Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- VIIth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 172004 **Date: 28/05/2012**

Subject Name: Production Optimization Techniques

Time: 02:30 pm – 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)** There are four machines and four operators. Operator A charges Rs.6, 7, 7 and 8 on machines I, II, III and IV respectively. Operator B charges Rs. 7, 8, 9 and 7, operator C charges Rs. 8, 6, 7 and 6, and operator D charges Rs. 8, 7, 6 and 9 respectively. Assign one operator to one machine so that overall payment is minimum. Also calculate minimum payment. **07**

(b) ABC company has one hob regrinding machine. The hobs needing grinding are sent from company's tool crib to this machine which is operated one shift per day of 8 hours duration. It takes on an average half an hour to regrind a hob. The arrival of hobs is random with an average of 8 hobs per shift. **07**

1. Calculate the present utilization of the hob regrinding machine.
2. What is the average time for the hob to be in the regrinding section?
3. The management is prepared to recruit another grinding operator when the utilization of the machine increases to 80%. What should the arrival rate of hobs then be?

Q.2 **(a)** A book binder has one printing press, one binding machine and a machine to carry out finishing operation. The sequence in which the operation to be performed is Printing-binding-finishing. Determine the order in which the books should be processed in order to minimize the total time required to process all the books. Also find the total elapsed time. Processing time for 5 books on different machines is given in the table below. **07**

Book	Processing time (in minutes)				
	1	2	3	4	5
Printing time	60	90	80	90	50
Binding time	50	60	20	30	40
Finishing time	80	100	60	70	100

(b) Solve the following with graphical method **07**

Maximize $Z = 15\,x_1 + 10\,x_2$

Subject to $4\,x_1 + 6\,x_2 \leq 360$, $3\,x_1 \leq 180$, $5\,x_2 \leq 200$

$x_1\,,\,x_2 \geq 0$

OR

(b) Solve the following with graphical method **07**

Minimize $Z = 6\,x_1 + 14\,x_2$

Subject to $5\,x_1 + 4\,x_2 \geq 60$, $3\,x_1 + 7\,x_2 \leq 84$, $x_1 + 2\,x_2 \geq 18$

$x_1\,,\,x_2 \geq 0$

Q.3 **(a)** What is the significance of sensitivity analysis in linear programming? **07**

(b) Explain the method solving the Linear programming problem with two phase method with the help of a flow diagram. **07**

OR

Q.3 Solve the following with Big M. **14**

Minimize $Z = 5x_1 + 3x_2$

Subject to $2x_1 + 4x_2 \leq 12$, $2x_1 + 2x_2 = 10$, $5x_1 + 2x_2 \geq 10$

Q.4 **(a)** A company is manufacturing two models of office chairs. Every month they produce 300 chairs of model A and 400 chairs of model B. Both the models of chairs require handles of common design and quantity needed is two handles per chair. The manufacturer is purchasing handles from the vendor who is offering following price schedule. **07**

Quantity per order	Price (Rs./Handle)
1-199	100
200-499	95
500 and more	90

The manufacturer is incurring ordering cost as Rs. 25/order and inventory carrying cost as 5% of stock value. Calculate following:

i) EOQ and ii) Optimal ordering quantity by calculating total annual cost.

(b) In order to meet an increased demand for the product a manufacturing company is considering three courses of action namely: **07**

1. Arrange overtime working
2. Give subcontract
3. Carry out expansion of the existing unit

The correct choice depends largely upon future demand which may be low, medium or high. The respective probabilities of the future demand are estimated as 0.1, 0.4 and 0.5. A cost analysis reveals effect upon the payoffs (profit) as under: (The payoffs are in thousands of Rs.)

Demand	Probability	Courses of Action		
		Overtime	Sub contract	Expansion
Low	0.1	-25	15	-180
Medium	0.4	50	45	40
High	0.5	80	55	160

OR

Q.4 **(a)** Bits enterprise is in the business of assembling and selling computers. They procure keyboards from a supplier. Yearly sale of computer is 9,600 and each computer requires one keyboard. Ordering cost per order is Rs.1,500/-. The annual stock holding cost is 10 % of the stock value. The company can procure the items according to the following schedule offered by supplier with the basic price of keyboard as Rs. 550/- per piece. **07**

Ordering Qty.	Discount on basic price
1 – 599	No discount
≥ 600	10 %

Find out EOQ and Optimal Ordering Quantity. Also find out minimum annual cost for the procurement of this component.

(b) What is the procedure to make and use the decision tree? **07**

Q.5 **(a)** A machine M, costing Rs.9000 has no salvage value and has a maintenance cost of Rs.200 in the first year of its operation which rises by Rs. 2000 in each of the successive years. Assuming that the machine replacement can be done only at the end of a year, determine the best age at which the machine be replaced. Further the company has an offer to replace the machine M which is a year old, by another machine N which costs Rs. 8000. The machine N needs Rs. 2000 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 be replaced by machine N? If so, when? **07**

(b) The major elements of the project have been identified, as under, along with their durations and immediately preceding elements. **07**

Activity	Duration (weeks)	Immediate predecessors
A	14	-
B	4	A
C	2	B
D	1	C
E	2	A
F	3	E
G	2	E
H	4	E
I	3	H,L
J	12	K
K	4	D,F,G
L	2	J
M	2	H,L

Draw the network diagram and show the critical path. Also find out the total duration of the project.

OR

Q.5 A company has three production facilities P, Q and R with production capacity of 7, 9 and 18 units (in 100s) per week of a product, respectively. These units are to be shipped to four warehouses D, E, F and G with requirement of 5, 8, 7 and 14 units (in 100s) per week, respectively. The transportation costs (in rupees) per unit between factories to warehouses are given in the table below. **14**

	D	E	F	G	Supply
P	19	30	50	10	7
Q	70	30	40	60	9
R	40	8	70	20	18
Demand	5	8	7	14	34

Find out the initial solution of this transportation problem to minimize the total transportation cost by North West corner method, least cost method and Vogel's approximation method. Also show total transportation cost in each case.

****