



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Vocation

Level: Under Graduate

Branch: Food Processing and Quality Control

Course / Subject Code: BV03009041

Course / Subject Name: Engineering Properties of Food Materials

w. e. f. Academic Year:	2024-25
Semester:	3
Category of the Course:	Core Courses

**Prerequisite:** Basic knowledge of food science, physics, and mathematics.

<b>Rationale:</b>	Understanding the engineering properties of food materials is essential for designing and operating food processing systems efficiently. This course enables students to analyze physical, thermal, mechanical, and electrical properties critical to food material handling, processing, packaging, and storage. The insights gained will enhance the quality, safety, and sustainability of food production systems.
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## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Explain fundamental engineering properties of food materials and their significance in food processing.
02	Analyze the physical, thermal, and rheological properties of food materials. (U, A)
03	Apply engineering principles to solve problems related to food material handling and processing.
04	Design experiments to measure and interpret food material properties using modern tools.

## Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	0	3	50	0	0	0	50

## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b>Introduction to Engineering Properties of Food Materials</b> Overview and significance of engineering properties.	07	15



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	Classification: Physical, mechanical, thermal, electrical, and rheological properties. Applications in food processing, packaging, and storage.		
2.	<b>Physical Properties of Food Materials</b> Density, porosity, and specific surface area. Color, shape, and texture analysis. Measurement methods and applications.	10	20
3.	<b>Thermal Properties of Food Materials</b> Thermal conductivity, specific heat, and diffusivity. Measurement techniques and applications in food processing. Thermal behavior during heating, cooling, and freezing.	10	20
4.	<b>Rheological and Mechanical Properties</b> Stress-strain relationships, viscoelastic behavior. Texture profile analysis and instruments used. Applications in extrusion, mixing, and other processes.	10	25
5.	<b>Electrical and Dielectric Properties of Food Materials</b> Electrical conductivity and permittivity. Applications in dielectric heating and food quality analysis. Case studies on microwave and RF heating.	08	20
	<b>Total</b>	<b>45</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
24	25	21	15	15	

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## References/Suggested Learning Resources:

### (a) Books:

1. Mohsenin, N. N. (1986). *Physical Properties of Plant and Animal Materials*. CBS Publishers.
2. Rao, M. A., & Rizvi, S. S. H. (2014). *Engineering Properties of Foods*. CRC Press.
3. Singh, R. P., & Heldman, D. R. (2014). *Introduction to Food Engineering*. Academic Press.
4. Sahay, K. M., & Singh, K. K. (2004). *Unit Operations of Agricultural Processing*. Vikas Publishing.



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**(b) Open-source software and website:**

1. NPTEL Food Engineering
2. Food Properties Database

**Suggested Course Practical List:**

1. Determination of bulk density, porosity, and specific gravity of food materials.
2. Measurement of thermal conductivity using the steady-state method.
3. Texture profile analysis using a texture analyzer.
4. Analysis of electrical conductivity and permittivity of food samples.
5. Rheological property evaluation using a viscometer.

**List of Laboratory/Learning Resources Required:**

1. Texture Analyzer.
2. Rheometer/Viscometer.
3. Thermal Conductivity Measurement Apparatus.
4. Dielectric Property Measurement Setup.
5. Standard Food Samples for Analysis.

**Suggested Project List:**

1. Design and development of a low-cost texture analyzer.
2. Study of thermal properties of indigenous food products.
3. Development of a database for electrical properties of common food materials.
4. Optimization of food processing parameters using engineering properties.

**Suggested Activities for Students:**

1. Conduct a field survey to document engineering properties of local agricultural products.
2. Develop infographics or posters explaining the applications of food material properties.
3. Organize a seminar or group discussion on emerging trends in food property analysis.
4. Participate in hackathons to design innovative tools for measuring food properties.

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