CHEMICAL PROCESS EQUIPMENT DESIGN

Course Code: 15CH1137

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Course Outcomes :

At the end of the Course, the Student will be able to:

CO 1 Introduce the student to the fundamentals of design of flow sheets for the Chemical Process

CO 2 Selection of suitable material of construction for the design and Mechanical Design of Pressure vessels, storage vessels and various components

CO 3 Select and develop Process design of Heat exchangers and evaporators

CO 4 Design methods of Tray towers and Packed towers.

CO 5 Select and Design of Reaction vessels of a given process

UNIT-I (10 Lectures)

INTRODUCTION TO PLANT DESIGN. PROCESS DESIGN DEVELOPMENT:

Design project procedure, design information from the literature, flow diagrams, preliminary design, comparison of different processes, equipment design, scale-up in design. Materials of construction, selection of materials, fabrication of equipment.

UNIT-II (10 Lectures)

MECHANICAL DESIGN OF PROCESS EQUIPMENT:

Pressure vessels – calculation of thickness of cylindrical and spherical shells subjected to internal pressure, heads or covers. Storage vessels – storage of nonvolatile liquids, storage of volatile liquids, storage of gases. Supports for vessels – bracket or lug supports, leg supports, skirt supports, saddle supports.

UNIT-III (10 Lectures)

HEAT TRANSFER EQUIPMENT DESIGN:

Design of double pipe heat exchangers, Shell and tube heat exchangers (1-2,2-4), optimum design and heat recovery, selection of suitable heat exchanger. Design of single and multiple effect evaporators without boiling point elevation.

UNIT-IV (10 Lectures)

MASS TRANSFER EQUIPMENT DESIGN:

Finite-stage contactors- bubble cap tray, sieve tray and valve tray units, maximum allowable vapor velocities, plate and column efficiency, other design factors. Continuous contactors – types of packing, liquid distribution, pressure drop, packing efficiencies. Relative merits of plate and packed towers, selection of contacting equipment.

UNIT-V (10 Lectures)

REACTOR DESIGN:

Types of reactors, process design of batch reactor and continuous flow reactors, selection of reactors, mechanical features of reactor design.

TEXT BOOKS:

1. Coulson J.M and Richardson J.F, "Chemical Engineering", Vol. 6, Pergamon Press, 4th Ed, 2005.
2. Process Equipment Design by M. V. Joshi, 3rd Edition, Macmillan India Limited 2003.

REFERENCES:

1. Backhurst, J.R and Harker, J.H - Process Plant Design, Heieman Educational Books, London (1973).
2. Thakore S.B. and Bhat, B.I, "Introduction to Process Engineering and Design", Tata McGraw-Hill Publishing Co., New Delhi, 2007.
3. Process Heat Transfer: Kern D.Q., McGraw Hill book Co.Inc., 1982
4. Perry J.H "Chemical Engineering Handbook", 7th Edition, McGraw Hill, 1999.