Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code: 3150506 Date:27-05-2024

Subject Name: Chemical Process Plant Design & Economics

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define: (1) Salvage value (2) Book value (3) Market Value	**03**
	(b)	Differentiate between batch and continuous process.	**04**
	(c)	Discuss types of flow diagrams in brief.	**07**
Q.2	**(a)**	Explain about Scale Models.	**03**
	(b)	Differentiate between Standard and Special equipment	**04**
	(c)	State and discuss the factors to be considered in selection of the location of a chemical plant.	**07**
		OR	
	(c)	List all points in feasibility survey. Explain 'Markets' & 'Properties of products' with respect to the same.	**07**
Q.3	**(a)**	Write briefly on overhead v/s underground piping.	**03**
	(b)	List methods for determining depreciation. Explain any one in detail.	**04**
	(c)	The fixed cost of steam line for circular pipe is express as: (35x+65) Rs./hr. Cost of loss of heat from pipe is given as: (225/x) Rs./hr. Where x is thickness of insulation, in Cm. Determine the optimum value of thickness and also calculate the total cost of pipe per meter for optimum thickness.	**07**
		OR	
Q.3	**(a)**	List out six important requirements for piping layout.	**03**
	(b)	List out costs involved in Direct and Indirect Cost.	**04**
	(c)	Explain about various utilities in chemical process industries.	**07**
Q.4	**(a)**	The capital cost of a 9 million tones per annum refinery is estimated at Rs.320 crores in 1996 when cost index is 250.What would have been cost of 6 million tones per annum refinery in 1992 when cost index was 200.	**03**
	(b)	Explain: (1) Rate of return (2) Payback period.	**04**
	(c)	The original value of a heat exchanger is Rs, 6.00 lacs. At the end of useful life of 10 years its salvage value is estimated to be Rs. 50,000. Determine the asset value of the heat exchanger at the end of 5 years using: i) Straight line method ii) Sum of years digit method	**07**

OR

Q.4 **(a)** A D Fine Chemicals Ltd. sells a chemical for Rs.120 per kg and it cost Rs. 80 per kg to produce it, and has annual fixed cost of Rs. 12,00,000. How much kg of product will the company need to sell to break-even? **03**

(b) Explain: (1) Battery limit (2) Grass Root Plant **04**

(c) An existing plant has been operating in such a way that a large amount of heat is being lost in the waste gases. It has been proposed to save money by recovering the heat that is now being lost. Four different heat exchangers have been designed to recover the heat, and all prices, costs, and savings have been calculated for each of the designs. The results of these calculations are presented in the table. **07**

Design	No.1	No.2	No.3	No.4
Total initial installed cost ($)	10,000	16,000	20,000	26,000
Operating cost $/year	100	100	100	100
Fixed charges, % of initial cost per year	20	20	20	20
Value of heat saved ($/year)	4100	6000	6900	8850

The company in charge of the plant demands at least a 10 percent annual return based on the initial investment for any unnecessary investment. Only one of the four designs can be accepted. Neglecting effects due to income taxes and the time value of money, which (if any) of the four designs should be recommended?

Q.5 **(a)** Using diagram explain break – even point and discuss importance of break-even analysis. **03**

(b) The total investment for a chemical plant is 50 million, and the working capital is 5000,000. If the plant can produce an average of 8000 kg of final product per day during a 365 day year, what selling price per kg of product would be necessary to give a turnover ratio of 1.0? **04**

(c) Discuss various practical factors of alternative investment and replacement decision. **07**

OR

Q.5 **(a)** Draw a typical master plot plan of an industry. **03**

(b) Sketch tree diagram only for cash flow in an industrial unit. **04**

(c) Write short note on CPM and PERT. **07**

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