This question paper contains 6 printed pages.]

5533 *Your Roll No. .....*

B.A. Prog. / II **J**

OPERATIONAL RESEARCH

(A)

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 any **six** questions, selecting at least **one** question from **each** section. All questions carry equal marks.*

SECTION – A

Linear Programming

1. (a) Use simplex method to solve the following L.P.P.

Maximize $Z = 4x_1 + 10x_2$

subject to $2x_1 + x_2 \leq 50$

$2x_1 + 5x_2 \leq 100$

$2x_1 + 3x_2 \leq 90$

$x_1, x_2 \geq 0.$

[P.T.O.

(b) What do you mean by two phase method for solving a given L.P.P. ? Why is it used ?

2. (a) State the general rules for converting any primal L.P.P. into its dual.

(b) Apply the Principle of duality to solve the L.P.P. :

Maximize $Z = 3x_1 + 2x_2$

subject to $x_1 + x_2 \geq 1$

$x_1 + x_2 \leq 7$

$x_1 + 2x_2 \leq 10$

$x_2 \leq 3$

$x_1, x_2 \geq 0.$

3. (a) Use dual simplex method to solve the following L.P.P.

Maximize $Z = -3x_1 - x_2$

subject to $x_1 + x_2 \geq 1$

$2x_1 + 3x_2 \geq 2$

$x_1, x_2 \geq 0.$

(b) Solve graphically the game whose payoff matrix is :

$$\begin{bmatrix} 2 & 3 & 11 \\ 7 & 5 & 2 \end{bmatrix}$$

4. (a) Explain Vogel's Approximation Method for solving a Transportation Problem.

(b) Solve the following Assignment Problem :

Jobs

Machines	I	II	III	IV
A	10	12	9	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

Section B

Inventory Management

5. (a) What do you mean by selective inventory control ? From the following details, draw a plan of ABC selective control.

Item	Units	Unit Cost (Rs.)
1	410	6.20
2	700	5.0
3	1150	7.10
4	2900	0.40
5	300	3.50
6	30	8

7	2400	3
8	60	22
9	3800	1.5
10	150	10
11	6000	0.20
12	4000	0.50

(b) Derive the optimal order quantity and minimum total cost for EOQ problem with finite replenishment rate when no shortages are allowed.

6. (a) Neon lights in an industrial park are replaced at the rate of 100 units per day. The physical plant orders the neon lights periodically. It costs Rs. 100 to initiate a purchase order. A neon light kept in storage is estimated to cost about Rs. 0.02 per day. The lead time between placing and receiving an order is 12 days. Determine optimal inventory policy for ordering the neon lights.

(b) Explain two bin system and periodic review system for the management of inventories.

7. (a) A commodity is to be supplied at a constant rate of 200 units per day. Supplies of any amounts can be had at any required time, but each ordering costs

Rs. 50/- cost of holding the commodity in inventory is Rs. 2 per unit per day while the delay in the supply of the item induces a penalty of Rs. 10/- per unit per delay of 1 day. Find the optimal order quantity and the minimum cost.

(b) Obtain an expression for fundamental EOQ without shortages.

Section C

Queuing Theory

8. Obtain steady state solution for the queuing model M/M/I/∞/FIFO.

9. (a) Derive the differential difference equation for queuing model M/M/I/K/FIFO and solve it to obtain p_0, the probability that the system is empty.

(b) We have a telephone booth with Poisson arrivals spaced 10 minutes apart on the average and exponential call lengths averaging 3 minutes.

(i) What is the probability that an arrival will have to wait more than 10 minutes before the phone is free ?

(ii) What is the probability that it will take him more than 10 minutes altogether to wait for the phone and complete his call ?

(iii) Find the probability that the phone will be in use.

10. (a) Derive the following expressions for M/M/C/∞/FIFO :

(i) the probability that an arrival has to join the queue.

(ii) p_0, the probability that the system is empty.

(b) Explain generalized birth death queuing system and its particular cases.