GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3733011
Semester – III
Subject Name: Process plant design and flow-sheeting

Type of course: Elective

Prerequisite: The student should have basic understanding of Chemical Engineering Economics and Plant design.

Rationale: Process plant design and flowsheeting involve the understanding of designing the process plants or creating design layouts of plant. It also involves the fundamentals of chemical engineering viz. development of flow diagrams, importance of various design consideration during the development and design of any process. This subject also deals with the basics as well as advanced understanding of various process auxiliaries and utilities used in chemical plant.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

Content:

Sr. No.	Content	Total Hrs
1	Introduction: Basic concepts, General Design Considerations, Process design development, layout of plant items, Economic aspects and optimum design, Practical considerations in design and engineering ethics, Network analysis, PERT/CPM	9
3	Analysis of cost estimation, Factors affecting investment and production costs, Estimation of capital Investment and total product cost, Interests, Time value of money, Taxes and Fixed Charges, Salvage value, Depreciation calculation	6
3	Flow-sheeting: Synthesis of flow sheet: Propositional logic and semantic equations, Deduction theorem, Algorithmic flow sheet generation using P-graph theory, Sequencing of operating units, Feasibility and optimization of flow sheet using various algorithms viz, Solution Structure Generation (SSG), Maximal Structure Generation (MSG), Simplex, Branch-and-bound etc. ,	10
4	Optimum Design and Design Strategy: Break-even analysis, Optimum production rates in plant operation, Optimum batch cycle time applied to evaporator and filter press, Economic pipe diameter, Optimum insulation thickness, Optimum cooling water flow rate and optimum distillation reflux ratio.	8

5	**Process Auxiliaries:** Basic considerations and flow diagrams in chemical engineering plant design. Piping design: Selection of material, pipe sizes, working pressure, Basic principles of piping design, piping drawings, pipe installations, overhead installations, Process steam piping, selection and determination of steam – pipe size, Piping insulation, application of piping insulation, weather proof and fire resisting pipe insulation jackets, piping fittings, pipe joints. Valves: Types of valves, selection criteria of valves for various systems. Pumps: Types of pumps	**12**

Reference Books:

1. M.S. Peters and Timmerhaus, Plant design and Economics for Chemical Engineers, Mc Graw Hill 4th Edition.
2. Anil Kumar, Chemical Process Synthesis and Engineering Design, Tata McGRaw Hill (1982)
3. F.C. Vibrandt and C.E. Dryden, Chemical Engineering Plant Design, McGraw Hill, 5th Edition.
4. Roger Hunt and Ed Bausbacher, Process Plant layout and Piping Design, PTR Prentice-Hall Inc.,
5. Jack Broughton; Process utility systems; Institution of Chem. Engineers, U.K.

Course Outcomes: At the end of the course, the students will be be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Analyze, synthesize, and design processes for manufacturing products commercially	20
CO-2	Recognize economic, construction, safety, operability and other design constraints	35
CO-3	Estimate fixed and working capitals and operating costs for process plants	20
CO-4	Use commercial flowsheeting software to simulate	25