Paper Code: MME105	Roll No.

M.Tech.
(SEM I) ODD SEMESTER EXAMINATION 2015-16
Applied Operations Research (MME 105)

Time: 3 hours **Total Marks: 100**

Attempt Any Five Questions. All question carry equal marks.
Use of normal distribution table is permitted.

1. :

a) Model building is the essence of operations research. Discuss **[5]**

b) Discuss and describe the role of linear programming in decision-making bringing out limitations, if any. **[5]**

c) A soft drink company calculated the market share of two of its products against its major competitor, which has three products. The company found out the impact of additional advertisement in any one of its product against the other.

Company A	B1	B2	B3
A1	6	7	15
A2	20	12	10

What is the best strategy for the company as well as the competitor? What is the payoff obtained by the company and the competitor in the long run? Use the graphical method to obtain the solution. **[10]**

2. :

a) Write the dual of the following primal LP problem:

Min $Z_x = 2x_1 + 3x_2 + 4x_3$ subject to i) $2x_1 + 3x_2 + 5x_3 \geq 2$

ii) $x_1 + 4x_2 + 6x_3 \leq 5$ iii) $3x_1 + x_2 + 7x_3 = 3$ and

$x_1, x_2 \geq 0$, x_3 is unrestricted. **[6]**

b) Explain the theory of dominance in the solution of rectangular game. **[5]**

c) At what average rate must a clerk at a super market work in order to ensure a probability of 0.90 so that the customer will not have to wait longer than 12 minutes? It is assumed that there is only one counter at which customers arrive in a Poisson

fashion at an average rate of 15 per hour. The length of service by the clerk has an exponential distribution. **[9]**

3. :

a) Explain ABC analysis. What are its advantages and limitation? **[6]**

b) A 4-ton vessel is loaded with one or more of three items. The following table gives the unit weight, w_i, in tons and the unit revenue r_i in thousands of dollars for item i. How should the vessel be loaded to maximise the total return?

Item i	wi	ri
1	2	31
2	3	47
3	1	14

[14]

4. :

a. What is Stochastic Programming; list the approach to solve a stochastic programming problem? **[5]**

b. The following table gives the cost of transporting material from supply points A, B, C and D to demand E, F, G, H and I

		To				
		E	**F**	**G**	**H**	**I**
From	**A**	8	10	12	17	15
	B	15	13	18	11	9
	C	14	20	6	10	13
	D	13	19	7	5	12

The present allocation is as follows:
A to E 90; A to F 10; B to F 150; C to F 10; C to G 50; C to I 120; D to H 210; D to I 70.

i) Check if the allocation is optimum. If not, find the optimum schedule.

ii) If in the above problem, the transportation cost from A to G is reduced to 10, what will be the new optimum schedule? **[15]**

5. :

a. Find the optimum order quantity for a product for which price breaks are as follows:

Quantity (units)	Price per Unit (Rs)
0 < Q1 < 500	10
500 $\leq$ Q2	9

The monthly demand for the product is 200 units, the cost of storage is 2 per cent of the cost and the cost of ordering is Rs 350 **[15]**

b. Explain graphical method of solving an LP problem. **[5]**

6. **a.** Discuss the role of sensitivity analysis in linear programming. Under what condition is it needed, and under what conditions do you think it is not necessary? **[10]**

b. What is integer linear programming? How does the optimal solution of an integer programming problem compare with that of linear programming? **[10]**

7. **a.** A salesman travels from one place to another; he cannot, however travel from one and back. The distances (in km) between pairs of cities are given below:

		To City			
		P	**Q**	**R**	**S**
From City	**P**		15	25	20
	Q	22		45	55
	R	40	30		25
	S	20	26	38	

The problem is to chalk out a route which enables him to visit each of the cities only once, so that the total distance covered by him is minimum. **[15]**

b. Briefly discuss Birth & Death processes. **[5]**