This question paper contains 4+2 printed pages]

Your Roll No:.....

5601

B.A. (Programme)/II **D**

OPERATIONAL RESEARCH

Paper II—Operational Research–I

(Admissions of 2004 and onwards)

Time : 3 Hours *Maximum Marks : 75*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Answer *Five* questions in all, selecting at least *one* question from each Section. *All* questions carry equal marks.

Section I

(Linear Programming)

1. (*a*) What is linear programming problem ? What are its major assumptions ? 5

(*b*) A firm manufactures two products A and B on which the profits earned per unit are Rs. 3 and Rs. 4 respectively. Each product is processed on two machines M1 and M2. Product A requires one minute

P.T.O.

of processing time on M1 and two minutes on M2, while B requires one minute on M1 and one minute on M2. Machine M1 is available for not more than 7 hours and while Machine M2 is available for 10 hours during any working day. Find the number of units of products A and B to be manufactured to get maximum profit. (Use graphical method). 10

2. Use simplex method to solve the following LPP :

Maximize $z = 4x_1 + 10x_2$

Subject to :

$$2x_1 + x_2 \leq 50$$

$$2x_1 + 5x_2 \leq 100$$

$$2x_1 + 3x_2 \leq 90;$$

x_1 and $x_2 \geq 0$. 15

3. (*a*) Solve the following assignment problem : 10

	A	B	C	D
I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

(*b*) Write the dual of the following linear programming problem : 5

Max. $Z = 6x_1 + 4x_2$

Subject to constraints :

$$2x_1 + 3x_2 \leq 30$$

$$3x_1 + 2x_2 \leq 24$$

$$x_1 + x_2 \geq 3$$

$$x_1, x_2 \geq 0.$$

Section II

(Inventory Management)

4. (*a*) What is Inventory management ? Define the terms set-up cost, holding cost and shortage or penalty cost as applied to an inventory problem. 8

(*b*) The demand for an item is uniform at a rate of 20 units per month. The fixed cost is Rs. 10/- each time a production run is made. The production cost is Re. 1/- per item, and the inventory carrying cost is Re. 0.25 per item per month. If the shortages cost is Rs. 1.25 per item per month, determine how often to make a production run and of what size it should be. ? 7

5. Find the expression for EOQ of the deterministic inventory model with shortages with instantaneous production and fixed order cycle. Usual notations may be used. 15

6. (*a*) Explain ABC analysis. What are its advantages and disadvantages ? 7

(*b*) Find the optimum order quantity for a probabilistic discrete inventory model with uniform demand. Shortages are allowed and fully backlogged. Set up-cost per period is negligible. 8

Section III

(Queueing Theory)

7. (*a*) Define a Queueing system. What are the various characteristics of a Queueing system ? 7

(*b*) Define a Poisson process. State and prove the Markovian property of exponential distribution. 8

8. Derive the steady state probability distribution of the number of units in an M/M/1 : ∞/FCFS Queueing system. Also find the expression for the expected number of units in the system. 15

9. (*a*) In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average 36 minutes. Calculate the following :

(*i*) the mean queue size (line length)

(*ii*) the mean waiting time in the queue and

(*iii*) the probability that the queue size exceeds 10. 8

(*b*) Describe the measures of performance of a Queueing system and Kendall's Notation in Queuing theory. 7