Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 172004 **Date:16/12/2015**

Subject Name: Production Optimization Techniques

Time: 10:30am to 1:00pm **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)** Explain in brief **07**

(a) Linear programming
(b) Assumptions of a linear programming model
(c) Application of linear programming.

(b) Differentiate between Transportation and Assignment problem. Can an Assignment problem be solved using Transportation technique? Explain giving example. **07**

Q.2 **(a)** Explain the similarity and the difference between Infeasible and Unbounded solution related to graphical method using a suitable example. Also explain unbounded solution space with an optimum solution. **07**

(b) A manufacturer produces three models of a certain product. He uses two types of raw material (A and B) of which 4000 and 6000 units respectively are available. The raw material requirements per unit of the three models are given below. **07**

Raw Material	Requirement per unit of given model		
	I	II	III
A	2	3	5
B	4	2	7

The labour time for each unit of model I is twice that of model II and three times that of model III. The entire labour force for the factory can produce the equivalent of 2500 units of model I. A market survey indicates that the minimum demand of the three models are 500, 500 and 375 units respectively. However the ratios of the number of units produced must be equal to 3 : 2 : 5. Assume that the profit per unit of models I , II and III are Rs. 60, 40 and 100 respectively. Formulate the problem as a linear programming model in order to determine the number of units of each product which will maximize the profit. Do not solve.

OR

(b) Evening shift resident doctors in a Govt. hospital work five consecutive days and have two days off. Their five days of work can start on any day of the week and the schedule rotates indefinitely. The hospital requires the following minimum number of doctors working **07**

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
35	55	60	50	60	50	45

No more than 40 doctors can start their five working days on the same day. Formulate the general linear programming model to minimize the number of doctors employed by the hospital. Do not solve.

Q.3 **(a)** Based on the data given below answer the following questions, showing workings **07**

			1.50	0.75	1.40	0.65	0	0	0
C_j	V_j	b_i	X_1	X_2	X_3	X_4	X_5	X_6	X_7
0.65	X_4	510	0	0	0.5	1	□	-0.5	-2.5
0.75	X_2	190	0	1	□	0	0	0.5	-0.5
1.50	X_1	100	1	0	1	0	0	0	□
	Z_j	□	□	□	□	□	□	□	□
$\Delta_j = Z_j - C_j$			0	0	0.05	0	2.60	□	-0.5

Complete the missing elements in the table denoted by '□'.

(b) For the above problem Q.3(a) answer the following **07**

i. Is the solution optimum? Give reasons.
ii. What is the value of the objective function?
iii. What is the value of an additional unit of capacity on machines 1 and 2?
iv. What happens to the value of the objective function and the product and slack variables if 20 units of X_3 are produced?
v. Find out the optimum product mix and the objective function value of the optimum product mix.

OR

Q.3 **(a)** A company has three production centres and two regional offices. The availability, requirements and the shipping costs are as shown in the table below. **07**

Region / Centre	R1	R2	Capacity
C1	40 / 5	60 / 8	100
C2	/ 9	160 / 6	160
C3	80 / 5	/ 10	80
Requirement	120	220	

The company's marketing department if flooded with complaints of unsatisfactory service from the customers in the second region. The company is considering the breaking up of this region into two and establishing sales offices separately to improve the services of customer orders. The shipping costs to the new region office (R3) from production centers C1, C2 and C3 is estimated to be Rs. 5, Rs. 7 and Rs. 6 respectively. The opening of the new regional office R3 is expected to reduce the requirements of R2 to 110 and hence R3 to 110.

Determine the optimum shipping schedule and cost before and after the breakup of region R2.

(b) Explain the recognition of the special issues in LP from Transportation matrix : the existence of **07**

i. Degeneracy
ii. Alternate solution
iii. Infeasible solution
iv. Unbounded solution

Q.4 **(a)** Differentiate between single stage and multistage decisions. **07**

Also explain the following :

- Hurwicz criterion
- Minimax principle
- Decision making under risk and uncertainty

(b) What do you understand by Float? Explain the different types of float and their significance. **07**

OR

Q.4 **(a)** Define the following (1) Balking (2) Reneging (3) Jockeying. Explain the Kandalls notation for a Queuing system. **07**

(b) Discuss briefly about the different types of inventory and various costs involved in inventory problems. **07**

Q.5 **(a)** Following are the manpower requirements for each activity in a project. **07**

Activity	Normal time	Manpower required	Activity	Normal time	Manpower required
0-1	2	4	4-7	6	3
1-2	3	3	5-7	6	6
1-3	4	3	6-8	5	2
2-4	2	5	7-9	4	2
3-5	4	3	8-9	4	9
3-6	3	4			

Draw the network diagram of the project activities. If only 9 men are available for the execution of the project, then rearrange the activities suitable for leveling the manpower resource.

(b) Justify the Johnsons rule of sequencing for n jobs - two machines giving a suitable example. **07**

OR

Q.5 **(a)** Differentiate PERT & CPM. Under what conditions would you recommend scheduling by PERT? State the conditions where CPM is a better option and why. **07**

(b) The below table gives the operation cost, maintenance cost and the salvage value at the end of every year of a machine whose purchase values is Rs. 12000. Find the economic life of the machine assuming the interest rate as 0%. **07**

End of year (n)	Operation cost at the end of year (Rs.)	Maintenance cost at the end of the year (Rs.)	Salvage value at the end of year (Rs.)
1	2000	2500	8000
2	3000	3000	7000
3	4000	3500	6000
4	5000	4000	5000
5	6000	4500	4000
6	7000	5000	3000
7	8000	5500	2000
8	9000	6000	1000

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