[This question paper contains 6 printed pages.]

1272 *Your Roll No.* .....

B.A. Prog. / II **C**

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

SECTION I

(Linear Programming)

1. (a) Old hens can be bought for Rs. 2.00 each and young ones cost Rs. 5.00 each. The old hens lay 3 eggs per week and the young ones 5 eggs per week, each being worth 30 paise. A hen costs Re. 1.00 per week to feed. If I have only Rs. 80.00 to spend for hens, how many of each kind should I buy to give a profit of more than Rs. 6.00 per week. Assuming that I can not have more than 20 hens ? Write a mathematical model of the problem.

P.T.O.

(b) Use graphical method to solve the L.P.P.

Maximize $Z = 2x_1 + 4x_2$

Subject to, $x_1 + 2x_2 \leq 5$

$x_1 + x_2 \leq 4$

and $x_1, x_2 \geq 0$

2. (a) What is sentivity analysis? Discuss its significance?

(b) Write the dual of the L.P.P.

Maximize $Z = 4x_1 + 6x_2 + 18x_3$

Subject to, $x_1 + 3x_2 \geq 3$

$x_2 + 2x_3 \geq 5$

and $x_1, x_2, x_3 \geq 0$

3. (a) Given $x_{13} = 50$ units, $x_{14} = 20$ units, $x_{21} = 55$ units $x_{23} = 30$ units, $x_{32} = 35$ units, $x_{34} = 25$ units

Is it an optimal solution to the transportation problem.

					Available unit
	6	1	9	3	70
	11	5	2	8	55
	10	12	4	7	90
Required unit	85	35	50	45	

If not, modify it to obtain a better feasible solution.

(b) A department head has four tasks to be performed and three subordinates, the subordinates differ in efficiency, the estimates of the time, each subordinates would take to perform, is given below in the matrix. How should he allocate the tasks one to each man, so as to minimize to total man hours ?

	Man		
Task	1	2	3
I	9	26	15
II	13	27	6
III	35	20	15
IV	18	30	20

SECTION II

4. (a) What are the types of Inventory ? Why are they maintained ?

(b) An oil engine manufacturer purchases lubricants at the rate of Rs. 42 per piece from a vendor. The requirement of these lubricants is 18,00 per year. What should be the order quantity per order, if the cost per placement of an order is Rs. 16, and Inventory carrying charge per rupee per year is only 20 paise.

P.T.O.

5. (a) The demand for a certain item is 16 units per period. Unsatisfied demand causes a shortage cost of Re. 0.75 per unit per short period. The cost of ordering is Rs. 15.00 per order and the holding cost is 15% of average inventory valution per period item cost is Rs. 8.00 per unit. (Assume that shortages are being back ordered at the above mentioned cost. Find the minimum cost purchase quantity.

(b) Explain the significance of lead time and safety stock in inventory control.

6. (a) Explain ABC and VED inventory classification system and indicate their advantages. How can these two system be combined ?

(b) A contractor has to supply 10,000 bearings per day to an automobiles manufacturer. He finds that, when he starts a production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for one year is Rs. 2 and setup cost of a production run is Rs. 1800. How frequently should production run be made ?

SECTION III

(Queuing Theory)

7. (a) What are the limitation of Queuing Theory ? What information can be made by analysing a queuing system ?

   (b) If the number of arrivals in some time interval follows a poisson distribution. Obtain the distribution of the time interval between two consecutive arrivals.

8. For a $\{CM/M/1) : (\infty/f_1 f_0)\}$ Queuing Model, in the steady-state case obtain expression for the mean and variance of queue length in terms of relevant parameter λ and μ.

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) and

   (ii) the probability that the queue size exceeds 10

(b) Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter-arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 lines, one of which is reserved for shunting purpose). Calculate the probability that the yard is empty and find the average queue length.