GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering
Level: UG
Branch: Food Engineering & Technology
Subject Code: BE03051031
Subject Name: Introduction to Food Engineering & Technology

WEF Academic Year :	2024-25
Semester :	3rd
Category of the Course :	PCC

Prerequisite :	Nil
Rationale :	The primary objective of incorporating this subject into the Food Processing Technology degree program is to provide students with a fundamental understanding of food processing and preservation techniques. This course also introduces the basic principles of heat transfer and mass transfer in food systems. Additionally, students will gain insights into the current status and advancements of the food industry in India, preparing them for industry-oriented applications and innovations.

Course Outcome :

After Completion of the Course, Student will able to :

No.	Course Outcomes
CO-1	Get acquainted with the status and scope of Indian food industry.
CO-2	Understand the basic engineering principles involved in processing of food.
CO-3	Know the basic principles of food spoilage and the methods of food preservation.
CO-4	Get aware about the mass and energy balances in various food processing operations.

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
						Theory		Tutorial / Practical			
L	T	P	PBL*	TH		ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
60	0	30	30	120	04	70	30	20	30	50	200

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

* **Problem Based Learning (PBL) aims to accommodate learning beyond syllabus as per clause 9.4 of NBA manual.**

Course Content :

Sr. No.	Course Content	No. of Hours	Weightage (%)
1	**Fundamentals of Food Engineering** • Introduction to food engineering and its significance in food processing • Basic engineering principles applied in food technology	08	15

	• Units and dimensions in food engineering • Mass and energy balance in food processing		
2	**Heat Transfer in Food Processing** • Fundamentals of heat transfer: Conduction, convection, and radiation • Heat exchangers and their applications in food industries • Thermal processing of foods: Pasteurization, sterilization, and blanching • Evaporation and its applications in food concentration	10	20
3	**Fundamentals of Mass and Energy balance** • Application of mass and energy balances in food engineering operations • Principles of mass transfer in food systems • Diffusion and osmosis in food processing	09	20
4	**Food Preservation and Processing Technologies** • Principles and methods of food preservation • Refrigeration and freezing: Cold storage systems • Drying and dehydration of food products • Emerging food processing technologies: High-pressure processing, irradiation, and pulsed electric fields	10	25
5	**Food Industry Overview and Equipment** • Overview of the food processing industry and its current status • Equipment and machinery used in food processing • Process control and automation in food industries • Sustainability and waste management in food engineering	8	20

Reference Book :

1. Fundamentals of Food Process Engineering by R. T. Toledo
2. Food Engineering Operations by Brennan and Cowell
3. Food Process Engineering by Heldman and Singh
4. Intro to Food Process Engineering by P. G. Smith
5. Transport Process & Unit Operations by Geankoplis

Suggested Course Practical List :

1. Study of Unit Operations in Food Processing
2. Measurement of Mass and Energy Balance in a Food Processing System
3. Determination of Thermal Conductivity of Food Materials
4. Study of Heat Transfer in Pasteurization and Sterilization Processes
5. Determination of Fluid Flow Properties (Newtonian and Non-Newtonian Fluids)
6. Study of Different Types of Pumps Used in Food Industries

7. Demonstration of Drying and Dehydration Techniques in Food Preservation
8. Freezing and Thawing of Food Products – Effect on Texture and Quality
9. Study of Food Packaging Techniques and Machinery Used in the Food Industry
10. Visit to a Food Processing Unit to Understand Industrial Food Engineering Applications

List of Laboratory/Learning Resources Required :

Open Source websites:

http://foodscience.uark.edu/
http://www.sciencedirect.com/science/book/
http://www.ucc.ie/en/ace-dfsct/

- **List of suggested activities for Problem Based Learning:**

Sr. No.	Activity Name	Suggested Topics/Focus Area	Hours	Evaluation Criteria
1	Industry/Research Laboratory Visit	Visit to food processing unit, R&D center, food testing lab (e.g., dairy, bakery, oil mill, FSSAI lab)	10 h (Visit + Report)	Report with observations, flow diagram, critical control points
2	Technical Video-Based Learning	Unit operations (drying, milling), food safety (HACCP, ISO 22000), thermal processing	10 h	Report/Presentation based on learning outcomes
3	Assignment Writing (Numericals)	Mass/energy balance, drying rate, thermal conductivity, food refrigeration load	10 h	Based on assignment depth and accuracy
4	Problem Solving / Coding	Shelf life prediction models, food drying simulation (using Python/Excel), curve fitting for kinetics	10 h	Based on correctness and code output
5	Online Course (MOOCs)	NPTEL/SWAYAM course on Food Processing, Food Microbiology, Packaging Technology	10 h	Based on completion certificate and assessment
6	Complex Problem Solving	Case: Spoilage in packaged milk; identify root cause and solution	10 h	Based on root cause analysis and justification
7	Industrial Safety Videos	Food plant safety, hygiene and sanitation, machinery safety	10 h	Based on quiz or summary report

8	Discussion on Research Papers	Food fortification, novel food packaging, extrusion, nanotechnology in food	20 h (5 papers × 4 h)	Evaluation of scientific depth, summary of findings
9	Poster/Chart/PowerPoint Presentation	Food adulteration detection, cold chain, pasteurization process, millet-based products	6 h	Presentation clarity and content relevance
10	Model Development (Working/Non-working)	Mini spray dryer, solar dryer, shell & tube heat exchanger, agitator mixer	8–12 h	Internal/external demonstration and explanation
11	Industrial Exposure (2–3 Days)	Observe processes in dairy/fruit processing/bakery/oil refinery, identify inefficiencies	20 h	Critical evaluation report with suggested solutions
12	Group Discussion (Technical Trends)	Food sustainability, functional foods, AI in food industry, alternative proteins	1 h per GD	Technical input and communication skill
13	Case Study-Based Learning	Real case: Maggi ban (regulatory aspect), Patanjali contamination issue, FSSAI recall cases	10 h	Report with fact analysis and regulatory links
14	Application / Software Development	Nutrition calculator app, food label generator, moisture loss calculator	10 h	Based on functionality and usability

- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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