# 38 DAIRY ENGINEERING

## Unit 1: Dairy and Food Engineering-I

Basics of fluid mechanics, pumps, Concept of rheology: ideal elastic, plastic and viscous behaviour, viscoelasticity, rheological properties, Food texture, Freezing, freezing curves, freezing time, freezing equipment, freeze drying, freeze concentration.

## Unit 2: Evaporation and Drying

Evaporation techniques and evaporators, drying fundamentals and type of dryers, spray dryer, equipments for separation and product recovery.

## Unit 3: Dairy and Food Engineering-II

Water activity and its measurement methods, water sorption isotherms, sorption hysteresis, IMF and their application; Permeability and shelf-life, permeability to gases and vapours, measurement methods, permeability of multilayer materials, Membrane types, properties and selection of membrane; microwave heating processes and parameters.

## Unit 4: Thermal Engineering

Basics of thermodynamics and heat transfer,vapour and gas power cycles, fins, fin efficiency, effectiveness. Heat Exchangers: classification, LMTD, effectiveness-NTU approach, Fick's law of diffusion, equimodal diffusion, mass transfer coefficients. Dimensionless numbers used in heat and mass transfer.

## Unit 5: Process Equipment Design

Dairy processing equipments, equipment for aseptic processing and packaging, Pressure vessels: codes and regulations, design for pressure and temperature, allowable stress, corrosion control, cylindrical and spherical shells, formed heads, reinforcement openings, tests and non-destructive examination, design and stress evaluation; milk storage tank: horizontal silos, vertical silos, insulated and un-insulated, nozzles and mountings; constructional features and material for high pressure vessels; multi shell construction; solid walled vessel; bracket support; leg support, skirt support, saddle support; construction codes and design considerations for heat exchangers.

## Unit 6: Refrigeration Engineering

Vapour compression refrigeration system: major components and their different types; theoretical and actual vapour compression cycle; Effect of operating parameters on COP; multi-pressure commercial refrigeration systems; Vapour absorption refrigeration system. Heat Pumps: Design and construction of cold storage and air-conditioning systems: cooling loads and

calculation, Psychometry. Equipment selection, insulating materials, vapour barriers, Ice bank tank.

**Unit 7 Instrumentation and Process Control**

Elements of generalized measurement system, static and dynamic characteristics of instruments. Transducers for measurement of process variables like temperature, pressure, flow, level, consistency, pH and humidity. Indicating and Recording Devices: Digital indicators, strip and circular chart recorders. Principles of Automatic Process Control: Process characteristics, control system parameters, discontinuous, continuous and composite control modes, PLC.