I. Course Title : Application of Engineering Properties in Food Processing

II. Course Code : PFE 508

III. Credit Hours : 2+1

IV. Aim of the course

To acquaint the students with different techniques of measurement of engineering properties and their application in the design of processing equipment.

V. Theory

Unit I

Physical characteristics of different food grains, fruits and vegetables: Shape and size, description of shape and size, volume and density, porosity, surface area. Rheology: ASTM standard, terms, physical states of materials, classical ideal material, rheological models and equations, viscoelasticity, creep-stress relaxation, non-Newtonian fluid and viscometry, rheological properties, force, deformation, stress, strain, elastic, plastic behaviour.

Unit II

Contact stresses between bodies, Hertz problems, firmness and hardness, mechanical damage, dead load and impact damage, vibration damage, friction, effect of load, sliding velocity, temperature, water film and surface roughness. Friction in agricultural materials, rolling resistance, angle of internal friction, angle of repose, flow of bulk granular materials, aero dynamics of agricultural products, drag coefficients, terminal velocity.

Unit III

Thermal properties: Specific heat, thermal conductivity, thermal diffusivity, methods of determination, steady state and transient heat flow. Electrical properties: Dielectric loss factor, loss tangent, A.C. conductivity and dielectric constant, method of determination, energy absorption from high frequency electric field.

Unit IV

Application of engineering properties in design and operation of agricultural equipment and structures.

VI. Practical

Experiments for the determination of physical properties like length, breadth, thickness, surface area, bulk density, porosity, true density, coefficient of friction, angle of repose and colour for various food grains, fruits, vegetables, spices and processed foods, aerodynamic properties like terminal velocity, lift and drag force for food grains, thermal properties like thermal conductivity, thermal diffusivity and specific heat. Rheological properties: firmness and hardness of grain, fruits and stalk, electrical properties like dielectric constant, dielectric loss factor, loss tangent and A.C. conductivity of various food materials.

VII. Learning outcome

Student's capability to apply properties of food for design of equipment and structures.

VIII. Lecture Schedule

S.No.	Topic	No. of Lectures
1.	Physical characteristics of different food grains, fruits and vegetables: Shape and size, description of shape and size.	3
2.	Volume and density, porosity, surface area.	1
3.	Rheology: ASTM standard, terms, physical states of materials, classical ideal material.	2
4.	Rheological models and equations, visco elasticity.	2
5.	Creep-stress relaxation, non-Newtonian fluid and viscometry.	1
6.	Rheological properties, force, deformation, stress, strain, elastic, plastic behavior.	1
7.	Contact stresses between bodies, Hertz problems, firmness and hardness	1
8.	Mechanical damage, dead load and impact damage.	2
9.	Vibration damage, friction, effect of load, sliding velocity.	1
10.	Temperature, water film and surface roughness.	1
11.	Friction in agricultural materials, rolling resistance, angle of internal friction, angle of repose.	2
12.	Flow of bulk granular materials.	1
13.	Aero dynamics of agricultural products, drag coefficients, terminal velocity.	3
14.	Thermal properties: Specific heat, thermal conductivity, thermal diffusivity.	1
15.	Methods of determination, steady state and transient heat flow	1
16.	Electrical properties: Dielectric loss factor, loss tangent.	1
17.	A.C. conductivity and dielectric constant, method of determination.	2
18.	Energy absorption from high frequency electric field.	1
19.	Application of engineering properties in design and operation of agricultural equipment and structures.	3
	Total	**30**

IX. List of Practicals

S.No.	Topic	No. of Practicals
1.	To determine the size of grains, pulses, oil seeds, spices, fruits and vegetables.	1
2.	To determine the shape of various food grains and fruits and vegetables.	1
3.	To determine the bulk density of food grains and fruits and vegetables.	1
4.	To determine the particle density/true density and porosity of solid grains.	1
5.	To study the comparison pycnometer for finding the particle density of food grains.	1
6.	To determine the angle of repose of grains, oilseeds etc.	1
7.	To find the coefficient of external friction for different food grains.	1
8.	To determine the coefficient of internal friction of different food grains.	1
9.	To plot the normal stress vs. sheet stress curves for different food grains.	1
10.	To study the separating behaviour of a grain sample in a vertical wind tunnel (Aspirator column).	1
11.	To study the thermal properties (thermal conductivity, thermal diffusivity and specific heat) of food grains.	2

S.No.	Topic	No. of Practicals
12.	To determine the Rheological properties: firmness and hardness of grain, fruits, stalk and vegetables.	1
13.	To study the electrical properties (dielectric constant, dielectric loss factor) of various food materials.	1
14.	To study the electrical properties (loss tangent and A.C. conductivity) of various food materials.	1
	Total	**15**

X. Suggested Reading

- Ludger F and Teixeira AA. 2007. *Food Physics Physical Properties - Measurement and Application*. Springer.
- Mohesenin NN. 1980. *Thermal Properties of Foods and Agricultural Materials*. Gordon and Breach Science Publisher.
- Mohesenin NN. 1980. *Physical Properties of Plant and Animal Materials*. Gordon & Breach Science Publisher.
- Peleg M and Bagelay EB. 1983. *Physical Properties of Foods*. AVI Publisher.
- Peter B. 2007. *The Chemical Physics of Food*. Wiley-Blackwell.
- Rao MA and Rizvi SSH. 1986. *Engineering Properties of Foods*. Marcel Dekker.
- Singhal OP and Samuel DVK. 2003. *Engineering Properties of Biological Materials*. Saroj Prakasan.
- Sitkei. 1986. *Mechanics of Agricultural Materials*. Elsevier.

I. Course Title : Food Quality and Safety

II. Course Code : PFE 509

III. Credit Hours : 2+1

IV. Aim of the course

To acquaint and equip the students with the latest standards to maintain food quality and safety.

V. Theory

Unit I

Food safety:Need for quality control and safety, strategy and criteria, microbiological criteria for safety and quality, scope of food toxicology, toxic potential and food toxicants, biological and chemical contaminants.

Unit II

Food additives and derived substances, factors affecting toxicity, designing safety in products and processes, intrinsic factors, establishing a safe raw material supply, safe and achievable shelf life.

Unit III

Process equipment and machinery auditing, consideration of risk, environmental consideration, mechanical quality control.

Unit IV

Personnel hygienic standards, preventative pest control, cleaning and disinfesting system, biological factors underlying food safety.