Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2016

Subject Code:172004 **Date:18/05/2016**

Subject Name:Production Optimization Techniques

Time:02:30 PM to 05:00 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) A food products' company is contemplating the introduction of a revolutionary new product with new packaging or replacing or the existing product at much higher price (S1). It may even make a moderate change in the composition of the existing product, with a new packaging at a small increase in price (S2), or may mall a small change in the composition of existing product, backing it with the word 'New' and a negligible increase in price (S3). The three possible states of nature or events are: (i) high increase in sales (N1), (ii) no change in sales (N2) and (iii) decrease in sales (N3). The marketing department of the company worked out the payoffs in terms of yearly net profits for each of the strategies of three events (expected sales). This is represented in following table: **07**

	States of Nature		
Strategies	N1	N2	N3
S1	7,00,000	3,00,000	1,50,000
S2	5,00,000	4,50,000	0
S3	3,00,000	3,00,000	3,00,000

Which strategy should the concerned executive choose on the basis of

(a) Maximum criterion (b) Minimax regret criterion

(c) Maximax criterion (d) Laplace criterion?

(b) State and discuss the methods of solving an assignment problem. How is the Hungarian method better than other methods for solving assignment problem? **07**

Q.2 (a) Solve the following LPP: **07**

Maximise $Z=8X_1 - 4X_2$

Subject to $4X_1 + 5X_2 \leq 20$

$-X_1 + 3X_2 \geq -23$

$X_1 \geq 0$, X_2 unrestricted in sign

(b) What is trans-shipment problem? Explain how it can be formulated and solved as a transportation problem. **07**

OR

(b) Solve the following transportation problem. Obtain the initial solution by NW corner rule. **07**

		To				
		1	2	3	4	Supply
From	A	7	3	8	6	60
	B	4	2	5	10	100
	C	2	6	5	1	40
Demand		20	50	50	80	200

Q.3 (a) A timber merchant manufactures three types of plywood the data below give the production hours per unit in each of three production operations, maximum time available, and profit per unit. **07**

Plywood	Operation (Hours) I	II	III	Profit per Unit (Rs)
Grade A	2	2	4	40
Grade B	5	5	2	30
Grade C	10	3	2	20
Maximum Time Available	900	400	600	

How many units of each grade of plywood should be produced to maximize the total profit?

(b) a) A machine M_1 Costing Rs 9,000 has a maintenance cost of Rs 200 in the first year of its operation which rises by Rs 2,000 in each of the successive years. Assuming that the machine replacement can be done only at the end of year, Determine the best age at which the machine be replaced. **07**

b) There is an offer to replace the machine M_1 which is a year old, by another machine M_2 which cost Rs 8,000. The machine M_2 needs Rs 2,000 to be spent on installation, has no salvage value and requires Rs 400 on maintenance in the first year followed by an increase of Rs 800 per annum in the yearly expenditure on maintenance. Should the machine M_1 be replaced by Machine M_2? If so, When?

OR

Q.3 (a) A company plans to assign 5 salesman to 5 district in which it operates. Estimates of sales revenue in thousands of rupees for each sales man in different districts are given in the following table. In your opinion, what should be the placement of the salesmen if the objective is to maximise the expected sales revenue? **07**

Expected Sales Data					
Salesman	District				
	D_1	D_2	D_3	D_4	D_5
S_1	40	46	48	36	48
S_2	48	32	36	29	44
S_3	49	35	41	38	45
S_4	30	46	49	44	44
S_5	37	41	48	43	47

(b) A group of process plants in an oil refinery are fitted with valves. Over a period of time the failure pattern of these 400 valves has been observed and it is as follows : **07**

Month	:	1	2	3	4	5	6	7	8	Total
Number of valves failing	:	8	20	48	104	120	56	32	12	400

It costs Rs 100 to replace each valve individually. If all the valves are replaced at a time, it costs Rs 50 per valve.

The maintenance department is considering following replacement policies :

a) To replace all valves simultaneously at fixed intervals, in addition to replacing valves as and when they fail.

b) To replace valves as and when they fail.

Suggest an optimal replacement policy.

Q.4 (a) Solve the following transportation problem for maximum profit. **07**

Per Unit Profit (Rs)	
	Market

		A	B	C	D
Warehouse	X	12	18	6	25
	Y	8	7	10	18
	Z	14	3	11	20

Availability at warehouses :
X : 200 units
Y : 500 units
Z : 300 units

Demand in the markets :
A : 180 units
B : 320 units
C : 100 units
D : 400 units

(b) Find the sequence that minimises the total elapsed time required (T) in completing the following jobs. Each job is processed in the order ABC. Also, calculate T. **07**

Job		1	2	3	4	5	6	7
Machine A	:	10	8	12	6	9	11	9
Machine B	:	6	4	6	5	3	4	2
Machine C	:	8	7	5	9	10	6	5

OR

Q.4 **(a)** The data for a project are : **07**

Activity	Preceding Activity	Time (in weeks)		Cost (in Rs)	
		Normal	Crash	Normal	Crash
A	None	3	2	18,000	19,000
B	None	8	6	600	1,000
C	B	6	4	10,000	12,000
D	B	5	2	4,000	10,000
E	A	13	10	3,000	9,000
F	A	4	4	15,000	15,000
G	F	2	1	1,200	1,400
H	C, E, G	6	4	3,500	4,500
I	F	2	1	7,000	8,000

a) Draw a project network diagram and find the critical path.
b) If a deadline of 17 weeks imposed for completion of the project, what activities will be crashed, what would be the additional costs, and what would be the critical activities of the network after crashing?

(b) Give the various sequencing models that are available for solving sequencing problems. Give suitable examples. **07**

Q.5 **(a)** The following table shows for each activity needed to complete the project the normal time, the shortest time in which the activity can be completed of a building contract and the cost per day for reducing the time of each activity. The contract includes a penalty clause of Rs 100 per day over 17 days. The overhead cost per day is Rs 160. **07**

Activity	Normal time in days	Shortest time in days	Cost of Reduction per day (Rs)
1-2	6	4	80
1-3	8	4	90
1-4	5	3	30
2-4	3	3	-
2-5	5	3	40
3-6	12	8	200
4-6	8	5	50
5-6	6	6	-

The cost of completing the eight activities in normal time is Rs 6500.

a) Calculate the normal duration of the project, its cost and the critical path.

b) Calculate the cost/time function for the project and state:

i. The lowest cost and associated time.

ii. The shortest time and associated cost.

(b) How would you deal with replacement of items that fail completely and suddenly? **07**

OR

Q.5 **(a)** Give general structure of queuing system and explain. Illustrate some queuing situations. **07**

(b) A salesman wants to visit cities 1, 2, 3 and 4. He does not want to visit any city twice before completing the tour of all the cities and wishes to return to his home city, the starting station, Cost of going from one city to another in rupees is given in table below.

		To City			
		1	2	3	4
From City	1	0	30	80	50
	2	40	0	140	30
	3	40	50	0	20
	4	70	80	130	0

Find the Least cost rout.

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