Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– V • EXAMINATION – WINTER 2016

Subject Code: 152005 **Date: 28/11/2016**
Subject Name: Quantitative Techniques in Management
Time: 10:30AM – 01:00PM **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)** A firm makes two products A and B, and has a total production capacity of 9 tonnes per day. The firm has a permanent contract to supply at least 2 tonnes of A and at least 3 tonnes of B per day to another company. Each tone of A requires 20 machine hours production time and each tone of B 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 tonne of A and Rs.120 per tonne of B. Formulate the linear programming problem. **04**

(b) Solve the following LP Problem with simplex method. **10**

Maximize $Z = 1000x_1 + 4000x_2 + 5000x_3$

Subject to $3x_1 + 3x_3 \leq 22$

$x_1 + 2x_2 + 3x_3 \leq 14$

$3x_1 + 2x_2 \leq 14;$

$x_1, x_2, x_3 \geq 0$

Q.2 **(a)** Five machines (M1 to M5) are available to do five different jobs (J1 to J5). The estimated time taken by each machine (in hours) to do each job is indicated in the following table. **07**

	J1	J2	J3	J4	J5
M1	2	9	2	7	1
M2	6	8	7	6	1
M3	4	6	5	3	1
M4	4	2	7	3	1
M5	5	3	9	5	1

Find the assignment of machines to jobs to minimize the total time taken.

(b) Given the following data regarding the processing times (in minutes) of six jobs on three machines M1, M2 and M3. The order of processing is M1-M2- **07**

Job	M1	M2	M3
1	6	16	26
2	24	12	28
3	10	8	18
4	4	12	24
5	18	6	16
6	22	2	26

Determine the order in which the jobs should be processed in order to minimize the total elapsed time. Also find out the total elapsed time and idle times of three machines.

OR

(b) A company plans to fill six positions. Since the positions are known to vary considerably with respect to skill and responsibility, different types of aptitude tests and interviews are required for each. While the aptitude tests are conducted by people from the clerical positions, the job interviews are held by **07**

the personnel from the management cadre. The job interviews immediately follow the aptitude test. The time required (in minutes) by each of the positions is given here:

Position	P1	P2	P3	P4	P5	P6
Aptitude test	140	180	150	200	170	100
Job Interview	70	120	110	80	100	90

If it is desired to minimize the waiting time of the management personnel, in what order the position filling be handled? What would be the total elapsed time for the entire process?

Q.3 Mahendra Logistic Company has 5 trucks available at Location A, 10 trucks at Location B, 7 trucks at Location C and 3 trucks at Location D. Customers X, Y and Z require 5,8 and 10 trucks respectively. Variable cost (in thousands of Rs.) for getting trucks to the customers are as under: **14**

From ▼ To ►	X	Y	Z
A	7	3	6
B	4	6	8
C	5	8	4
D	8	4	3

Solve the transportation problem.

OR

Q.3 (a) Explain the methods for finding out initial feasible solution for the transportation problems. **06**

(b) Explain the following with the help of a suitable example: **08**

1. Prohibited route
2. Dummy market
3. Degeneracy in transportation problem
4. Unbalanced transportation problem

Q.4 (a) Draw the network for the following data and find critical path and total duration of the project. **07**

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6	6-7
Duration (days)	2	4	5	1	6	5	7	2

(b) The cost of an equipment is Rs.62000 and its scrap value is Rs.2000. the life of the equipment is 8 years. The maintenance costs for each year are as under: **07**

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	1000	2000	3500	5000	8000	11000	16000	24000

Suggest the optimal replacement policy.

OR

Q.4 (a) Explain the following: **06**

1. Critical path
2. Crashing of a project
3. Resource leveling

(b) The initial cost of a machine is Rs.30000 and running cost of the machine is as under: **08**

Year	1	2	3	4	5	6	7
Running Cost (Rs.)	5000	6000	8000	10000	13000	16000	20000

Suggest the optimal replacement policy. The rate of interest is 10% and the scrap value is nil.

Q.5 **(a)** A company has developed a new product in its R & D laboratory. The company has the option of setting up production facility to market this product straight away. If the product is successful, then over the three years expected product life, the returns will be Rs. 120 lakh with a probability of 0.70. If the market does not respond favourable, then the returns will be only Rs. 15 lakh with probability of 0.30. **07**

The company is considering whether it should test market this product building a small pilot plant. The chance that the test market will yield favourable response is 0.80. If the test market gives favourable response, then the chance of successful total market improves to 0.85. If the test market gives poor response then the chance of success in the total market is only 0.30.

As before, the returns from a successful market will be Rs. 120 lakh and from an unsuccessful market only Rs. 15 lakh. The installation cost to produce for the total market is Rs. 40 lakh and the cost of the test marketing pilot plant is Rs. 5 lakh. Draw a decision tree diagram; carry out necessary analysis to determine the optimal decisions.

(b) What are the applications of Operation Research? Explain with the help of real life examples. **07**

OR

Q.5 **(a)** Explain the following: **07**

1. Importance of sensitivity analysis in simplex method
2. Duality

(b) Define: **07**

1. Queue
2. Length of system
3. Waiting time in the system
4. Waiting time in the queue
5. Server
6. Traffic intensity
7. FCFS

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