

Total No. of Questions :10]

SEAT No. :

**P3997**

**[4959]-1183**

[Total No. of Pages :5

**B.E. (Chemical)**

**PROCESS ENGINEERING COSTING AND PLANT DESIGN**

**(2012 Course) (Semester - II)**

*Time : 2½ Hours]*

*[Max. Marks :70*

*Instructions to the candidates:*

- 1) *Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data, if necessary.*

**Q1)** A project engineer wants to confirm the process of phenol for commissioning purpose. The target is to produce phenol efficiently with high purity and the by-product sale. The literature says, phenol can be produced by five different routes, say Route -1 to Route - 5. How will you select a specific route achieving target comparing the different routes or processes? **[10]**

OR

**Q2)** A reactor, which will contain corrosive liquids, has been designed. The two alternatives are Reactor A & Reactor B given below: **[10]**

Data Type	Reactor - A	Reactor - B
Material	Mild steel	Stainless steel
Installation cost	Rs. 5,000	Rs. 15,000
Service Life	3 years	-
Scrap value	0	0

On the basis of equal capitalized costs for both types of reactors, what should be the useful life period for the stainless steel reactor if money is worth 6% compounded annually?

**P.T.O.**

**Q3)** The total capital investment for a conventional chemical plant is Rs. 15,00,000 and the plant produces 3 million kg of product annually. The selling price of the product is Rs. 0.4 /kg. The working capital amounts to 15% of total capital investment. The investment is from company funds and no interest is charged. The different costs such as raw material cost are Rs. 0.045/kg, labour Rs. 0.04/kg, utilities Rs. 0.25/kg and packing Rs. 0.04/kg. The distribution cost is 5% of total product cost. **[10]**

OR

**Q4) a)** Draw & explain tree diagram showing cash flow for industrial operations. **[5]**

b) Explain the graph of cumulative cash position showing effects of cash flow with time for industrial operation neglecting time value of money. **[5]**

**Q5) a)** A plant produces refrigerators at the rate of 'P' units per day. The variable costs per refrigerator have been found to be Rs.  $47.73 + 0.1 P^{1.2}$ . The total daily fixed charges are Rs. 1750, and all other expenses are constant at Rs. 7325 per day. The profit is selling price per refrigerator minus total cost per refrigerator. Total cost per refrigerator is given as, **[8]**

$$C_T = 47.73 + 0.1 P^{1.2} + (1750 + 7325) / P$$

If the selling price per refrigerator is Rs. 173, determine:

i) The daily profit at a production schedule giving the minimum cost per refrigerator.

ii) The daily profit at a production schedule giving the maximum daily profit.

iii) The production schedule at break-even point.

b) Explain with neat sketch the break-even chart for production schedule and its significance for optimum analysis. **[8]**

OR

- Q6) a)** The annual direct production costs for a plant operating at 70% capacity are Rs. 2,80,000 while the sum of annual fixed charges, overhead costs, and general expenses is Rs. 2,00,000. What is the break-even point in units of production per year if total annual sales are Rs. 5,60,000 and the product sales at Rs. 40 per unit? What were the annual gross earnings and net profit for this plant at 100% capacity in 1988 when corporate income taxes required a 15% tax on the first Rs. 50,000 of annual gross earnings, 25% on annual gross earnings of Rs. 50,000 to Rs. 75,000, 34% on annual gross earnings above Rs. 75,000 and 5% on gross earning from Rs. 1,00,000 to Rs. 3,35,000? [8]
- b) Explain the graphical and analytical general procedure for determining optimum conditions. [8]
- Q7) a)** Explain the composite curves for following heat recovery system. [8]

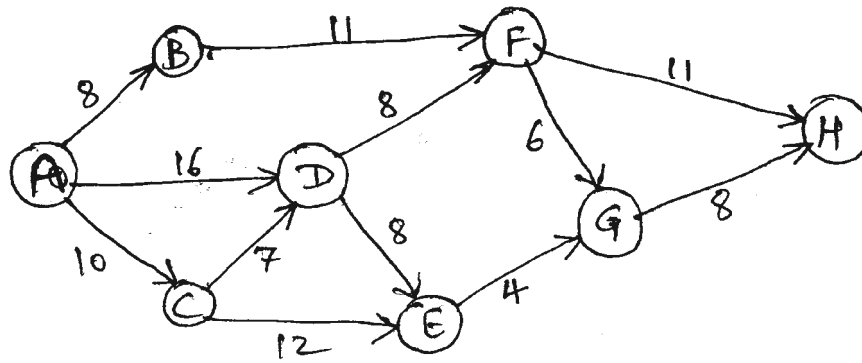
Stream	Type	Supply temperature $T_s, ^\circ\text{C}$	Target temperature $T_t, ^\circ\text{C}$	$\Delta H$ MW	Heat Capacity $C_p$ MW. $\text{K}^{-1}$
$R_1$	Cold	20	180	32	0.2
$R_2$	Hot	250	40	-31.5	0.15
$R_3$	Cold	140	230	27	0.3
$R_4$	Hot	200	80	-30	0.25

- b) Explain in detail the main factors considered while making the techno-economic feasibility study? [8]

OR

- Q8) a)** Write a note on optimum flow rate of cooling water in condenser. [8]
- b) Write an explanatory note on Pinch technology. [8]

Q9) a) Consider the network shown below. Determine the critical path. [9]



The values mentioned are the time values in 'days' and A, B, C, D,... are the events here.

b) A chemical manufacturing company wants to estimate the time for the project. Various activities are identified as 10, 20, 30, ..... etc. The sequence is given below in the data. [9]

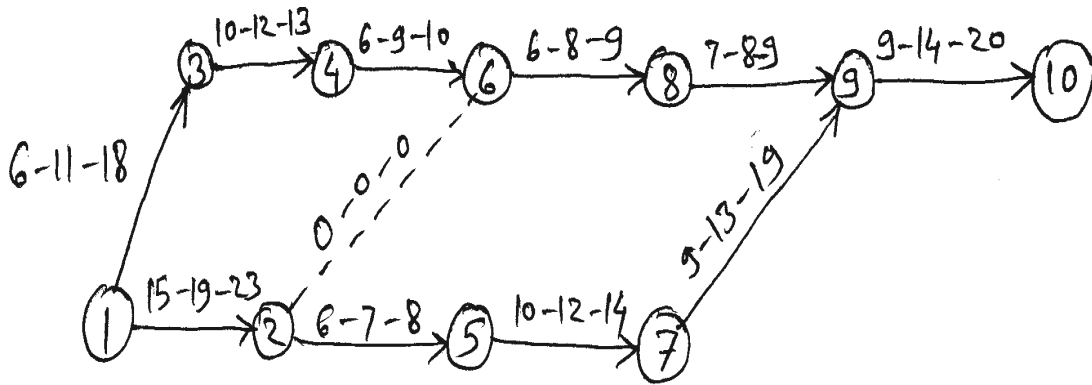
Draw the network for these activity and estimate the time for critical path.

Data:

Activity Sequence	Estimated time in week
(10, 20)	12
(10, 30)	13
(10, 40)	12
(20, 50)	10
(30, 70)	19
(40, 60)	11
(50, 70)	10
(50, 80)	12
(60, 90)	09
(70, 100)	20
(80, 100)	15
(90, 100)	20

OR

Q10)a) Determine the expected time and variance for each activity in the network shown below- [9]



b) Write the steps necessary to draw CPM and differentiate between PERT and CPM. [9]

EEE