7E4062

B.Tech. (Sem. VII) (Main) Examination, January - 2010
Mechanical Engineering
(TME3 Operations Research)

Time : 3 Hours]

[Total Marks : 80
[Min. Passing Marks : 24

Attempt overall **five** questions selecting **one** question from each unit. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. _____ Nil _____   2. _____ Nil _____

UNIT - I

1 (a) Discuss the various phases in solving an OR problem.

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   (b) Discuss the role of OR in decision making.

4

   (c) Construct the dual of the problem :

   Minimize $Z = x_2 + 3x_3$,

   subject to $2x_1 + x_2 \leq 2$,

   $x_1 + 2x_2 + 6x_3 \geq 5$,

   $-x_1 + x_2 + 2x_3 = 2$.

   $x_1, x_2, x_3 \geq 0$

6

OR

1 A 'XYZ' Company have two bottling plants, one located at 'G' and the other at 'J'. Each plant produces three drinks 'A', 'B' and 'C'. The numbers of bottles produced per day are as follows :

Drink	Plant G	Plant J
Drink A	1,500	1,500
Drink B	3,000	1,000
Drink C	2,000	5,000

The market survey indicated that during the month of April, there will be a demand of 20,000 bottles of drink 'A', 40,000 bottles of drink 'B' and 44,000 bottles of drink 'C'. The operating costs per day of plants at 'G' and 'J' are 600 and 400 monetary units. For how many days each plant be run in April so as to minimize the production cost, while still meeting the market demand ? Solve by two-phase Simplex method.

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UNIT - II

2 A transport company engaged in carrying parcels has three branches to serve five customers. The distance (km) from each branch to each of the customers is given below :

Branches	Customers					No. of trucks available
	A	B	C	D	E	
I	10	8	12	9	3	15
II	4	4	6	6	7	12
III	15	7	11	13	8	16
No. of trucks required	8	8	4	7	6	

If an arrival of a VVIP blocks the traffic from branch I to customers C and D and from branch II to customers D and E, what should be the optimal allocation in order to minimize the total transportation cost ?

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OR

2 (a) The processing times (minutes) taken by 5 operators to make 5 different products are given below. The effective working hours in a day are 6 :

Operators	Products				
	1	2	3	4	5
A	10	12	18	15	9
B	12	10	20	18	10
C	8	9	15	10	8
D	9	8	24	12	12
E	10	15	18	12	10

Profits per product are Rs. 4, 2, 3, 3 and 4 for products 1, 2, 3, 4 and 5 respectively. Find the allocation of erators to products so as to maximize total profit.

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(b) Explain Bellman's principle of optimality.

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UNIT - III

3 A dairy firm wants to determine the quantity of butter it should produce to meet the demand. Past record have shown the following demand patterns :

Quantity Required (kg)	No. of days demand occurred
15	6
20	14
25	20
30	80
35	40
40	30
50	10

The stocks are restricted to the range of 15 to 50 kg. due to inadequate storing facilities. Butter costs Rs. 40 per kg and is sold at Rs. 50 per kg.
(i) Construct a conditional profit table.
(ii) Determine the action alternative associated with the maximization of expected profit.
(iii) Determine EVPI.

5+6+5

OR

3 (a) Explain the branch and bound method in integer programming.
(b) Solve the game whose pay-off matrix is as follows :

Player B

$$
\begin{array}{c|cccc}
 & B_1 & B_2 & B_3 & B_4 \\
\hline
A_1 & 3 & 2 & 4 & 0 \\
\text{Player A} \quad A_2 & 3 & 4 & 2 & 4 \\
A_3 & 4 & 2 & 4 & 0 \\
A_4 & 0 & 4 & 0 & 8 \\
\end{array}
$$

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4   (a)   What is Economic Order Quantity (EOQ)

4

  (b)   Derive the EOQ formula $q_0 = \sqrt{2C_3R/C_1}$. where the symbols having usual meanings.

6

  (c)   What are limitations of EOQ formula and assumptions in EOQ formula ?

6

OR

4   (a)   What is an inventory system ? Explain clearly the different costs that are involved in inventory problems with suitable examples.

8

  (b)   The annual demand for an item is 3200 units. The unit cost is Rs. 6 and inventory carrying charges 25% per annum. If the cost of one procurement is Rs. 150, determine :
    (i)   Economic Order Quantity
    (ii)   No. of orders per year
    (iii) Time between two consecutive orders and
    (iv) Optimal cost.

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UNIT - V

5   (a)   What do you understand by simulation ? Explain briefly the limitations and advantages of simulation.

6

  (b)   Distinguish between mathematical models and simulation models.

4

  (c)   Explain Monte Carlo method of simulation with suitable example.

6

OR

5   (a)   Explain briefly the main characteristics of queueing system. Describe the fundamental components of a queueing system with suitable example.

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  (b)   Obtain the steady equation for the model M/M/1 : FIFO and derive the formula for
    (i)   average number of units in the queue
    (ii)   average waiting time of an arrival in the queue.

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