Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA - SEMESTER– IV EXAMINATION – WINTER 2016

Subject Code: 2640003 **Date:24/10/ 2016**

Subject Name: Operation Research

Time:10.30 AM TO 01.00 PM **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. Give the main characteristics of operation research. Briefly trace the history of operation research. **07**

(b) Reliance Industry produces two products: X and Y. production of both the products requires the same process – I and II. The production of Y also results in a byproduct Z at no extra cost. The product X can be sold at a profit of Rs 3 per unit and Y at a profit of Rs 8 per unit. Some quantity of this byproduct can be sold at a unit profit of Rs 2, the remainder has to be destroyed and the destruction cost is Rs 1 per unit. Forecasts show that only up to 5 units of Z can be sold. The company gets 3 units of Z for each unit of Y produced. The manufacturing times are 3 hours per unit for X on process I and II, respectively and 4 hours and 5 hours per unit for Y on process I and II, respectively. Because the product Z is a byproduct of Y, no time is used in production Z. the available times are 18 and 21 hours of process I and II, respectively. Formulate this problem as an LP model to determine the quantity of X and Y which should be produced, keeping Z in mind, to make the highest total profit to the company. [DO NOT SOLVE] **07**

Q.2 **(a)** Use the graphical method to solve the following LP problem. **07**

Minimize $Z=3x_1 + 2x_2$

Subject to the constraints,

(i) $5x_1 + x_2 \geq 10$ (ii) $1x_1 + x_2 \geq 6$ (iii) $1x_1 + 4x_2 \geq 12$ and $x_1, x_2 \geq 0$

(b) What is linear programming? Give the mathematical model of linear programming problem. Briefly explain with an example. **07**

OR

(b) (1) With reference to a transportation problem define the following terms. **03**

(i)Feasible solution (ii) Optimum solution (iii) Non-degenerate

(2) Explain the difference between a transportation problem and an assignment problem. **04**

Q.3 **(a)** Use the Simplex method to solve the following LP problem. **07**

Maximize $Z=3x_1+5x_2+4x_3$

Subject to the constraints,

(i)$2x_1+3x_2 \leq 8$ (ii) $2x_2+5x_3 \leq 10$ (iii) $3x_1+2x_2+4x_3 \leq 15$ and $x_1,x_2,x_3 \geq 0$

(b) Determine an initial basic feasible solution to the following transportation problem by using (a) LCM and (b) VAM **07**

Source	Destination				
		D1	D2	D3	D4	Supply
	A	20	21	16	18	10
	B	17	28	14	16	9
	C	29	23	19	20	7
	Demand	7	10	4	5	

OR

Q.3 **(a)** Use the Big-M method to solve the following LP problem. **07**

Minimize $Z=600x_1 + 500x_2$

Subject to the constraints,

(i)$2x_1 + x_2 \geq 80$ (ii) $x_1+2x_2 \geq 6$ and $x_1, x_2 \geq 0$

(b) A salesman has to visit five cities C_1, C_2, C_3, C_4 and C_5. The distances in kilometer between the cities are as follows: **07**

From City	To City					
		C_1	C_2	C_3	C_4	C_5
	C_1	---	17	16	18	14
	C_2	17	---	18	15	16
	C_3	16	18	---	19	17
	C_4	18	15	19	---	18
	C_5	14	16	17	18	---

If the salesman starts from city C_1 and has to come back to city C_1, which route should he select so that total distance travelled by him is minimized?

Q.4 **(a)** (1) Define the following terms: **04**

(i)Payoff matrix (ii) saddle point (iii) two-person zero-sum game (iv) competitive game

(2)What is queuing theory? Explain some important applications of queuing theory? **03**

(b) The production department of a company requires 3600 kilogram of raw material for manufacturing a particular item per year. It has been satisfied that the cost of placing an order is Rs 36 and the cost of carrying inventory is 25 per cent of the investment in the inventories. The price is Rs 10 per kilogram. Help the purchase manager to determine an ordering policy for new material. **07**

OR

Q.4 **(a)** Define simulation. Explain types of simulation. Give one application area when this technique is used in practice. **07**

(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	30,000	20,400	14,400	9,650
Cost of spares (Rs)	4,000	4,270	4,880	5,700	6,800
Cost of labor (Rs)	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine.

Q.5 **(a)** An established company has decided to add a new product to its line. It will buy the product from a manufacturing concern, package it, and sell it to a number of distributors that have been selected on a geographical basis. Market research has already indicated the volume expected and the size of sales force required. The steps shown in the following table are to be planned. **07**

Sr.No.	Activity	Predecessors	Duration(days)
1	A	---	6
2	B	A	4
3	C	B	7
4	D	A	2
5	E	D	4
6	F	E	10
7	G	---	2
8	H	G	10
9	I	J,H	6
10	J	---	13
11	K	A	9
12	L	C,K	3
13	M	I,L	5

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

(b) Solve the following sequencing problem, giving an optional solution when passing is not allowed. **07**

Machine	Job				
	A	B	C	D	E
M_1	11	13	9	16	17
M_2	4	3	5	2	6
M_3	6	7	5	8	4
M_4	15	8	13	9	11

OR

Q.5 **(a)** A small project involves 7 activities, and their time estimates are listed in the following table. Activities are identified by their beginning (i) and ending (j) node numbers. **07**

Activity (i-j)	Estimated Duration (weeks)		
	Optimistic	Most Likely	Pessimistic
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

1) Draw the network diagram of the activities in the project.
2) Find the expected duration and variance for each activity.
3) Find the expected project length.

(b) A manufacturing company processes 6 different jobs on two machines M and N. number of units of each job and its processing time on M and N are given below. Find the optimal sequence, the total minimum elapsed time and idle time for either machine. **07**

Job Number	Number of Units of each job	Processing Time (in minutes)	
		Machine M	Machine N
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

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