

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII • EXAMINATION – WINTER 2013

Subject Code: 172004**Date: 28-11-2013****Subject Name: Production Optimization Techniques****Time: 10:30 TO 01:00****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) Solve the following problem by simplex method: 07Maximize $Z = 40x_1 + 35x_2$ Subject to $2x_1 + 3x_2 \leq 60$ $4x_1 + 3x_2 \leq 96$ $x_1, x_2 \geq 0$

- (b) A firm own facilities at seven places. Its manufacturing plants at places A, B and C with daily output of 500, 300 and 200 units of an item respectively. It has warehouses at places P, Q, R and S with daily requirement of 180, 150, 350 and 320 units respectively. Per unit shipping charges on different routes are given below. 07**

To:	P	Q	R	S
From A	12	10	12	13
From B	7	11	8	14
From C	6	16	11	7

The firm wants to send the output from various plants to warehouses involving minimum transportation cost. How should it route the product so as to achieve its objective?

Q:2 (a) Solve the following assignment problem and obtain the minimum cost at which all the job can be performed. 07

worker	Job (Cost in '00 Rs)				
	1	2	3	4	5
A	25	18	32	20	21
B	34	25	21	12	17
C	20	17	20	32	16
D	20	28	20	16	27

- (b) Ten jobs are required to be processed on two machines M_1 and M_2 in the order M_1 followed by M_2 . Processing times are given in the following table. Determine all the possible optimal sequences and evaluate the total elapsed time and idle time for machines. 07**

Jobs	J_1	J_2	J_3	J_4	J_5	J_6	J_7	J_8	J_9	J_{10}
M_1	7	8	10	3	7	4	5	8	5	6
M_2	4	2	6	6	5	7	2	6	7	6

OR

- (b) A company engaged in producing tinned food has 300 trained employees on its rolls, each of whom can produce one can of food in a week. Due to the developing taste of public for this kind of food, the company plans to add to existing labour force, by employing 150 people, in a phased manner, over the 07**

next five weeks. The newcomers would have to undergo a two week training programme before being put to work. The training is to be given by employees from among the existing ones and it is a known fact that one employee can train three trainees. Assuming that there would be no production from the trainers and trainees during training period, as the training is off-the-job. However, the trainees would be remunerated at the rate of Rs 300 per week, the same rate would applied as for the trainers. The company has booked the following orders to supply during the next five weeks:

Week	1	2	3	4	5
No.of cans	280	298	305	360	400

Assume that the production in any week would not be more than the number of cans ordered for so that every delivery of the food would be 'fresh'. Formulate this problem as an LP model to develop a training schedule that minimizes the labour cost over five week period.

- Q:3** Explain, by taking the illustration, Vogel's approximation method to obtain the initial feasible solution of the transportation problem and Stepping stone method to optimize that initial feasible solution. **14**

OR

- Q:3** How do you distinguish between resource levelling and resource allocation problems? State and explain an algorithm for resource allocation. **14**

- Q:4 (a)** Find the sequence that minimizes 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

- (b)** A company has four sales representatives who are to be assigned to four different sales territories. The monthly sales increases estimated for each sales representative for different sales territories (in lakhs of rupees), are shown in the following table: **07**

Sales representatives	Sales Territories			
	I	II	III	IV
A	200	150	170	220
B	160	120	150	140
C	190	195	190	200
D	180	175	160	190

Suggest optimal assignment and total maximum sales increase per month.

OR

- Q:4 (a)** With help of quantity cost curve, explain the significance of EOQ. Discuss the assumptions underlying the basic EOQ formula. What are the limitations of using the formula for an EOQ? **07**
- (b)** Give a general structure of queuing system and explain. Illustrate some queuing situations. **07**

- Q:5 (a)** Machine A costs Rs. 9000. Its annual operating costs are Rs 200 for the first year, and then increase by Rs 2000 every year. Determine the best age at which the machine should be replaced. If the optimum replacement policy is followed, what will be the average yearly cost of owning and operating the machine? Machine B costs Rs. 10,000. Its annual operating costs are Rs 400 for the first year, and then increases by Rs 800 every year. Should the machine A be replaced by machine B? When? **07**

- (b)** A project with the following activities duration and manpower requirement is given: **07**

Activity	1-2	1-3	1-4	2-5	2-6	3-7	4-8	5-9	6-9	7-8	8-9
Duration (days)	2	2	0	2	5	4	5	6	3	4	6

Draw the network diagram of the project indicating Earliest and Latest times and float of each activity.

OR

- Q:5 (a)** 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
Number of valve failing	8	20	48	104	120	56	32	12

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:

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

Suggest an optimal replacement policy.

- (b)** Motor city Auto Co. must decide whether or not to introduce a new car, which features a radically new pollution control system. They must also decide whether the results of test marketing of limited production will cost Rs. 4 crores. **07**

The marketing department has made the following estimations:

1. If the new car achieves high acceptance by the public, company profit will increase by Rs. 25 crores.
2. Low acceptance will reduce company profit by Rs. 15 crores.
3. Not introducing the car will not affect the profit.

The probabilities for the different outcomes through alternate actions are as follows:

1. If the test market is not done the possibility of high acceptance is 0.40.
2. The assumed probability for favourable result from test marketing is 0.50
3. The conditional probability for high acceptance after favourable results is 0.64.
4. If the car is introduced in spite of unfavourable test marketing results the probability of low acceptance is 0.84.

Construct the decision tree and determine the optimal course of action.
