

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – SUMMER 2013****Subject Code: 152005****Date: 23-05-2013****Subject Name: Quantitative Techniques in Management****Time: 10.30 am - 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** Food A contains 20 units of vitamin X and 40 units of vitamin Y per gram. Food B contains 30 units each of vitamin X and Y. The daily minimum human requirements of vitamin X and Y are 900 and 1200 units respectively. How many grams of each type of food should be consumed so as to minimize the cost, if food A costs 60 paise per gram and food B costs 80 per gram? (Use two phase simplex method) **14**

- Q.2 (a)** A company has factories at X, Y and Z that supply products to warehouses at O, P and Q. The weekly capacities of the factories are 200, 160 and 90 units, respectively. The weekly warehouse requirements are 180, 120 and 150 units, respectively. The unit shipping costs (in rupees) are as under: **07**

	O	P	Q	Supply
X	16	20	12	200
Y	14	8	18	160
Z	26	24	16	90
Demand	180	120	150	450

Determine the optimal distribution for this company in order to minimize its total shipping cost.

- (b)** Three buildings A, B and C are to be added to increase the production capacity of a plant. Bids are received from five building contractors. The bid figures are given in millions of rupees and are shown in the table below: **07**

Contractor	A	B	C
1	2.90	1.62	-
2	3.10	1.75	2.81
3	3.05	1.80	2.90
4	2.85	1.55	2.75
5	-	1.70	3.00

Find the assignment of buildings to the contractors that will result in a minimum total cost to the company.

OR

- (b) A company has one surplus truck in each of the cities A, B, C, D and E and one deficit truck in each of the cities 1, 2, 3, 4, 5 and 6. The distance between the cities in kilometers is shown in the table below. Find the assignment of trucks from cities in surplus to cities in deficit so that the total distance covered by the vehicles is minimum. 07

	1	2	3	4	5	6
A	12	10	15	22	18	8
B	10	18	25	15	16	12
C	11	10	3	8	5	9
D	6	14	10	13	13	12
E	8	12	11	7	13	10

- Q.3 (a)** A manufacturer is offered two machines A and B. Machine A is priced at Rs. 50000 and its running costs are estimated at Rs. 8000 for each of the first five years increasing by Rs. 2000 per year in the sixth and subsequent years. Machine B has the same capacity as A, costs Rs. 25000 but would have running costs of Rs. 12000 per year for six years, increasing by Rs. 2000 per year thereafter. If money is worth 10% per year, which machine should be purchased? (assume that the machine will eventually be sold for scrap at a negligible price) 07

- (b) A glass factory that specializes in crystal is developing a substantial backlog and for this the firm's management is considering three courses of action: To arrange for subcontracting (S_1), to begin overtime production (S_2), and to construct new facilities (S_3). The correct choice depends largely upon the future demand, which may be low, medium, or high. By consensus, management ranks the respective probabilities as 0.10, 0.50 and 0.40. A cost analysis reveals the effect upon the profits. This is shown in the table below: 07

Demand	Probability	Course of Action		
		S_1	S_2	S_3
Low (L)	0.10	10	-20	-150
Medium (M)	0.50	50	60	20
High (H)	0.40	50	100	200

Show this decision situation in the form of a decision tree and indicate the most preferred decision and its corresponding expected value.

OR

- Q.3 (a)** The data on the operating cost per year and resale price of equipment A whose purchase price is Rs. 10000 are given below: 07

Year	1	2	3	4	5	6	7
Operating Cost (Rs)	1500	1990	2300	2900	3600	4500	5500
Resale Value (Rs)	5000	2500	1250	600	400	400	400

- (i) What is the optimum time for replacement?
(ii) When equipment A is two years old, equipment B, which is a new model for the same usage, is available. The optimum period for replacement is four years with an average cost of Rs. 3600. Should we change equipment A with equipment B? If so, When?

- (b) Mahesh Chemical Company produces two products A and B. Products are produced and sold on a weekly basis. The weekly production cannot exceed 25 for product A and 35 for product B because of limited available facilities. The company employs total of 60 workers. Product A requires 2 man-weeks of labour, while B requires one man-week of labour. Profit margin on A is Rs. 60 and on B is Rs. 40. Formulate this problem as an LP problem and solve graphically for maximum profit. **07**

- Q.4** Six jobs A,B,C,D,E and F are required to be performed on four machines, M_1 , M_2 , M_3 and M_4 in the order of M_1 - M_3 - M_2 - M_4 . Using the processing times given below, determine the optimal sequence(s) of the job performance. Find out the total elapsed time and idle time of each machine. **14**

Job	No. of units of each Job	M_1	M_2	M_3	M_4
A	4	12	6	6	8
B	3	8	6	3	12
C	2	13	6	4	9
D	2	9	4	2	14
E	1	10	7	6	12
F	2	12	2	7	10

OR

- Q.4** Given the following data: **14**

Job	Machine A	Machine B	Machine C
1	12	7	6
2	10	6	5
3	9	6	6
4	14	5	4
5	7	4	2
6	9	4	4

The order of processing of each job is A-C-B. The sequence suggested is Jobs 5, 3, 6, 2, 1, 4. Determine the total elapsed time for the sequence suggested. Is the sequence optimal? If 'No', determine the optimal sequence and the total elapsed time associated with it. Also find out idle time of each machine.

- Q.5 (a)** Following information is available for a project. Draw a network corresponding to the same and obtain the early and late start and completion times, and determine the critical activities. **07**

Activity	1-2	1-3	2-6	3-4	3-5	4-6	5-6	5-7	6-7
Duration (weeks)	4	6	8	7	4	6	5	19	10

- (b) What do you understand by queuing structure? Explain First come first served, last come first served and priority service basis of customer handling with suitable examples of each. **07**

OR

Q.5 (a) A project has the following characteristics:

07

Activity	Preceding Activity	Expected completion time (in hrs.)
A	-	5
B	A	2
C	A	6
D	B	12
E	D	10
F	D	9
G	D	5
H	B	9
I	C,E	1
J	G	2
K	F,I,J	3
L	K	9
M	H,G	7
N	M	8

(i) Draw a PERT network for this project,

(ii) Find the critical path and the project completion time.

(b) A company has received a contract to supply gravel to three new construction projects located in towns Nagpur, Chennai and Jamshedpur. The construction engineers have estimated that the required amounts of gravel which will be needed at these construction projects are:

07

Project location	Nagpur	Chennai	Jamshedpur
Weekly requirement (truckload)	72	102	41

The company has 3 gravel pits located in towns X, Y and Z. The gravel required by the construction projects can be supplied by three pits. The amount of gravel that can be supplied by X is 76, Y is 82 and Z is 77 truckloads.

The company has computed the delivery cost from each pit to each project site. These costs (in Rs.) are shown in the following table:

Pit	Nagpur	Chennai	Jamshedpur
X	4	8	8
Y	16	24	16
Z	8	16	24

Schedule the shipment from each pit to each project in such a manner that it minimizes the total transportation cost within the constraints imposed by pit capacities and project requirements. Also find the minimum cost.
