Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:3150506 Date:03/02/2021

Subject Name:Chemical Process Plant Design & Economics

Time:10:30 AM TO 12:30 PM Total Marks: 56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Define and explain cost index. Also, state its usefulness.	**03**
	(b)	What is a plant design project? Enlist the stages through which it moves to completion.	**04**
	(c)	With special reference to Break-even point, Explain the factors affecting the estimation of investment and production cost.	**07**
Q.2	**(a)**	Discuss types of flow diagrams in brief.	**03**
	(b)	Write a note on types of valves and selection of valves.	**04**
	(c)	State and discuss the factors to be considered in selection of the location of a chemical plant.	**07**
Q.3	**(a)**	Define the terms: i) Book value ii) Service life iii) Salvage value	**03**
	(b)	Explain types of depreciation according to their causes.	**04**
	(c)	List and explain the items to be considered in estimation of total product cost.	**07**
Q.4	**(a)**	Mention various methods for estimating capital investment.	**03**
	(b)	List the items to be considered for estimating Fixed capital investment and working capital.	**04**
	(c)	The original investment for an asset was Rs. 500000 and the asset was assumed to have a service life of 12 years with Rs. 100000 salvage value at the end of the service life. After the asset has been in use for 5 years, the remaining service life and final salvage value are re-estimated at 10 years and Rs. 50000, respectively. Under these conditions, what is the depreciation cost during the sixth year of the total life if straight-line depreciation is used?	**07**
Q.5	**(a)**	Discuss any three safety aspects to be considered in a chemical plant project.	**03**
	(b)	Differentiate between Standard and Special equipment.	**04**
	(c)	What is BAR chart? Explain planning of a project schedule using it.	**07**
Q.6	**(a)**	Differentiate between continuous process and batch process	**03**
	(b)	Write a note on specification sheet of equipment.	**04**
	(c)	Compare CPM and PERT techniques of project management.	**07**
Q.7	**(a)**	Explain Importance of utility in chemical industry.	**03**
	(b)	Write a short note on pipe fittings.	**04**
	(c)	Discuss various practical factors of alternative investment and replacement decision.	**07**
Q.8	**(a)**	State various waste treatment and disposal methods.	**03**
	(b)	Explain the importance of laboratory development of Pilot plant.	**04**
	(c)	Enlist various methods of Profitability analysis .Explain any two methods in detail.	**07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – WINTER 2021

Subject Code:3150506 Date:23/12/2021

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.**

Q.1	**(a)**	List out names of different types of process flow diagrams.	**03**
	(b)	What are the major components included in detailed equipment flow sheet?	**04**
	(c)	Explain in detail about chemical plant design.	**07**
Q.2	**(a)**	List out six factors affecting investment and production cost.	**03**
	(b)	Explain 'sum of the year digit' method.	**04**
	(c)	What is a pilot plant? Explain semi-commercial and commercial evolutionary stages in a pilot plant.	**07**
		OR	
	(c)	Enlist various factors to be considered for comparison of different processes. Discuss any two of them in detail.	**07**
Q.3	**(a)**	List out six important requirements for piping layout.	**03**
	(b)	Distinguish between standard and special equipment in a chemical plant.	**04**
	(c)	Explain about various utilities in chemical process industries.	**07**
		OR	
Q.3	**(a)**	What is the role of chemical engineer in a chemical process industry?	**03**
	(b)	List out four basic functions of automatic process control.	**04**
	(c)	With suitable example discuss about various factors to be considered in selection of location of a chemical production plant.	**07**
Q.4	**(a)**	With suitable example write in brief about salvage value.	**03**
	(b)	Explain about (i) physical depreciation and (ii) functional depreciation.	**04**
	(c)	What are various methods used for Fixed capital cost estimates? Explain any two of them in detail.	**07**
		OR	
Q.4	**(a)**	With suitable example write in brief about depletion cost.	**03**
	(b)	Explain following cost index: (i) Marshall and Swift Equipment Cost Index (ii) Chemical Engineering Plant Cost Index	**04**
	(c)	Define: Depreciation. The original value of a piece of equipment is Rs. 11, 00,000, completely installed and ready for use. Its salvage value is estimated to be Rs 75,000 at the end of a service life. Estimated service life is 10 years. Determine the asset (or book) value of the equipment at the end of 5 years using following two methods: (i) Straight line method. (ii) Text book declining balance method.	**07**

Q.5 **(a)** Define: (i) payback period (ii) net present worth (iii) rate of return on investment. **03**

(b) Explain electrical hazards and health hazards in chemical process plant. **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.5 **(a)** Answer the followings: **03**

(i) The performance of a specific task in critical path method (CPM) is known as _____.
(a) node.
(b) dummy event.
(c) activity.
(d) contract.

(ii) PERT technique of network analysis is mainly useful for_____?
(a) small projects.
(b) large and complex projects.
(c) research and development projects.
(d) deterministic activities.

(iii) Select the incorrect statement:
(a) A critical path always begins at the very first event.
(b) A critical path always terminates at the last event.
(c) Critical activities control the project duration.
(d) Critical activity is the one for which free float is zero.

(b) Discuss planning of project schedule by 'BAR CHART' in detail. **04**

(c) Write a short note on program evaluation and review technique (PERT). **07**

****

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?

****