Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2170503 **Date: 04/05/2017**

Subject Name: Plant Design & Project Engineering

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.**

Q.1 **(a)** The geographical location of the final plant can have strong influence on the success of the industrial venture. Explain how the geographical and non-geographical factors affect the site selection of a chemical plant. Mention the conventional locational analysis methods. **07**

(b) How does a pilot plant help in gathering information for full scale operation? Is it advisable to dismantle the pilot plant once the full scale operation gets started? Name the types of flow diagrams. **07**

Q.2 **(a)** Enlist the methods for estimating capital investment. Discuss any one of them with further elaboration. What are the selection criteria of the methods? **07**

(b) Define/explain the following terms in context with plant design & economics, citing examples or mathematical correlation and/or additional illustration wherever possible: **07**

(i) Payout period (ii) Cost index (iii) Current and cash ratio (iv) ROI (v) Battery limit (vi) Contingency (vii) Liquid and fixed asset

OR

(b) An existing warehouse is worth $500,000, and the average value of the goods stored in it is $400,000. The annual insurance rate on the warehouse is 1.1 percent, and the insurance rate on the stored goods is 0.95 percent. If a proposed sprinkling system is installed in the warehouse, both insurance rates would be reduced to three-quarters of the original rate. The installed sprinkler system would cost $20,000, and the additional annual cost of maintenance, inspection, and taxes would be $300. The required write-off period for the entire investment in the sprinkler system is 20 years. The capital necessary to make the investment is available. The operation of the warehouse is now giving an 8 percent return on the original investment. Give reasons why you would or would not recommend installing the sprinkler system. **07**

Q.3 **(a)** Explain break-even point with a diagram. Discuss the importance of break even analysis. **07**

(b) What are the different methods of assessing the profitability of a project? **07**

The total investment for a chemical plant is $1 million, and the

working capital is $ 100,000. If the plant can produce an average of 8000 kg of final product per day during a 365 day year, what selling price in dollars per kg of product would be necessary to give a turnover ratio of 1.0?

OR

Q.3 **(a)** Discuss the method for evaluation of total product cost showing the individual components. **07**

(b) State Sixth tenth factor rule. A heat exchanger of area 10 m^2 costed Rs 50,000 in the year 2008, what is the estimated cost of a 15 m^2 exchanger in 2010? Assume that the cost index in 1985 was 270 and in 1987 it is 320. **03+04**

Q.4 **(a)** Discuss the practical factors of alternative investment and replacement decision? **07**

(b) 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 **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

designs. The results of these calculations are presented in the table. 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?

OR

Q.4 **(a)** Discuss with rough sketches different types of pipe fittings with specific uses. What are the advantages and disadvantages of vertical and horizontal layouts? **07**

(b) A proposed chemical plant will require a fixed-capital investment of $10 million. It is estimated that the working capital will amount to 25 percent of the total investment, and annual depreciation costs are estimated to be 10 percent of the fixed-capital investment. If the annual profit will be $3 million, determine the standard percent return on the total investment and the minimum payout period. **07**

Q.5 **(a)** State and explain the factors affecting investment and production cost. **07**

(b) An R & D Project has certain activities to execute. First three of these activities include design (21), building prototype (5) and evaluating equipment (7). The first activity does not have any predecessor, but it is the predecessor of 2nd and 3rd activity. 4th activity is testing of prototype (2), in which building of prototype is **07**

the predecessor. Writing equipment report (5), method report (8), and final report (2) are considered as 5th, 6th and 7th activities. 3rd and 4th activities are the predecessor of 5th and 6th activity. 5th and 6th activities are the predecessors of 7th activity. Construct the network diagram and indicate the critical path. The numbers in the brackets indicate the time (in weeks) required for that particular activity.

OR

Q.5 **(a)** The original investment for an asset was $10,000, and the asset was assumed to have a service life of 12 years with $2000 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 reestimated at 10 years and $1000, respectively. Under these conditions, what is the depreciation cost during the sixth year of the total life if straight-line depreciation is used? **07**

(b) Show with a labeled graph how the asset value of a property varies with time using the straight line, multiple straight lines, SYD and declining balance method. **07**

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