

**PROJECT ENGINEERING**  
**(CHEN 4231)**

**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) Which of the following does not come under the purview of structural optimization?
    - (a) Selection of shell-and-tube or plate type heat exchanger
    - (b) Interconnection between reactor and separator
    - (c) Arrangement of reactors in series
    - (d) Allowable pressure drop.
  
  - (ii) Parametric optimization will consider
    - (a) Recycle ratio
    - (b) Stream flow rates
    - (c) Catalyst Temperature
    - (d) All of the foregoing.
  
  - (iii) At the breakeven point,
    - (a) total product cost is less than total income
    - (b) total product cost is equal to the total income
    - (c) total product cost is greater than the total income
    - (d) none of the foregoing is true.
  
  - (iv) The PERT network is
    - (a) a deterministic network
    - (b) a probabilistic network
    - (c) a virtual network
    - (d) sometimes deterministic and sometimes probabilistic.
  
  - (v) The CPM network is
    - (a) a deterministic network
    - (b) a probabilistic network
    - (c) a virtual network
    - (d) sometimes deterministic and sometimes probabilistic.

- (vi) The method of calculation of depreciation which incurs maximum financial protection for the organization is  
(a) declining balance method (b) sum of the years digit method  
(c) sinking fund method (d) straight Line method.
- (vii) Book value of a property  
(a) is the worth of the property in the market  
(b) is the worth of the property as shown in the owner's accounting records  
(c) is independent of time  
(d) cannot be predicted, without experimental determination.
- (viii) The method of calculation of depreciation which incurs time value of money is:  
(a) declining balance method (b) sum of the years digit method  
(c) sinking fund method (d) straight line method.
- (ix) Asset value of a property  
(a) is the worth of the property in the market  
(b) is the worth of the property as shown in the owner's accounting records  
(c) is independent of time  
(d) cannot be predicted, without experimental determination.
- (x) The  $\beta$  distribution is  
(a) synonymous with binomial distribution (b) a discrete distribution  
(c) a skewed distribution (d) both (a) and (b) correct.

### **Group- B**

2. (a) Enumerate the Six major factors/Characteristics for Plant Location/site selection of Chemical Industries. [(CO1)(Remember/LOCQ)]  
(b) Discuss the scale up/scale down concept of a chemical process. [(CO1)(Analyze/IOCQ)]  
**6 + 6 = 12**
3. (a) Enumerate few Safety Measures to be incorporated in a Chemical Project. [(CO1)(Remember/LOCQ)]  
(b) Show that the capitalized cost of an asset can be expressed as  $K_v = C_v + \frac{C_R}{e^{in} - 1}$   
If the interest is compounded continuously, where,  $K_v$  = capitalized cost,  $C_v$  = original cost,  $C_R$  = replacement cost  $i$  = annual interest rate,  $n$  = service life (year). [(CO1)(Analyze/IOCQ)]  
**4 + 8 = 12**

### **Group - C**

4. A piece of equipment having a salvage value Rs. 20,000 is estimated to have a service life of 10 years. The original cost of the equipment was Rs. 2,00,000. Determine the following:

- (i) The depreciation charge for the fifth year if straight line depreciation method is used.
- (ii) The depreciation charge for the fifth year if double declining balance method is used. [[CO2](Evaluate/HOCQ)]
- (6 + 6) = 12**

5. A plant is producing 10,000t/y of a product. The overall yield is 70% on a mass basis (kg of product per kg raw material). The raw material costs Rs. 1,000/t, and the product sells for Rs. 3,500/t. A process modification has been devised that will increase the yield to 75%. The additional investment required is Rs. 35,00,000, and the additional operating costs are negligible. Is the modification worth-making? [[CO2](Evaluate/HOCQ)]
- 12**

### Group - D

6. Set up energy balance equations and find the optimum cooling water flow rate for a condenser used in a chemical plant. Clearly state all assumptions in arriving at your result. [[CO3](Evaluate/HOCQ)]
- 12**
7. Starting from the total mechanical energy balance equation and considering that turbulent flow in the pipe exists for which  $f = Re^{0.16}$ . Determine the economic pipe diameter. State all the assumptions you make in your calculation. [[CO3](Evaluate/HOCQ)]
- 12**

### Group - E

8. Listed in the table are the activities and sequencing necessary for a maintenance job on the heat exchangers in a refinery.

Activity	Description	Predecessor Activity
A	Dismantle pipe connections	---
B	Dismantle heater, closure and floating front	A
C	Remove tube bundle	B
D	Clean bolts	B
E	Clean heater and floating head front	B
F	Clean tube bundle	C
G	Clean shell	C
H	Replace tube bundle	F,G
I	Prepare shell pressure test	D, E, H
J	Prepare tube pressure test and reassemble	I

- Draw a Network diagram of activities for the project. Number the network using Fulkerson's rule. [[CO4](Evaluate/HOCQ)]
- 12**

9. Discuss the difference between PERT and CPM network. State the development of Network techniques from Gantt Chart.

[(CO4)(Analyse/IOCQ)]

**(7 + 5) = 12**

---

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	10.42	27.08	62.5

**Course Outcome (CO):**

After completion of the subject the students will be able to:

1. Understand the basics of project engineering and apply that to organize the activities of project engineering for economic analysis of the project.
2. Apply cost and profitability analysis for the project under considerations and study the preliminary feasibility of the project.
3. Implement innovative ideas to optimization of the plant design components in regard to requirement of energy, time and ultimately cost.
4. Perform network analysis of the project and critically examine the schedule for the completion and cost impacts for the project.

\*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question