Dimensional analysis and similitude: Rayleigh's method and Buckingham's `pi' theorem, types of similarities, dimensionless numbers; Introduction to fluid machinery.

Practical

Study of manometers and pressure gauges; Study of transmissibility of liquid pressure; Study of various types of flow such as laminar flow, uniform flow, steady flow, vertex flow, rotational flow;   Determination of meta-centric height; Verification of Bernoulli's theorem, determination of coefficient of discharge of venturi-meter and orifice meter; Determination of coefficient of friction in pipeline; Determination of coefficient of discharge for rectangular and triangular notch; Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice; Determination of coefficient of discharge for mouth piece; Determination of efficiency of hydraulic ram; Measurement of velocity by current meter; Study of open channel flow: velocity distribution in open channels and determination of Manning's coefficient of Rugosity and Chezy's roughness coefficient; Study of various types of models and prototypes: geometrical, kinematic and dynamic similarities; Study on non-dimensional constants such as Froude's number and Reynold's number; Study of various types of pumps and its components.

Suggested Reading

1. Bansal, R. K. 2019. *A Text book of Fluid Mechanics*. Laxmi Publications, New Delhi.
2. Ramanuthan, S. 2011. *Hydraulics, Fluid Mechanics & Hydraulic Machines*. Dhanpat Rai & Sons, Delhi.
3. Khurmi, R. S. and Khurmi, N. 1987. *Hydraulics, Fluid Mechanics and Hydraulic Machines*. S. Chand & Co. Ltd., New Delhi.
4. Modi, P. N. and Seth, S. M. 2017. *Hydraulics & Fluid Mechanics including Hydraulic Machines*. Standard Book House, Delhi.

Engineering Properties of Agricultural Produce and Food Science   3 (2+1)

Objective

To make the students acquainted with the different engineering properties of agricultural produce and to help them understand the importance of these properties in handling, processing and storage

Theory

Different engineering properties of food and their importance; Application of engineering properties in handling, processing and storage; Physical properties, viz. shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area; Colour properties, CIE colour model.

Thermal properties, viz. heat capacity, specific heat, thermal conductivity, thermal diffusivity, heat of respiration, co-efficient of thermal expansion; Electrical and dielectric properties as resistance, capacitance, dielectric loss factor, loss tangent, and dielectric constant; Frictional properties, viz. static friction, kinetic friction, rolling resistance, angle of internal friction, angle of repose, flow of bulk granular materials; Aero-dynamic characteristics such as drag coefficient, terminal velocity.

Rheological characteristics of food, elastic, plastic and viscous behaviour, visco-elasticity; rheological models to explain food characteristics; Fluid behaviour as Newtonian, non-Newtonian, pseudo-plastic, dilatant, thixotropic, rheopectic and Bingham plastic; Textural characteristics of foods.

Non-destructive methods of quality determination of foods; Principles of machine vision systems, spectroscopy, hyperspectral imaging and acoustic techniques.

Introduction to food science and food technology; Biochemical reactions involved in food processing and storage; Food spoilage agents, general methods for food preservation (physical, chemical and biological methods); Food microbiology: Classification of microorganisms, multiplication of bacteria, Different beneficial and harmful microorganisms in relation to food preservation and spoilage, industrial bacteriology and food fermentation.

Practical

Determination of the size of grains, fruits and vegetables using measuring instruments and using projection system; Determination of the shape (sphericity and roundness); Determination of the bulk and particle volume, bulk and particle density, specific gravity and porosity of grains; Determination of the volume, density and specific gravity of large individual objects (F and V); Determination of the surface area of the F and V; Determination of angle of repose, co-efficient of friction of different grains on different surfaces and angle of internal friction; To study the terminal velocity of grains and separating behavior of grains in a vertical wind tunnel; Determination of specific heat and thermal conductivity of some food grains; Determination of electrical properties of food materials; Determination of hardness of food materials; Determination of viscosity of food; Study and comparison of colour of food materials; Determination of carbohydrates; Determination of total nitrogen; Determination of oil content; Determination of ash content; Study of different types of microorganisms and microbiological examination of food products.

Suggested Readings

1. Mohesin, N. N. 1980. *Physical Properties of Plants & Animals*. Gordon & Breach Science Publishers, New York.

2. Rao, M. A. and Rizvi, S. H. 1995. *Engineering Properties of Foods*. Marcel Dekker Inc. New York.

3. Serpil, S. and Servet, G. S. 2005. *Physical Properties of Foods*. Springer Science+Business Media, LLC, 233 Spring Street, New York.

4. Singhal, O. P. and Samuel, D. V. K. 2003. *Engineering Properties of Biological Materials*. Saroj Prakasan, New Delhi.

Farm Machinery and Equipment- I   3 (2+1)

Objective

To make the students acquainted with the basic construction and operational features of different farm machineries used in operations such as seed-bed preparation, sowing, planting and transplanting, etc., and their economics of operation