CHEMICAL ENGINEERING ECONOMICS **Course Code : 315308**

Programme Name/s : **Chemical Engineering**
Programme Code : **CH**
Semester : **Fifth**
Course Title : **CHEMICAL ENGINEERING ECONOMICS**
Course Code : **315308**

I. RATIONALE

Chemical engineering economics is essential for success in the fields of production, management, sales, marketing, and research and development of new chemical projects including plant layout. A plant-design project progresses through several phases, from initial market and economic analysis to commercial production. Chemical engineers must use economic considerations in addition to engineering theories while planning a new chemical plant from plant layout to end product. The present course is designed for better comprehension regarding economic aspects in whole spectrum of installing chemical engineering industry.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

• Assess the economic feasibility of propose project on plant layout

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Prepare layout of chemical industry using principles and factors of plant location and layout
- CO2 - Plan to evaluate feasibility of project using concept of cost
- CO3 - Calculate interest on investment in project
- CO4 - Interpret depreciation for different assets
- CO5 - Apply concept of taxes, insurance and profitability on project

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315308	CHEMICAL ENGINEERING ECONOMICS	CEE	AEC	4	-	-	2	6	2	03	30	70	100	40	-	-	-	-	25	10	125

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 List out the factors to be considered while selecting plant location TLO 1.2 State factors considered while planning layout TLO 1.3 Describe principles of plant layout TLO 1.4 Compare different methods of layout planning TLO 1.5 Explain economic factor considered for plant location and layout	**Unit - I Plant Location & Layout** 1.1 Factors to be considered for selecting plant location: Primary factors and specific factors 1.2 Plant layout: Definition, factors considered in planning layout 1.3 Principles of plant layout 1.4 Methods of layout planning: Unit areas concept, two-dimensional layout, scale models 1.5 Factors to be considered, economic point of view for selecting plant location and layout as a sample (This point to be covered after completion of all units)	Lecture Using Chalk-Board Presentations
2	TLO 2.1 Calculate cost for given industrial operation TLO 2.2 Draw tree diagram showing cash flow for industrial operation TLO 2.3 Describe capital investment TLO 2.4 List factors affecting investment and production cost	**Unit - II Cost and Investment** 2.1 Total cost: Material cost, labour cost, production cost, expenses, fixed and variable overheads, components of cost, simple numerical on cost 2.2 Cash flow for industrial operations 2.3 Capital investment: Introduction to fixed capital investment and working capital investment 2.4 Factors affecting investment and production cost	Lecture Using Chalk-Board Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain terminologies used in economics TLO 3.2 Apply the concepts of ordinary and exact interest to solve financial problems TLO 3.3 Differentiate between compound interest and simple interest TLO 3.4 Compare nominal and effective interest rates	**Unit - III Elements of Economics and Interest** 3.1 Basic terms in economics: Income, investment, reserve, assets and liabilities, utility, market, money trade cycle, profit, price 3.2 Simple interest, ordinary and exact interest, simple numerical 3.3 Compound interest, simple numerical 3.4 Nominal and effective interest rates, simple numerical	Lecture Using Chalk-Board Presentations
4	TLO 4.1 Describe types of depreciation TLO 4.2 Explain cost for maintenance and repair TLO 4.3 Compare straight line method and fixed percentage method TLO 4.4 Calculate depreciation using straight line method and fixed percentage method	**Unit - IV Depreciation** 4.1 Types of depreciation: Physical depreciation and functional depreciation 4.2 Depletion and cost for maintenance and repairs 4.3 Service life and estimated life of manufacturing equipment 4.4 Numerical Methods for determining depreciations: Straight line method, fixed percentage method	Lecture Using Chalk-Board Presentations
5	TLO 5.1 Compare various types of taxes applicable to industries in India TLO 5.2 Classify insurance for a manufacturing unit TLO 5.3 Implement self-insurance strategies within an industrial context TLO 5.4 Explain concept of break-even point	**Unit - V Taxes, Insurances and Profitability** 5.1 Types of taxes: Goods and Service Tax (GST), property, excise and Income Tax (IT) 5.2 Insurance for manufacturing unit 5.3 Self insurance 5.4 Profit, Rate of Return (ROR) on investment, payout period and turnover ratio, Break-Even Point (BEP), chart	Lecture Using Chalk-Board Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Self Learning

- 1. Draw tree diagram (use AUTOCAD/any suitable software) showing cash flow for industrial operation.

2. Prepare report on costing of suggested project.
3. Visit textile / sugar/ chemical / dairy / pharmaceutical / fertilizer/ paper industry and prepare a report on different taxes applicable to concern industry.
4. Visit to nearby chemical industry and prepare report on depreciation of equipment.
5. Visit to nearby chemical industry and prepare report on economics of plant layout.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	-NA-	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Plant Location & Layout	CO1	6	4	4	4	12
2	II	Cost and Investment	CO2	12	4	6	8	18
3	III	Elements of Economics and Interest	CO2,CO3	8	2	4	8	14
4	IV	Depreciation	CO2,CO3,CO4	6	4	4	4	12
5	V	Taxes, Insurances and Profitability	CO2,CO3,CO5	8	4	6	4	14
Grand Total				**40**	**18**	**24**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two Class Test of 30 marks

Summative Assessment (Assessment of Learning)

- End Semester Exam of 70 Marks

XI. SUGGESTED COS - POS MATRIX FORM

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	2	1	2	3	1			
CO2	2	3	2	2	1	2	1			
CO3	2	3	2	2	1	2	1			
CO4	2	3	2	2	1	2	1			
CO5	2	3	2	2	1	2	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Max S. Peters Klaus D. Timmerhaus	Plant Design & Economics for Chemical Engineers	McGraw-Hill, ISBN: 9780072392661, 0072392665
2	Donald E. Garrett	Chemical Engineering Economics	Springer, ISBN: 9789401165440, 9401165440
3	T. R. Banga, S. C. Sharma	Industrial Organisation and Engineering Economics	Khanna, ISBN: 978-81-7409-078-2
4	Thane Brown	Engineering Economics and Economic Design for Process Engineers	CRC Press, ISBN: 9781420008104, 1420008102
5	James R. Couper	Process Engineering Economics	CRC Press, ISBN: 9780203911396, 0203911393

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://archive.nptel.ac.in/courses/103/105/103105166/	Video Lectures
2	https://archive.nptel.ac.in/courses/103/103/103103039/	Video Lectures
3	https://www.nptelvideos.com/lecture.php?id=2864	Video Lectures
4	https://www.nptelvideos.com/lecture.php?id=2868	Video Lectures
5	https://www.nptelvideos.com/lecture.php?id=2870	Video Lectures

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students