

LECTURE SCHEDULE

Department: Dairy Engineering

Course No. - DTE- 221

Course Title: Dairy Process Engineering Credit Hrs- 3 (2+1)

Course Teacher: Dr. Jahangir Badshah

Theory

S. No.	Topics to be covered	No. of Classes
1	Basic principles and difference between Vaporisation and Evaporation. Application of evaporators.	01
2	Factors affecting Boiling points of liquid in evaporation. Need of Vacuum in evaporation of milk.	01
3	Properties of heat sensitivity, Foaming ability, Scaling and effects on operation, Effects on Viscosity. Selection of metals.	01
4	Construction and operation: Different types of evaporators used in dairy industry, short tube Horizontal and vertical evaporators.	01
5	Natural Circulation and Forced convection evaporators. Single effect Rising Film Evaporators. Construction, operation and maintenance.	01
6	Single effect Falling Film Evaporators. Construction, operation and maintenance.	01
7	Calculation of heat transfer area and water requirement of condensers.	01
8	Basic concepts of multiple effect evaporators. Operations and various feeding systems.	01
9	Economy of operation, Thermo processor (TVR).	01
10	MVR system, Care and maintenance of evaporators.	01
11	Construction, operation and maintenance of double effect evaporators with accessories	01
12	Numericals on double effect evaporators.	01
13	Construction, operation and maintenance of Triple effect evaporators with accessories	01
14	Different types of condensers spray ponds and cooling towers.	01
15	Different types of Vacuum producing devices. Liquid ring water vacuum pump and Steam jet ejectors. Single stage and multi-stage.	02
16	Drying: Introduction to principle of drying, Equilibrium moisture constant, bound and unbound moisture.	01
17	Rate of drying- constant and falling rate and related numerical.	01
18	Effect of Shrinkage and effects on properties of powder.	01
19	Classification of dryers- spray and drum dryers.	01

20	Spray drying: Principle of spray drying. Wet bulb temperature and air inlet and outlet temperatures of spray drying. Numerical.	01
21	Components of Spray Dryers: Air heating systems, Atomization and feeding systems.	01
22	Factors affecting bulk density of powder, porosity and angle of repose.	01
23	Spray dryer controls and its effects on moisture content and properties of powder.	01
24	Theory of solid gas separation and principle and working of cyclone separators.	01
25	Bag Filters and control of stack losses. Wet scrubber and stack loss controls.	01
26	Care and Maintenance of drum and spray dryers. Numerical on drum dryers.	02
27	Fluidization: Mechanisms of fluidization characteristics of gas-fluidization systems, Minimum Porosity, Bed Weight, Pressure drop in fluidized bed,	02
28	Application of fluidization in drying, Batch fluidization, Fluidized bed dryers.	01
29	Processing equipments: Mechanization and equipment used in manufacture of indigenous dairy products.	02
30	Ice-cream making equipments.	01
31	Cheese making equipments.	01
32	Packaging machines for milk & milk products.	01
33	Membrane Processing: Ultra filtration, Reverse Osmosis, Nano filtration, microfiltration and electro dialysis.	02
34	Materials for membrane construction for Ultra filtration of milk and Reverse Osmosis of milk.	01
35	Effect of milk constituents on operation and membranes for electro-dialysis.	01
	Total	40

Practical (DTE -221)

S. No.	Practical to be covered	No. of Classes
1	Constructional details, operation and maintenance of Vacuum pan evaporator for production of condensed milk.	01
2	Constructional details, operation and maintenance of single effect falling evaporators.	01
3	Constructional details, operation and maintenance of multiple effect evaporators.	01
4	Visit to Milk Condensing unit in a dairy plant.	01
5	Constructional details, operation and maintenance of spray drier.	01
6	Constructional details, operation and maintenance of butter making equipment.	01
7	Constructional details, operation and maintenance of equipment related to ghee production.	01
8	Constructional details, operation and maintenance of ice-cream making equipment.	01
9	Constructional details, operation and maintenance of cheese making equipment.	01
10	Constructional details, operation and maintenance of reverse osmosis.	01
11	Constructional details, operation and maintenance of ultra filtration system.	01
12	Design problems on double effect evaporator and vacuum pan.	01
13	Visit to a Spray dryer Plant.	01
14	Visit to a Drum Dryer plant.	01
15	Visit to a membrane Filtration plant for Reverse Osmosis.	01
16	Operation and Maintenance of membrane filtration plant.	01
17	Constructional details, operation and maintenance of Vacuum pan evaporator for production of condensed milk.	01
	Total	17

Suggested Reading:

1. Fundamentals of Food Process Engineering by R. Toledo (2000), CBS Publishers & Distributors, Daryaganj, New Delhi -110 002.
2. Theoretical Concepts and Formulas in Food Process Engineering by Md. Irfan Ahmad Ansari (2010), Jain Brothers, Karol Bagh, New Delhi -110 005.
3. Objective Type questions bank on Food Process Engineering and Technology by Md. Irfan Ahmad Ansari (2010), Jain Brothers, Karol Bagh, New Delhi -110 005

4. GATE Solved Problems in Food Process Engineering by Md. Irfan Ahmad Ansari (2018), Jain Brothers, Karol Bagh, New Delhi -110 005.
5. Technology of Dairy Plant Operations by K.P.S. Sangwan (2008), AGROBIOS (INDIA).