

GUJARAT TECHNOLOGICAL UNIVERSITY
B.E SEM-VII Examination-Nov/Dec.-2011

Subject code: 172004**Date: 26/11/2011****Subject Name: Production Optimization Techniques****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** An Air-force is experimenting with three types of bombs A, B and C in which three kinds of explosives, viz., P, Q and R are to be used. Taking various factors in to account, it has been decided to use maximum 600kg of explosive P, at least 480kg of explosive Q and exactly 540kg of explosive R. Bomb A requires 3, 2, 2kg, bomb B requires 1, 4, 3kg and bomb C requires 4, 2, 3kg of explosives P, Q and R respectively. A is estimated to give the equivalent of a 2 ton explosion, bomb B, a 3 ton explosion and bomb C, a 4 ton of explosion respectively. **14**
- a. Formulate the linear programming model to maximize explosion capacity.
 - b. Under what production schedule can the Air-Force make the biggest bang? Also calculate the maximum explosion capacity.

- Q.2 (a)** A small scale industrial unit consists of 6 activities as given below: **07**

Activity	Preceding activity/s	Duration in days
A	None	5
B	A	6
C	B	5
D	A	4
E	D	3
F	C,E	4

Draw the network diagram and calculate EST, LST, EFT, LFT and floats. Find the critical path and calculate the total project duration.

- (b)** A product is produced by four factories A, B, C and D. Their unit production costs are Rs. 2, Rs. 3, Rs. 1 and Rs. 5 respectively. Their production capacities are: factory A- 50 units, B- 70 units, C- 30 units and D- 50 units. These factories supply the product to four stores (I, II, III and IV), demands of which are 25, 35, 105 and 20 units respectively. Unit transportation cost in rupees from each factory to each store is given in the table below. **07**

	I	II	III	IV
A	2	4	6	11
B	10	8	7	5
C	13	3	9	12
D	4	6	8	3

Determine the extent of deliveries from each of the factories to each of the stores so that the total production and transportation cost is minimum.

OR

- (b) A company has received a contract to supply sand to three new construction projects located in towns Mumbai, Rajkot and Hyderabad. The construction engineers have estimated that the required amounts of sand which will be needed at these construction projects are: 07

Project location	Mumbai	Rajkot	Hyderabad
Weekly requirement (truckload)	72	102	41

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

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

Pit	Mumbai	Rajkot	Hyderabad
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.

- Q.3 (a) A company is considering the purchase of a new machine at Rs.15,000. The economic life of the machine is expected to be 8 years. The salvage value of the machine at the end of the life will be Rs. 3,000. The annual running cost is estimated to be Rs.7,000. 07

- Assuming an interest rate of 5 percent, determine the present worth of future costs of the proposed machine.
- Compare the new machine with the presently-owned machine that has an annual operating cost of Rs.5,000 and cost of repair Rs. 1,500 in the second year, with an annual increase of Rs. 500 in the subsequent years of its life.

(Note: The running, operating and repairing costs are assumed to be incurred at the end of the years.)

- (b) Five lectures by experts are to be scheduled so as not to conflict with one another. The lectures are to be delivered in the afternoon on week days only, otherwise, because of other class schedules, certain students will be forced to drop out these lectures. The following table indicates the number of absentees lecture-wise and day-wise. Schedule these lectures in such a way as to minimize the total number of students forced to remain absent. 07

Lecture	1	2	3	4	5
Monday	3	2	3	9	10
Tuesday	11	5	9	10	2
Wednesday	1	3	8	2	4
Thursday	8	11	10	5	2
Friday	8	6	5	6	9

OR

- Q.3 (a)** The following mortality rates have been observed for a certain type of fuse in a multinational company: **07**

Week	1	2	3	4	5
Percentage failing by the week end	5	15	35	57	100

There are 1,000 fuses in use and it costs Rs 5 to replace an individual fuse. If all fuses were replaced simultaneously it would cost Rs. 1.25 per fuse. It is proposed to replace all fuses at fixed intervals of time, whether or not they have burnt out, and to continue replacing burnt out fuses as and when they fail. At what time intervals should the group replacement be made? Also prove that this optimal policy is superior to the individual replacement policy.

- (b)** The company operates in 4 territories and 4 salesmen are available for an assignment. The territories are not equally rich in their sales potential. It is estimated that a typical salesman operating in each territory would bring in the following sales: **07**

Territory	Western	Northern	Southern	Eastern
Annual Sales (in '000 Rs)	126	105	84	63

The 4 salesmen also differ in their ability. It is estimated that they are working under the same conditions. The yearly sales would be proportional as under:

Salesman	A	B	C	D
Proportion	7	5	5	4

If the criterion is maximum expected sales the intuitive answer is to assign the best salesman the richest territory, the next best to the 2nd richest and so on. Verify the answer by assignment technique.

- Q.4** A manufacturing company processes 6 different jobs on two machines A and B. Number of units of each job and its processing times on A and B are given in the following table. Find the optimum sequence, the total minimum elapsed time and idle time for each machine. **14**

Job Number	No. of Units of each job	Processing Time (in hours)	
		Machine A	Machine B
1	3	5	8
2	4	16	7
3	2	6	11
4	5	3	5
5	2	9	7.5
6	3	6	14

OR

- Q.4** A businessman has two independent investments A and B available to him, but he lacks the capital to undertake both of them simultaneously. He can choose to take A first and then stop, or if A is successful then take B, or vice versa. The probability of success on A is 0.7, while for B it is 0.4. Both investments require an initial capital outlay of Rs 2,000 and both return nothing if the venture is unsuccessful. Successful completion of A will return Rs 3,000 (over cost), successful completion of B will return Rs 5,000 (over cost). Draw the decision tree and determine the best strategy. **14**

- Q.5 (a)** A company is manufacturing electric fans. They need 24000 blades annually. They purchase the blades from a blade manufacturing company which has offered following price schedule. **07**

Quantity per order	Price in Rs. per Blade
1-999	43
1000-1999	42
≥ 2000	41

Ordering cost per order is Rs. 150 and stock-holding cost as a fraction of stock value is 5%. Find out :

- (i) Economic Ordering Quantity
(ii) Optimal ordering quantity by calculating total annual cost.
- (b)** MG Television company operates two assembly lines, Line 1 and Line 2. **07**
Each line is used to assemble the components of three types of televisions: LED, LCD and Plasma. The expected daily production on each line is as under:

TV model	Line 1	Line 2
LED	3	1
LCD	1	1
Plasma	2	6

The daily running costs for two lines are Rs. 6,000 for Line 1 and Rs. 4,000 for Line 2. It is given that the company must produce at-least 24 LED, 16 LCD and 48 Plasma TV sets for which an order is pending. Formulate this problem as LP problem taking the objective function as minimization of total cost. Also determine graphically the number of days that the two lines should be run to meet the requirements.

OR

- Q.5 (a)** A water pump manufacturing company is consistently making 50 no. of multistage water pumps of the same design every month. Assembly of each pump requires four ball bearing of same size. The manufacturer has received following price schedule from the supplier of ball bearings: **07**

Quantity per order	Price (Rs./Ball bearing)
1 to 199	180
200 to 349	160
350 and more	150

The manufacturer is incurring ordering cost as Rs. 150/order and inventory carrying cost as 30% of stock value. Calculate following:

- i) Economic Ordering Quantity
ii) Optimal ordering quantity by calculating total annual cost.
- (b)** A Factory operates for 8 hours everyday and has 240 working days in the year. It buys a large number of small machines which can be serviced by its maintenance engineer at a cost of Rs 4 per hour for the labour and spare parts. The machines can, alternatively, be serviced by the supplier at an annual contract price of Rs.20,000 including the labour and spare parts needed. The supplier undertakes to send a repairman as soon as a call is made but in no case more than one repairman is sent. The service times of the maintenance engineer and the supplier's repairman are both exponentially distributed with respective means of 1.7 and 1.5 day. The machine breakdowns occur randomly and follow Poisson distribution, with an average of 2 in 5 days. Each hour that a machine is out of order, it costs the company Rs 8. Which servicing alternative would you advise? **07**
