



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Vocation

Level: Under Graduate

Branch: Food Processing and Quality Control

Course / Subject Code: BV03009051

Course / Subject Name: Engineering Properties of Food Materials- Lab

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

**Prerequisite:** Basic understanding of material properties, physics, and fundamental engineering concepts.

<b>Rationale:</b>	The course emphasizes hands-on training in understanding and determining the engineering properties of materials, soils, and fluids used in agricultural and civil engineering applications. It equips students with practical skills to evaluate materials' behavior under different conditions, ensuring their suitability for real-world applications.
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## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	Measure and analyze fundamental engineering properties such as density, porosity, permeability, and strength.
02	Conduct experiments to determine the thermal, hydraulic, and mechanical properties of engineering materials.
03	Interpret experimental results to assess material suitability for various engineering applications.
04	Use open-source software tools and experimental setups for data analysis and reporting.

## 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)	
0	0	2	1	0	0	20	30	50

## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Basics of Engineering Properties	03	10



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	Introduction to engineering materials and their classification.		
2.	<b>Determination of Physical Properties</b> <ul style="list-style-type: none"> <li>• Determination of Bulk Density, Particle Density, and Porosity</li> <li>• Measurement of Moisture Content (Gravimetric and Volumetric Methods)</li> <li>• Determination of Specific Gravity of Solids and Liquids</li> </ul>	<b>07</b>	<b>25</b>
3.	<b>Determination of Mechanical Properties</b> <ul style="list-style-type: none"> <li>• Tensile and Compressive Strength Tests of Food Materials</li> <li>• Shear Strength Testing of Materials Food Materials</li> <li>• Hardness and Impact Testing of Food</li> <li>• Stress-Strain Analysis for Ductile and Brittle Materials</li> </ul>	<b>08</b>	<b>30</b>
4.	<b>Determination of Thermal and Hydraulic Properties</b> <ul style="list-style-type: none"> <li>• Measurement of Thermal Conductivity using Guarded Hot Plate Method</li> <li>• Determination of Thermal Diffusivity</li> <li>• Hydraulic Conductivity Test using Constant/Falling Head Permeameter</li> <li>• Capillarity and Water Retention Capacity in Soils</li> </ul>	<b>07</b>	<b>20</b>
5.	<b>Data Analysis and Interpretation</b> <ul style="list-style-type: none"> <li>• Data Analysis and Graph Plotting using Python or MATLAB</li> </ul>	<b>05</b>	<b>15</b>
<b>Total</b>		<b>30</b>	<b>100</b>

**Suggested Specification Table with Marks (Practical):**

Distribution of Practical Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>20</b>	<b>15</b>	<b>21</b>	<b>20</b>	<b>12</b>	<b>12</b>

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. G.K. Das, *Principles of Soil Mechanics and Foundation Engineering*. PHI Learning.
2. S.K. Garg, *Irrigation Engineering and Hydraulic Structures*. Khanna Publishers.
3. B.C. Punmia, *Soil Mechanics and Foundations*. Laxmi Publications.

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

1. [NPTEL](http://www.nptel.ac.in/) for engineering properties and laboratory techniques.
2. LibreTexts Engineering for open-source material



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## **Suggested Course Practical List:**

1. Determination of physical properties like density, porosity, and moisture content.
2. Tensile and compressive strength tests of materials.
3. Thermal conductivity measurement using a guarded hot plate method.
4. Hydraulic conductivity test using a constant head or falling head permeameter.
5. Soil compaction and Atterberg limits determination.
6. Capillarity experiment in soils.
7. Stress-strain analysis of a ductile material.
8. Data analysis and plotting using software like Python or MATLAB.

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

1. **Equipment:**
  - Universal Testing Machine (UTM)
  - Permeameters (constant and falling head)
  - Thermal conductivity apparatus
  - Compaction apparatus
  - Hardness and impact testing machines
2. **Software:**
  - Open-source tools like Python, SciPy, and MATLAB for data analysis.
3. **Other Materials:**
  - Soil, aggregate, metals, and plastics samples for experiments.
  - Standardized experimental setups.

## **Suggested Project List:**

1. Comparative analysis of permeability in natural and compacted soils.
2. Stress-strain behavior of a composite material under varying temperatures.
3. Study of thermal diffusivity in agricultural soils with different moisture contents.
4. Analysis of the mechanical strength of 3D-printed materials versus traditional materials.

## **Suggested Activities for Students:**

1. Create a mini-report on the engineering properties of locally available materials.
2. Design an experiment to measure an unconventional property (e.g., bio-based material properties).
3. Participate in a field survey to collect material samples for lab testing.
4. Develop a Python-based tool for plotting experimental results.

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