EXTENDED LECTURE OUTLINE

PFE6 312 Food and Dairy Engineering (3+1)

Lecture schedule :

1. Introduction to different unit operations in food processing; Process flow charts for preparation of various food products - Jam, Ketchup, Canning
2. Mass and energy balance- basic principle– law of conservation of mass
3. Dehydration of foods : a) Dryers for solid foods, - working principle and operation of direct and indirect type solar dryers, tray dryer, tunnel dryer, vacuum dryer, microwave dryer, freeze dryer. b) Dryers for liquid foods – Working principle and operation of drum dryer, spray dryer and vacuum band dryer
4. Evaporation of food products : Working principle, types of evaporators - working principle of single effect evaporator and multiple effect evaporator, definition of seam economy, factors affecting steam economy.
5. Thermal processing: thermos bacteriology (heat resistance of microbes) - thermophilic, mesophilic, psychrophilic organism, D value(Decimal Reduction Time), Z value and F value,
6. Canning – introduction and process flow chart of canning, retorts – boiling water bath canner, still retort, agitating retort and continuous retort, aseptic processing - process flow chart.
7. Non-thermal processing - working principle of vacuum processing, high pressure processing, PEF processing, Ultrasonication, radiation processing and their applications ; Principles and applications of novel heating methods - ohmic, infrared and dielectric heating
8. Mixing: Theory of mixing of solids and pastes, mixing index, mixers for solids, liquid foods and pastes, viz. tumbling mixer, screw mixer, ribbon mixer, liquid mixers, sigma-blade mixer, anchor and gate agitator;
9. Separation processes: principle and equipment for sedimentation of solids in liquid and solids in air; Principle and operation of tubular bowl centrifuge and disc bowl centrifuge;
10. Filtration: Introduction to filtration, construction and working principles of types of filters as plate and frame filter press, shell and leaf filter, centrifugal filter, rotary drum filter, continuous belt filter;
11. Membrane separation: principle, characteristics and applications of reverse osmosis, nanofiltration, ultra-filtration and microfiltration;
12. Extrusion cooking: working principle, factors affecting extrusion cooking, single and twin-screw extruders.
13. Unit operations in milk processing: Engineering – Density, viscosity, freezing point, Boiling point, color and flavour, thermal – Specific heat, thermal conductivity and thermal diffusivity and chemical properties – Protein, lactose, fat composition
14. Pasteurization – working principle : LTLT & HTST pasteurizer, sterilization – ultra high temperature processing,

15. Homogenization - Principle, advantages, cream separation- working principle of centrifugal cream separator
16. Process flow chart of butter, cheese, paneer and ice cream.
17. Filling and packaging: Selection of different types of packaging materials for different types of food products - Plastic films (PET, HDPE, LDPE, PP), Paper and Paper board , steel cans and aluminium cans and foils and glass;
18. Equipment for filling and packaging of liquid foods - principle of operation - gravity filler, filling by metering, FFS system – verticle form fill seal, Filling of paste - piston type filler, filling of powders – Auger(screw filler); aseptic filling of pouches and bottles
19. Nanotechnology: Introduction and applications in food industry;
20. Basics of food plant design and layout – definition and objectives plant design and layout, basic utilities – water, process steam, fuel, electric power, refrigeration, ETP

Reference Books :

1. Ahmed, T. 1997. Dairy Plant Engineering and Management. Kitab Mahal.
2. Dash, S. K., Chandra, P. and Kar, A. 2024. Food Engineering Principles and Practice. CRC Press, Boca Raton, USA
3. McCabe, W. L., Smith, J. C. and Harriott. 1999. Unit Operations of Chemical Engineering. McGraw Hill.
4. Rao, D. G. 2009. Fundamentals of Food Engineering. PHI learning Pvt. Ltd, New Delhi
5. Singh, R. P. and Heldman, D. R. 1993. Introduction to Food Engineering. Academic Press.
6. Toledo, R. T. 1997. Fundamentals of Food Process Engineering. CBS Publishers