

20FT006 - ADVANCES IN FOOD ENGINEERING

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3	-	2	4

L	T	P
45	15	-

WA/RA	SSH/HSB	CS	SA	S	BS
15	30	-	5	5	-

Course Description and Objectives:

This course deals with technologies related to handling, processing, and storage of 'fruits and vegetables' and 'Cereal and Pulses'. The objective of this course is to impart skill and knowledge required to apply the principles and concepts behind 'fruit and vegetable' and 'cereals and pulses' processing including post-harvest handling, specific processing techniques, quality analysis and stabilizing shelf life of the products.

Course Outcomes:

Upon successful completion of this course student should be able to:

- CO1: Understand the physical, chemical, and mechanical properties of food and their handling and storage.
- CO3: Apply the knowledge of properties in the designing of food processing equipments.
- CO4: Gain practical knowledge of food properties.
- CO5: Develop the conceptual knowledge of food properties which can be utilized at industrial level.

SKILLS

- ✓ Perform cumulative and differential particle size analysis.
- ✓ Identify the suitable mixer required for mixing cohesive and non-cohesive solids.
- ✓ Recognize the required specifications of the size reduction equipment for a given feed.
- ✓ Identify the filtration equipment required for a specific application.
- ✓ Compare the efficiency of separation, size reduction, mixing and drying equipment.

ACTIVITY:

Report on processing and storage equipment and plant set up for a particular food processing plant.

UNIT - I

ENGINEERING PROPERTIES OF BIOLOGICAL MATERIALS

Physical characteristics: Shape and size, description of shape and size, volume and density, porosity, surface area and their methods of determinations. Rheological properties: physical states of a material, classical ideal materials, rheological models and rheological equations, visco-elasticity, creep-stress relaxation, Non-Newtonian fluid and viscometry, rheological properties of solid and liquid food, force, deformation, stress, strain, elastic, plastic behaviour. Thermal properties: Specific heat, thermal conductivity, thermal diffusivity, methods of determination, steady state and transient heat flow.

UNIT - II

TRANSPORT PROCESSES IN FOOD ENGINEERING

Heat Transfer- Fourier's law, conduction, convection and radiation heat transfer, steady state and transient heat transfer, Mass transfer, molecular diffusion, Fick's law, diffusion in solids, liquids and gases, effective moisture diffusion, heat and mass transfer analogy. Equation of continuity, type of fluid flow and their classifications, Bernoulli's equation, pipe flow, channel flow, flow through porous media

UNIT - III

FOOD EQUIPMENT DESIGN

Design considerations of agricultural and food Processing Equipments. Dryers, working principle RPEC, LSU and Drum Dryer. Determination of heat and air requirement for drying grains. Design of Single effect and multiple effect Evaporators. Working principle and design aspects of material handling equipments like belt conveyor, screw conveyor, bucket elevator and pneumatic conveyors.

UNIT - IV

FOOD PLANT DESIGN

Food Plant Location, Food Plant Layout, Process Selection, Forecasting methods, Facilities & Aggregate Planning, Scheduling Food Plant Operations, Financial Analysis, Process Flow Analysis, PERT/CPM Models, Decision Analysis, Computer Simulation, Feasibility Studies of Food Plant.

UNIT - V

FOOD PROCESS MODELLING

The principles of Modelling, kinetic Modelling, the Modelling of heat and mass transfer; introduction diffusion equation, the Navier-stokes equations, heat and mass transfer in porous media Luikov's equation. Modelling thermal processes: cooling and freezing, introduction

Modelling product heat load during cooling & freezing, Modelling food quality and microbiological safety

LIST OF EXPERIMENTS:

1. Experiment on minimal processing of fruits and vegetables
2. Experiment on microwave heating of food materials
3. Experiments on vacuum dryer
4. Experiments on freeze dryer
5. Experiments on extrusion cooking of foods
6. Experiments on value addition by flaking
7. Experiment on osmotic dehydration of fruits
8. Experiment on canning of fruits and vegetables
9. Experiment on freeze drying of fruits
10. Visit to cold storage
11. Manufacture of fruit squashes, RTS beverages
12. Experiment on irradiation of potatoes
13. Visit to fruit/vegetable processing
14. Experiment on vacuum packaging of fruits
15. Experiment on vacuum packaging of meat and meat products
16. Experiment on vacuum packaging of vegetables
17. Determination of tensile strength and elongation of packaging materials
18. Determination of water absorption of packaging materials
19. Experiments on modified atmospheric storage of fruits and vegetables
20. Experiment on packaging of powdered materials and oils using FFS machines
21. Visit to food industries and familiarize with packaging operations

TEXT BOOKS:

1. Bird R. Byron, Warren E. Stewart and Edwin N. Lightfoot. 2006. Transport Phenomena. Wiley India Pvt. Ltd., New Delhi
2. Earle, R.L. 1985. UNIT Operations in Food Processing. Pergamon Press. London.
3. Geankoplis J. Christie. 1999. Transport Process and UNIT Operations. Third Edition, Prentice Hall of India, New Delhi.

REFERENCEBOOKS:

1. Albert Ibarz, Gustavo V. Barbosa – Canovas, “UNIT Operations in Food Engineering”. 2nd Edition, Taylor & Francis, 2014.
2. Smith, PG. Introduction to food process engineering, 2nd edition, Springer 2011.
3. Chapman & Hall. USA, CBS publications New Delhi, 2007.