10. Derive Chapman-Kolmogorov equations.

11. Using geometric programming, solve the following problems

Minimize $z = 2x_1^2 x_2^{-3} + 8x_1^{-3}x_2 + 3x_1x_2$

$x_1, x_2 \geq 0.$

12. What do you understand by a Markov chain? Give suitable examples.

13. Solve the game whose payoff matrix is given by

		Plyaer B		
		B_1	B_2	B_3
Player A	A_1	1	3	1
	A_2	0	–4	–3
	A_3	1	5	–1

14. Solve the following using Lagrangean method :

Optimize $z = 4x_1^2 + 2x_2^2 + 3x_3^2 - 4x_1x_2$

Subject to the constraints :

$x_1 + x_2 + x_3 = 15$

$2x_1 - x_2 + 2x_3 = 20$

$x_1, x_2, x_3 = 0.$

OPERATIONS RESEARCH

Time : Three hours Maximum : 100 marks

SECTION A — (4 × 10 = 40 marks)

Answer any FOUR questions.

1. Write the procedure for two phase simplex method to solve a LPP.

2. A company has three operational departments (weaving, processing and packing) with capacity to produce three different types of clothes namely suitings, shirting woolens yielding a profit of Rs. 2, Rs. 4 and Rs. 3 per metre respectively. One meter of suiting requires 3 minutes in weaving, 2 minutes in processing and 1 minute in packing. Similarly one metre of shirting requires 4 minutes in weaving, 1 minute in processing and 3 minutes in packing. One meter of woolen requires 3 minutes in each department. In a week, total run time of each department is 60, 40 and 80 hours for weaving, processing and packing respectively. Formulate the linear programming problem to find the product mix to maximize the profit.

3. Use simplex method to

Minimize $z = x_2 - 3x_3 + 2x_3$

subject to the constraints :

$3x_2 - x_3 + 2x_5 \leq 7$

$-2x_2 + 4x_3 \leq 12$

$-4x_2 + 3x_3 + 8x_5 \leq 10$

$x_1, x_2, x_3, x_4, x_5 \geq 10.$

4. Tasks A, B,...,H and I constitute a project. With this notation construct the network diagram having the following constraints : A < D, A < E, B < F, D < F, C < G, C < H, F < I, G < I. Find the minimum time of completion of the project, when the time of completion of each task is as follows :

Task :	A	B	C	D	E	F	G	H	I
Time :	8	10	8	10	16	17	18	14	9

5. Obtain the optimal strategies for both – persons and the value of the game for zero sum two – person game whose payoff matrix is as follows :

$$\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}$$

6. Find the optimum integer solution to the following L.P.P.

Maximize $z = x_1 + 4x_2$

Subject to the constraints :

$x_1 + 4x_2 \leq 7$

$5x_1 + 3x_2 \leq 15$

$x_1, x_2 \geq 0$ and are integer.

7. Find the maximum value of

$z = x_1^2 - 2x_2^2 + 3x_2 + x_3$

Subject to the constraints :

$x_1 + x_2 + x_3 \leq 1$

$x_1, x_2, x_3 \geq 0.$

8. Derive Exponential distribution.

SECTION B — (3 × 20 = 60 marks)

Answer any THREE questions.

9. Solve the following separable programming problem :

Minimize $z = x_1 + x_2^4$

Subject to : $3x_1 + 2x_2^2 \leq 9,$

$x_1, x_2 \geq 0.$