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

Estd. 1962
"A++" Accredited by NAAC (2021)
With CGPA 3.52

SU/BOS/Sci & Tech/ 316 **Date: 23/05/2025**

To,

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

Subject: Regarding revised syllabus of **B. Tech.** Part - III (Sem - V & VI) degree **Programme (Deparment of Technolgy)** 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 - III (Sem - V & VI) under the Faculty of Science & Technology as per NEP 2020.

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, shall be implemented from the academic year **2025-26** onwards. A soft copy containing the syllabus is attached herewith and it is available on university website **www.unishivaji.ac.in NEP-2020@suk (Online Syllabus).**

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October/ November 2025 & March / April 2026. 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,

Dr. S. M. Kubal
Dy. Registrar

Copy to: for Information and necessary action

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

Shivaji University

Vidyanagar, Kolhapur-416004, Maharashtra.

Department of Technology

As per NEP2020 guidelines

Third Year B.Tech (Food Technology),Detailed Curriculum, 2025-26 onwards

Shivaji University, Kolhapur
Department of Technology

Third Year B.Tech(Food Technology), Semester-V

Teaching & Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1	Professional Core Course	PCC 311	Food Process Engineering II	03	-	-	03	03	30:70	00:00
2	Professional Core Course	PCC312	Food Packaging Technology	03	-	02	05	04	30:70	50:00
3	Professional Core Course	PCC313	Sugar and Confectionery Technology	03	-	02	05	04	30:70	50:50
4	Vocational and Skill Enhancement Courses	VSEC311	Technology of Cereal and Bakery Products	03	-	02	05	04	30:70	00:50
5	Humanities and Social Sciences, Management Environmental Course	HSMEC 311	Food Quality and Safety Management	03	-	02	05	04	30:70	50:00
6	MDM course	MDM-311	Multidisciplinary Minor Course-II*	03	-	-	03	03	30:70	00:00
7.	Ability Enhancement Course	AEC311	Introduction to Foreign Language	01	-	-	01	01	-	50:00
							-	**23**	**600**	**300**
8	Mandatory Audit Course	MAC311	Aptitude Enhancement Course II	01	-	-	01	ISE at Course in charge end		
9	Project Based Learning	PBL311	Mini Project III & Industrial Visit	-	-	02	02	ISE at Course in charge end		
			Total Hours	20	00	10	**30**	-		

*Note: The MDM course will be from the chosen Multidisciplinary Minor Title

Shivaji University, Kolhapur

Department of Technology

Third Year B.Tech(Food Technology), Semester-VI

Teaching & Evaluation Scheme

S.N.	Category	Code	CourseTitle	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1	Professional Core Course	PCC 321	Food Biotechnology	03	-	-	03	03	30:70	00:00
2	Professional Core Course	PCC322	Design and Development of New Products	03	-	02	05	04	30:70	50:50
3	Professional Core Course	PCC323	Legume and Oilseed Technology	03	-	02	05	04	30:70	00:50
4	#Professional Elective Course	PEC321	Elective I	03	-	-	03	03	30:70	00:00
5.	$Open Elective Course	OEC 321	Open Elective I	03	-	-	03	03	30:70	00:00
6	*MDM course	MDM 321	Multidisciplinary minor course III	03	-	-	03	03	30:70	00:00
7	Humanities and Social Sciences, Management, Environmental Course	HSMEC 321	Entrepreneurship Development for Food Technologists	02	-	-	02	02	00:00	50:00
8	Project Seminar Internship	PSI 321	Research Project Phase-I	-	-	02	02	01	-	50:50
				-	-	-	-	**23**	**600**	**300**
9	Mandatory Audit Course	MAC321	Design Thinking and Innovation III	01	-	-	01	ISE at Course in charge end		
10	Mandatory Audit Course	MAC 322	Aptitude Enhancement Course III	01	-	-	01	ISE at Course in charge end		
			Total Hours	22	00	06	**28**	-		

*Note: The MDM course will be from the chosen Multidisciplinary Minor Title

#**Professional Elective Course**: (Functional Foods and Nutraceuticals/ Snack Foods Technology/ Waste Management of Food Industries/Engineering Mathematics-III)

$**Open Elective Course:** (Industrial Economics and Management, Professional Communication, Principles of Management)

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC311</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Food Process Engineering II (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Knowledge of Principles of Food Preservation</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course deals with basic principles of food process engineering to apply in the food processing industry. Topics presented illustrate applications of process engineering during the handling, processing, storage, packaging and distribution of food products.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. To provide students with a fundamental understanding of the principles and practices involved in food processing
2. To introduce the application of engineering principles such as heat and mass transfer, fluid mechanics, and thermodynamics in food processing
3. Explain the working of various processing equipment with its application in food processing industries.
4. To equip students with the skills to design and optimize food processing operations and systems
5. To develop critical thinking and problem-solving skills specific to challenges in food processing engineering.
6. To expose students to the latest technologies and innovations in food processing, including automation and control systems.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Students will be able to understand fundamentals of the principles and practices involved in food processing and engineering operations
2. Studentswillbeabletounderstandallunitoperationsanditsapplicationsinfoodprocessing
3. Students will be able to apply engineering principles to design and analyze food processing systems
4. Students will be able to analyze and solve issues with the working of the food processing equipment used for the different unit operations</td></tr>
</table>

	5. Students will be able to evaluate how various unit operations work individually and together 6. Students will gain proficiency in using modern technologies and tools relevant to food processing engineering

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

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

Unit No.	Course Content	Hours
1.	**Thermal processing** Principles of Blanching, Pasteurization and Sterilization. Microbial survivor curves, thermal death time F, spoilage probability, methods for process calculations.	07
2.	**Refrigeration and Freezing** **Refrigeration:** Refrigeration system and its components. Selection of a refrigerant. Cold– storage plants **Freezing:** Food Freezing systems, Frozen food properties, Calculation of freezing time by Plank's equation and other modified methods	07
3.	**Crystallization** Theory and principles of Crystallization, nucleation, crystal growth, crystallization equipment, applications of crystallization in food processing	07
4.	**Distillation and Gas Absorption** **Distillation** :Vapour liquid equilibrium, batch and continuous distillation, steam distillation, equipment, applications to food industries **Gas Absorption** : Principles, equipment and applications in food processing	06
5.	**Extrusion processes of Food and 3 D Food Printing**	05

	Extrusion: Basics principle of extrusion, Extrusion systems : cold and hot extrusion; single screw and twin screw extruder design, extrusion cooking, application of extrusion **3 D Food Printing:** Fundamentals of 3D Food Printing Technology, Materials and Ingredients Used for Printing, Potential in Personalized Nutrition and Space Food	
6.	**Internet of Things (IoT) and AI in Food Processing** Role of IoT in Food processing , AI and Machine Learning Applications in Food Industry, Automation and Robotics in Food Engineering	**07**
Sr.no.	**Reference Books**	
1.	Rao,D.G.(2012).FundamentalofFoodEngineering.PHILearningPrivateLimited,NewDelhi.	
2.	Singh,R.P.,andHeldman,D.R.(2001).IntroductiontoFoodEngineering,3rded.,AcademicPress,SanDiego,CA.AcademicPresspublications.69–78,144–157.	
3.	Geankoplis,C.J.(2002).Transportprocessesandunitoperations.PrenticeHallof India.	
4.	CoulsonandRichardsons.(1998).ChemicalEngineering,VolIandII,AsialiBooksPvt ltd.	
5.	McCabe and Smith “Unit Operations ”McGraw-Hill, NewYork	
Sr.no	**Reference Textbooks**	
1.	Treybal,R.E.(1981).Mass Transfer Operations.3rdedition.McGrawHill.	
2.	Dennis, R.H.(1981).“FoodProcessEngineering.AcademicPublishingandPress,King Saud University.	
3.	Rao,M.A. SyedS. H.Rizvi, andAshimK.Datta.(2008).Engineering properties of foods. CRC Press.	
Sr.no	**Weblinks**	
1.	**https://onlinecourses.nptel.ac.in/noc24_ag03/preview**	
2.	**http://rpaulsingh.com/course/index.html**	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC312</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Food Packaging Technology (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">In order to complete the course successfully, it is important to have good knowledge of basic food technology subjects.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Food Packaging is a professional course targeted to cater the food packaging industry needs trained food professionals. The main objective of this subject is to impart knowledge and skills related to designing packaging system in food products and developing skills in handling of packaging equipment in the students. This course explains the different types of packaging materials, its characteristics and wide application in food industry. This course
Included many newer packaging techniques.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-
1. Explain the role of different packaging materials
2. Describe the properties of different packaging materials
3. Demonstrate different packaging materials for different food products
4. Introduce different quality characteristics for different packaging materials
5. Illustrate the designing of different packaging materials.
6. Elaborate newer food packaging technologies.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Justify the role of packaging materials for food preservation
2. Choose suitable packaging materials for different food products
3. Design food grade packaging materials</td></tr>
</table>

	4. Understand the properties of different packaging materials 5. Assess quality characteristics for different packaging materials 6. Know newer food packaging technologies

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

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

Unit No.	Course Content	Hours
1.	**Introduction to Food Packaging** Need for Packaging and Functions of packaging. Levels of packaging. Factors affecting quality of good materials– product environment and spoilage factors, labelling laws, Package Environment, Classification of packaging materials and its Application	05
2.	**Paper and Plastic Packaging:** Paper: Manufacturing method, types, characteristics and advantages. Plastic: Manufacturing method, types, characteristics and advantages. Lamination, need of lamination, types, properties, advantages and disadvantages of each type. Types of coatings. Need of coating, methods of coatings.	06
3.	**Glass and Metal Packaging:** Glass: Manufacturing method, types, characteristics and advantages. Metal: Manufacturing method, types, characteristics and advantages.	08

4.	**Packaging of Specific Foods:** Packaging Machineries, Packaging of specific foods with its properties like bread, biscuits, coffee, milk powder, egg powder, carbonated beverages, Snack foods etc. Packages type i.e. FFS, Stand able pouches	**07**
5.	**Food Packaging Techniques:** Food and Packaging material interactions including migration, scalping offlavor ; Aseptic processing and packaging, Biodegradable packaging	**07**
6.	**Novel Food Packaging:** CAP/MAP packaging, Irradiated packaging, Retort pouch, Microwaveable packaging, packaging for high pressure processing ,active packaging ;smart/intelligent packaging	**06**
Sr.no.	**Reference Books**	
1.	Paine, F. A., &Paine, H. Y. (2012). A hand book of food packaging. Springer Science & Business Media.	
2.	Grumezescu, A.M. (Ed.). (2016).Food packaging .Academic Press.	
3.	Kadoya, T.(Ed.).(2012).Food packaging .Academic Press.	
4.	Ahvenainen , R.(Ed.).(2003).Novel food packaging techniques. Elsevier.	
Sr.No.	**Reference Textbooks**	
1.	Coles, R., McDowell, D., & Kirwan, M. J. (Eds.). (2003). Food packaging technology (Vol. 5). CRC press.	
2.	Robertson, G.L. (2005).Food packaging :principles and practice. CRC press.	
3.	Lee, D. S., Yam, KL.& Piergiovanni, L. (2008).Food packaging science and technology. CRC press.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC312</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Food Packaging Technology (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">IOE = 50</td><td colspan="2">EOE = 00</td><td>Total=50</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Food Packaging is a professional course targeted to cater the food packaging industry needs trained food professionals. The main objective of this subject is to impart knowledge and skills related to designing packaging system in food products and developing skills in handling of packaging equipment in the students. This course explains the different types of packaging materials, its characteristics and wide application in food industry. This course included many newer packaging techniques.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The Course Teacher will
1. Impart practical knowledge and skills
2. Introduce students to food packaging
3. Discuss different equipment’s used to assess the quality of packaging material
4. Explain the relation between shelf life and packaging material</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students will be able to
1. Understand different packaging Materials
2. Use different analytical equipment’s for quality analysis of packaging material
3. Asses suitable packaging material for different food products
4. Extend the shelf life of different food products</td></tr>
</table>

	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	3	3	2	2	2	1			1
CO 2	3	3	2	3	3	2	1	2	1	1	1	1
CO 3	3	3	2	3	3	2	2	2	1	1		
CO 4	3	2	3	3	3	3	3	1	1	2	3	1

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

Ex. No.	List of Experiments	Hours
1.	Classification of various packages based on material and rigidity	2
2.	Measurement of thickness of given packaging material	2
3.	Qualitative tests for Plastics	2
4.	Determination of water absorption of given packaging material	2
5.	Determination of bursting strength of given packaging material	2
6.	Measurement of tear resistance of given packaging material	2
7.	Determination of puncture resistance of given packaging material	2
8.	Measurement of tensile strength of given packaging material	2
9.	Determination of water-vapour transmission rate	2
10.	Determination of drop test of food package	2
11.	Visit to packaging industry	2
Sr. No.	**Suggested Text Books**	
1.	Institute'sLaboratoryCourseManualandequipmentwiseStandardOperatingProcedure to follow etc.	
2.	Paine, F. A., &Paine, H. Y. (2012). A handbook of food packaging. Springer Science & Business Media.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B. Tech. (Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC313</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Sugar and Confectionery Technology (Theory)</td></tr>
<tr><td>Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td></td><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total = 100</td></tr>
<tr><td>Pre-requisite (if any)</td><td colspan="5">Principles of Food Preservation Technology (PCC 212)</td></tr>
<tr><td>Course Rational</td><td colspan="5">Confections refer to food items that are rich in sugar and carbohydrates. It includes a wide range of products such as chocolate confectionery i.e Dark chocolate and Sugar confectionery i.e Boiled Sweets, Toffees, Caramels, Chewing gums. Consumer habits, tastes, and preferences are constantly evolving. This has led to innovation in the field of confectionery. This course includes the processing of confectionery products, information about required ingredients, required small and large scale equipment. It also includes the required rules and regulations and quality management systems in the confectionery chocolate industry. Students will be expected to learn about processing, Quality management, and new innovations in the confectionery Industry.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course teacher will ensure to-
1. Study the current market status and future aspects of confectionery industry along with the fundamentals of confectionery.
2. Study the properties and processing of different sugars along with its applications.
3. Highlight the importance and role of various ingredients and understand the different machinery required in confectionery.
4. Understand the different types of sugar confectionery products and their manufacturing process.</td></tr>
</table>

	5. Understand the different types of cocoa products and their manufacturing process. 6. Understand the quality management and development of new confectionery products.
Course Outcome	By the end of the course, the students will be able to- 1. Understand the current market status and future aspects of confectionery industry along with the fundamentals of confectionery 2. Explain the different types of properties and processing of different sugars along with its applications. 3. Understand purpose and functions of various ingredients and the different machinery required in confectionery. 4. Create and understand the sugar confectionery products and their manufacturing process. 5. Create and understand the cocoa products and their manufacturing process. 6. Apply quality management system in Sugar and confectionary industry. Create new confectionery 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	1	2	2	1	1	1	2	1	1			
CO 2	1	2	1	2	1	1	2	1	2			
CO 3	2	1	2	1	3	2	3	2	1			
CO 4	1	2	2	1	2	3	3	2	2			
CO 5	2	1	1	3	2	1	3	2	2			
CO 6	2	1	2	2	2	2	3	1	2			

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

Unit No.	Course Content	Hours
1.	**Introduction of sugar and Confectionary** • Present status • future scope • Fundamentals of confectionery	03
2.	**Natural Sugar and Sugar alcohol processing** • Processing of Invert sugar, Glucose syrup, High fructose corn syrup, Lactose powder, Maltose syrup, Honey, • Jaggery processing and its applications • Sugar alcohol processing and its application	06
3.	**Machinery and Additives in confectionery** • Types of machinery • Types of Additives • Role and application of additives in confectionery	05
4.	**Cocoa and Chocolate processing** • Cocoa processing : cocoa bean processing, roasting, fermentation, production of cocoa butter, cocoa powder • Chocolate processing: Ingredients, mixing, refining, conching, tempering, moulding, cooling, coating. Problems in Chocolate processing	08
5.	**Sugar based confectionery processing** • High boiled sweets • Toffee • Fudge • Caramel • Lozenges • Fondants • Chewing gums • Problems in confectionery products	09

6.	**Quality management and Innovation in confectionery Industry** • FSMS system in Confectionery industry • New product development in Confectionery • Spoilage and microbial analysis	**08**

Sr. No.	**Text Books**
1.	Minifie, B.W. (2010). Chocolate, cocoa and confectionery – Science and Technology. 3rd Edition, Aspen Publishers Inc., Great Britain.
2.	E.B. Jackson (1999). Sugar Confectionery Manufacture, 2nd Edition, Aspen Publishers Inc., Great Britain
3.	Edwards, W. P. (2018). The science of sugar confectionery. Royal Society of Chemistry
4.	Lees, R. (2012). Sugar confectionery and chocolate manufacture. Springer Science & Business Media.
Sr. No.	**Reference Books**
1.	Hartel, R. W., Joachim, H., and Hofberger, R. (2018). Confectionery science and technology (pp. 85-124). Cham, Switzerland: Springer
2.	Mohos, F. A. (2017). Confectionery and chocolate engineering: principles and applications. John Wiley & Sons.
3.	W. Ray, Junk and Harry M. Pancost (1973). Hand Book of Sugars for Processors, Chemists and Technologists: AVI Publishing, West port.
4.	Minifie, B. (2012). Chocolate, cocoa and confectionery: science and technology. Springer Science & Business Media.
Sr. No.	**Important web links**
1.	https://www.fssai.gov.in/upload/uploadfiles/files/8_%20Chapter%202_7%20(Sweets%20%26%20Confectionary).pdf

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B. Tech. (Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC313</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Sugar and Confectionery Technology (Practical)</td></tr>
<tr><td>Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td></td><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">IPE:50</td><td colspan="2">EOE: 50</td><td>Total =100</td></tr>
<tr><td>Pre-requisite (if any)</td><td colspan="5">Principles of Food Preservation Technology (PCC 212)</td></tr>
<tr><td>Course Rational</td><td colspan="5">This course will be able to provide the students hands-on experience in development different sugar and chocolate based products, acquire adequate knowledge of various types of ingredients, different types of machineries, packaging materials used in confectionery industry. Students acquire knowledge of experimental data analysis, technical report writing and work in teams.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course teacher will ensure to-
1. Elaborate the role of different additives in sugar and confectionery.
2. Study the different physicochemical properties of sugar and confectionery products.
3. Understand the working principles of sugar confectionery and chocolate equipment.
4. Understand the different types of sugar confectionery products and their process.
5. Understand the different types of chocolate-based products and their process.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">By the end of the course, the students will be able to-
1. Understand the basic functions of different ingredients.
2. Apply the hands-on experience on development of different products.
3. Understands the working principle different types of equipment.</td></tr>
</table>

	4. Analysed the different quality characteristics of sugar and confectionery products. 5. Understand and apply precautions as per the standard operating procedure

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

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

Experiment No.	**Experiment Title/Objective**	**Hours**
1.	Development of Invert Sugar by chemical method	2
2.	Effect of a Boiling point on the solubility of sugar	2
3.	Development of Jaggery based nutritious bar	2
4.	Development of Hard boiled candy	2
5.	Development of fruit-based Toffee	2
6.	Preparation of Chocolate	2
7.	Preparation of medicated lozenges	2
8.	Effect of different emulsifier on chocolate quality	2

9.	Preparation of caramel	2
10.	Indian traditional sweet	2
11.	Sensory Evaluation	2
12.	Market research survey	2
Sr. No.	**Text Books**	
1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure To follow.	
2.	Potter, N. N., & Hotchkiss, J. H. (1995). Confectionery and chocolate products. In Food science (pp. 464-477). Springer, Boston, MA.	
Sr. No.	**Reference Books**	
1.	Hartel, R. W., Joachim, H., and Hofberger, R. (2018). Confectionery science and Technology (pp. 85-124). Cham, Switzerland: Springer	
2.	Mohos, F. A. (2017). Confectionery and chocolate engineering: principles and applications. John Wiley & Sons.	
3.	W. Ray, Junk and Harry M. Pancost (1973). Hand Book of Sugars for Processors, Chemists and Technologists: AVI Publishing, West port.	
4.	Minifie, B. (2012). Chocolate, cocoa and confectionery: science and technology. Springer Science & Business Media.	
Sr. No.	**Important web links**	
1.	https://fssai.gov.in/upload/uploadfiles/files/Manual%20of%20methods-sugar%20and%20confectionary%20including%20sweetening%20agent.pdf	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B. Tech. (Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">VSEC 311</td></tr>
<tr><td>Course Category</td><td colspan="5">Vocational and Skill Enhancement Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Technology of Cereal and Bakery Products (Theory)</td></tr>
<tr><td>Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td></td><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total = 100</td></tr>
<tr><td>Pre-requisite (if any)</td><td colspan="5">Principles of Food Preservation Technology (PCC 212)</td></tr>
<tr><td>Course Rational</td><td colspan="5">Cereal Processing industry and Bakery industry are most established food industries in India. The course will focus on making students understand the basics of cereals, get familiar with different cereals products, the nutritional value of cereals and the importance of cereals for Indian population. It hopes that by the end of this course students will have a complete knowledge about cereals and bakery products. The course is completely Industry oriented which includes all the knowledge that is expected in commercial industry.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course teacher will ensure to-
1. Support students in understanding the present status plus future prospects of cereals and their importance.
2. Understand the morphology of wheat, their structure, their composition, and their milling respectively.
3. Understand the morphology of rice, their structure, their composition, and their milling respectively.
4. Understand the morphology of corn, their types, their milling and their products respectively.
5. Learn the physicochemical properties and processing of Barley, Sorghum and millets respectively.
6. Educate the different processing aspect of bakery products.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">By the end of the course, the students will be able to-</td></tr>
</table>

	1. Understand the present status plus future prospects of cereals and their importance. 2. Memorize the morphology of wheat, their structure, their composition, and their milling respectively. 3. Understand the morphology of rice, their structure, their composition, and their milling respectively 4. Understand the morphology of corn, their types, their milling and their products respectively. 5. Enumerate the physicochemical properties and processing of Barley, Sorghum and millets respectively. 6. Familiarize the different bakery 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	1	3	3	3		3	3		1	1	1	3
CO 2	1	3	3	3		3	3		1	1	1	3
CO 3	1	3	3	3		3	3		2	1	1	3
CO 4	1	3	3	3		3	3		2	1	1	3
CO 5	1	3	3	3		3	3		2	1	1	3
CO 6	1	2	3	3		3	3		3	2	2	3

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

Unit No.	Course Content	Hours
1	**Introduction** • Introduction of Cereals, • Present status and future prospects of cereals (Rice, Wheat, Corn, Maize, Sorghum and Rye)	03
2	**Wheat** • Morphology • Structure • Composition	06

	• Milling • Products	
3	**Rice** • Morphology • Structure • Composition • Milling • Parboiling • Products	**07**
4	**Corn** • Types of Corn • Wet milling and dry milling • Corn flakes • Starch • Corn syrup	**07**
5	**Barley, Sorghum and Millets – Oat / Rye** • Barley Morphology, Physico-chemical properties, processing (Malting) • Sorghum Morphology, Physico-chemical properties, sorghum by products • Millets: Oat / Rye, Importance of Millet, composition, processing of millet	**07**
6	**Bakery Products** • Bread • Biscuits • Cookies • Cake • Pastry • Role of ingredients • Bakery machineries • Quality control	**09**

Sr. No.	Text Books
1.	Colin Wrigley, Ian Batey and Diane Miskelly. (2017). Cereal Grains: Assessing and Managing Quality. 2nd Edition Elsevier Science and Technology
2.	DW Kent-Jones and Arthur James. (1967). Amos Modern cereal chemistry London, Food Trade
3.	Matz Samuel (1999).Cereal Technology ,Pan-Tech International
Sr. No.	**Reference Books**
1.	A. R. Daniel. (1967). Bakery Materials and Methods Paperback.4th Edition. Elsevier Science Ltd; 4th edition
2.	EIRI Board. (2010).Modern Bakery Technology & Fermented Cereal Products. BIOGREEN
3.	Jan A. Delcour and R. Carl Hoseney (2009). Principles of Cereal Science and Technology. Cereals & Grains Assn
4.	Khetarpaul Neelam, Grewal Raj Bala and SudeshJood (2013). Bakery Science and Cereal Technology. Daya Publishing House
5.	Pomeranz Y. (1988). Wheat: Chemistry and Technology: 2. 3rd Edition. AmerAssn of Cereal Chemists
Sr. No.	**Important web links**
1.	https://fostac.fssai.gov.in/doc/Bakery%20Level%201.pdf

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B. Tech. (Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">VSEC311</td></tr>
<tr><td>Course Category</td><td colspan="5">Vocational and Skill Enhancement Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Technology of Cereal and Bakery Products (Practical)</td></tr>
<tr><td>Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td></td><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">IOE:00</td><td colspan="2">EOE: 50</td><td>Total = 50</td></tr>
<tr><td>Pre-requisite (if any)</td><td colspan="5">Principles of Food Preservation Technology (PCC 212)</td></tr>
<tr><td>Course Rational</td><td colspan="5">This course has wide applications in cereal processing and bakery industry. The course is completely Industry oriented which includes all the practical techniques that are expected in commercial industry. Hence the student will be well versed with basic and advanced technique which is need of the hour for providing employment opportunities in the cereal processing industry and bakery industry.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course teacher will ensure to-
1. Determine physicochemical properties of wheat and wheat flour.
2. Familiarize themselves with good manufacturing practices and standard operating procedures used in laboratory activities.
3. Prepare bread and biscuits.
4. Guide the students to prepare cake.
5. Evaluate the sensory characteristics of bakery products.
6. Introduce the utensils and equipment used in bakery.</td></tr>
<tr><td>Course Outcome</td><td colspan="5">By the end of the course, the students will be able to-
1. Determine physicochemical properties of wheat and wheat flour.
2. Familiarize themselves with good manufacturing practices and standard operating
3. Prepare bread and biscuits.
4. Prepare Cake.
5. Evaluate the sensory characteristics of bakery products.</td></tr>
</table>

	6. Describe the utensils and equipment used in bakery.

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	3		3	3		1	1	0	3
CO 2	2	3	3	3		3	2		2	2	1	3
CO 3	3	3	3	3	3	3	1	2	3	3	3	3
CO 4	3	3	3	3	3	3	1	2	3	3	3	3
CO 5	3	2	3	3	2	3	3	2	2	3	3	3
CO 6	3	1	1	1		3	1		1	3	3	3

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

Experiment No.	Experiment Title/Objective	Hours
1.	Demonstration of various machineries and utensil used inbaking	2
2.	To study Physico-chemical properties of cereal	2
3.	To study Physico-chemical properties of cereal flour	2
4.	Determination of gluten content	2
5.	Preparation of bread	2
6.	Preparation of biscuit	2
7.	Preparation of Cookie	2
8.	Preparation of Cake	2
9.	Evaluation of Sensory Characteristics of Bakery Products	2
10.	Preparation of wheat based product	2
11.	Preparation of rice based product	2
12.	Market research survey	2
Sr. No.	**Text Books**	

1.	Colin Wrigley, Ian Batey and Diane Miskelly. (2017). Cereal Grains: Assessing and Managing Quality. 2nd Edition Elsevier Science and Technology
2.	DW Kent-Jones and Arthur James. (1967). Amos Modern cereal chemistry London, Food Trade
3.	Matz Samuel (1999).Cereal Technology,Pan-Tech International
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1.	A. R. Daniel. (1967). Bakery Materials and Methods Paperback.4th Edition. Elsevier Science Ltd; 4th edition
2.	EIRI Board. (2010).Modern Bakery Technology & Fermented Cereal Products. BIOGREEN
3.	Jan A. Delcour and R. Carl Hoseney (2009). Principles of Cereal Science and Technology. Cereals & Grains Assn
4.	Khetarpaul Neelam, Grewal Raj Bala and SudeshJood (2013). Bakery Science and Cereal Technology. Daya Publishing House
5.	Pomeranz Y. (1988). Wheat: Chemistry and Technology: 2. 3rd Edition. Amer Assn of Cereal Chemists
Sr. No.	**Important web links**
1.	https://fostac.fssai.gov.in/doc/Bakery%20Level%201.pdf
2.	https://www.fssai.gov.in/upload/uploadfiles/files/CEREALS_AND_PRODUCTS.pdf

<table>
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<tr><td>Course Code</td><td colspan="5">HSMEC 311</td></tr>
<tr><td>Course Category</td><td colspan="5">Humanities and Social Sciences , Management Environmental Course</td></tr>
<tr><td>Course title</td><td colspan="5">Food Quality and Safety Management (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Basic knowledge of food science, microbiology, and chemistry is required. Familiarity with industry standards and regulations in food quality and safety is recommended.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course provides a comprehensive understanding of food quality and safety management principles in the food industry. It prepares students to implement standards, ensure regulatory compliance, and maintain consumer trust through effective quality assurance practices.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. Introduce the basic knowledge of food quality and Safety aspects
2. Classify the quality assessment of Perishable and Non Perishable food material
3. Explore the regulatory aspects in food processing industry
4. Explain the various quality attributes of food
5. Describe the hygiene and sanitation in food processing industry
6. Introduce different certification system in Food processing industry</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Understand the food quality aspects and need of food safety
2. Demonstrate the functional role and safety issues of food contaminants, adulteration, additives, packaging &labeling
3. Apply and analyze the quality assessment for nonperishable food products
4. Understand the various regulatory aspects for food business operators
5. Interpret the role, standard and law set by Indian and global regulatory authorities with respect to food quality control
6. Evaluate the hygiene and sanitation condition in food processing plant, equipment, storage and handling</td></tr>
</table>

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	-	3	2	-	1	-	-	-	2
CO 2	2	3	2	3	3	-	2	1	-	-	-	2
CO 3	3	3	3	2	3	3	1	-	2	-	-	-
CO 4	2	3	2	-	2	3	-	1	-	-	-	3
CO 5	1	2	3	-	3	2	2	-	1	-	-	3
CO 6	2	-	3	3	2	1	2	-	-	1	-	3

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

Unit No.	Course Content	Hours
1.	**Introduction to food quality & Food safety management** Food quality, its role in industry, Factors affecting quality control, Quality Attributes-Classification: Quality attributes, dominant attributes, hidden attributes	02
2.	**Methods of quality assessment of Perishable food material** Sampling and specification of raw materials and finished products, Methods of quality assessment of food materials fruits, vegetables, dairy products, meat, poultry, egg and processed food products etc.	08
3.	**Methods of quality assessment of Non Perishable food material** Methods of quality assessment of food materials Cereals, Bakery and confectionery, Spices and plantation Crop	08
4.	**Regulatory system in food processing** Food laws and standards: FSSAI, Concept of Codex Alimentations/ /USFDA Food Safety Modernization Act (FSMA)/, BIS standards, BRC standards , International Food Standard (IFS)	08
5.	**Voluntary standards** Food Safety management system: ISO 22000, HACCP, PRP and OPRP: GMP, GLP. GAP, GHP, GDP, Global Food Safety Initiative (GFSI) and Global-Gap.	08

6.	**Sensory Evaluation** Introduction -Panel Screening, Selection of Panel members, Requirements for conducting Sensory Evaluation and serving, Procedures, Methods of Sensory Evaluation, Instrumental analysis in quality control	**05**
Sr.No.	**Reference Books/ Text Books**	
1.	Lasztity, R. (Ed.). (2009). Food Quality and Standards-Volume II (Vol. 10). EOLSS Publications..	
2.	Leo ML.2004. Handbook of Food Analysis. 2nd Edition. Vol 1,2 and 3, Marcel Dekker	
3.	AOAC International. 2003. Official methods of analysis of AOAC International. 17th Ed. Gaithersburg, MD, USA, Association of Analytical Communities	
4.	Alli, I. (2003). Food quality assurance: principles and practices. CRC Press..	
5.	Galanakis, C. M. (Ed.). (2019). Food quality and shelf life. Academic Press.	
6.	Ranganna, S. 2001. Handbook of Analysis and Quality Control for Fruit and Vegetable Products, 2nd Ed, Tata-McGraw-Hill Publ	
Sr. No.	**Important web links**	
1.	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=iWHzbXYGExXDS52DSnAzdQ==	
2.	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=NuAs6SreCGryddEfs4kkBA==	

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<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">IOE = 50</td><td colspan="2">EOE = 00</td><td>Total=50</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Basic knowledge of food science, microbiology, and chemistry is required. Familiarity with industry standards and regulations in food quality and safety is recommended.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course will be able to provide the students hands-on experience of quality analysis. Students acquire knowledge of experimental data analysis, technical report writing and work in teams.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. Apply theoretical knowledge to hands-on experiments, assessing the quality of products.
2. Develop practical skills in quantifying and analyzing food using laboratory techniques.
3. Adhere to safety protocols while conducting food additives experiments.
4. Interpret and communicate experimental results, linking practical findings to real-world applications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Demonstrate proficiency in conducting practical experiments to assess the quality characteristics of food.
2. Master the use of laboratory techniques for quantifying and analyzing different types of food.
3. Implement safety measures effectively, ensuring a secure environment during food quality practical sessions.
4. Communicate and interpret experimental results, fostering a practical understanding of the applications and implications of food quality snd safety in the food industry.</td></tr>
</table>

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	3		3	3		3	3	3	3
CO 2	3	3	3	3		3	3	3	3	3	3	3
CO 3	3	3	3	3		3	3		3	3	3	3
CO 4	3	3	3	3		3	3		3	3	3	3

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

Experiment No.	**Experiment Title/Objective**	**Hours**
1.	Quality tests for raw materials of different foods.	2
2.	Sampling methods for different types of foods as per Codex, FSSAI, and Industry practice.	2
3.	Adulteration in raw materials – FSSAI DART Book.	2
4.	Assessment of food label as per labelling and display regulations	2
5.	Quality testing of finished products for different foods.	2
6.	Determining Critical Control Point (CCP) for various foods.	2
7.	Prepare Hazard Analysis Critical Control Point (HACCP) Plan for different foods.	2
8.	Risk assessment for different foods.	2
9.	Traceability Plan for different foods.	2
10.	Regulatory compliance for different foods.	2
11.	Developing a Regulatory Compliant Food Label.	2
12.	Inspection of manufacturing facility as per FSSAI Schedule IV requirement.	2
Sr. No.	**Text Books**	

1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.
2.	Khandke, S. S., & amp; Mayes, T. (1998). HACCP implementation: a practical guide to the implementation of the HACCP plan. Food control, 9(2-3), 103-109.
3.	Association of Official Agricultural Chemists, & Horwitz, W. (1975). Official methods of analysis (Vol. 222). Washington, DC: Association of Official Analytical Chemists.

Year, Program, Semester	Third Year B.Tech(Food Technology), Part III, Semester V				
Course Code	MDM311 (311.1)				
Course Category	Multidisciplinary Minor				
Course Title	Deep Learning and Neural Network (Theory)				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-		03	03
Evaluation Scheme	**ISE**			**ESE**	**Total**
	30			70	100
Pre-requisites(if any)	Basic Mathematics, matrix arithmetic, probability.				
Course Rationale	This course is aimed to make students understand advanced algorithms of neural networks.				
Course Objectives	The course teacher will ensure to- 1. Strengthen important Mathematical concepts required for Deep learning and neural network. 2. Get a detailed insight of advanced algorithms of neural networks. 3. Introduce different deep learning network.				
Course Outcomes	By the end of the course, the students will be able to- 1. Design and implement Artificial Neural networks. 2. Decide when to use which type of NN. 3. Implement and analyze various deep learning architectures				

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	-	-	2	-	2	-	-	-	-	-	-	-
CO 2	-	2	-	-	2	-	-	-	-	-	-	-
CO 3	-	2	3	-	3	-	-	-	-	-	-	-

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

Unit No.	Course Content	Hours
1.	Information flow in a neural network, understanding basic structure and ANN.	**07**
2.	Training a Neural network, how to determine hidden layers, recurrent neural network.	**08**
3.	Convolution neural networks, image classification and CNN.	**07**
4.	RNN and LSTMs. Applications of RNN in real world.	**07**
5.	Creating and deploying networks using tensor flow and keras	**07**
	Text Books	
1.	John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons.	
2.	AdamGibson,JoshPatterson,DeepLearning,APractitioner'sApproach,ShroffPublisher/ O'ReillyPublisherMedia	
3.	Christopher M.Bishop, Neural Networks for Pattern Recognition, Oxford.	
4.	Russell Reed, Robert J MarksII, NeuralSmithing: Supervised Learning in Feed forward Artificial Neural Networks, Bradford Book Publishers	
	Lab Work	
1.	Introduction to Kaggle and how it can be used to enhance visibility.	
2.	Build general features to build a model for text analytics.	
3.	Build and deploy your own deep neural network on a website using tensor flow.	
	Assessment	
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks.**10 marks will be given based on the assignments of lab work**. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work.	

	b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

Year, Program, Semester	Third Year B.Tech(Food Technology), Part III, Semester V				
Course Code	MDM-311(311.2)				
Course Category	Multidisciplinary Minor				
Course title	Alcohol Manufacturing(Theory)				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE**		**ESE**	**Total**	
	30		70	100	
Pre-requisites(if any)	Basic understanding of mathematics. First year undergraduate level of (bio) chemistry and biology and overview of the fundamental courses of Chemical Engineering				
Course Objectives	Alcohol manufacturing involves a variety of industrial processes and technologies, including fermentation, distillation, filtration, and aging. Teaching students about these processes equips them with practical knowledge applicable to various industries, such as brewing, distilling, and wine making.				
Course Outcomes	By the end of the course, the students will be able to- 1. Demonstrate a comprehensive understanding of the principles and processes involved in alcohol manufacturing. 2. Identify and evaluate the suitability of different raw materials for alcohol production based on their chemical composition and availability. 3. Apply microbial and enzymatic techniques t optimize fermentation processes for alcohol production. 4. Operate and maintain equipment used in various stages of alcohol manufacturing, including fermentation tanks, stills, and purification systems. 5. Interpret and comply with regulatory requirements and safety standards relevant to alcohol production facilities.				

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-

CO4	2	2	3	1	-	-	-	-	-	-	-	-
CO5	2	2	2	1	1	-	-	-	-	-	-	-

Level of Mapping as: Low1, Moderate2, High 3

Unit No.	Course Content	Hours
1.	**Introduction to Alcohol Manufacturing** Introduction to Alcohol Technology, Raw Material of Alcohol Industry, Storage and handling of raw material.	6
2.	**Raw Materials** Study of different yeast strains used in alcohol industries, Study of yeast production as Single protein cell, Wet milling of grain for alcohol production, Grain dry milling cooking for alcohol production, Use of cellulosic feed stocks for alcohol production.	6
3.	**Fermentation** Study of different alcoholic fermentation techniques, Biochemical processes in fermentation, Batch fermentation, Continuous fermentation, Modern techniques of Continuous fermentation, Bio still fermentation, Fermentation vessel design and operation, By product of alcoholic fermentation.	7
4.	**Distillation** Principles of distillation, Batch and continuous distillation techniques Distillation equipment and operation, Steps for optimizing Performance of Distillation Columns, Effective utilization of column heat. Pinch Technology. Principles of distillation.	7

Text / Reference Books

1.	T.P. Lyons, K.A. Jacques, D.R Kensal,(November1999),The Alcohol Textbook: A Reference for the Beverage, Fuel and Industrial Alcohol Industries, (3rdedition), Nottingham University Press
2.	T.P. Lyons(Editor),D. R Kelsall (Editor),J.E. Murtagh (Editor), (1October 1995),The Alcohol Textbook :Ethanol Production by Fermentation and Distillation ,Nottingham University Press

Reference Books

1.	Johann G. Stichlmair, James R.Fair, (29September1998), Distillation: Principles and Practices, (1stedition), Wiley- VCH.

Year, Program, Semester	Third Year B.Tech(Food Technology), Part III, Semester V				
Course Code	MDM311 (311.3)				
Course Category	Multidisciplinary Minor				
Course title	Embedded Systems for IoT(Theory)				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE**			**ESE**	**Total**
	30			70	100
Pre-requisites(if any)	Knowledge of Embedded systems, microcontroller, computer networking				
Course Rationale	The proliferation of the Internet of Things (IoT) has led to an increased demand for professionals skilled in designing and developing embedded systems tailored for IoT applications. This course is designed to provide students with a deep understanding of embedded systems and their integration within the IoT ecosystem. It aims to equip students with the knowledge and skills necessary to design, program, and optimize embedded systems for efficient communication, data processing, and control in IoT environments.				
Course Objectives	The course teacher will ensure to- 1. Make students know the basic concept and architecture of embedded systems. 2. Learn different design platforms used for an embedded system for IoT applications. 3. Have knowledge about the IoT enabled technology.				
Course Outcomes	By the end of the course, the students will be able to- 1. Understand the embedded system concepts and architecture of embedded systems. 2. Understand the different hardware/software co-design techniques for microcontroller-based embedded systems, apply techniques in IoT applications. 3. Understand and implement communication protocols suitable for IoT devices. 4. To be able to design web/cloud based IoT applications. 5. Design and implement interfaces for connecting sensors and actuators to embedded system				

	6. Identify and address security challenges specific to embedded systems in IoT.

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			2	-	-	-	-	-	-	-	-
CO 3	3		2	-	-	-	-	-	-	-	-	-
CO 4	-		-	-	-	-	-	-	-	-	-	-
CO 5	-		3	-	3	-	-	-	-	-	-	-
CO 6	-		3	-	3	-	-	-	-	-	-	-

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

Unit No.	Course Content	Hours
1.	**Purpose and requirement specification, IoT level specification**, Functional view specification, Operational view specification, Device and component integration, Pillars of Embedded IoT and Physical Devices: The internet of devices.	06
2.	**Design of Embedded Systems:** Common Sensors, Actuators, Embedded Processors, Memory Architectures, Software architecture	06
3.	**Inputs and Outputs**: Digital Inputs and Outputs, Digital Inputs, Digital Outputs, Bus In, Bus Out, and Bus In Out, Analog Inputs and Outputs, Analog Inputs, Analog Outputs, Pulse Width Modulation (PWM), Accelerometer and Magnetometer, SD Card, Local File System (LPC1768).	06
4.	**IoT Enabling Technologies**: Communications, RFID and NFC (Near-Field Communication), Bluetooth Low Energy (BLE), LiFi, 6LowPAN, ZigBee, Z-Wave, LoRa, Protocols, HTTP, WebSocket, MQTT, CoAP, XMPP, Node-RED,	06

	Platforms, IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT, Thing Worx, GE Predix, Xively, macchina.io, Carriots.	
5.	**Web of Things and Cloud of Things**: Web of Things versus Internet of Things, Two Pillars of the Web, Architecture Standardization for WoT, Platform Middleware for WoT, Cloud of Things. IoT Physical Servers,	**06**
6.	**Cloud Offerings and IoT Case Studies**: Introduction to Cloud Storage Models, Communication API.	**06**

Reference Books	
1.	RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, Internet of Things, John Wiley and Sons.
2.	Klaus Elk, “Embedded Software for the IoT”.
3.	Elizabeth Gootman et. al, “Designing Connected Products”, Shroff Publisher/O’Reilly Publisher.
4.	Perry Xiao, “Designing Embedded Systems and the Internet of Things (IoT) with the ARM Mbed”.
Sr. No.	**Important web links**
1.	https://www.coursera.org/learn/iot

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Category</td><td colspan="5">Ability Enhancement Course</td></tr>
<tr><td>Course Code</td><td colspan="5">AEC 311</td></tr>
<tr><td>Course title</td><td colspan="5">Introduction to Foreign Language</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="3">-</td><td>IOE= 50:00</td><td>Total=50</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course provides a competitive edge for engineering graduates in their career choices. They will be able to communicate in a second language. The course enhances listening, reading skills and memory. Our graduates may be able to participate more effectively and responsibly in a multi-cultural world if they know another foreign language in addition to the English.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. Help students to understand basics and deepen their knowledge in a chosen foreign language
2. Guide them to communicate and translate in the chosen foreign languages
3. Help them describe, narrate, and ask/answer questions in the foreign language in the present time about a variety of topics related to family, daily activities, eating, and traveling
4. Comprehend the foreign language with sufficient ability to grasp the main idea and some supporting details in short conversations(spontaneous or recorded) that pertain to the topics mentioned above
5. Explain how to write sentences and short paragraphs on familiar topics relating to personal interests and practical needs
6. Narrate on how the foreign language functions with awareness and understanding of the language culture</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Learn alphabets and acquire knowledge of basic grammar of the foreign language, common words and phrases therein
2. Learn to read the simple texts in foreign language
3. Speak a little using the greetings, well wishes etc. in Foreign Language
4. Count numbers, answer to the questions like, what is your name, surname, tell age, and can initiate little communication in Foreign Language
5. Translate both verbally and written, simple sentences in the foreign language
6. Achieve institute’s mission with respect to global education and foreign language education</td></tr>
</table>

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			3		3
CO 2										3		3
CO 3									2	3		2
CO 4									2	3		2
CO 5									2	3		3
CO 6							3			2		3

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

Unit No.	**Course Content**	**Hours**
1.	General Information on Basic Grammar of the foreign language, Introduction to alphabets	**03**
2.	Gender of Noun, Number of Noun, Pronouns, Adjectives, Verbs and their usage in simple sentences, Numbers (up to 10), Simple Greetings in foreign language.	**03**
3.	General Questions in foreign language, like What is your name/surname? Who/What is this? etc.	**02**
4.	Simple narration about self/family/friend/University in foreign language chosen for studies. Practicing the learnt topics in the class itself.	**02**
5.	Formation of simple sentences using Parts of Speech, Information on Cases, One or Two simple lessons from any book.	**02**
6.	Basic information on Country & Culture of language under study.	**01**
Sr.No.	**Reference Books/ Text Books**	
1.	Based on the language chosen, the suitable text and reference books may be selected.	
Sr. No.	**Important web links**	
1.	https://swayam.gov.in/	

2.	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester V</td></tr>
<tr><td>Course Code</td><td colspan="5">MAC311</td></tr>
<tr><td>Course Category</td><td colspan="5">Mandatory Audit Course</td></tr>
<tr><td>Course title</td><td colspan="5">Aptitude Enhancement Course II</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>-</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="5">IE at Course incharge end</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Aptitude Enhancement Course II builds on the foundational skills developed in its predecessor. The course aims to further hone students; critical thinking, problem-solving, quantitative aptitude, and analytical abilities, equipping them for competitive environments and professional success. The course emphasizes practical application and fosters a holistic approach to aptitude development, aligning with industry expectations and global standards.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. To enhance quantitative and analytical aptitude through structured problem-solving activities.
2. To develop logical reasoning and data interpretation skills critical for decision-making.
3. To strengthen verbal communication and comprehension abilities for professional contexts.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Solve complex quantitative problems using structured methodologies.
2. Apply logical reasoning and interpret data effectively to make informed decisions.
3. Demonstrate proficiency in verbal reasoning and comprehension through real-world applications.
4. Exhibit readiness for competitive exams and professional aptitude assessments.</td></tr>
</table>

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	2	3						2		
CO 3			3		2				3		2	
CO 4				3			2	2		3		

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

Unit No.	Course Content	Hours
1.	**Advanced Quantitative Aptitude** • Topics: Percentages, Profit and Loss, Time and Work, Time, Speed, and Distance. • Activities: Solving case-based problems, peer-to-peer discussion on strategies.	02
2.	**Logical Reasoning and Data Interpretation** • Topics: Puzzles, Syllogisms, Seating Arrangements, Charts, and Graphs. • Activities: Solving logical puzzles, analyzing data sets in small groups.	02
3.	**Verbal Ability and Reading Comprehension** • Topics: Synonyms, Antonyms, Sentence Completion, Passage Analysis. • Activities: Group discussions on comprehension passages, vocabulary quizzes.	02
4.	**Problem-Solving Techniques and Strategy** • Topics: Problem-solving frameworks, time management in aptitude tests. • Activities: Mock problem-solving sessions with timed activities.	02
5.	**Industry-Oriented Aptitude Applications** • Topics: Case studies on industry challenges, real-world data sets. • Activities: Case analysis, presentations on problem-solving approaches.	03
6.	**Assessment and Feedback** • Activities: Practice aptitude tests, individual feedback sessions on performance.	02
Pedagogical Strategies		

- Interactive Tutorials: Engaging students with group activities and discussions.
- Gamified Learning: Using quizzes and competitions to enhance participation.
- Practice-Based Learning: Real-world problems and mock tests for application-oriented learning.

Assessment Methods

1. Formative Assessment:

- Group Assignments: Solving aptitude problems collaboratively (20%).
- Quizzes: Timed quizzes on specific units (20%).

2. Summative Assessment:

- Mock Aptitude Test: Comprehensive test covering all units (60%).

Sr.No.	Reference Books/ Text Books
1.	Aggarwal, R. S. (2018). Quantitative Aptitude for Competitive Examinations. S. Chand Publishing.
2.	Thorpe, E. (2017). The Pearson Guide to Logical Reasoning and Data Interpretation. Pearson.
3.	Bradberry, T., & Greaves, J. (2009). Emotional Intelligence 2.0. TalentSmart.
4.	Barrett, S., & Berry, J. (2011). Critical Thinking Skills for Education and Work. Oxford.

Year, Program, Semester	Third Year B.Tech(Food Technology), Part III, Semester V				
Course Code	PBL311				
Course Category	Project Based Learning				
Course title	Mini Project III & Industrial Visit				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	-	-	02	02	-
Evaluation Scheme	**IE at Course in charge end**				
Course Rationale	The course Mini Project III & Industrial Visit aims to consolidate students learning by integrating theoretical knowledge and practical exposure. It emphasizes applying advanced Food Technology principles to solve real-world problems through innovative project work and gaining industry insights during structured industrial visits. This course fosters professional readiness by emphasizing research, innovation, collaboration, and exposure to industrial practices, aligning with Outcome-Based Education (OBE) and Bloom Taxonomy principles.				
Course Objectives	The course teacher will ensure to- 1. Facilitate advanced application of theoretical knowledge to solve real-world food technology problems. 2. Provide experiential learning through advanced project work and industrial exposure to contemporary food technology practices. 3. Develop critical thinking, innovation, and professional skills to prepare students for industry or research-oriented careers.				
Course Outcomes	By the end of the course, the students will be able to- 1. Synthesize and apply chemical engineering concepts to design and execute innovative projects independently. 2. Critically analyze and interpret data from projects and industrial visits to derive meaningful conclusions. 3. Collaborate in multidisciplinary teams to address complex engineering challenges. 4. Demonstrate professionalism, effective communication, and ethical behavior during industrial interactions and project work.				

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	3							2
CO 2	2	3	2	3	3							3

CO 3			2						3	2		
CO 4								3		3		

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

Unit No.	Course Content	Hours
1.	**Project Ideation and Proposal Development** • Identifying real-world chemical engineering problems and formulating project proposals. • Literature review and benchmarking existing solutions. • Developing problem statements and objectives for innovative projects.	04
2.	**Advanced Project Planning and Execution** • Designing experiments and simulations aligned with project objectives. • Resource allocation, risk assessment, and timeline management. • Conducting hands-on experiments or simulations with faculty guidance.	04
3.	**Data Analysis and Solution Optimization** • Data collection, processing, and statistical analysis. • Application of advanced chemical engineering tools/software (e.g., Aspen, MATLAB). • Optimizing solutions for technical feasibility and cost-effectiveness.	04
4.	**Industrial Visit Preparation and Execution** • Pre-visit briefing on industrial site operations and safety protocols. • Guided industrial visit to a chemical engineering facility. • Observation and documentation of processes, safety measures, and technologies.	05
5.	**Reflection and Knowledge Sharing** • Analyzing and presenting industrial visit observations. • Comparing theoretical knowledge with industry practices. • Sharing project progress through group discussions and presentations.	05
6.	**Project Presentation and Evaluation** • Preparing detailed project reports and presentations. • Oral presentations to faculty and peers with Q&A sessions. • Peer and rubric-based evaluations of teamwork, innovation, and outcomes.	04

Third Year B.Tech (Food Technology), Semester-VI

Year, Program, Semester	Third Year B.Tech(Food Technology), Part III, Semester VI				
Course Code	PCC321				
Course Category	Professional Core Course				
Course title	Food Biotechnology (Theory)				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE:30**		**ESE: 70**		**Total=100**
Pre-requisites(if any)	Basic understanding of biochemistry and microbiology are helpful.				
Course Rationale	The course provides knowledge about the basic concepts of food nutrients and its roles. It aims to equip students with the foundational knowledge necessary to understand the concept of biotechnology and promote better technological concepts in welfare of people.				
Course Objectives	The course teacher will ensure to- 1. Understand the fundamentals of food biotechnology and genetics. 2. Comprehend the principles behind important analytical techniques employed in biotechnology as well as in genetic modification of foods. 3. Describe recombinant technology and molecular cloning. 4. Interpret microbial cultures used in food industry 5. Formulate upstream and downstream processes of various fermented food products. 6. Make use of new techniques for production of fermented foods.				
Course Outcomes	By the end of the course, the students will be able to- 1. Explain basic knowledge of cell culture technology 2. Comprehend the techniques utilised in production of different useful secondary metabolites. 3. Describe the applications of cell culture technology at the industrial level. 4. Express role of fermented food products. 5. Summarize Plant Tissue culture and its types 6. Enumerate principles behind important analytical techniques				

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

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

Unit No.	Course Content	Hours
1.	**Introduction to Food Biotechnology** • History and development of biotechnology • Regulatory, ethical and social aspects of biotechnology of foods • importance of biotechnology in food safety	07
2.	**Cell Culture Technology:** • Immobilization of cells • Molecular Cloning and its methods • r-DNA technology • Microbial cultures for food fermentation • strain improvement techniques	07
3.	**Genetic Engineering** • PCR, electrophoresis • Mutation and types of mutations, • Genetically modified crops such as Golden rice, tobacco and Bt.Cotton • Plant Tissue culture, ovule culture, ovary culture, anther culture	07
4.	**Overview of Biotechnological aspects :** • Industrial production of alcoholic beverages (beer, wine) and distilled alcoholic beverages such as whiskey, rum and vodka • Antibiotics, Organic acids(vinegar, lactic acid) • Single cell protein, Glycerol, Enzymes	06
5.	**Metabolic Engineering:** • Introduction to metabolic engineering. • Upstream processing	05

	• Downstream processing	
6.	**Biochemical and microbial analysis of Fermented Food:** • Traditional fermented foods like idli, yoghurt, cheese • Soy fermented foods	**07**

Sr.No.	**Reference Books**
1.	Knorr, D. 1982. Food Biotechnology. Marcel Dekker, New York
2.	Stanburry P.P. and Whitaker, A. 1984. Principles of Fermentation Technology. Pergamon Press, Oxford UK.
3.	Steinkraus, K.H. 1983. Handbook of Indigenous Fermented Foods. Marcel Dekker, N. York.
4.	Comprehensive Biotechnology by Murray &Mooyoung, Academic press
5.	Fermentation Biotechnology, Principles, Processed Products by Ward OP, Open University Press.
Sr.No	**Reference Textbooks**
1.	Bains W. 1993, Biotechnology from A to Z, Oxford Univ. Press, Oxford.
2.	Crueger, W. and Crueger A. 1984. Biotechnology: A Textbook of Industrial Microbiology. Science Tech. Madison, USA
3.	Joshi, V.K. and Pandey, A. Ed. 1999. Biotechnology. Food Fermentation, (2 Vol. set). Education Publ. New Delhi.
Sr.No	**Web links**
1.	https://onlinecourses.nptel.ac.in/noc25_bt33/preview

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC322</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Design and Development of New Products (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">In order to complete the course successfully, it is important to have good knowledge of basic food technology subjects.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course is intended to familiarize students with the product implementation stage of food product development including preliminary product description, prototype development, product testing and the formal presentation of a new product development .Students will learn the importance of team work, product specification, food formulation, food ingredient technology, ingredient interaction and how to conduct and terminate a project in an orderly manner.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-
1. Understand and gain experience in the process of food product development
2. Gain Knowledge in food product ingredient technology.
3. Prepare prototype for a new food product
4. Identify challenges involved in the development of a new food product and how to find solution
5. Understand techniques and knowledge related to the consumer product in development
6. Develop critical thinking skills related to food products.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Describe the basic fundamentals of new product development.</td></tr>
</table>

	2. Apply the relationship between theoretical and practical aspects of new product development 3. Analyze the theoretical and practical aspects of new product development 4. Develop solutions for the development of new product 5. Explain the importance of new product development 6. Work effectively in terms to manage new challenges

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

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

Unit No.	Course Content	Hours
1.	**Design and Development of New Products:** Basic Fundamentals of Development of New Products, Need, importance, and objectives of formulation for new product development, The New Product Development Team.	07
2.	**Formulation of New Product :** Ideas, business philosophy and strategy of new product, Formulation based on sources availability and cost competitiveness for concept developments of new products.	07
3.	**Technology for New Product :** Adaptable technology and sustainable technology for standardized formulation for Process development.	07

4.	**Scale up and Trials :** Process control parameters and scale-up, production trials for new product development at lab and pilot scale.	**06**
5.	**Quality Assessment :** Quality assessment of newly developed products	**05**
6.	**Marketing, Economics of New Product, Commercialization and Launching:** Market testing and marketing plan, Costing and economic evaluation of developed products, Commercialization/product launch for marketing	**07**
Sr.no.	**Reference Books**	
1.	Saguy, I.S., & amp; Graf, E.(1990).Food product development: from concept to the market place. Springer Science & amp; Business Media.	
2.	O sullivan, M. (2016).A handbook for sensory and consumer-driven new Product development: innovative technologies for the food and beverage industry. Wood head Publishing.	
3.	Beckley,J.H.,Herzog,L.J.,&Foley,M.M.(Eds.).(2017).Accelerating new food product Design and development .John Wiley & amp; Sons.	
4.	Moskowitz, H.R., Porretta ,S., & amp; Silcher ,M.(2008).Concept research in food product design And development. John Wiley & amp; Sons.	
Sr.no	**Reference Textbooks**	
1.	Fuller, G.W. (2004).New food product development: from concept to market place .CRC Press.	
2.	Aramouni, F.,& amp; Deschenes, K.(2014).Methods for developing new food products : An Instructional Guide. DEStech Publications, Inc.	
3.	Earle, R., & amp; Anderson, A. (Eds.). (2001).Food product development: Maximizing success.CRC press**.**	
4.	Moskowitz, H. R., Saguy,I.S.,& amp ;Straus,T.(2009).An integrated approach to new food Product development .CRC Press.	

Year, Program, Semester	Third Year B. Tech. (Food Technology), Part III, Semester VI				
Course Code	PCC322				
Course Category	Professional Core Course				
Course Title	Design and Development of New Products (Practical)				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	-	-	02	02	01
Evaluation Scheme	**IOE:50**			**EOE: 50**	**Total = 100**
Pre-requisite (if any)	-				
Course Rational	This course has wide applications in cereal processing and bakery industry. The course is completely Industry oriented which includes all the practical techniques that are expected in commercial industry. Hence the student will be well versed with basic and advanced technique which is need of the hour for providing employment opportunities in the cereal processing industry and bakery industry.				
Course Objective	The course teacher will ensure to- 1. Elaborate the role of market survey and fundamentals of new products. 2. Demonstrate and Explain the method of formulating a new product 3. Elaboratethelegalrequirements,designingplantlayout,machineryrequiredfordevelopingnew products 4. Explain the different quality characteristics of new product 5. Discuss the precautions as per the standard operating procedure				
Course Outcome	By the end of the course, the students will be able to- 1. Understand the market survey and fundamentals required for new to product development 2. Apply the hands-on experience to the development o products				

	3. Understands the legal requirements, designing plant layout, machinery required for developing new products 4. Analyzed the different quality characteristics of new product 5. Apply precautions as per the standard operating procedure

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	3	3	3	3	2	2	2	1			1
CO 2	2	1	3	2	3	2	1	2	1	1	1	1
CO 3	2	2	3	3	2	3	2	2	1	1		
CO 4	3	2	3	3	3	2	3	1	2	2	3	1
CO 5	2	1	1	1		2						

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

Experiment No.	Experiment Title/Objective	Hours
1.	Market Survey of selected new food product	2
2.	Preparation of purchase report for a selected raw material and packaging material.	2
3.	Draw the feasible plant layout for a selected new product	2
4.	Selection of small and automated machineries for a selected new product.	2
5.	Study and write the legal requirements for the same selected new product	2
6.	Prepare a proposal scale up and cost estimation of selected new product	2
7.	Physicochemical assessment of selected new product	2
8.	Sensorial assessment of selected new product	2
9.	Microbial assessment of selected new product	2

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B. Tech. (Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC 323</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Legume and Oilseed Technology (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">In order to complete the course successfully, it is important to have good knowledge of basic food science, nutrition and food processing.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course deals with knowledge and understanding of different legumes present worldwide, principles and its processing methods .Also it makes students to learn about different fermented products that can be prepared from different legumes.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-
1. Explain to the students about legume present worldwide and their application in processing.
2. Describe about various unit operations and machinery required for legume processing.
3. Demonstrate the various legumes based fermented products.
4. Introduce students to the traditional and modern way of milling.
5. Elaborate different oil extraction methods.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Justify the role of basic food science, nutrition and knowledge of food processing for legume processing.
2. Choose legumes for effective utilization to develop various processed products.
3. Design the equipment required for legume processing.
4. Understand the methods of milling.
5. Assess the processing scenario of legume based processed products.</td></tr>
</table>

	6. Know the various quality aspects of legumes and its proposed

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

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

Unit No.	Course Content	Hours
1	**Present Status and future prospects of legumes and oil Seeds** Major and minor legumes, oilseeds and pulses grown in world and their application, present Status and future prospects of Pulse milling industry in India and world	06
2	**Morphology and classification of legumes, oilseeds and pulses** Morphology and Classification of legumes, oilseeds and pulses. Chemical composition and nutritional value. Antinutritional factors, their chemistry, methods of removal of antinutritional factors	06
3	**Dehulling and Milling of oilseeds, legumes and pulses** Methods of dehulling-. Home, cottage and commercial scale. Modern techniques of dehulling. Milling of oilseeds, legumes and pulses: Dal milling principles, methods, equipment and effect on quality. Principle products, fermented products of legumes.	06
4	**Processing of oilseeds, legumes and pulses.** Soaking principles, methods of soaking, sprouting, puffing, and roasting. Physical and bio-chemical changes during these processes Texturized vegetable protein, hydrolyzed vegetable protein, formulation and processing, Types of processed products	08
5	**Cooking quality of dhal** Cooking quality of dhal, methods, factors affecting quality of dhal, cooking of dhal,	06

	Quick cooking of dhal and instant dhal.	
6	**Oil extraction and Refining of oils** Oil extraction methods: mechanical Pressing. Solvent extraction process: principle, Pre-treatment - breaking, cracking, flaking, extraction principle and Desolventization. Factors affecting the extraction process. Refining of oils: Refining, degumming, Neutralization, bleaching, filtration, deodorization of oils and their principles and Process controls.	**07**

Sr.no.	**Reference Books**
1	Achhayya K.T. Oil seeds and Oil Milling in India. Oxford and IBH Publishing Co., New Delhi, 1999
2	Heldman, D.R. and Singh R.P.Ed.IV 2009. Introduction to Food Engineering. ElsevierPub
3	Desrosier, N.W, “The Technology of Food Preservation”, CBS Publishers and Distributors, New Delhi 1996.
4	Ruth H. Matthews: Pulses – Chemistry, Technology and Nutrition Mercel Dekker Inc. USA (1989)
Sr.no	**Reference Textbooks**
1	Chakraverty A, Majumdar A.S, Vijaya Raghavan G.S and Ramaswamy H.S. Hand Book of Post Harvest Technology. Marcel Dekker Inc., New York. Basel, 1999.
2	Chakraverty A. Post-Harvest Technology of Cereals, Pulses and Oil seeds. Oxford and IBH Publishing Co. Ltd., Calcutta
3	Bailey′s Industrial Oil and Fat Products: Processing Technologies Edible Oil and Fat Products: 5” by Fereidoon Shahidi
1.	Ruth H. Matthews: Pulses – Chemistry, Technology and Nutrition Mercel Dekker Inc. USA (1989)

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PCC323</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Legume and Oilseed Technology (Practical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">IOE = 00</td><td colspan="2">EPE = 50</td><td>Total = 50</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">In order to complete the course successfully, it is important to have agood knowledge of basic food science, nutrition and food processing</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The purpose of this course is to provide the students hands-on experience in processing of various legumes.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The Course Teacher will ensure to-
1. Help students analyse the physicochemical properties of legumes
2. Introduce students about the various processed products of legume
3. Illustrate the students about methods of Milling
4. Demonstrate about development of protein rich products from oil extracted waste</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Analyze different physico-chemical properties of legumes and oil seeds
2. Know about tools and equipment used for post-harvest Technology of legumes and oilseeds
3. Design and develop various processed products of legume
4. Choose legume for the development of protein rich products from legumes</td></tr>
</table>

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	3	3	2	2	2	1			1
CO 2	3	3	2	3	3	2	1	2	1	1	1	1
CO 3	3	3	2	3	3	2	2	2	1	1		
CO 4	3	2	3	3	3	3	3	1	1	2	3	1

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

Ex. No.	**List of Experiments**	**Hours**
1	Physical properties of legumes and oil seeds	2
2	Methods and principles of dehulling	2
3	Dal milling process.	2
4	Cooking quality of dal	2
5	Fermented product of legumes	2
6	Production of protein rich product.	2
7	Preparation of quick cooking dhal	2
8	Puffing of legumes	2
9	Soaking of legumes and changes in its biochemical nature after soaking.	2
10	Determination of anti nutritional factors in legumes	2
11	Preparation of composite legume flour	2
12	To study the oil extraction methods	2
13	Visit to dal mill/oil industry	2
Sr.No.	**Suggested Text Books**	
1.	Institute's Laboratory Course Manual and equipment wise Standard Operating Procedure to follow.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PEC321 (321.1)</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Program Elective I (Functional Foods and Nutraceutical)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">A prerequisite for functional food and nutraceutical development is a comprehensive understanding of Food Chemistry, Human Nutrition and bioactive compounds, their health benefits.</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course on Functional Foods and Nutraceuticals explores the role of bioactive compounds in promoting health and preventing diseases. It aims to equip students with knowledge to develop innovative products that bridge nutrition and medicine.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-
1. Introduce functional foods and nutraceuticals, their history, and classification.
2. Explore sources, bioavailability, and health applications of vitamins, minerals, and bioactive.
3. Explain the benefits of probiotics, prebiotics, and symbiotic for health.
4. Analyze functional ingredients like dietary fiber, omega-3s, and phytochemicals.
5. Discuss regulatory, safety, and quality aspects of nutraceuticals.
6. Evaluate trends in bioactive compounds and their applications.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Understand the basics and significance of functional foods and Nutraceuticals.
2. Assess the role of vitamins, minerals, and bioactive in health.
3. Demonstrate the health benefits of probiotics, prebiotics, and symbiotic.
4. Analyze the nutritional benefits of dairy, seafood, fruits, and cereals.
5. Apply regulatory and safety guidelines for nutraceuticals.
6. Evaluate emerging trends and research in bioactive compounds</td></tr>
</table>

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	2	2	3	3	2	-	-	-	-	2
CO 2	3	3	2	3	3	3	-	-	-	-	-	3
CO 3	3	3	2	3	3	2	-	-	-	-	-	2
CO 4	3	3	3	3	3	3	-	-	-	-	-	3
CO 5	2	3	2	2	3	3	2	2	-	2	-	3
CO 6	3	3	3	2	3	2	2	2	-	-	-	3

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

Unit No.	Course Content	Hours
1.	**Introduction to Functional Foods and Nutraceuticals** • Definition, history, and market trends • Classification based on chemical nature and mechanism of action • Sources of nutraceuticals (phytochemicals, animal products, and microbes) • Applications in disease management (CVD, cancer, diabetes, obesity, osteoarthritis, immune enhancement, mood disorders) • Basis of claims, safety, and regulatory issues	03
2.	**Vitamins, Minerals, and Bioavailability** • Types, sources, and functions of vitamins and minerals • Role of vitamins (A, D, E, K, C, B-complex) in health • Importance of minerals (calcium, iron, magnesium, zinc, selenium) • Bioavailability of nutrients • Safety and toxicity measurements	08
3.	**Probiotics, Prebiotics, and Synbiotics** • Probiotics: definition, types, health benefits • Gastrointestinal health, cancer prevention, immune function • Advances in strains (Lactobacillus, L. Casei, L. Casei Shirota) • Prebiotics: non-digestible carbohydrates, resistant starch, gums • Synbiotics: combination and synergistic effects • Quality assurance, safety, and regulatory challenges	08

4.	**Functional Ingredients in Foods** • Dietary fiber, oligosaccharides, resistant starch • Omega-3 fatty acids, conjugated linoleic acid • Health benefits of milk, milk products, and seafood • Fruits and vegetables: nutritional and functional benefits • Cereals, grains, and their role in functional foods • Medical foods and infant formulas	**08**
5.	**Phytochemicals and Antioxidants** • Phytochemicals: definition, classification, and mechanism of action • Terpenoids, carotenoids, polyphenols (flavonoids, isoflavones, tannins, curcumin, resveratrol) • Sulfur-containing compounds (sulphides, glucosinolates) • Antioxidants: definition, classification, mechanism of action • Endogenous antioxidants (SOD, catalase, glutathione peroxidase) • Exogenous antioxidants (retinol, β-carotene, ascorbic acid, tocopherol) • Role in preventing cancer, CVD, aging, and inflammation	**08**
6.	**Bioactive Compounds and Emerging Trends** • Bioactive principles in spices, condiments, and plant extracts: • Capsaicin, piperine, gingerol, eugenol, curcumin, resveratrol, quercetin • Organosulfur compounds: health benefits • Honey as a functional food • Effect of germination on cereals and legumes • Nutritional and functional benefits of mushrooms • Aloe species as sources of functional bioactives • Nutraceuticals in maternal nutrition	**04**

Sr.No.	**Reference Books/ Text Books**
1.	Egbuna, C., &Dable-Tupas, G. (2020). Functional foods and nutraceuticals. Springer Nature Switzerland AG, 1, 1-632.
2.	Kesharwani, R. K., Keservani, R. K., & Sharma, A. K. (Eds.). (2022). Nutraceuticals and Functional Foods in Immunomodulators. Springer.
3.	Keservani, R. K., Sharma, A. K., &Kesharwani, R. K. (Eds.). (2018). Nutraceutical and functional foods in disease prevention. IGI Global.
4.	Galanakis, C. M. (Ed.). (2021). Nutraceutical and functional food components: Effects of innovative processing techniques. Academic Press.
5.	Glenn R. Gibson and Christine M. Williams, Functional Foods Concept to Product, Woodhead Publishing Ltd and CRC Press LLC

6.	M Guo, Functional foods: Principles and technology, Woodhead Publishing Limited, Abington Hall, Abington, Cambridge
Sr. No.	**Important web links**
1.	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=NuAs6SreCGryddEfs4kkBA==
2.	https://onlinecourses.swayam2.ac.in/ugc19_hs33/preview

Course Outcome and Program Outcome Mapping

Year, Program, Semester	Third Year B.Tech(Food Technology), Part III, Semester VI					
Course Code	PEC321 (321.2)					
Course Category	Professional Elective Course					
Course title	Program Elective I (Snacks Food 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-requisites(if any)	The student should have knowledge of types of food.					
Course Rationale	The course is all about a science and engineering field that deals with the study of snack food processing and its products.					
Course Objectives	The course teacher will ensure to- 1. Introduce students to snack foods technology. 2. Describe emphasis on to the principles and processing of different snack foods. 3. Illustrate the processing of various snack foods. 4. Describe the technology for coated nuts preparation 5. Explain Engineering principles and concepts to handle, store and process of extruded snack foods 6. Categorize the equipment, about the operations and importance of quality control in the snack industry.					
Course Outcomes	By the end of the course, the students will be able to- 1. Understand the concept of snack foods Knowledge about the nutritional profile and consumer demand for snack foods. 2. Identify the purpose and functions of snack foods. 3. Classify and explain the different types of snack products. 4. Apply knowledge for selecting suitable techniques for the snack food processing operations. 5. Analyze flow chart for the production processes of various extruded snack products. 6. Evaluate the hygiene and sanitation condition in snack food processing plant, equipment, storage and handling.					

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

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

Unit No.	Course Content	Hours
1.	**Introduction to Snack Food** • Importance of snack food Industries • Scope of snack food technology • Present status of snack foods industries.	04
2.	**Grain Based Snacks:** • Technology for Whole Grains Snacks – roasted, toasted, puffed, popped, flaked • Technology for Batter-Based and Dough-Based Products • Technology for Formulated Products – chips, wafers, papads, instant premixes	08
3.	**Horticulture produce-based Snacks** • Technology for Fruit-Based Snacks • Technology for Vegetable-Based Snacks • Technology for Coated Nuts	07
4.	**Extruded Snacks:** • Formulation and Processing Technology • Colouring and Flavouring • Packaging • Machinery and Equipment, Use, and Care	07
5.	**Shelf Life Study of Snacks:** • Micro organism growing in Snack Foods at different temperature • Quality characteristics of Snack foods • FSSAI regulations regarding Snack foods	06
6.	**Equipments:**	07

	• Equipments for frying, Baking and drying • Equipments for flaking, popping and blending • Equipments for Coating and chipping	

Sr.No.	Reference Books
1.	dmund WL. Snack Foods Processing. AVI Publ.
2.	Frame ND. 1994. The Technology of Extrusion Cooking. Blackie Academic.
3.	Gordon BR. 1997. Snack Food.AVI Publ
4.	Samuel AM. 1976. Snack Food Technology. AVI Publ.
5.	The Complete Technology Book on Snack Foods Dr.Himadri. Panda (2nd Revised Edition)
Sr.no	**Reference Textbooks**
1.	Extrusion of Food, Vol 2; Harper JM; 1981, CRC Press.
2.	New protein foods, vol.I,II, A.L. Altschul.
Sr.no	**Weblinks**
1.	https://iisdt.in/product/certificate-in-snacks-processing/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B. Tech. (Food Technology), Part III Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PEC321 (321.3)</td></tr>
<tr><td>Course Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Program Elective I (Waste Management of Food Processing Industries)</td></tr>
<tr><td>Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td></td><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total = 100</td></tr>
<tr><td>Pre-requisite (if any)</td><td colspan="5">Principles of Food Preservation Technology (PCC 212)</td></tr>
<tr><td>Course Rational</td><td colspan="5">The aim of the course is to provide students with advanced knowledge in the field of agriculture and food industries waste management, particularly on waste treatment ways. The focal point of the course is based on the importance and role of waste management in the environment within the frame of the sustainable concept aspects, description and classification of by-products in agriculture and food industry sectors and possibilities of their reduction and eventually possible re-use.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The course teacher will ensure to-
1. Study various waste from agricultural and food industries and evaluate its possible impact on the environment.
2. Recognize and communicate common methods of waste treatment and disposal.
3. Learn the working principles of treatment methods used for effluent and solid waste generated in food industries.
4. Understand different waste water treatment and solid waste disposal methods.
5. Learn different techniques used to prepare by products.
6. Understand legal aspects related to waste management.</td></tr>
</table>

Course Outcome	By the end of the course, the students will be able to- 1. Identify various waste from agricultural and food industries and evaluate its possible impact on the environment. 2. Recommend a variety of ways to treat and dispose of waste. 3. Identify various by products from agricultural and food industry and ways to utilize them. 4. Suggest different waste water treatment and solid waste disposal methods. 5. Judge the importance of development of by-products. 6. Analyze and apply legal aspects related to waste management.

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	3	3		3	3		3	3	3	3
CO 2	3	3	3	3		3	2		3	2	3	3
CO 3	3	3	3	3		3	3		2	3	3	2
CO 4	3	2	2	3		3	3		3	3	3	3
CO 5	3	3	3	3		3	3		3	3	3	2
CO 6	3	3	3	3		3	3		3	3	3	3

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

Unit No.	**Course Content**	**Hours**
1.	**Introduction** • Types of waste • Magnitude of waste generation in different food processing industries • Scope and importance of waste management • Effluent treatment • Environmental Protection Act	**06**
2.	**Waste Water Characterization**	**06**

	• Physical characteristics • Chemical characteristics • Biological characteristics	
3.	**Wastewater treatment** • Preliminary treatments • Primary treatments • Secondary treatments • Tertiary treatments	**08**
4.	**Solid Waste Management** • Sources of Solid Wastes • Biological composting • Drying • Incineration • Landfill Digester • Vermicomposting	**07**
5.	**Characterization and utilization of by-products** • Cereals (breweries) Industry • Oil Industry • Fruits and vegetables (wineries) processing Industry • Plantation crops • Sugar Industry	**06**
6.	**Characterization and utilization of by-products** • Dairy • Poultry • Meat Industry • Fish Industry	**06**

Sr. No.	**Text Books**
1.	Norman G. Marriott, Robert B. Gravani. (2006). Principles of Food Sanitation, 5thEdition. Springer Science and Business Media.

2.	Verma L.R. Joshi and V.K. (2000). Postharvest Technology of Fruits and Vegetables:

Year, Program, Semester	Third Year B. Tech. (Food Technology), Part III Semester VI				
Course Code	PEC321 (321.4)				
Course Category	Professional Elective Course				
Course title	Program Elective I (Engineering Mathematics-III, For B.Tech Food 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-requisites(if any)	Engineering Mathematics-I, II.				
Course Rationale	**-**				
Course Objectives	The course teacher will ensure to- 1. Provide students with skills in complex variable, numerical methods which would enable them to devise engineering solutions for given situations they may encounter in them in their profession. 2. Elaborating numerical methods and statistics. 3. Develop mathematical skills and enhance logical thinking power of students.				
Course Outcomes	By the end of the course, the students will be able to- 1. To understand the complex variable and its applications. 2. Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution 3. Apply numerical methods for solving problems in different areas of engineering**.**				

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	PSO 1	PSO 2	PSO 3
CO 1	3	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CO 2	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0

CO 3	3	2	1	0	0	1	0	0	0	0	0	0	0	0	0

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

Unit No.	Course Content	Hours
I	**Complex Number:** Definition of complex number, Algebra of complex number, Geometrical Representation of complex number, Polar & Exponential form of complex number, De Moivre's theorem.	07
II	**Complex Variables:** Functions of complex variable, Circular and hyperbolic functions,Cauchy-Riemann equations, Analytic functions, Harmonic functions.	06
III	**Numerical Solution of Algebraic and Transcendental equations:** Zeroes of polynomial and transcendental equation using Bisection method, Iterative method, Secant method, Regula-falsi method and Newton-Raphson method, Newton-Raphson method for system of equations, Mullers method, Rate of convergence of above methods.	07
IV	**Interpolation and Approximation** Newton's forward and backward difference interpolation formula, Lagrange's interpolation formula, Newton's divided difference interpolation formula, Hermite interpolation formula,	07
V	**Numerical Differentiation and Integration** Numerical differentiation: Methods based on interpolation, Numerical integration: Newton cotes formula, Trapezoidal rule, Simpson's 1/3rd rules, Simpson's 3/8th rules.	07
VI	**Numerical solutions of Differential Equations of first order and first degree** Taylor's series method, Picard's method, Euler's method, Modified Euler's method, Runge-Kutta fourth order formula.	05

Text Books

i)	B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi.
ii)	M. K. Jain, S. R. K. Iyengar, R. K. Jain, "Numerical methods for scientific and Engineering Computation", 2012, New Age International Limited Publishers.
iii)	S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 2020.
iv)	S. D. Sharma, "Operations Research ", 11th Edition.

Reference Books	
i)	S.C. Chapra, R.P. Canale, “Numerical method for Engineers”, 2015, Tata McGraw Hill Publications
ii)	H. K. Dass, “Advanced Engineering Mathematics”, 2014, S. Chand Publishing.
iii)	Erwin Kreyszig, “Advanced Engineering Mathematics”, Fifth Edition, John Wiley & Sons.
iv)	M. D. Greenberg, “Advanced Engineering Mathematics”, 2nd Edition, Pearson Education.
v)	C. R. Wylie, “Advanced Engineering Mathematics”, 6th Edition, McGraw Hill Publication, New Delhi.
Useful web links	
1	https://nptel.ac.in/courses/111105121
2	https://nptel.ac.in/courses/111106100
3	https://nptel.ac.in/courses/111107119
4	https://nptel.ac.in/courses/111105134
5	https://nptel.ac.in/courses/111101165

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Food Technology), Part III Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">OEC 321 (321.1)</td></tr>
<tr><td>Course Category</td><td colspan="5">Open Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Open Elective I-Industrial Economics and Management (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">BSC211, BSC 221,HSMEC 211,PCC 223</td></tr>
<tr><td>Course Rationale</td><td colspan="5">This course provides basic knowledge about the concepts of economics and management. The emphasis is deal with various concepts related to economic problems, national income, inflation, food processing industries, principles of management, production, finance, and marketing management and its relevance.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course aims to provide students with:
1. Fundamentals of Economics – Understanding the basic concepts of micro and macroeconomics relevant to industries.
2. Industrial Structure & Growth – Analyzing different industrial structures, market conditions, and factors influencing industrial growth.
3. Cost & Production Analysis – Understanding cost concepts, production functions, and pricing strategies for business decision-making.
4. Market Structures & Competition – Examining different types of market structures such as monopoly, oligopoly, and perfect competition.
5. Economic Policies & Industrial Development – Evaluating government policies, trade regulations, and their impact on industries.
6. Financial & Business Management – Gaining knowledge of financial statements, investment decisions, and capital management.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Explain fundamental economic concepts and their application in industrial decision-making.</td></tr>
</table>

	2. Analyze industrial structures, growth factors, and government policies affecting industries. 3. Apply cost and production theories to optimize business operations and pricing strategies. 4. Differentiate various market structures and assess competition levels in industrial sectors. 5. Evaluate financial statements and investment decisions to enhance business profitability. 6. Gain knowledge of finance.

	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	1	-	1	-	-	-	1	2	1
CO 2	3	3	2	2	-	1	1	-	-	1	3	2
CO 3	3	3	3	3	2	1	1	-	-	1	3	2
CO 4	2	3	3	2	2	2	1	-	1	2	2	2
CO 5	3	2	2	3	2	1	2	1	1	2	3	2
CO 6	3	2	3	2	1	2	2	2	2	3	3	3

Course Outcome and Program Outcome Mapping

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

Unit No.	Course Content	Hours
1.	**Demand Analysis and Forecasting** Economic problem, law of diminishing utility, consumer surplus. Demand: concepts, types of demand, demand function, law of demand and determinant of demand, Forecasting concept, types, steps and techniques of demand forecasting.	04
2.	**Market and Inflation** Concepts of costs, cost curves and revenue curves of a firm Market, break-even point Market: Meaning, types of market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition. Inflation: Causes, measurement, effects,	08

	Controlling of inflation. Index Numbers.	
3.	**Industrialization** Industrialization: Need, Importance and Problems, Classification of Industries: role, problems and remedies, Industrial Productivity: norms, measurement, Importance and Factors affecting productivity. New Economic Reforms: Liberalization, Privatization and Globalization GATT, WTO agreement, Foreign Exchange.	**07**
4.	**Principles of Management** Definition, nature, levels of management, functions of management. Planning Nature, importance, types of plans, planning process, decision making. Organization: Principles of organization, organizational structure. Directing, Theories of Motivation, Communication: process and barriers, Leadership styles, Controlling: Control techniques.	**07**
5	**Production Management** Production Management: Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Concepts of material management and inventory control: importance and various methods.	**06**
6	**Financial and Marketing Management** Financial Management: Scope and importance, capital structure planning, Working capital management, sources of funds. Marketing Management: Definition of marketing, marketing concept, objectives and functions of Marketing. Marketing Research – Meaning; Definition; objectives; Importance; Limitations. Advertising – meaning, objectives, functions.	**07**

Sr.no.	**Text Books**
1	Divedi, D.N, "Managerial Economics". Vikas, New Delhi,2003
2.	Ahuja, H.L, "Advanced Economic Theory". S. Chand Publication, New Delhi,2017
3.	Gupta, R.S., Sharma, B.D., Bhalla, N.S, "Principles and Practice of Management". Kalyani Publishers,2018
4.	Pugel. T.A, "International Economics". McGraw-Hill Education, 16th edition,2016
Sr.no.	**Reference Books**

1	Koutsoyiannis, "Modern Microeconomics". Macmillan Press Ltd.,2008
2	Jhingan, M.L, "Principles of Economics" (Hindi and English), Vikas, New Delhi,2019
3	Seth, M.L., "Principles of Economics" (Hindi and English), Laxmi Narayan, Agra, 2020
4	Ahuja, H.L., "Economic Environment of Business - Macroeconomic Analysis" S. Chand Publication, New Delhi, 2019.
5	Ahuja, H.L., "Macro Economics Theory and Policy" S. Chand Publication, New Delhi,2019.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">OEC 321 (321.2)</td></tr>
<tr><td>Course Category</td><td colspan="5">Open Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Open Elective I-Professional Communication (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Professional Communication course is designed to equip students with essential communication skills required for success in academic, professional,
and business environments. Effective communication is a crucial competency
in today’s globalized world, where professionals must convey their ideas clearly, persuasively, and professionally in various settings</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1.Enhance Verbal and Non-Verbal Communication Skills
2.Improve Business and Technical Writing
3.Develop Public Speaking and Presentation Skills
4.Strengthen Interpersonal and Team Communication
5.Adapt to Digital and Cross-Cultural Communication
6.Prepare for Career Success</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1.Communicate Effectively in Professional Settings
2.Write Clear and Professional Documents
3.Deliver Engaging and Persuasive Presentations
4.Demonstrate Strong Interpersonal and Teamwork Skills
5.Adapt to Digital and Cross-Cultural Communication
6.Enhance Employability and Professional Growth</td></tr>
</table>

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

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

Unit No.	Course Content	Hours
1.	**Communication principles:** Business and professional excellence in the workplace, Verbal and non-verbal communication, Listening	04
2.	**Entering the workplace:** Resumes, interviews and negotiations; Diverse workplace,	08
3.	Developing in the workplace: Interpersonal communication, Strengthening terms and conducting meetings,	07
4.	**Excellence in the workplace:** Technology in the workplace, Business and professional writings, Leadership and conflict management	07
5	**Presenting in the workplace:** Informing and persuading, Speech design, speech delivering	06
6	**Surviving in the workplace:** Work life balance	07
	Assignments: Based on the following activity - The Assignment work includes six assignments based on theory curriculum and - The tutorial work is also consisting of the industrial survey and report writing. Students have to follow the guidelines given below. Evaluation of the students will be done on completion of the Report and presentation. 1. Form the group of students not exceeds than five.	

	2. Select the appropriate product or service based industry in the nearby region. 3. Take permission of industry for the visit. 4.Visit the industry and make the survey with respect to organization structure, various departments and their functions, processing of raw material to form final product, Administration, vision, mission, goals, growth etc. 5. Go for multiple visits if required. 6. Prepare the Industrial Survey report in detail and submit at the end of semester. 7. Prepare and make presentation on the industrial survey.	

Sr.no.	**Reference Books**
1	Kelly M. Quintanilla, Shawn T. Wahl, “Business and professional Communication- Keys for workplace excellence”, 4 th Edition, Sage publications
Sr.no	**Important web references**
1	https://swayam.gov.in/
2	https://nptel.ac.in/

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Food Technology), Part III Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">OEC 321 (321.3)</td></tr>
<tr><td>Course Category</td><td colspan="5">Open Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Open Elective I-Principles of Management (Theory)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:30</td><td colspan="2">ESE: 70</td><td>Total=100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course provides an overview of management and its evolution. It examines management functions of planning, organizing, leading, and controlling and its impact on the business organization. It discusses necessary skills and functions required for efficient manager in contemporary business environment. Overall, it enables students to analyse and understand changing business environment, and the role of ethics, social responsibility and environmental issues in contemporary business environment.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-
1. Enable the students to study the evolution of management.
2. Study the functions and principles of management.
3. Learn the application of the principles in an organization.
4. Enable the effective and barriers communication in the organization.
5. Study the system and process of effective controlling in the organization.
6. Study the communication skills in the organization.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Describe the importance of principles of management.
2. Associate the importance of planning and decision making in an organization.
3. Interpret the knowledge of organization and its types.</td></tr>
</table>

	4. Acquire concepts in various authorizes and responsibilities of an organization.

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

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

Unit No.	Course Content	Hours
1.	**Introduction to Management:** Management – An Emerging Profession, Definition, Nature, Scope, Purpose, and characteristics of Management, Functions, roles, skills of an effective Manager **Evolution of Management Thought :** Classical Theory, Scientific Management , Management Process or Administrative Management, Bureaucracy, Behavioural Science Approach, Quantitative Approach, Systems Approach, Contingency Approach, Operational Approach	**04**
2.	**Planning:** Types of Plans, Planning Process, Introduction to Strategic Management, Types of Strategies, Understanding environment of business: Environmental appraisal – Industry Analysis - Porter's Model of competitive advantage, analysis of organisational resources and capabilities	**08**

	Forecasting and Premising: Introduction to Forecasting, Essential Components in Business Forecasting, Determinants of Business Forecasts, Benefits of Forecasting, Techniques of Forecasting, Limitations of Forecasting	
3.	**Decision-making :** Introduction, Components of Decision-making, Decision-making Process, Group Decision-making, Creativity Problem-solving **Management by Objectives and Styles of Management :** Core Concepts of MBO, Characteristics of Management by Objectives, Process of MBO, Defining the Goal, Action Plan, Final Review, Benefits of Management by Objectives, Limitations of Management by Objectives, Styles of Management, American Style of Management, Japanese Style of Management, Indian Style of Management	**07**
4.	**Organizing and Directing:** Introduction, Organizational Design, Hierarchical Systems , Organization Structure, Types of Organization Structure, Formal and Informal Organization, Factors Determining Span of Management, Centralization and Decentralization, Span of control, Understanding authority and responsibility, Principles of Delegation, Authority, Developing a culture of Innovation and performance **Staffing and Coordination**: Introduction, Human Resource Management, Recent Trends in HRM, Technology in HRM, Economic Challenges, Workforce Diversity, Concept of Coordination, Need for Coordination, Importance of Coordination, Principles of Coordination, Coordination Process, Types of Coordination, Issues and Systems Approach to Coordination, Techniques of Coordination	**07**
5	**Career Development Strategy:** Introduction, Concept and Elements of Career, Overview of Career Development, Significance and Advantages of Career Development, Objectives of Career Development, Types of Career Development Programmes, Different Stages or Cycles of Career Development Process, Career Anchors, Steps in the Career Planning Process **Leadership styles of Managers:** Leadership Concept, Nature, Importance, Attributes of a leader, Role of a leader in demonstrating awareness of legal, personnel, and strategic issues relating to globalization, culture and gender diversity in an organization, Role of leader in conflict resolution and negotiations	**06**

6	**Organizational Communication:** Communication in Organizations: Introduction, Importance of Communication in the Workplace; Understanding Communication Process, Barriers to Communication, Use of tone, language and styles in Communication, Role of Perception in influencing communication, Role of culture in communication **Change management:** Concept of change, change as a natural process, Importance & Causes of change – social, economic, technological, organizational, Developing a climate for learning, Concept of learning organizations Challenges of Contemporary Business: Role of Ethics, Corporate social responsibility, and environmental issues	**07**
Sr. No.	**Text Books**	
1.	Harold Koontz, O'Donnell and Heinz Weihrich, (2012). Essentials of Management. New Delhi, 9th Edition, Tata McGraw Hill	
2	Stephen P. Robbins, David A. Decenzo, 2016. Fundamentals of Management, Pearson Education, 9th Edition	
Sr. No.	**Reference Books**	
1.	Dessler, G. (1985). Management fundamentals: Concepts, applications, and skill development. Sage Publications.	
2.	Daft, R. L., & Daft, R. L. (2009). Principles of management. South-Western, Cengage Learning India Pvt. Limited.	
Sr. No.	**Important web links**	
1.	https://onlinecourses.nptel.ac.in/noc24_mg47/preview	

Year, Program, Semester	Third Year B.Tech (Food Technology), Part III Semester VI				
Course Code	MDM 321 (321.1)				
Course Category	Multidisciplinary Minor				
Course Title	**Introduction to Data Analytics(Theory)**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-		03	03
Evaluation Scheme	**ISE**			**ESE**	**Total**
	30			**70**	**100**
Pre-requisites(if any)	Solid foundation in basic mathematics, including algebra, calculus, and probability.				
Course Rationale	This course would focus on expertise to become a proficient data scientist.				
Course Objectives	The course teacher will ensure to- 1. Provide the knowledge and expertise to become a proficient data scientist 2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science 3. Produce Python code to statistically analyse a dataset. 4. Critically evaluate data visualizations based on their design and use for communicating stories from data.				
Course Outcomes	By the end of the course, the students will be able to- 1. Explain how data is collected, managed and stored for data science. 2. Understand the key concepts in data science, including their real- world applications and the toolkit used by data scientists. 3. Implement data collection and management scripts using MongoDB.				

Course Outcome and Program Outcome Mapping

CO/PO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	3	-	-	-	-	-	-	-
CO3	-	-	2	2	-	-	-	-	-	-	-	-

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

Unit No.	Course Content	Hours
1.	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Pythonin Data Science.	**07**
2.	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA-Quantitative technique, EDA-Graphical Technique, Data Analytics Conclusion and Predictions	**07**
3.	Feature Generation and Feature Selection (Extracting Meaning from Data)-Motivatingapplication:user(customer)retention-FeatureGeneration(brainstorming,roleofdomainexpertise,andplacefor imagination)-Feature Selection algorithms.	**08**
4.	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects-Exercise: create your own visualization of a complex data set.	**07**
5.	ApplicationsofDataScience,DataScienceandEthicalIssues-Discussionsonprivacy,security,ethics- A look back at Data Science- Next-generation data scientists	**07**
	Text Books	
1.	Joel Grus, Data Science from Scratch, Shroff Publisher Publisher/O'ReillyPublisher Media.	
2.	Annalyn Ng,Kenneth Soo,Numsense!Data Science for the Layman,Shroff Publisher Publisher	
3.	Cathy O'Neiland Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher Media	
4.	Jure Leskovek, Anand Rajaramanand Jeffrey Ullman. Mining of Massive Datasets.v2.1, Cambridge University Press	
5.	Jake Vander Plas, Python Data Science Handbook, Shroff Publisher Publisher/O'ReillyPublisherMedia	
6.	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher/O'Reilly Publisher Media.	
	Lab Work	
1.	Python Environment setup and Essentials.	
2.	Mathematical computing with Python (NumPy).	
3.	Scientific Computing with Python (SciPy).	
4.	Data Manipulation with Pandas.	
5.	Prediction using Scikit-Learn	
6.	Data Visualization in python using mat plot lib	
	Assessment	
	a) ISE has a total weightage of 30 marks which is a(20+10)marks pattern. Theory paper examination will be conducted at central level for 20 marks.**10 marks will be given based on the assignments of lab work**. It consists of assignments, quiz, seminars,	

	presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 c) Marks and then it will be scaled down for 70 marks.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech (Food Technology), Part III Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">MDM321(321.2)</td></tr>
<tr><td>Course Category</td><td colspan="5">Multidisciplinary Minor</td></tr>
<tr><td>Course title</td><td colspan="5">Technology of Malting & Brewing</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td>03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="3">ISE</td><td>ESE</td><td>Total</td></tr>
<tr><td colspan="3">30</td><td>70</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">Basic understanding of biochemistry and microbiology</td></tr>
<tr><td></td><td colspan="5">This course provides students with a comprehensive understanding of the scientific, technical, and practical aspects of beer production. Understanding the technology behind malting and brewing is crucial for students aspiring to work in this industry.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-
1. Discuss the fundamental principles and processes involved in malting and brewing.
2. Explore the anatomy and biochemistry of grains used in malting and brewing, with a focus on barley.
3. Explain the malting process, including steeping, germination, and kilning, and its impact on grain modification and enzyme development.
4. Illustrate about the role of enzymes, particularly amylases and proteases, in the malting and mashing processes.
5. Enlist brewing techniques, including mashing, lautering, boiling, fermentation, and conditioning, and their effects on flavor, aroma, and alcohol content.
6. Describe the microbiology of brewing, including the role of yeast and other microorganisms in fermentation and the prevention of spoilage.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-
1. Demonstrate a comprehensive understanding of the malting and brewing processes, including their chemical and biochemical principles.
2. Identify and evaluate different types of grains suitable for malting and brewing based on the characteristics and quality parameters.
3. Apply malting techniques to produce malt with desired attributes for brewing purposes.
4. Utilize brewing equipment and techniques to produce various styles of beer while controlling factors such as color, flavor, and alcohol content.
5. Analyze and interpret data from laboratory tests and sensory evaluations to assess the quality of malt and beer.
6. Acquire proficiency in trouble shooting common issues encountered during the malting and brewing processes.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	1	-	-	-	-	-	-	-	-
CO4	2	2	3	1	-	-	-	-	-	-	-	-
CO5	2	2	2	1	1	-	-	-	-	-	-	-
CO6	2	2	2	2	-	-	-	-	-	-	-	-

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

Unit No.	Course Content	Hours
1.	**Introduction to Malting and Brewing** Introduction of brewing, history of brewing; Raw materials :barley ,hops, water, yeast; Adjuncts for beer production :Maize ,rice ,millet, wheat, sugar etc	06
2.	**Malting Process** Malt production, role of enzymes for malting; Barley storage, steeping, germination, kilning, cooling, storage; Malt from other cereals, caramel malt, roasted malt, smoked malt, malt extract; Malt quality evaluation ,Wort production, malt milling, Mashing, Mashing vessels; Wort boiling ,clarification ,cooling and aeration	06
3.	**Brewing Process Overview** Beer production methods, fermentation technology, changes during fermentation; Filtration procedure and equipment, beer stabilization conditions and durations, beer carbonation process	06
4.	**Yeast and Brewing Equipment** Types of brewing yeast, Yeast propagation and handling, Fermentation kinetics, Brew house equipment and layout, Fermentation vessels ,Packaging equipment.	06
5.	**Brewing Techniques and Styles** Ale brewing, Lager brewing, Specialty beer styles, Craft brewing techniques, Sustainable sourcing of ingredients.	06
6.	**Emerging Trends in Malting and Brewing,** Novel ingredients and flavors, Brewing with alternative grains, Non-alcoholic brewing	06
	Text / Reference Books	
1.	Kunze Wolfgang, (January 1, 2014), Technology Brewing and Maltin, (5th edition), VLB Berlin.	
2.	J. S. Hough, D. E. Briggs, R. Stevens, T. W. Young, (1 March 2013), Malting and Brewing Science: Volume II Hopped Wort and Beer, (1st ed. 1982 edition) Springer-Verlag New York Inc. Softcover reprint of the original.	
	Reference books	

1.	D.E. Briggs, R. Stevens, Tom W. Young, J.S. Hough, ((December 1, 1981), Malting and Brewing Science, Volume 1: Malt and Sweet Wort, (2nd edition), Springer.

Year, Program, Semester	Third Year B.Tech (Food Technology), Part III Semester VI				
Course Code	MDM321(321.3)				
Course Category	Multidisciplinary Minor				
Course title	**IoT with Arduino, ESP, and Raspberry Pi**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE**		**ESE**		**Total**
	30		70		100
Pre-requisites(if any)	Knowledge of Embedded systems, microcontroller, computer networking				
Course Rationale	The Internet of Things (IoT) has become a pivotal aspect of modern technology, and understanding how to create IoT solutions using popular platforms like Arduino, ESP (Espressif), and Raspberry Pi is essential. This course is designed to provide students with hands-on experience in building IoT applications using these widely used hardware platforms. It aims to enable students to design, develop, and deploy IoT projects by combining hardware, software, and connectivity elements.				
Course Objectives	The course teacher will ensure to- 1. Give students hands-on experience using different IoT architectures. 2. Provide skills for interfacing sensors and actuators with different IoT architectures. 3. Develop skills on data collection and logging in the cloud.				
Course Outcomes	By the end of the course, the students will be able to- 1. Understand Arduino Uno, NODE MCU 8266 and Raspberry PI along with critical protocols and its communication to cloud. 2. Apply commonly used IOT protocols such as REST API, MQTT through IOT based demonstration. 3. Solve analog sensor and digital sensor interfacing with IOT devices. 4. Program ESP devices for IoT applications, including setting up wireless connectivity. 5. Use Raspberry Pi as an IoT gateway and implement data processing tasks. 6. Successfully integrate sensors and actuators with the chosen platforms to achieve specific IoT functionalities.				

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	-		2	-	-	-	-	-	-	-	-
CO 3	3		2	-	-	-	-	-	-	-	-	-

CO 4	-		3	-		-	-	-	-	-	-	-
CO 5	-		3	-	3	-	-	-	-	-	-	-
CO 6	-		-	-	3	-	-	-	-	-	-	-

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

Unit No.	Course Content	Hours
1.	**IoT- introduction and its components** IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).	06
2.	**Arduino Uno – getting started with the Uno boards** blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module	06
3.	**ESP 8266-12E Node MCU – getting started with the ESP board** Micro python and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API-GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home Automation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).	06
4.	**Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS** Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.	06
5.	**Raspberry pi3 interfacing with Sensor** DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3 Mobel B Comparison, LoRawan /LPWAN – Overview.	06
6.	**IoT Case Studies:** Introduction to Cloud Storage Models, Communication API.	06
	Reference Books	
1.	. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd	

2.	Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.
3.	Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.
4.	Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI. " O'Reilly Publisher Media, Inc."
Sr. No.	**Important web links**
1.	https://www.coursera.org/learn/iot

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">HSMEC 321</td></tr>
<tr><td>Course Category</td><td colspan="5">Humanities and Social Sciences, Management, Environmental Course</td></tr>
<tr><td>Course title</td><td colspan="5">Entrepreneurship Essentials</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>02</td><td>-</td><td>-</td><td>02</td><td>02</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">ISE:50</td><td colspan="2">ESE: 00</td><td>Total=50</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="5">-</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The course provides foundational knowledge on various aspects of entrepreneurial venture creation and management during its life-cycle</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. To introduce students to the fundamentals of entrepreneurship, including mission, vision, and entrepreneurial qualities.
2. To familiarize students with business model generation, value propositions, competitive advantage, and lean startup methodologies.
3. To develop an understanding of market research, business planning, pitching, and go-to-market strategies.
4. To educate students on various funding options, including bootstrapping, crowd funding, angel investors, venture capital, and government support programs.
5. To provide knowledge on legal aspects such as intellectual property rights (IPR), GST, labor laws, and human resource management in startups.
6. To analyze strategies for entrepreneurial ventures, risk assessment, and the key factors that drive start up success or failure</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Students will be able to understand the key characteristics of entrepreneurs and differentiate between myths and realities in entrepreneurship.
2. Students will be able to utilize the Business Model Canvas and lean startup principles to create a strong value proposition.
3. Students will be able to Conduct market research, develop business plans, and craft compelling pitches to attract investors or customers.</td></tr>
</table>

	4. Students will be able to assess various financial resources, including government incentives and private funding, for launching and scaling ventures. 5. Students will be able to apply knowledge of IPR, taxation, and labor laws to ensure business compliance while effectively managing a startup team. 6. Students will able to implement strategic management techniques to assess risks, pivot business models when necessary, and maximize the success of a start-up.

Course Outcome and Program Outcome Mapping

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

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

Unit No.	Course Content	Hours
1	Introduction, Mission, vision, entrepreneurial qualities, Myths & Realities about entrepreneurship entrepreneurial qualities, basic reasons for failing of start-ups.	**04**
2	Value proposition, Business Model canvasBusiness model generation, Competitive advantage, Lean start-up concept. Team and early recruit, Legal forms of business	**05**
3	Marketing management ,Market research with examples, Business plans ,Pitching, Go-to-market strategies, Does & Don'ts	**04**
4	Government incentives for entrepreneurship, Incubation, acceleration, Funding new ventures – bootstrapping, crowd sourcing, angel investors, VCs, debt financing,	**05**

5	Legal aspects of business (IPR, GST, Labour law)Human Resource management in start-ups Pivoting, Entrepreneurial cases, Risk assessment and analysis	**04**
6	Strategy management for entrepreneurial ventures, Factors driving success and failure of ventures	**04**
Sr.no.	**Reference Books**	
1	Effective Entrepreneurial Management: Strategy, Planning, Risk Management, and Organization - Robert D. Hisrich , Veland Ramadani, Springer (2017)	
2	Entrepreneurship- Theory, Process Practice –by Kuratko & Hodgetts, Thompson South-Western Publication.	
3	Entrepreneurship –by Robert D. Hisrich (Edition-9)	
4	The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company – by Steve Blank & Bob Dorf	
5	Marketing Management – Philip Kotler, Kevin Lane Keller	
Sr.No	**Reference Textbooks**	
1	The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses *by Eric Ries.*	
2	Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers *by Alexander Osterwalder and Yves Pigneur.*	
3.	Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant *by W. Chan Kim and Renée Mauborgne.*	
Sr.no	**Web links**	
1.	***https://onlinecourses.nptel.ac.in online course on*** Entrepreneurship Essentials by Manoj K Mondal, IIT Kharagpur	
2.	Human Resource Management by IIM Bangalore *on* edX	
3.	Entrepreneurship Essentials *by Harvard Business School Online.*	
4.	Marketing Management by Philip Kotler on Coursera*.*	

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">PSI 321</td></tr>
<tr><td>Course Category</td><td colspan="5">Project Seminar Internship</td></tr>
<tr><td>Course title</td><td colspan="5">Research Project Phase-I</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>-</td><td>-</td><td>02</td><td>02</td><td>01</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="2">IOE:50</td><td colspan="2">EOE: 50</td><td>Total=100</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Research Phase I 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.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">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.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Develop innovative research proposals addressing challenges in food technology.
2. Design experiments and methodologies for investigating food processing and quality aspects.
3. Conduct hands-on research and simulations using advanced tools in food engineering.
4. Analyze, interpret, and optimize experimental results for real-world applications.
5. Apply scientific writing and technical presentation skills to communicate research effectively.
6. Demonstrate ability for independent research, problem-solving, and lifelong learning in food science and technology.</td></tr>
</table>

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	-	3	2	2	-	-	-	-	3
CO 2	3	3	3	3	3	3	2	-	-	-	-	2
CO 3	3	3	3	3	3	2	-	-	-	-	-	2
CO 4	3	3	3	3	3	3	-	-	-	-	-	3
CO5	-	2	2	-	2	2	-	-	2	3	-	3
CO6	2	3	3	3	3	3	2	-	-	-	-	3

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

Unit No.	Course Content	Hours
1.	**Research Ideation and Proposal Development** Identifying research gaps in food science, food engineering, and food safety. Problem statement formulation and defining research objectives. Literature review: benchmarking existing technologies and solutions.	**04**
2.	**Research Methodology and Experimental Planning** Designing experiments and research methodologies for food technology projects. Selection of raw materials, food ingredients, and process parameters. Ethical considerations and safety regulations in food research.	**04**
3.	**Hands-on Experimentation and Simulation** Conducting laboratory experiments and pilot-scale studies. Application of software tools (e.g., MATLAB, Design-Expert, ANSYS for food processing). Risk assessment and quality control measures in research execution.	**04**

4.	**Data Collection, Processing, and Analysis** Statistical data analysis and modeling techniques in food technology research. Application of sensory evaluation, rheology, and chromatography techniques. Interpretation of experimental data and hypothesis validation	**04**
5.	**Optimization and Solution Development** Process optimization techniques using Response Surface Methodology (RSM). Cost-benefit analysis and industrial feasibility assessment. Scaling up research findings from lab to industry applications.	**06**
6.	**Research Communication and Presentation** Technical report writing and research documentation. Presentation of findings through posters, PowerPoint, and publications. Preparing for thesis defense and responding to technical queries.	**02**

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">MAC321</td></tr>
<tr><td>Course Category</td><td colspan="5">Mandatory Audit Course</td></tr>
<tr><td>Course title</td><td colspan="5">Design Thinking and Innovation III</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>-</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="5">IE at Course in charge end</td></tr>
<tr><td>Course Rationale</td><td colspan="5">The Design Thinking & Innovation III course aims to bridge the gap between conceptual design and real-world application. By integrating advanced design thinking methodologies with industry-relevant challenges, the course prepares students to develop, validate, and execute innovative solutions. This progression ensures that students transition from ideation to actionable strategies that are market-ready and impactful.</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. To advance students' capabilities in synthesizing complex design challenges into feasible solutions.
2. To refine iterative problem-solving skills through industry-focused projects and case studies.
3. To cultivate a proactive, entrepreneurial mindset that addresses sustainability and societal needs.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Analyze complex problems to develop innovative, user-centric design solutions.
2. Apply advanced prototyping techniques to validate and optimize product concepts.
3. Collaborate effectively across disciplines to deliver actionable and sustainable innovations.
4. Evaluate and align solutions with market trends, user feedback, and ethical considerations.</td></tr>
</table>

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	3	3									
CO 2	2		2	2	3							
CO 3									3	3		
CO 4	2						2					2

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

Unit No.	Course Content	Hours
1.	**Design Thinking Framework Revisited** • Advanced principles of empathy, ideation, and prototyping. • Reflection on learning from Design Thinking & Innovation I and II. • Introduction to systems thinking in the design context.	02
2.	**Problem Scoping and Opportunity Identification** • Techniques for problem discovery and framing. • Identifying gaps and opportunities in existing systems. • Leveraging tools like Journey Mapping and SWOT Analysis.	02
3.	**Ideation Techniques and Advanced Prototyping** • Brainstorming 2.0: Mind Mapping and SCAMPER techniques. • Prototyping with a focus on technology integration. • Real-world prototyping examples from diverse industries.	03
4.	**Validation and Iterative Development** • Usability testing methods and feedback incorporation. • Iterative design models: Agile and Lean principles. • Creating Minimum Viable Products (MVPs).	02
5.	**Innovation Strategy and Entrepreneurship** • Bridging design with business models (Canvas Model). • Strategies for market positioning and scaling innovations. • Ethical considerations and sustainable innovation practices.	03
6.	**Case Studies and Capstone Projects** • Real-world applications of design thinking in Chemical Engineering.	02

	• Group projects focusing on an innovative solution for an industry-related problem. • Presentation and feedback.	

Pedagogical Strategies

- Interactive Sessions: Facilitators to encourage collaborative discussions andproblem-solving activities.
- Hands-On Assignments: Individual and group-based projects for practicalapplication.
- Case Studies: Industry-specific scenarios for analysis and solution generation.
- Technology Integration: Use of tools like Miro, Figma, or Scilab for design processes.

Assessment Methods

1. Formative Assessments:
   - Assignments: Application of unit-specific tools (20%).
   - Group Activities: Problem framing and solution ideation tasks (30%).
2. Summative Assessments:
   - Final Presentation of Capstone Project (50%).

Sr.No.	Reference Books/ Text Books
1.	Brown, T. (2009). Change by Design. Harper Business.
2.	Lewrick, M., Link, P., &; Leifer, L. (2018). The Design Thinking Playbook. Wiley.
3.	Plattner, H., Meinel, C., &; Leifer, L. (2020). Design Thinking Research. Springer.
4.	Christensen, C. M. (2013). The Innovator Dilemma. Harvard Business Review Press.

<table>
<tr><td>Year, Program, Semester</td><td colspan="5">Third Year B.Tech(Food Technology), Part III, Semester VI</td></tr>
<tr><td>Course Code</td><td colspan="5">MAC 322</td></tr>
<tr><td>Course Category</td><td colspan="5">Mandatory Audit Course</td></tr>
<tr><td>Course title</td><td colspan="5">Aptitude Enhancement Course III</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>01</td><td>-</td><td>-</td><td>01</td><td>-</td></tr>
<tr><td>Evaluation Scheme</td><td colspan="5">IE at Course in charge end</td></tr>
<tr><td>Course Rationale</td><td colspan="5">Basic Mathematical Concepts</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The course teacher will ensure to-

1. Equip students with techniques for solving quantitative aptitude problems like interest and mixture.
2. Enhance logical reasoning abilities, including decision-making and assertion-reason analysis.
3. Develop skills to calculate and apply geometric areas, volumes, and surface areas in problem-solving.
4. Introduce fundamental concepts of probability and statistics for solving quantitative problems.
5. Strengthen abilities to solve time-based problems, improving speed and accuracy.
6. Train students to recognize and solve logical sequences and patterns in reasoning and mathematics</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">By the end of the course, the students will be able to-

1. Solve quantitative aptitude problems related to Boats and Streams, Trains, Mixtures, and Interest calculations effectively.
2. Develop logical reasoning skills for problems like decision-making, number ranking, and time sequence tests.
3. Calculate areas, volumes, and surface areas of geometric shapes and apply them to practical problems.
4. Apply probability and statistical analysis in solving real-world problems like stocks, shares, and series.
5. Solve time-based problems involving calendars, clocks, and distances, enhancing time management skills.
6. Master advanced techniques in Permutations, Combinations, and other mathematical concepts for higher-level exams</td></tr>
</table>

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

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

Unit No.	Course Content	Hours
1.	**Quantitative Aptitude 1** • Boats and Streams, Problems on Trains, Alligation or Mixture, Simple Interest.	02
2.	**Quantitative Aptitude 2** • Compound Interest, Area, Volume and Surface Area, Races and Games of Skill.	02
3.	**Quantitative Aptitude 3** • Calendar, Clocks, Stocks and Shares, Permutations and Combinations.	02
4.	**Quantitative Aptitude 4** • Probability, True Discount, Banker's Discount, Heights and Distances, Odd Man Out and Series.	02
5.	**Logical Reasoning 1** • Number ranking and time sequence test, Decision making, Assertion and reason, Situation reaction Test.	03
6.	**Logical Reasoning 2** • Mathematical Operations, Inserting the missing one, logical sequence of words.	02

General Instructions:

- Each Student has to write at least 6 assignments on entire syllabus.Quizzes: Timed quizzes on specific units (20%).

2. Summative Assessment:

- Mock Aptitude Test: Comprehensive test covering all units (60%).

Sr.No.	Reference Books/ Text Books
1.	Dr. R S Aggarwal — Quantitative aptitude, S. Chand Publication. Publishing.
2.	R V Praveen — Quantitative aptitude and logical reasoning, 2nd Edition, PHI Publication.
Assessment	
1.	Assessment will be done by Course Teacher. MCQ Test can be conducted based on the syllabus.

The Equivalence for the Courses of Food Technology at Third Year B. Tech. Semester V and Semester VI of pre-revised Program under the faculty of Science and Technology is as follows.

SEM – V

Sr. No.	Third Year B.Tech Semester V Pre-revised syllabus	Third Year B.Tech Semester V Revised syllabus	Remark
1	Food Quality and Safety Management(Theory & Lab)	Food Quality and Safety Management(Theory & Lab)	Content revision.
2	Fruits and Vegetables Processing Technology(Theory & Lab)	-------	Shift to previous semester with Content revision.
3	Dairy Technology(Theory & Lab)	-	Shift to previous semester with Content revision.
4	Food Process Engineering-II(Theory & Lab)	Food Process Engineering II(Theory & Lab)	Content revision.
5	Process Instrumentation, Dynamics and control (Theory and laboratory)	-	Based on discussions with PAB Members, faculty members and considering applications to the present programme, the subject is removed and new subjects are introduced
6	-	Food Packaging Technology(Theory & Lab)	Shift from next semester with Content revision.
7	-	Sugar and Confectionery Technology(Theory & Lab)	Shift from next semester with Content revision.
8	-	Technology of Cereal and Bakery Products(Theory & Lab)	Shift from next semester with Content revision.
10	Internship I	-	Shifted to semester VIII with increasing

			time span as per suggestions of PAB
11	Introduction to Foreign Language	Introduction to Foreign Language	Content is revised and converted as a Credit course
12	-	Aptitude Enhancement Course II	Newly introduced.
13	-	Mini Project III & Industrial Visit	Clubbing of courses with modification
14	-	Multidisciplinary Minor Course II	As per NEP feature, MDM is introduced.

SEM – VI

Sr. No.	Third Year B.Tech Semester VI Pre-revised syllabus	Third Year B.Tech Semester VI Revised syllabus	Remark
1	Sugar and Confectionery Technology(Theory & Lab)	------	Shifted to previous semester
2	Technology of Cereals and Bakery Products(Theory & Lab)	------	Shifted to previous semester
3	Design and Development of New Products(Theory & Lab)	Design and Development of New Products	Content revision.
4	Process Equipment Design and Drawing	-----	Based on discussions with PAB Members, faculty members and considering applications to the present programme, the subject is merged in other courses
5	Industrial Economics and Management	------	The title and content are revised and shifted in the next semester
6	Food Laws and Regulations	------	The title and content are revised and shifted in the next semester
7	-----	Food Biotechnology	Shifted from next semester

8	-----	Legume and Oilseed Technology	Shifted from next semester
9	-----	Elective I(Functional Food and Nutraceutical/ Snacks Food Technology/ Waste Management of Food Industries/ Engg. Mathematics III)	Shifted from next semester
10	-----	Open Elective I	Shifted from next semester
11	-----	Research Project Phase-I	Shifted from next semester
12	Mini Project	-----	Shifted in the previous semester with content revision.
13	Research Methodology	-	Shifted to the previous semester
14	------	Design Thinking and Innovation III	Newly introduced.
15	-----	Aptitude Enhancement Course III	Newly introduced.
16	------	Major Project Lab-I & Industrial Visit	Clubbing of courses and shifting from next semester
17		Multidisciplinary Minor Course III	As per NEP feature, MDM is introduced.