

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA – SEMESTER – IV EXAMINATION – WINTER 2015

Subject code: 640003

Date: 07/12/2015

Subject Name: Operations Research

Time: 10.30 a.m. to 01.00 p.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) Answer the Following questions in short (Any SEVEN) **14**

- 1 Operation Research.
- 2 Components of lines programming Problem
- 3 Mathematical definition of Transportation Problem
- 4 Saddle point And Value of game
- 5 Customer behavior in queue
- 6 Inventory control
- 7 Types of Failure in Replacement
- 8 Errors and Dummies in network

Q.2 (a) Use the Simplex Method to solve the following LP problem **07**

$$\text{Max } Z = 5x_1 + 7x_2$$

Subject to constraints

$$x_1 + x_2 \leq 4$$

$$3x_1 + 8x_2 \leq 24$$

$$10x_1 + 7x_2 \leq 35$$

$$x_1, x_2 \geq 0$$

Q.2 (b) Determine the optimal sequence of performing 5 jobs on 4 machines. The machining of each job is required in the order ABCD and the processing timings are as follows **07**

Jobs	Machines			
	A	B	C	D
1	8	3	4	7
2	9	2	5	5
3	6	4	5	8
4	12	5	1	9
5	7	1	2	3

OR

(b) ABC printing press has two departments. Both are capable enough to print both hard cover paperback books. The printing department A can produce 100 hard cover books in 2 hours or 100 paperback books in one hour. The printing department B can bind 100 hardcover books in 1 hour or 100 paperback books in 2 hours. The operational capacity of department A is to work for at least 80 hours and the department B is 60 hours. The printing cost of one hardcover book is Rs 10 and Rs 88 per copy for the paperback. You are supposed to plan the printing schedule to minimize the cost. (Do not solve the problem) **07**

Q.3 (a) Explain the difference between Transportation Problem and Assignment Problem. **07**

- (b) A small assembly plant assembles PCs through 9 interlink stages according to the following precedence / process. 07

Stage From	to	Duration (Hours)
1	2	4
1	3	12
1	4	10
2	4	8
2	5	6
3	6	8

Stage From	to	Duration (Hours)
4	6	10
5	7	10
6	7	0
6	8	8
7	8	10
8	9	6

- (i) Draw an Arrow Diagram (Network) representing the above assembly work.
 (ii) Tabulate earliest start, earliest finish, latest start and latest finish time for all the stages.
 (iii) Find the critical path and the assembly duration.
 (iv) Tabulate the Total Float, Free Float and Independent Float.

OR

- Q.3 (a)** Solve the following game to find the Saddle point. 07

Player B

Player A		B ₁	B ₂	B ₃	B ₄	B ₅
	A ₁	4	0	1	7	-1
	A ₂	0	-3	-5	-6	5
	A ₃	3	2	2	4	3
	A ₄	-6	1	-2	0	-5

- (b) For a new machine costing Rs 10,000, the scrap value at any time is fixed and it is Rs 3000. Maintenance cost M(n) (in the nth year) is variable and 500, 700, 800, 1200, 2000, 2500, 2800 and 2500 are the maintenance cost in rupees per year for first eight years in succession. Find the best period of replacement. 07

- Q.4 (a)** What is Random Number? Explain Monte-Carlo simulation. 07

- (b) Customers arrive at a sales counter manned by single person according to a Poisson process with a mean rate of 20 per hour. The time required to serve a customer has an exponential distribution with a mean of 100 seconds. Find the average waiting time of a customer in system and in queue. 07

OR

- Q.4 (a)** A firm owns facilities at six places. It has manufacturing plants at places A, B and C with daily production of 50, 40 and 60 units respectively. At point D, E and F, it has three ware houses with daily demands of 20, 95 and 35 units respectively. Per unit shipping costs are given in the following table. If the firm wants to minimize its total transportation cost, how should it route its products? 07

Plants	Ware house		
	D	E	F
A	6	4	1
B	3	8	7
C	4	4	2

Find the feasible solution of the following transportation problem by NWCM and Optimize by MODI method.

- Q.4 (b)** There are five workers and their work time to complete their jobs on different machine is given below. Assign one machine to each worker that minimizes the total working time. **07**

	Machines				
	M ₁	M ₂	M ₃	M ₄	M ₅
W ₁	8	5	7	7	8
W ₂	9	5	6	7	8
W ₃	6	8	5	6	9
W ₄	8	10	7	6	5
W ₅	4	6	5	6	4

- Q.5 (a)** In a factory there are six jobs. To perform each of which should go through two machines A and B, in the order AB. The processing timings (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapse time, T. What is the value of T? **07**

Jobs	Machine A	Machine B
1	7	3
2	4	8
3	2	6
4	5	6
5	9	4
6	8	1

- (b)** Find the graphical solution of the following LP problem, **07**
 Maximize $Z=5x+10y$
 subject to
 (i) $2x+y \geq 8$; (ii) $3x+4y \leq 24$; (iii) $y \geq 2$; $x, y \geq 0$

OR

- Q.5 (a)** Explain the difference between Primal and Dual relationship. **07**
(b) A factory needs 1500 units of 6" bar (raw material) every month. The cost of one such bar is Rs 28. Ordering cost per order is Rs 150. The inventory carrying cost is 0.2 fraction of a rupee per year. Find the following **07**
 1. EOQ
 2. Total inventory cost per year.
 3. Number of orders per year.
