

22PCM304T					Design of Petrochemical Process Equipment					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To introduce basic concepts, and design calculations piping system
- To familiarize basic knowledge on design of storage Tanks
- To enumerate different factors considered in design pressure vessels
- To introduce fundamental concepts on mixing and reactor design

UNIT I: Fundamentals of Piping**12 Hr.**

A brief revision covering friction factor, pressure drop for flow of non-compressible and compressible fluids, (Newtonian Fluids), pipe sizing, Pipes and Tube Standards, Types of valve fittings and Valves, selection of fittings, economic velocity of liquid and gas handling. Pipe line networks and their analysis for flow in branches, restriction orifice sizing. Pipe supports, pressure drop calculations for non-Newtonian fluids. Determination of internal and external design pressures, Pipe line design on fluid dynamic parameter. , selection of valves Design of pipeline for natural gas, Pipeline design for transportation of crude oil. Power required in fan, blower and adiabatic compressor.

UNIT II: Storage Tanks**14 Hr.**

Study of various types of storage vessels and applications, Atmospheric vessels, vessels for storing volatile and non-volatile liquids, storage of gases, Losses in storage vessels, Various types of roofs used for storage vessels, Design of cylindrical storage vessels as per IS: 803- design of base plates, shell plates, roof plates, wind girders, curb angles for self-supporting and column supported roofs. Design of rectangular tanks as per IS: 804. Stresses in the shell of a tall vertical vessel, and period of vibration. Vessel supports- introduction and classification of supports, design of skirt supports considering stresses due to dead weight, wind load, seismic load, design of base plate, skirt bearing plate, anchor bolts, bolting chairs and skirt shell plates Design of saddle supports, ring stiffeners.

UNIT III: Pressure Vessels**14 Hr.**

Stresses due to static loads, thermal stresses, stresses caused by bending and wind loads. Thin and thick wall cylinders under internal and external pressure. Thin and thick-walled spherical shells under internal and external pressure, prediction of failure of vessels by maximum normal stress theory and maximum strain theory., different types of heads, design of stiffening rings, design of nozzle, reinforcement pad, gasket, flanges, agitator, design of jackets for heating and cooling.

UNIT IV: Reactor Vessels & Agitators**12 Hr.**

Agitators: a study of various types of agitators, their selection, application, baffling, agitator, shaft diameter calculations, twisting moment, equivalent bending moment, Power requirement calculate ns for agitation systems.

Reaction vessels: classification, heating systems, design of vessels, study and design of various types of jackets like plain, half coil, channel, limpet oil, study and design of internal coil reaction vessels, heat transfer coefficients in coils.

Max. 52 Hr.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Estimate pressure loss in pipeline networks

CO2: Select proper pipe and pipe fitting based on pressure loss in pipeline

CO3: Analyse various factors effect selection of storage vessels and suggest thickens and dimensional requirement of storage vessels

CO4: Design pressure vessels based on process and external conditions:

CO5: Calculate power requirements of mixing and agitations equipment

CO6: Analyse various factors to Analyse be considered in the design of reacting vessels

TEXT/REFERENCE BOOKS

- (1) Process Equipment Design – M V Joshi & V V Mahajani, 5th Edition, Trinity Press, 2017
- (2) Applied Process Design for Chemical and Petrochemical Plants” vol 1, 2 and 3 Ernest E. Ludwig, Gulf Professional Publishing 3rd Edition , 2001.
- (3) Introduction to Process Engineering and Design by S B Thakore and B I Bhatt, Tata McGraw Hill, 1st Edition, 2007
- (4) Coulson& Richardson’s Chemical Engineering - Vol. 6 by R K Sinnott,CBSPD. 2006
- (5) Process equipment design” by L.E. Brownell and E. Young, John Wiley, New York, 1963

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Part A: 10 Questions each carrying 5 marks

Part B: 5 Questions each carrying 10 marks

Exam Duration: 3 Hr.

50 Marks

50 Marks