Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER– IV EXAMINATION – SUMMER 2016

Subject Code: 2640003 Date:31-05-2016

Subject Name: Operations Research (OR)

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)** Define Operation Research. Explain the features and application areas of operations research. **07**

(b) **(1)** Construct the dual of the problem **04**

Minimize $Z_x = x_1 - 3x_2 - 2x_3$

subject to the constraints

(i) $3x_1 – x_2 + 2x_3 \leq 7$ (ii) $2x_1 - 4x_2 \geq 12$ (iii) $-4x_1 + 3x_2 + 8x_3 = 10$

and x1, x2 ≥ 0 and x3 unrestricted in sign.

(2) Differentiate between PERT and CPM. **03**

Q.2 **(a)** Solve the following LP problem using simplex method. **07**

Maximize $Z = 16x_1 + 17x_2 + 10x_3$

subject to the constraints

(i) $x_1 + x_2 + 4x_3 \leq 2000$ (ii) $2x_1 + x_2 + x_3 \leq 3600$ (iii) $x_1 + 2x_2 + 2x_3 \leq 2400$

(iv) $x_1 \leq 30$

and $x_1, x_2, x_3 \geq 0$

(b) Solve the following LP problem using Big-M method. **07**

Maximize $Z = 3x_1 – x_2$

subject to the constraints

(i) $2x_1 + x_2 \leq 2$, (ii) $x_1 + 3x_2 \geq 3$, (iii) $x_2 \leq 4$

and $x_1, x_2 \geq 0$

OR

(b) A manufacturer produces two different models, A and B of the same product. The raw materials R1 and R2 are required for production. At least 18 kg of R1 and 12 kg of R2 are must be used daily. Also at most 34 hours of labour are to be utilized. 2 kg of R1 are needed for each model A and 1 kg of R1 for each model B. For each model of A and B, 1 kg of R2 is required. It takes 3 hours to manufacture a model A and 2 hours to manufacture a model B. The profit is Rs.50 for each model A and Rs. 30 for each model B. How many units of each model should be produced to maximize the profit? Formulate this problem as an LP model. (Do Not Solve). **07**

Q.3 **(a)** Find the initial basic feasible solution to the transportation problem in which the cells contain transportation cost in rupees by using. **07**

(i) LCM & (ii) VAM

	D1	D2	D3	D4	Supply
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	950

(b) Explain Errors and Dummies in network diagram with suitable figure. **07**

OR

Q.3 **(a)** Solve the following assignment problem : **07**

	1	2	3	4	5
A	41	72	39	52	25
B	22	29	49	65	81
C	27	39	60	51	40
D	45	50	48	52	37
E	29	40	45	26	30

(b) A plant manager is considering the replacement policy for a new machine. He estimates the following costs (all costs in rupees): **07**

Year	Replacement cost at the beginning of the year	Resale value at the end of the year	Operating costs
1	100	60	25
2	110	50	30
3	125	40	40
4	140	25	50
5	160	10	65
6	190	0	80

Find an optimal replacement policy and its corresponding minimum cost.

Q.4 **(a)** A project has following activities and other characteristics: **07**

Activity	Preceding Activity	Time estimates in weeks		
		Optimistic	Most Likely	Pessimistic
A	—	4	7	16
B	—	1	5	15
C	A	6	12	30
D	A	2	5	8
E	C	5	11	17
F	D	3	6	15
G	B	3	9	27
H	E,F	1	4	7
I	G	4	19	28

Draw the PERT network diagram, identify the critical path and find the project completion time.

(b) What is Simulation? Explain its advantages and disadvantages. **07**

OR

Q.4 **(a)** Briefly Explain the structure of Queuing system. **07**

(b) Attempt the following **04**

1 For what value of λ, the game with following pay-off matrix is strictly determinable?

Player A	Player B		
	B1	B2	B3
A1	λ	6	2
A2	-1	λ	-7
A3	-2	4	λ

2 Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially, with mean 3 minutes. Find: **03**

1. The probability that an arrival finds that four persons are waiting for their turn.
2. The average number of persons waiting and making telephone calls.
3. The average length of the queue that is formed time to time.

Q.5 **(a)** Find an optimal sequence for the following sequencing problems of four jobs and five machines, when passing is not allowed. Its processing time(in hours) is given below: **07**

Jobs:	Machine				
	M1	M2	M3	M4	M5
A	7	5	2	3	9
B	6	6	4	5	10
C	5	4	5	6	8
D	8	3	3	2	6

also find the total elapsed time and idle time for each machine.

(b) What is 'Inventory'? List and explain the different types of Inventories. **07**

OR

Q.5 **(a)** A book binder has one printing press, one binding machine and manuscripts of a number of books. The time required for performing the printing and binding operations on each book are shown below. The binder wishes to determine the order in which the book should be processed, so that the total time required to process all books is minimized. **07**

Book	1	2	3	4	5	6
Printing time(Hours)	30	120	50	20	90	110
Binding time(Hours)	80	100	90	60	30	10

(b) (i) What is Replacement? Describe some important Replacement Situations. **03**

(ii) Write the algorithm for Processing n Jobs 2 machines. **04**

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