Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER– IV • EXAMINATION – SUMMER 2016

Subject Code: 640003 **Date: 31-05-2016**

Subject Name: OPERATIONS RESEARCH

Time:10.30a.m. To 01.00p.m. **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Briefly Explain the Assumptions and General Mathematical Model of LPP. **07**

(b) A firm manufactures two products A and B on machine I and II as shown below: **07**

Machine	Product		Available Hours
	A	B	
I	30	20	300
II	5	10	110
Profit per unit (Rs.)	6	8	

Formulate this as a Linear Programming Problem.

Q.2 **(a)** Use the graphic method to solve the following LPP: **07**

Maximize: $15X_1 + 10X_2$ subject to -

$3X_1 \leq 180$; (ii) $5X_2 \leq 200$ (iii) $4X_1 + 6X_2 \leq 360$; and (iv) $X_1, X_2 \geq 0$

(b) Solve the following LPP by Simplex method: **07**

Maximize: $Z = 21x_1 + 15x_2$

Subject to $-x_1 - 2x_2 \geq -6$; $4x_1 + 3x_2 \leq 12$;

$x_1, x_2 \geq 0$

OR

(b) Use Big –M Method to solve the following PL problem: **07**

Maximize: $Z = 2x_1 + 4x_2$

Subject to the following constraints:

$2x_1 + x_2 \leq 18$; $3x_1 + 2x_2 + \geq 30$; $x_1 + 2x_2 = 26$; and $x_1, x_2 \geq 0$

Q.3 **(a)** Determine an initial basic feasible solution to the following transportation problem using (i) NWCM; (ii) LCM and (iii) VAM: **07**

Source	Destination				
	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	70	20	18
Demand	5	8	7	14	34

(b) What is Operations Research? Briefly explain the application areas of OR. **07**

OR

Q.3 **(a)** Time taken by workers on various jobs (in hours): **07**

Worker	Job				
	A	B	C	D	E
I	10	5	13	15	16
II	3	9	18	13	6
III	10	7	2	2	2
IV	7	11	9	7	12
V	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man-hours? Apply HAM.

(b) A company that operates for 50 weeks in a year is concerned about its stock of copper cable. This costs Rs. 240 a meter and there is a demand for 8,000 meters a week. Each order costs Rs. 1,050 for administration and Rs. 1,650 for delivery, while holding costs are estimated at 25% of value held a year. Help the purchase manager to determine an ordering policy for raw material by calculating – **07**

(a) EOQ; (b) No of orders per annum; (c) Optimum ordering cycle period (d) The minimum yearly variable inventory cost; (e) The minimum yearly total inventory cost.

Q.4 **(a)** (i) Alternative (or Multiple) Optimal Solutions in Linear Programming; **07**

(ii) Maximin Value and Minimax Value in Game Theory

(iii) Event and Activity in PERT/CPM network

(b) The precedence relationships of the activities, and activity time estimates (in Days) of a project is as follows: **07**

Activity	Predecessors	Duration (days)
A	--	6
B	A	4
C	B	7
D	A	2
E	D	4
F	E	10
G	--	2
H	G	10
I	J, H	6
J	--	13
K	A	9
L	C, K	3
M	I, L	5

(a) Draw a network diagram for this project

(b) Indicate the critical path

OR

Q.4 **(a)** What is Simulation? Brief explain the "Monte Carlo" Method of Simulation. **07**

(b) Find the sequence that minimizes the total time required in performing the following jobs on three machines in the order ABC. Processing time in hours is given in the following table: **07**

Job	1	2	3	4	5
Machine A	8	10	6	7	11
Machine B	5	6	2	3	4
Machine C	4	9	8	6	5

Also find the minimum time elapsed and Idle time of each machine.

Q.5 **(a)** Consider the game with the following payoff matrix: **07**

Player – A	Player – B				
	B_1	B_2	B_3	B_4	B_5
A_1	-2	0	0	5	3
A_2	3	2	1	2	2
A_3	-4	-3	0	-2	6
A_4	5	3	- 4	2	6

(i) Determine the saddle point

(ii) Determine the value of game

(iii) Determine the optimal strategies for players A and B

(iv) Is the game fair? Why?

(v) Is the game strictly determinable? Why?

(b) The data collected in running a machine, the cost of which is Rs. 60,000, are given below: **07**

Year	1	2	3	4	5
Resale Value (Rs.)	42,000	30000	20,400	14,400	9,650
Cost of spares (Rs.)	4,000	4,270	4,880	5,700	6,800
Cost of labour (Rs.)	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine.

OR

Q.5 **(a)** A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can, on an average, service 12 customer per hour. After suitable assumptions, answer the following: **07**

a) What is the average number of customers waiting for the service of the clerk?

b) What is the average time a customer has to wait before being served?

c) What is the probability of 3 customers waiting in the queue?

d) What is the expected number of customers in the queue?

(b) Write dual of the following LPP: **07**

Minimize: $Z = 10x_1 + 20x_2$

Subject to: $3x_1 + 2x_2 \geq 18$; $x_1 + 3x_2 \geq 8$; $2x_1 - x_2 \leq 6$; $x_1, x_2 \geq 0$

****