Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/M.Tech(PE)/SEM-2/PEM-210/2012

2012

APPLIED OPERATIONS RESEARCH

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Graph sheet(s) will be supplied by the Institution.

Answer any *five* questions. 5 × 14 = 70

1. a) Explain how Operations Research can be applied to Productions Engineering as a mathematical modeling technique in order to find out an optimized solution space of a given problem. 4

   b) A firm makes two products X and Y and has a total production capacity of 9 tons per day, X and Y requiring the same production capacity. The firm has a permanent contract to supply at least 2 tons of X and at least 3 tons of Y per day to another company. Each ton of X required 20 machine-hours production time and each ton of Y requires 50 machine-hours production time. The daily maximum possible number of machine-hours is 360. All the firm's output can be sold and the profit made is Rs. 80 per ton of X and Rs. 120 per ton of Y. It is required to determine the production schedule for maximum profit and to calculate this profit. (Use graphical method) 6

   c) Use the graphical method to solve the following LP problem : 4

   Maximize $Z = 15x_1 + 10x_2$

   Subject to the constraints :

   i) $4x_1 + 6x_2 \le 360$

   ii) $3x_1 + 0x_2 \le 180$

   iii) $0x_1 + 5x_2 \le 200$

   $x_1, x_2 \ge 0$

2. a) The *XYZ* manufacturing company can make two products *A* and *B*, each of the products requires time on a cutting machine and a finishing machine. Relevant data are :

	Products	
	P_1	P_2
Cutting hours (per unit)	2	1
Finishing hours (per unit)	3	3
Profit (per unit)	Rs. 6	Rs. 4
Maximum sales (units per week)	—	200

The number of cutting hours available per week is 390 and the number of finishing hours available per week is 810. How much should be produced of each product in order to achieve maximum profit for the company. (Use Simplex method). 12

b) Interpret your answer. 2

3. A dairy firm has three plants located in a state. The daily milk production at each plant is as follows :

Plant 1 : 6 million litres

Plant 2 : 1 million litres

Plant 3 : 10 million litres

Each day, the firm must fulfil the needs of its four distribution centres is given in the following table :

Plant	***Distribution Centre***			
	D_1	D_2	D_3	D_4
P_1	2	3	11	7
P_2	1	0	6	1
P_3	5	8	15	9

Find the initial basic feasible solution for given problem by using :

a) North-west corner method

b) Least cost method

c) Vogel's approximation method

if the objective is to minimize the total transportation cost.

4. A traveling salesman has to visit 5 cities. He wishes to start from a particular city, visit each city once and then return to his starting point. The traveling cost (in '000 Rs.) of each city from a particular city is given below :

To City

		A	**B**	**C**	**D**	**E**
From City	**A**	∞	2	5	7	1
	B	6	∞	3	8	2
	C	8	7	∞	4	7
	D	12	4	6	∞	5
	E	1	3	2	8	∞

5. A company, for one of the *A* class items, placed 6 orders each of size 200 in a year. Given ordering cost = Rs. 600, holding cost = 40%, cost per unit = Rs. 40, find out the loss to the company is NOT operating scientific inventory policy. What are your recommendations for the future ? 12 + 2

6. A project is composed of 7 activities which are listed in the table given below. Activities are identified by their beginning (i) and end (j) node numbers.

Activity	***Estimated time (Weeks)***	***Most Likely (Weeks)***	***Pesimistic Time (Weeks)***
1 - 2	1	1	7
1 - 3	1	4	7
1 - 4	2	2	8
2 - 5	1	1	1
3 - 5	2	5	14
4 - 6	2	5	8
5 - 6	3	6	15

a) Draw the network diagram of the activities in the project.

b) Find the expected duration and variance of each activity.

c) What is the expected project length ?

d) What is the probability that the project will be completed at least 4 weeks earlier than expected time ?

e) If the project due date is 19 weeks, what is the probability of NOT meeting the due date ?

Given Z	0·50	0·67	1·00	1·33	2·00
Probability	0·3085	0·2514	0·1587	0·0918	0·0028

7. A dealer deals in perishable commodity, the daily demand and supply of which are random variables. Records of the past 500 trading days shows the following :

Tons Available	***Number of days***	***Tons Demanded***	***Number of days***
10	40	10	50
20	50	20	110
30	190	30	200
40	150	40	100
50	70	50	40

The trader buys the commodity at Rs. 20 per kg and sells at Rs. 30 per kg. If any of the commodities remains at the end of the day, it has no saleable value. The loss through unsatisfied demand is Rs. 8 per kg. Given the following random numbers of simulate 6 days trading :

3 1 1 8 6 3 8 4 1 5 7 9 0 7 3 2 4 3 7 5 8 1 2 7

Use the random numbers alternatively *i.e.* first pair (31) to simulate supply and second pair (18) to simulate demand.

8. Write short notes on any *four* of the following : $4 \times 3\frac{1}{2}$

a) Dummy activity

b) Critical path

c) EOQ

d) Simulation

e) Non-Linear problems

f) Degeneracy.