

2006 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

IV B.TECH II SEMESTER SUPPLEMENTARY EXAMINATIONS
OPERATIONS RESEARCH
(CHEMICAL ENGINEERING)

APR/MAY 2006

TIME - 3 HOUR
MARK - 80**Answer any FIVE Questions**
All Questions carry equal marks

1. Write an essay on Scope, Methodology and Phases of Operations Research. [16]
2. A firm manufactures three products A, B, and C. Each product is to be processed on three machines X, Y, and Z. The following table gives the processing times in hours and the machine availability and the net profit per unit in Rupees of each product. Product Processing time in Profit per unit in Rupees hours per unit
Machines. X Y Z A 3 2 1 2/- B 4 1 3 4/- C 2 2 3 2.50 Machine Availability In hours. 60 40 30 Formulate the mathematical model of the problem and solve by first simplex method. [16]
3. (a) Explain the concept Johnson Bekman Rule.
(b) Find the sequence that minimizes the total elapsed time required to complete the following jobs.
Job No 1 2 3 4 5 6
Machine A 3 5 4 2 2 1
Machine B 2 8 1 6 3 5 [6+10]
4. The following failure rates have been observed for a certain type of light bulbs: End of week : 1 2 3 4 5 6
7 8 Probability of failure to date : 0.05 0.13 0.25 0.43 0.68 0.88 0.96 1.00 The total no. of bulbs are 1000. The cost of replacing an individual bulb is Rs 1,25 . The decision is made to replace all bulbs simultaneously at fixed intervals and also to replace individual bulbs as they fail in service. If the cost of group replacement is 30 paise per bulb. What is the best interval between group replacements? [16]
5. (a) List the characteristics of competitive games. [4]
(b) Two companies A and B are competing for the same product. Their different strategies are given in the following pay off matrix. Company A
A1 A2 A3
Company B B1 2 -2 3
B2 -3 5 -1 What are the best strategies for both the companies? Find out the value of the Game.
6. The probabilities P_n of n customers in the system for $(M/M/1)=(GD/5/1)$ are given
 n 0 1 2 3 4 5 P_n 0.399 0.249 0.156 0.097 0.061 0.038 The arrival rate λ is 5 customers/hour. The service rate μ is 8 customers/hour.
(a) Compute the probability that an arriving customer will be able to enter the system.
(b) Compute the rate at which the arriving customer will not be able to enter the system.
(c) Compute the expected no. in the system.
(d) Compute the average waiting time in the queue. [16]
7. (a) Perform ABC analysis on the following sample of items in the inventory.

Item Annual Consumption Price / Unit in paise

- A 300 10
- B 2800 15
- C 30 10
- D 1100 5
- E 40 5
- F 220 100
- G 1500 5
- H 800 15
- I 800 5
- J 80 10

(b) Explain VED analysis? [6]

8. Six units of capital can be invested in three plants. Only an integer number of units can be allocated. The expected discounted return from each plant is given below. The objective is to maximize the over all expected return

Expected return	Amount allocated	Plant A	Plant B	Plant C
0	0	0	0	0
1	1	2	1	
2	2	3	2	
3	3	4	3	
4	4	5	5	
5	6	6	8	
6	8	7	9	

(a) the best allocation

(b) the best allocation if only four units of capital are available.

(c) the best allocation if $X_A \geq 2$. (X_A = number of units allocated to plant A),

(d) the best allocation if $X_C \geq ?$