

Sahay KM & Singh KK. 1994. *Unit Operation of Agricultural Processing*. Vikas Publ. House.

Singh RP & Heldman DR. 1993. *Introduction to Food Engineering*. Academic Press.

Singh RP. 1991. *Fundamentals of Food Process Engineering*. AVI Publ.

PFE 504

UNIT OPERATIONS IN FOOD PROCESS ENGINEERING

2+1

Objective

To acquaint and equip the students with different unit operations of food industries.

Theory

UNIT I

Review of basic engineering mathematics; Units and dimensions; Mass and energy balance.

UNIT II

Principles of fluid flow, methods of heat transfer, heat exchangers and their designs.

UNIT III

Psychrometry, dehydration, EMC, Thermal processing operations; Evaporation, dehydration/drying, types of dryers, blanching, pasteurization, distillation, steam requirements in food processing.

UNIT IV

Refrigeration principles and Food freezing. Mechanical separation techniques, size separation equipments; Filtration, sieving, centrifugation, sedimentation. Material handling equipment, conveyors and elevators; Size reduction processes; Grinding and milling.

UNIT V

Homogenization; Mixing- mixers, kneaders and blenders. Extrusion. Membrane technology. Non-thermal processing techniques.

UNIT VI

Food plant design; Food plant hygiene- cleaning, sterilizing, waste disposal methods, engineering aspects of radiation processing. Food packaging: Function materials, technique, machinery and equipment.

Practical

Fluid flow properties, study of heat exchangers problems, application of psychrometric chart, determination of EMC, study of driers, elevating and conveying equipments, size reduction equipments, cleaning and sorting equipments, mixing equipments, sieve analysis, kinetics of fruits and vegetables dehydration, calculation of refrigeration load, food plant design, gas and water transmission rate, solving of numerical problems.

Suggested Readings

Brennan JG, Butters JR, Cowell ND & Lilly AEI. 1990. *Food Engineering Operations*. Elsevier.

Earle RL. 1985. *Unit Operations in Food Processing*. Pergamon Press. Fellows P. 1988. *Food Processing Technology: Principle and Practice*. VCH Publ.

McCabe WL & Smith JC. 1999. *Unit Operations of Chemical Engineering*. McGraw Hill.

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