

17FT009 EQUIPMENT DESIGN AND PROCESS CONTROL

Hours Per Week :

L	T	P	C
3	1	0	4

Total Hours :

L	T	P	WA/RA	SSH/HSB	CS	SA	S	BS
45	15	-	15	30	-	5	5	-

Course Description and Objectives:

This course deals with the principles, mechanism, selection and design of different equipments used in food industry. The objective of this course is to introduce students to a wide range of equipments such as heat exchangers, dryers, freezer, filters for different process operations, their design considerations and material selection.

Course Outcomes:

- know about the designing aspects of food processing equipment
- understand the applications of processing equipment in food industry
- gain knowledge on process parameters in mechanical, thermal and mass transfer operations carried out in food processing.

SKILLS:

- ✓ able to Design common equipment used in food processing industries
- ✓ Perform design calculations for heat exchanger, dryer and evaporators

ACTIVITIES:

- Selection and optimization of operating and performance parameters in different food processing equipments

UNIT – I

Basic Scientific and Engineering principles of equipment design and process control, Properties of substances, chemical equation and stoichiometry, phases and phases rule, material and energy balances, energy balance and open system. Engineering properties of food materials and their significance in equipment design. Principles of CAD and its simple application.

UNIT – II

Design of Vessels: Codes and regulations, Materials of construction, Design for pressures, Design pressure and temperature loadings, allowable stresses, minimum thickness after forming, corrosion mechanism, corrosion control, Design for internal and external pressure, cylindrical and spherical shell, formed heads, re-enforcement openings.

UNIT – III

Design of food storage tank, horizontal and vertical silos, insulated and uninsulated, process plant piping: codes and regulations, testing, fabrication requirements, overall economic and safety considerations, heat exchangers: shell and tube heat exchangers, construction codes, general design considerations, clad tube sheet, plate type exchangers, air cooled heat exchangers, heat exchanger cost economics.

UNIT - IV

Instrument terminology and performance system accuracy, flow sheet symbols, instrument evaluation, electrical, mechanical, magnetic and optical transducers for measurement of process variables like temperature, pressure, flow, level, consistency and humidity, indicating and recording devices: direct acting and servo operated systems, digital indicators, strip and circular chart recorders, electronic data loggers, principles of automatic process control.

UNIT – V

Process characteristics, controller characteristics, closed loop system, pneumatic and electric controllers, final controlling elements, control valves, valve sizing, electronic actuators, motor drives and controls, introduction to programmable logic controllers (PLC): internal structure, interfacing with sensors and actuators, binary logic diagrams and ladder diagrams, choosing a PLC system.

TEXT BOOKS:

1. Considine DM. 1974. Process Instruments and Controls. Mc- Graw-Hill.
2. Considine DM. 1964. Handbook of Applied Instrumentation. Mc- Graw- Hill.
3. Eackman DP. 1972. Automatic Process Control. Wiley Eastern.
4. Evans FL. 1974. Equipment Design Hand Book. Vol. II. Gulf Publ.
5. Foust AS et al. 1960. Principle of UNIT Operations. JohnWiley & Sons

REFERENCE BOOKS:

1. Hesse ND, C.R. &Ruston JH. 1964. Process EquipmentsDesign. Affiliated East-West Press.
2. Kempe's Engineers Year Book 1996.Miller Information Services, UK.
3. Kern DQ. 1965. Process Heat Transfer. McGraw-Hill.
4. Liptak BG. 1995. Process Measurement and Analysis. Butterworth- Heinmann.
5. McCabeWL, Smith JC & Harriott P. 1993. McGraw Hill.