAE Handbook – Refrigeration</i> , American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta.	
2	Singh, R.P., and Heldman, D.R. 2014. <i>Introduction to Food Engineering</i> , 5 th ed., Academic Press, San Diego, CA. Academic Press publications	
3	Geankoplis, C. J. (2002). <i>Transport processes and unit operations</i> (3rd ed.). Prentice Hall of India.	
4	Arora, C.P. (2010). <i>Refrigeration and Air Conditioning</i> , 3 rd Edition, Tata McGraw-Hill Education.	
5	Arora, R.C. & Domkundwar, S. (2009). <i>A Course in Refrigeration and Air Conditioning</i> , Dhanpat Rai & Co.	
Sr. No.	Reference Books	
1.	Stoecker, W.F. & Jones, J.W. (1982). <i>Refrigeration and Air Conditioning</i> , McGraw-Hill.	
2.	Dossat, R.J. (2001). <i>Principles of Refrigeration</i> , Prentice Hall	
3.	Gosney, W.B. (1982). <i>Principles of Refrigeration</i> , Cambridge University Press.	
4.	ASHRAE (Latest Edition). <i>ASHRAE Handbook – Fundamentals</i> , ASHRAE.	
Sr. No.	Important web links	
1.	https://onlinecourses.nptel.ac.in/noc26_ag13/preview	

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII
Course Code	PEC 422.3
Course Category	Program Elective- IV (Through MOOC)
Course Title	Food Laws and Regulations

Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	3	-	-	3	3
Evaluation Scheme	ISE:30			ESE: 70	Total = 100
Pre-requisite (if any)	Basic knowledge of food science, food microbiology, and food chemistry is required. Familiarity with concepts of food safety, quality control, and food processing is recommended.				
Course Rational	This course provides students with comprehensive knowledge of national and international food laws, standards, and regulatory systems. It helps learners understand legal responsibilities, food safety requirements, trade regulations, and quality standards to ensure consumer protection, regulatory compliance, and safe food supply in the food industry.				
Course Objective	The course teacher will ensure to- 1. Introduce fundamentals of food safety and regulatory systems. 2. Explain Indian food laws and FSSAI regulations. 3. Describe hygiene, sanitation, and food safety management systems. 4. Explain global food standards and trade agreements. 5. Introduce export–import food regulations. 6. Create awareness of other laws related to food quality and consumer protection.				
Course Outcome	After completing this course, students will be able to: CO1: Understand basic concepts of food safety and food laws. CO2: Explain Indian food regulatory framework and FSSAI rules. CO3: Apply hygiene and FSMS principles in food businesses. CO4: Interpret global food standards and WTO agreements. CO5: Understand export–import regulations for food products. CO6: Evaluate legal requirements for food quality and consumer rights.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	–	2	1	1	–	–	–	2
CO 2	3	3	1	1	–	3	1	1	–	–	–	2

CO 3	2	2	1	2	1	2	2	2	–	–	–	1
CO 4	2	2	1	1	–	2	2	1	–	–	–	1
CO 5	2	2	1	1	–	2	1	1	–	–	1	1
CO 6	1	1	1	1	–	2	2	2	–	–	–	1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction to Food Safety and Food Science Food science and its scope. Food microbiology basics. Concept and importance of food safety. Need for food quality and consumer protection.	05
2.	Indian Food Regulatory System Old food laws and repealed acts like PFA and orders under Essential Commodities Act. Food Safety and Standards Act, 2006. Structure and functions of FSSAI. Food Safety Rules and major regulations such as licensing and registration, food product standards and additives, packaging and labelling, contaminants and residues, laboratory and sampling, imports, organic food, alcoholic beverages, food fortification, food recall, advertising and claims, and surplus food distribution.	08
3.	Hygiene, FSMS and Food Testing Sanitary and hygienic requirements for petty food business operators, general food businesses, milk and milk products, meat and meat products, and catering. Food Safety Management System and FSSAI guidance documents. Food safety guidelines during COVID-19. Food testing and methods of analysis. FSSAI initiatives like FoSTaC, Safe and Nutritious Food, online platforms, and training programs.	07
4.	Global Food Laws and Standards Codex Alimentarius Commission, structure and scientific basis. Harmonization of national standards with Codex. WTO agreements: SPS and TBT. International standard bodies such as ISO, OIE, IPPC, AOAC, ASTM, EU and USFDA. Global food safety and quality systems like HACCP, ISO 22000, GFSI, and BRC. National agencies implementing international standards.	07
5.	Export and Import Laws – 6 Hours	06

	Foreign Trade Policy. Export Quality Control and Inspection Act, 1963. Export Inspection Council. Export promotion bodies like APEDA, MPEDA, and CEPC. Plant and animal quarantine laws. Customs Act and import control regulations.	
6.	Other Food Related Laws and Standards Legal Metrology Act. Voluntary national standards like BIS and AGMARK. Consumer Protection Act. Environment Protection Act. Role of these laws in food quality, safety, trade, and consumer rights.	06

Sr. No.	Text Books
1	Fortin, N. D. (2022). Food regulation: law, science, policy, and practice. John Wiley & Sons.
2	Steier, G., and Patel, K. K. (Eds.). (2016). International food law and policy. Springer.
3	Upadhyaya, A. S., Kolas, A., and Beri, R. (2022). Food Governance in India. Routledge.
4	Fisher, C., and Scott, T. R. (2007). Food flavours: biology and chemistry. Royal Society of chemistry.
5	Kathuria, A. K., and Anand, D. (2022). Safe, Healthy, and Sustainable Diets: Role of Food Regulatory Bodies and Innovations from India. World Bank.
Sr. No.	Important web links
1.	https://fssai.gov.in/
2.	https://onlinecourses.swayam2.ac.in/nou25_ag13/preview
3.	https://www.commerce.gov.in/

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII				
Course Code	IKS 421				
Course Category	Indian Knowledge Systems				
Course Title	Indigenous Food Science				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	2	-	-	2	2
Evaluation Scheme	ISE:30			ESE:70	Total = 100
Pre-requisite (if any)	This interdisciplinary course introduces the principles of food science by				

	integrating modern scientific knowledge with the rich legacy of Indian Knowledge Systems (IKS). It explores the chemical, physical, and biological transformations of food and their influence on health and taste, while also delving into traditional culinary wisdom, food synergies, the science of Indian thali, and mindful eating practices.
Course Rational	By exploring the various dimensions of food through both modern science and India's age-old culinary traditions, the course reflects NEP's commitment to blended learning, value-based education, and interdisciplinary studies.
Course Objective	The course teacher will ensure to- 1. Familiarize students with the classification, nutritional value, and cultural context of traditional Indian foods 2. Understand ancient food processing and preservation technologies, such as sun-drying, fermentation, and smoking. 3. Study the principles of food habits based on Ayurveda, including <i>Sattvik</i>, <i>Rajasic</i>, and <i>Tamasic</i> diets, along with <i>Dinacharya</i> (daily routine) and <i>Ritucharya</i> (seasonal routine) 4. Analyse the scientific, chemical, and physical principles behind traditional food preparation methods. 5. Understand the role of traditional food systems in environmental sustainability, reducing waste, and improving resource efficiency. 6. Analyse the health benefits, bioactive components, and medicinal potential of traditional, regional foods.
Course Outcome	By the end of the course, the students will be able to- CO1: Understand the physical and chemical structures of major food components (macronutrients: carbohydrates, proteins, fats; micronutrients: vitamins, minerals) CO2: Analyse the chemical reactions and physicochemical changes that occur during cooking, food preparation, and storage. CO3: Recognize concepts of water activity, phase changes, colloidal systems (foams, emulsions), and rheological properties of food. CO4: Bridge traditional Indian food preparation and preservation techniques with modern scientific explanations. CO5: Identify the scientific rationale behind ancient Indian culinary practices,

	such as the use of spices, fermented foods, and seasonal diets. CO6: Learn the principles behind various food preservation methods, including heat treatment, low-temperature storage, fermentation, and drying.
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Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		3	2	2	2	2				1		1
CO 2	1		1	2	1	3	2	2				
CO 3	1	2		3	2	1	1	1	1		1	
CO 4	1	1	3	2	3	1	3					
CO 5	1		1		1	1	1			2	2	
CO 6	1	2	3	3		2						1

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction to Indic Food Wisdom - Concept of <i>Ahara</i> (Food) as medicine; classification of food based on <i>Guna</i> (Sattva, Rajas, Tamas) - Scientific understanding of Sweet, Sour, Salty, Pungent, Bitter, and Astringent and their physiological effects. - Overview of food mentioned in <i>Charaka Samhita</i>, <i>Sushruta Samhita</i>, and <i>Bhojana Kutuhalam</i> (a 17th-century encyclopedia on food science).	05
2.	Traditional Processing and Preservation - parboiling, puffing (<i>Murmura</i>), and malting, Sun-drying techniques for fruits, Milk Concentration, Pickling, Storage system: Granaries (Kothi) using Neem and Turmeric - Science behind <i>Idli</i>, <i>Dosa</i>, and <i>Dhokla</i>; natural microbial flora involved in traditional batters. - Processing and consuming foods based on Indian seasons to maintain metabolic balance.	04
3.	Introduction to Ayurvedic Nutrition	04

	- Five primary states of nature cognized by 5 senses (characteristics of five <i>mahabhutas</i>) - Body tissues (<i>dhatu</i>), their relationship with dosha, health and wellness - Tissue nourishment (<i>dhatuposhana</i>) 13 stages of metabolism (<i>agni</i>) - Un-metabolized toxins, indigestion and their role in manifestation of chronic disorders (characteristics of <i>ama</i>)	
4.	Rules on processing and consumption of food (<i>aharavidhi</i>) - Wholesome and unwholesome food and drinks for an individual (<i>pathya-apathya vichara</i>) - Food incompatibilities (<i>viruddha vichara</i>) - Personalized diet (<i>prakruti</i> and food relationship)	06
5.	Nutrition in Ayurveda - Functional properties of a material (rasapanchaka) - Rules on processing and consumption of food (aharavidhi) - Wholesome and unwholesome food and drinks for an individual (pathya-apathya vichara) - Food incompatibilities (viruddha vichara)	04
6.	An understanding on therapeutic diet for selected physiological and pathological conditions - Season Specific diet - Ayurvedic diet for Pregnancy, Lactation, Childhood & Adolescence and Elderly - Design Ayurvedic diet for Selected specific systemic diseases	03
Sr. No.	Text Books	
1	Bhartiya Knowledge Systems by M.C. Bora (Khanna Publishing).	
2	Ancient Food Technology by Merly Fiscal Arjona, Delve Publishing.	
3	Introduction to Indian Knowledge Systems: Concepts and Applications by B. Mahadevan, Vinayak Bhat, and Nagendra Pavana (Prentice Hall India)	
4	Festive Foods of India, Vanisha Nambia (2024), Mangalam Publications, Delhi.	

5	Sushruta Samhita, Maharisi Susruta, Edited: Kaviraja Ambikadutta Shastri, Chaukumba Sanskrit Samsthan, Varanasi.
6	Chunekar KC (ed.), Bhavaprakasa Nighantu of Bhavamisra, Chaukhambha Bharati Academy, Varanasi, 2004
Sr. No.	Reference Books
1.	Sastry JLN, Dravyaguna Vijnana, Vol-II, Chaukhambha Orientalia, Varanasi), 2005.
2.	Sastry JLN, Dravyaguna Vijnana, Vol-I, Chaukhambha Orientalia, Varanasi, 2005.
3.	Sharma, B. K. (2014). Food chemistry (13th ed.). Goel Publishing House.
4.	Sastry K (ed.), Caraka Samhita of Agnivesa with Cakrapanidatta Tika, Part I, Chaukhambha, Sanskrit Sansthan, Varanasi, 1997
Sr. No.	Important web links
1.	https://ift.onlinelibrary.wiley.com/journal/17503841
2.	https://www.sciencedirect.com/journal/current-research-in-food-science

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII				
Course Code	PSI 422				
Course Category	Project Seminar Internship				
Course Title	Case Study- Food Safety Management System (Online)				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	01	-	-	01	01
Evaluation Scheme	ISE:50			ESE:50	Total = 100
Pre-requisite (if any)					
Course Rational	This course is designed to develop analytical, presentation, and professional skills through online seminars based on case studies related to Food Safety Management Systems. It helps students understand real industrial practices, regulatory compliance, and quality assurance through discussion, review, and presentation of practical case studies.				
Course Objective	The course teacher will ensure to-				

	1. Introduce students to real case studies in Food Safety Management Systems. 2. Develop skills in case analysis and problem identification. 3. Improve presentation and communication abilities. 4. Build understanding of food safety regulations and standards. 5. Encourage teamwork, discussion, and professional ethics. 6. Promote independent learning and critical thinking..
Course Outcome	After completing this course, students will be able to: CO1: Understand structure and requirements of Food Safety Management Systems. CO2: Analyze food safety related case studies. CO3: Apply regulatory knowledge to real industry situations. CO4: Communicate case analysis effectively. CO5: Work individually and in teams for seminar activities. CO6: Demonstrate independent learning and professional attitude.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	–	–	–	2	1	1	1	1	–	2
CO 2	2	3	2	2	1	1	1	1	1	1	–	2
CO 3	3	3	2	2	1	2	1	1	1	1	–	2
CO 4	2	2	1	1	1	3	2	2	1	2	–	1
CO 5	1	1	1	1	1	1	1	1	3	3	–	1
CO 6	1	1	1	1	1	1	1	1	1	1	1	3

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction to FSMS and Seminar Guidelines Concept of Food Safety Management System, HACCP, ISO 22000, FSSAI requirements, seminar format, and evaluation method.	02
2.	Selection and Understanding of Case Study	02

	Selection of case study, background of food industry/organization, identification of food safety issues, and scope.	
3.	Case Analysis and Problem Identification Analysis of hazards, critical control points, non-conformities, root cause analysis, and risk assessment.	03
4.	Regulatory Compliance and Corrective Actions Application of FSSAI, ISO, Codex standards, corrective and preventive actions, documentation, and monitoring.	02
5.	Seminar Presentation and Discussion Preparation of PPT, report writing, presentation skills, peer review, discussion, and feedback.	03
6.	Evaluation and Learning Reflection Assessment of seminar performance, self-evaluation, learning outcomes, and career relevance.	01

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VII				
Course Code	VEC 421				
Course Category	Value Education Courses				
Course Title	Professional Ethics (Through MOOC)				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	1	-	-	1	1
Evaluation Scheme	ISE:50			ESE:00	Total = 50
Pre-requisite (if any)	-				
Course Rational	This course aims to develop ethical awareness and professional responsibility among engineering graduates. In a world of rapid technological change and complex socio-environmental challenges, engineers must balance technical excellence with moral integrity, social accountability, and human values. The course sensitizes students to ethical frameworks, professional codes of conduct, workplace dilemmas, and decision-making processes to help them act responsibly as global engineers and leaders.				
Course Objective	The course teacher will ensure to-				

	1. Understand the nature and scope of ethics. 2. Recognize ethical issues in engineering practice. 3. Apply ethical theories to real-world dilemmas. 4. Examine professional responsibilities and codes. 5. Develop moral reasoning and decision skills. 6. Demonstrate ethical leadership and communication.
Course Outcome	After completing this course, students will be able to: CO1: Explain fundamental concepts of ethics. CO2: Identify ethical challenges in engineering practice. CO3: Apply moral reasoning to resolve dilemmas. CO4: Interpret professional codes and responsibilities. CO5: Evaluate ethical dimensions in real situations. CO6: Communicate ethical decisions effectively.

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	0	0	0	2	2	3	0	1	0	1
CO 2	2	2	0	1	0	3	2	3	0	0	0	1
CO 3	1	3	1	2	1	2	2	3	0	1	0	2
CO 4	1	2	3	2	1	2	2	3	1	2	2	3
CO 5	1	2	3	2	1	2	2	3	1	2	2	3
CO 6	0	0	1	0	1	0	2	2	3	3	1	2

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
1.	Introduction to Ethics and Human Values • Definition, scope, and importance of ethics • Relationship between values, morals, and ethics • Human values and their role in engineering	2
2.	Professionalism and Engineering Ethics • Characteristics of a profession	2

	- Responsibilities of engineers toward society, employers, and peers - Role of professional bodies (e.g., IEEE, ASME, IEI)	
3.	Ethical Theories and Decision-Making Models - Utilitarianism, duty ethics, virtue ethics - Ethical decision-making frameworks - Case studies in engineering contexts	3
4.	Workplace Ethics and Professional Conduct - Conflict of interest, confidentiality, intellectual property rights - Ethics in research and publication - Harassment, discrimination, and whistleblowing	3
5.	Ethics in Emerging Technologies - Ethical issues in AI, automation, biotechnology, and data security - Environmental ethics and sustainable responsibility - Globalisation and cultural diversity in ethics	3
6.	Ethical Leadership and Communication - Traits of ethical leaders - Team ethics and collaborative responsibility - Case presentations and role-play exercises	2

Sr. No.	Reference Books
1	Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins (2018). Engineering Ethics: Concepts and Cases. Cengage Learning, Boston.
2	Govindarajan, M., Natarajan, S., and Senthil Kumar, V.S. (2004). Engineering Ethics. Prentice Hall of India, New Delhi.
3	Fleddermann, C.B. (2011). Engineering Ethics. Pearson Education, New Jersey.
4	Martin, M.W., and Schinzinger, R. (2009). Introduction to Engineering Ethics. McGraw-Hill, New York.
5	R. Subramanian (2015). Professional Ethics. Oxford University Press, New Delhi.

Year, Program, Semester	Final Year B. Tech. (Food Technology), Part IV, Semester VIII				
Course Code	PBL 421				
Course Category	Project Based Learning				
Course Title	MDM based Mini Project **				
Teaching Scheme and Credits	L	T	P	Total Contact Hours	Total Credits
	-	-	-	-	2
Evaluation Scheme	ISE:50			ESE:50	Total = 100
Pre-requisite (if any)	-				
Course Rational	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena in the Food Industry.				
Course Objective	The course teacher will, 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.				
Course Outcome	After successful completion of the course, students will be able to: CO1: Demonstrate application of theoretical concepts with instructor guidance. CO2: Collaborate effectively in instructor-led team-based projects. CO3: Communicate findings and insights professionally under instructor supervision.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2			2				2			
CO 2			3						3		2	1
CO 3										3		2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content
Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets. This activity may be planned after 4 th Semester and can be completed prior to 8 th Semester of their Major studies.
Course Assessment Process
This particular evaluation will be the part of 8th Semester of the major structure. The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work. The teachers will follow the instructions as below: Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including: • Rubric-based assessment for the project work and its report. • Peer evaluation for project. • Instructor-led discussions or presentations to evaluate communication skills and critical thinking. • Overall course grading based on a weighted average of individual assessments and participation. The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.