



# GUJARAT TECHNOLOGICAL UNIVERSITY

## BACHELOR OF ENGINEERING

Subject Code : 3165106

Subject Name :Engineering Properties of Biological Materials

WEF Academic Year :	2023-24
Semester :	6
Category of the Course :	Open Elective - II

### Prerequisite:Nil

**Rationale:**Study about different engineering properties of foods is necessary to understand to determine the quality. It is important to gain knowledge of engineering properties during processing, packing, storage and transport. This subject will also impart knowledge about electrical properties of food and its applications in food engineering

### Course Scheme:

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Practical		
				ESE (E)	PA(M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

### Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	<b>Introduction</b> Classification and importance of engineering properties of Agricultural Produce	2	05
2	<b>Physical properties</b> shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area of grains, fruits and vegetables.	5	20
3	<b>Thermal properties</b> Heat capacity, Specific heat, Thermal conductivity, Thermal diffusivity, Heat of respiration; Co-efficient of thermal expansion	5	20
4	<b>Frictional and Aerodynamic properties</b> Static friction, Kinetic friction, rolling resistance, angle of internal friction, angle of repose, Flow of bulk granular materials, Aero dynamics of agricultural products, drag coefficients, terminal velocity.	4	20
5	<b>Rheological properties</b> Force, deformation, stress, strain, elastic, plastic and viscous behaviour, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non-Newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic, Rheopectic and Bingham Plastic Foods, Flow curves.	6	20
6	<b>Electrical properties</b>	4	15



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	Dielectric loss factor, loss tangent, A.C. conductivity and dielectric constant, method of determination. Application of engineering properties in handling processing machines and storage structures		
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### Reference Book:

- 1) Mohesin, N.N. 1980. Physical Properties of Plants & Animals. Gordon & Breach Science Publishers , New York.
- 2) Mohesin, N.N. 1980. Thermal Properties of Foods and Agricultural Materials. Gordon & Breach Science Publishers , New York.
- 3) Prentice, J.H. 1984. Measurement in Rheological Properties of Food Stuffs. Elsevier Applied science Pub. Co. Inc. New York.
- 4) Rao, M.A. and Rizvi, S.H., 1995. Engineering Properties of Foods. Marcel Dekker Inc. New York.
- 5) Singhal O.P.& Samuel D.V.K. 2003. Engineering Properties of Biological Materials. Saroj Prakashan.

### Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level*
01	Identify the basic structure and importance of engineering properties of foods	RM
02	Understand different physical, thermal, frictional and aerodynamic properties of food materials and its application in food processing operations.	UN
03	Apply the rheological physical properties of food materials to design equipments.	AP
04	Discriminate between various foods based on its rheological state such Newtonian and non-Newtonian fluids.	AN
05	Develop food equipments based on thermal, electrical and magnetic properties of food	EL

\*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

### Suggested Course Practical List:

- 1) Determination of the size, shape, sphericity of food products.
- 2) Determination of roundness and roundness ratio of agricultural produce.
- 3) Determination of volume and surface area of grain, fruits and vegetables.
- 4) Determination of bulk density, true density and porosity of food grains.
- 5) Determination of porosity and specific gravity of grains.
- 6) Determination of frictional properties (angle of repose and coefficient of friction) of food grains.
- 7) Determination of average particle size and distribution of powdered material.
- 8) Determination of color of various food grains, fruits, vegetables, spices and processed foods by hunter color lab.
- 9) Determination of rheological properties of food material by viscometer.
- 10) Determination of electrical properties of food materials.

### List of Laboratory/Learning ResourcesRequired:

#### Equipment:

- 1) Digital Vernier Calipers



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- 2) Weighing balance
- 3) Angle of repose measurement apparatus
- 4) Tilting table apparatus for coefficient of friction
- 5) Terminal velocity measurement set up with Anemometer
- 6) Brookfield viscometer
- 7) Hunter colorimter

### List of Open Source Software/learning website:

- 1) <https://agrimoon.com/wp-content/uploads/Engineering-Properties-of-Biological-Materials-and-Food-Quality.pdf>
- 2) [https://ecourses.icar.gov.in/e-Learningdownload3\\_new.aspx?Degree\\_Id=04](https://ecourses.icar.gov.in/e-Learningdownload3_new.aspx?Degree_Id=04)

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