

GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: Chemical Engineering (05)
SUBJECT NAME: Plant Design & Project Engineering
SUBJECT CODE: 2170503
B.E. 7th Semester

Type of course: Chemical Engineering

Prerequisite: A course on Plant Design and Project Economics (170503)

Rationale: In this subject emphasis is made on economics in the process industries and in design work, because applied economics and plant design deal with practical application of chemical engineering principles. The first part of the course is deal with design aspect, selection of equipments, importance of utilities and auxiliaries for any process industries and second part is deal with various cost involve in industrial processes, capital investments and investment returns, cost estimation and optimum economic design methods. Plant design project economics is introduced to fill the gap between technical knowledge commercial sustainability of any plant by imparting brief description of any plant from top to bottom approach ,where syllabus covers details from equipment design, plant layout, selection criteria's& economics required to make system feasible.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	0	3	70	20	10	0	0	0	100

Contents:

Sr. No.	Content	Total Hrs.	Percentage Weightage
1.	Introduction: Basic considerations in chemical engineering plant design, optimization and feasibility of plant design.	3	6
2.	Process design aspects: Selection of process-factors affecting process selection. Types of project design, Importance of Laboratory development pilot plant, safety factors, types of flow diagrams.	4	7
3.	Selection of process equipments: Standard versus special equipment-material of construction for process equipments, selection criteria, and specification sheets..	4	7
4.	Process auxiliaries and Process utilities Piping design, layout, and supports for piping insulations. Pipe fittings, types of valves, selection of valves, process control and instrumentation control system design. Process water, boiler feed water, water treatment, waste treatment and disposal, disposal, steam, oil heating system, chilling plant, compressed air and vacuum.	6	12

5.	Plant location and layout: Factors affecting plant location, factors in planning layouts, principles of plant layout, use of scale models	7	13
6.	Cost estimation: Cash flow and cumulative cash position for industrial operations, factors affecting estimation of investment and production cost, breakeven point and its significance, total capital investment, fixed and working capital investment & their estimations, type of estimates, cost indexes, method for estimating capital investment,	8	15
7.	Estimation of total product cost Estimation of total product cost: manufacturing cost, general expenses, Manufacturing cost: direct production cost, fixed charges, plant overhead cost.	6	11
8.	Depreciation: Types of depreciation, Method for determining depreciation: straight line method, decline balance method, sum of the year digit method, shrinking fund method etc, single unit and group depreciation, adjustment of depreciation account, evaluation of depreciation methods	6	11
9.	Profitability, alternative investments and replacement: Methods for profitability evaluation, Evaluation of Break Even Point, % rate of return, Practical factors in alternative investment and replacement Studies.	4	7
10.	Project management: Planning of project schedule by BAR CHART, Inventory control scheduling a project using CPM/PERT methods.	6	11

Suggested Specification table with Marks (Theory):

Distribution Of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	15	15	5	5	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. M.S. Peters and Timmerhaus, "Plant design and Economics for Chemical Engineers", McGraw Hill 3rd Edition.
2. F.C. Vibrandt and C.E. Dryden, "Chemical Engineering Plant Design", McGraw Hill Fifth Edition.
3. Coulson & Richardson's Chemical Engineering Volume 6, Butterworth-Heinemann, 1999, 3rd Edition
4. Industrial Engineering and Management by O. P. Khanna, Dhanpat Rai & Sons, 1985 7th Edition.
5. Project Engineering: Suhas Mokashi, Mcmillan Publisher.

Course Outcome:

After successful completion of this course students will be able to,

- To learn basic economic concept, to understand and apply these concepts in the project works undertaken and to chemical engineering situation by solving problems
- Carry out the primary techno-economic feasibility of project.
- Select appropriate process for a project.
- Differentiate the equipment and be able to prepare specification sheet.
- Understand piping and instrumentation diagrams.
- Evaluate the project cost including capital investment, product cost, breakeven point, depreciation cost for equipment and the total project cost.
- Control and schedule of the project using CPME/PERT technique, calculations.
- Solve problems on profitability and replacement analysis.

List of Open Source Software/learning website:

- NPTEL lecture series
- Literature available on Plant design and project Economics.
- MIT Open course lecture on Chemical Reaction Engineering

ACTIVE LEARNING ASSIGNMENTS:

Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus is covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be submitted to GTU.