Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–7 • EXAMINATION – SUMMER 2015

Subject Code: 172004 **Date:04/05/2015**

Subject Name: Production Optimization Techniques

Time: 02.30PM-05.00PM **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 company produces three types of parts A, B and C for automatic washing machine. It purchases castings of parts from a local foundry and then finishes the parts on drilling, shaping and polishing machines. The selling price of A, B and C are Rs. 8, Rs.10 and Rs.14 respectively. The casting of parts A, B and C costs Rs.5, Rs.6 and Rs. 10 respectively. The shop possesses only one of each type of machine. Cost per hour to run each of the three machines are Rs.20 for drilling, Rs.30 for shaping and Rs. 30 for polishing. The capacities(parts per hour) for each part on each machine are shown in the table below **07**

Machine	Capacity per hour		
	A	B	C
Drilling	25	40	25
Shaping	25	20	20
Polishing	40	30	40

How many parts of each type the shop should produce per hour in order to maximize profit for an hours run? Formulate this problem as an LP model. Do not solve.

(b) Explain the significance of Duality and Sensitivity Analysis in Linear Programming. **07**

Q.2 **(a)** Explain the following related to the Transportation Problem: Feasible solution, Basic Feasible solution, Optimal Solution **07**

(b) Maximize **07**

$Z = x_1 + 2x_2 + 3x_3 - x_4$

Subject to Constraints $x_1 + 2x_2 + 3x_3 = 15$

$2x_1 + x_2 + 5x_3 = 20$

$x_1 + 2x_2 + x_3 + x_4 = 10$

$x_1, x_2, x_3, x_4 \geq 0$

OR

(b) An Air Force is experimenting with three types of bombs P, Q and R in which three kinds of explosives viz. A, B and C will be used. Taking the various factors into account, it has been decided to use maximum 600 kg of explosive A, atleast 480 kg of explosive B and exactly 540 kg of explosive C. Bomb P requires 3,2,2 kg, bomb Q requires 1, 4, 3 kg and bomb R requires 4, 2, 3 kg of explosives A, B and C respectively. Bomb P is estimated to give an equivalent of a 2 ton explosion, bomb Q a 3 ton explosion and bomb R a 4 ton explosion respectively. Under what production schedule can the Air Force make the biggest bang? **07**

Q.3 **(a)** Define each of the following terms: **07**

1. Activity
2. Earliest starting time (EST) & Latest starting time (LST)
3. Earliest finishing time (EFT) & Latest finishing time (LFT)
4. Critical path
5. Logical dummy activity

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

OR

Q.3 **(a)** Differentiate between CPM and PERT as network analysis techniques. **07**

(b) A project consists of 10 activities each of which requires either or both of the two types of resources R1 and R2 for its performance. The duration of the activities and their resource requirements are as follows: **07**

Activity	Duration (days)	Resource Requirement	
		R1	R2
1-2	3	3	2
1-3	2	6	-
1-4	6	4	-
2-6	4	-	4
3-5	2	2	2
4-5	1	4	-
4-8	4	4	-
5-7	3	3	2
6-7	2	1	3
7-8	4	4	5

Resource availability: R1 = 7units, R2 = 5units. Determine the duration of the project under the given resource constraint. If the resources were not a problem how long the project would take to complete in the normal course.

Q.4 **(a)** Differentiate between Crashing, Resource leveling and Resource Smoothing. **07**

(b) A manufacturer of jeans is interested in developing an advertising campaign that will reach four different age groups. Advertising campaigns can be conducted through TV, radio and magazines. The following table gives the estimated cost in Rs. per exposure for each age group according to the medium employed. In addition, maximum exposure levels possible in each of the media are 40, 30 and 20 million respectively. Also the minimum desired exposures within each age group, namely 13-18, 19-25, 26-35, 36 and older, are 30, 25, 15 and 10 million. The objective is to minimize the cost of obtaining the desired minimum exposure level in each group. **07**

Media	Age Group			
	13-18	19-25	26-35	36 and older
TV	12	7	10	10
Radio	10	9	12	10
Magazines	14	12	9	12

Formulate the above as a transportation problem and find an optimal solution.

OR

Q.4 **(a)** What problems arise when an assignment problem is solved using any Transportation technique? Also suggest the remedies to the problems. **07**

(b) An airline operating seven days a week has given the following schedule of its flights between New Delhi and Mumbai. The crews have a minimum of five hours between the flights. Obtain the pairing of flights that minimizes layover time away from home. For any given pairing the crew will be based at the city that results in the smallest layover. **07**

New Delhi – Mumbai			Mumbai – New Delhi		
Flight No.	Departure	Arrival	Flight No.	Departure	Arrival
101	5 am	7 am	201	7 am	9 am
102	7 am	9 am	202	8 am	10 am
103	1 pm	3 pm	203	1 pm	3 pm
104	7 pm	9 pm	204	6 pm	8 pm

Q.5 **(a)** What is the significance of Decision Theory? Explain the various types of Queue Disciplines. Clearly state the meaning of Renaging and Baulking. **07**

(b) The following mortality rates have been observed for a certain type of light bulbs : **07**

Month	1	2	3	4	5
Percent failing by month end	10	25	50	80	100

There are 1000 bulbs in use and it costs Rs. 10 to replace an individual bulb which has burnt out. If all bulbs were replaced simultaneously it would cost Rs. 2.5 per bulb. It is proposed to replace all the bulbs at fixed intervals, and individually those which fail between the intervals. What would be the best policy to adopt?

OR

Q.5 **(a)** What is inventory control? Explain the significance of carrying the inventory and the types of inventories in a manufacturing system. **07**

(b) 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

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