GUJARATTECHNOLOGICALUNIVERSITY

Program Name: M.E. in Chemical Engineering
Level: Post Graduate Degree
Branch: Chemical Engineering
Course/Subject Code: ME01030061
Course/Subject Name: Process Plant Design and flow sheeting

w.e.f.Academic Year:	2024-25
Semester:	1st Semester
Category of the Course:	PEC

Prerequisite:	The student should have basic understanding of Chemical Engineering Economics and Plant design.
Rationale:	Process Plant design and flow sheeting is concern with designing and project development of chemical plant. It also involves the development of plant layout, flow diagrams and various design consideration during the development of project. This subject also deals with the advanced understanding of various process auxiliaries and utilities used in chemical plant.

Course Outcome:

After Completion of the Course, Student will able to:

No	CourseOutcomes
01	Design and develop a chemical process and perform a complete economic analysis of the plant.
02	Evaluate the profitability of process for chemical plant.
03	Use commercial flowsheeting software to simulate plant
04	Analyze optimal condition for plant with process auxiliaries and utilities

TeachingandExamination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	AssessmentPattern andMarks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	ESE (E)	PA/ CA (M)	PA/CA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No.of Hours	% of Weightage
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	8	21
2.	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	14
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	21
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.	9	19
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	25
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

DistributionofTheoryMarks					
RLevel	**ULevel**	**ALevel**	**NLevel**	**ELevel**	**CLevel**
7	21	28	7	7	0

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(asperRevisedBloom'sTaxonomy)

References/SuggestedLearningResources:

(a) Books:

1. M.S. Peters and Timmerhaus, Plant design and Economics for Chemical Engineers, McGraw Hill 4th Edition.
2. F.C. Vibrandt and C.E. Dryden, Chemical Engineering Plant Design, McGraw Hill, 5th Edition.
3. Anil Kumar, Chemical Process Synthesis and Engineering Design, Tata McGRaw Hill (1982)
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.

(b) Opensourcesoftwareandwebsite:

1. NPTEL lecture series
2.DWSIM(open-source CAPE-OPEN compliant chemical process simulator)

SuggestedCoursePractical List:

1. Flowsheeting tutorials in DWSIM (open-source CAPE-OPEN compliant chemical process simulator)
2. Capital cost estimate in DWSIM (estimate capital and operating cost for a chemical plant based on data from the flowsheet)

ListofLaboratory/Learning ResourcesRequired:

SuggestedProject List:

Suggested Activities for Students:

Preparation of power-point slides, which include videos, animations, Pictures, graphics for better understanding theory – The faculty will allocate chapters/part of chapters to groups of students so that the entire syllabus is covered.

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