**B.TECH/CHE/6TH SEM/CHEN 3202/2018**

**PROJECT ENGINEERING**

**(CHEN 3202)**

**Time Allotted : 3 hrs Full Marks : 70**

***Figures out of the right margin indicate full marks.***

***Candidates are required to answer Group A and***

***any 5 (five) from Group B to E, taking at least one from each group.***

***Candidates are required to give answer in their own words as far as practicable.***

**Group – A**

**(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**

 (i) Depreciable value is written off at a faster rate in the first half of useful life if depreciation cost is calculated by

(a) declining balance method (b) sinking fund method

(c) straight line method (d) multiple straight line method.

 (ii) Matheson formula for calculation of depreciation cost fails when

(a) salvage value is high

(b) length of service life is low

(c) salvage value is zero

(d) length of service life is high.

 (iii) In an ordinary annuity plan payments are made

(a) at the beginning of each time interval

(b) at the end of each time interval

(c) at any time between beginning and end of each time interval

(d) at the mid point between beginning and end of each time interval.

 (iv) Optimum economic pipe diameter for fluid flow is determined by the

(a) viscosity of the fluid

(b) density of the fluid

(c) pumping cost plus fixed cost of the pipe

(d) pumping cost only.

 (v) Nominal interest rate and effective interest rate will be equal when interest is compounded

(a) monthly (b) continuously

(c) annually (d) daily.

 (vi) A linear optimisation problem can be solved graphically if the solution sets of the decision variables form

(a) concave zone (b) flat zone

(c) convex zone (d) any of the above zone.

 (vii) Free float of an activity in Project network is

(a) min (ES of successor) – EF of current activity

(b) ES – LF

(c) LF – EF

(d) LS – ES.

(Where, Early start = ES, Early finish = EF, Late start = LS & Late finish = LF)

 (viii) If activity 1 has duration of 6 days and is occurring concurrently with activity 2 which has duration of 9 days, and the activity 1 is delayed by 5 days, the project will take for completion

(a) 3 days longer (b) 2 days shorter

(c) 2 days longer (d) 4 days shorter.

 (ix) If there are 3 process streams with their respective enthalpies in a section of operations of a plant, then for obtaining global optimum pinch point temperature difference ($∆T$m), the no. of heat exchangers required will be

(a) 1 (b) 2 (c) 3 (d) 4.

 (x) Economic order / production quantity model is valid for constant demand of a product over the year to

(a) save storage capacity

(b) reduce the total cost of purchase, delivery and storage of the product

(c) reduce the one-time cash flow amount

(d) safeguard the on-shelf quality of products.

**Group – B**

2. (a) How would you proceed to make a pre-design cost estimation for a proposed chemical process plant?

 (b) What is an annuity? An equal amount R is paid every year at the end of the year for n years. If i is the interest rate, find an expression for the amount that would be due after completion of the annuity plan. What would be the present worth of this annuity?

 (c) A loan of Rs.1.0 lakh was made at 8 percent simple interest for 4 years. At the end of this time, no interest had been paid and the loan was extended for 6 more years at a new effective compound interest rate of 9 percent. What is the total amount owed at the end of 14 years if no intermediate payment is made.

**4 + (1 + 3 + 1) + 3 = 12**

3. (a) A reactor has been designed for handling mild corrosive liquids. If the reactor is made of mild steel, it will have an initial installed cost of Rs.2.5 lakh and its useful service life will be 3 years. However, if the reactor is made of stainless steel it will have an initial installed cost of Rs.7.5 lakh and its useful service life will be 12 years. At the end of useful service life the scrap value would be zero for either type of reactor, and both could be replaced at a cost equal to the original price. Money is worth 4 percent compounded annually. By comparing capitalised cost, determine which is reactor is cheaper.

 (b) Write short notes on

(i) Estimation of annual manufacturing cost

(ii) Payout period.

**6 + (3 + 3) = 12**

**Group – C**

4. (a) A company has a total income of Rs.25 × 106 per year. All expenses of the company except depreciation is Rs.15 × 106 lakh per year. At the start of the business it has been estimated that the value of all depreciable items is Rs.21.25 × 106 and service life has been estimated to be 20 years. The salvage value at the end of service life has been estimated to be Rs.1.25 × 106. 45 percent of all profit before taxes must be paid out as income tax. What would be the reduction in income tax charges for the 1st year of operation if the sum-of-the-years-digits methods were used for depreciation accounting instead of straight line method of depreciation accounting.

 (b) An existing plant has been operating in such a way that a large amount of heat is lost in the waste gases. It has been proposed to save money by recovering the heat. Four different heat exchanger have been designed to recover the heat and the following data have been calculated for each of the designs:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Design No.  | 1 | 2 | 3 | 4 |
| Initial installed cost (Rs. in lakh) | 5.0 | 8.0 | 10.0 | 13.0 |
| Operating cost per year (Rs.) | 5000 | 5000 | 5000 | 5000 |
| Fixed charges per year (% of initial cost) | 20 | 20 | 20 | 20 |
| Value of heat saved per year (Rs. in lakh) | 2.05 | 3.0 | 3.45 | 4.42 |

The company in charge of the plant demands at least a 10 percent annual return based on the initial investment for any unnecessary investment. Which of the four designs should be recommended?

**6 + 6 = 12**

5. 225000 kg of a solution of non volatile, non electrolyte solute in water containing 5 percent solid by weight is to be concentrated to 40 percent solid by weight per 24 hour day. A single effect or a multiple effect evaporator can be used and cost of a single effect evaporator of required capacity is 9.0 lakh. Same investment is required for each additional effect. Service life of evaporator has been estimated to be 10 years with a salvage value of Rs.3.0 lakh at the end of service life. Fixed charges other than depreciation amount to 20 percent of initial investment. Cost of steam is Rs.6 per 100 kg and administrative, labour and miscellaneous costs are Rs.2000/- per day, no matter how many evaporator effects are used. Assume that for N-effect evaporator steam economy is 0.9N. Plant will operate 300 days per year.

 If a minimum acceptable return on any investment is 15 percent, how many effects should be used?

**12**

**Group – D**

6. (a) A carpenter makes tables and chairs. Each table can be sold for a profit of Rs.30 and each chair for a profit of Rs.10. The carpenter can afford to spend up to 40 hours per week working and takes six hours to make a table and three hours to make a chair. Customer demand requires that he makes at least three times as many chairs as tables. Tables take up four times as much storage space as chairs and there is room for at most four tables each week. Formulate this problem as a linear programming problem and solve it graphically.

 (b) A public sector company manufactures and sells a telephone answering machine. The company's contribution margin income statement for the most recent year is given below:

|  |  |  |  |
| --- | --- | --- | --- |
| Description | Total (Rs.) | Per unit (Rs.) | % of sales |
| Sales (20,000 units) | 7,20,00,000 | 3600 | 100 |
| Variable expenses |

|  |  |
| --- | --- |
|  |  |

5,40,00,000 | 2700 | -- |
| Contribution margin | 1,8000,000 | 900 |  |
| Fixed expenses | 24,00,000 |  |  |
| Net operating income | 6,00,000 |  |  |

Find out the margin of safety both in rupees and percentage form and break-even sales in volume of sales and rupees.

**6 + 6 = 12**

7. (a) Name the methods of linear optimization and mention the steps involved in solving a linear optimization problem graphically?

 (b) A firm uses milling m/c, grinding m/c & lathe to produce two motor parts. The machining time required for each part , the machining time available on each different machines, the profit on each motor part are given below:

|  |  |  |
| --- | --- | --- |
| Type of Machine | Machining time required for the motor parts | Maximum time available per week (Minutes) |
| I | II |
| Milling m/c | 10 | 4 | 2,000 |
| Grinding m/c | 3 | 2 | 900 |
| Lathe | 6 | 12 | 3,000 |
| Profit/unit (Rs.) | 100 | 40 |  |

Determine the number of parts of I & II to be manufactured /week to maximise the profit with the help of graphical methods of solution for LPP.

**6 + 6 = 12**

**5**

**Group – E**

8. (a) Prepare a table for the following network event in PERT to evaluate different types of floats and standard deviation of the time estimates of each event.



 (b) Define Work Break- down Structure (WBS) with an example.

**6 + 6 = 12**

9. (a) What are the key differences between PERT & CPM network analysis techniques involved in project management & engineering?

 (b) Calculate the slacks for the events and determine the critical path of the network given hereunder. Put the calculations in the tabular form. The activity times are given in days along the arrows logically and the events are numbered from 10 to 80 chronologically.



**6 + 6 = 12**

**6**