Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3150506 Date:15/06/2022

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/explain the following terms in context with plant design and project engineering (i) Battery limit (ii) contingency (iii) grass root plant.	**03**
	(b)	Write in brief note on scale model	**04**
	(c)	How is preliminary and techno-economical feasibility of any project carried out	**07**
Q.2	**(a)**	Define 'pilot plant'. Explain the importance of laboratory development of 'pilot plant'.	**03**
	(b)	Write in brief on types of flow diagrams	**04**
	(c)	The total investment for a chemical plant is ₹ 100 million and the working capital is ₹ 10 million. If the plant can produce an average of 8000 kg of final product per day during a 365 day year, what selling price in ₹ per kg of product would be necessary to give a turnover ratio of 1.0?	**07**
		OR	
	(c)	Justify the various factors to be considered in location of petrochemical complex plant in Gujarat on sound physico- chemical principles?	**07**
Q.3	**(a)**	Write briefly on overhead v/s underground piping	**03**
	(b)	Discuss selection criteria of material handling equipment.	**04**
	(c)	Discuss on piping design and its layout used in chemical industry	**07**
		OR	
Q.3	**(a)**	Discuss advantages of standard equipment over special equipment.	**03**
	(b)	How is a specification sheet for a heat exchanger prepared	**04**
	(c)	A heat exchanger of area 10 m^2 had a cost ₹ 150,000 in 2014. What is the estimated cost of a 15 m^2 heat exchanger in 2021? Assume that the cost index in 2014 was 320 and in 2021 it is 450. Equipment cost-vs-capacity exponent is 0.6.	**07**
Q.4	**(a)**	What is capital investment? List all methods for fixed capital cost estimates	**03**
	(b)	Write in brief on factors to be considered in efficient plant layout	**04**
	(c)	List out factors affecting investment and production cost.	**07**
		OR	
Q.4	**(a)**	Define: Auto ignition temperature, Book value, Functional depreciation	**03**

(b) Discuss cost indices in chemical engineering cost estimation. Explain how will you use the index method **04**

(c) The original value of cyclone separator if ₹ 32,000/- and its salvage value is ₹ 2000/-. The service life is estimated to be 7 years. Determine the asset value at the end of 5 years using **07**

i. Straight line method.
ii. Text Book declining method
iii. Double declining balance method

Q.5 **(a)** Explain continuous process v/s batch process **03**

(b) Discuss on importance of utilities in chemical industry **04**

(c) The annual direct production cost of a plant operating at 60% capacity is ₹1,20,00,000/-. While the sum of total annual fixed charges, overhead cost and general expenses are ₹1,00,00,000. What is the breakeven point in units of production per year if total annual sales are ₹2,80,00,00/- and product sells at ₹2000/- per unit? What were the annual gross earnings and net profit for this plant at 100 % capacity? When income taxes required is 22% normal tax on the total gross earning plus a 26% surcharge on gross earnings above ₹ 25,00,000/-. **07**

OR

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

(b) Two pumps under consideration for installation at a plant have the following capital investments, salvage values and annual interest. **04**

	Capital investment ₹	Salvage value ₹	Interest rate per annum (%)
Pump A	40,000	3900	10
Pump B	50,000	20000	10

If annual cost of capital recovery is same for both the pumps. Then determine what should be the common life of the pumps. Maintenance and operational costs are negligible.

(c) Following activities are part of a front end engineering design project be scheduled using CPM **07**

Activity	Predecessor	Time (Weeks)
A	---	6
B	A	3
C	A	7
D	C	2
E	B.D	4
F	D	3
G	E.F	7

Draw the network and critical path by finding the slack time of each activity. What is the project completion time?

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