GANPAT UNIVERSITY
B.TECH. SEM. VII MECHATRONIC ENGINEERING
REGULAR EXAMINATION NOV/DEC-2012 EXAMINATION
MC704 OPERATION MANAGEMENT

Time: 3 Hrs]   [Total Marks: 70

Instructions:-
1. Attempt **all** Questions.
2. Figure to the **right** indicate full marks.
3. Answers to the two section must be written in **separate** drawing papers
4. Assume suitable data if **necessary**.
5. Draw neat sketch wherever essential.

SECTION – I

Q.1 (A) A standard weight of a special purpose brick is 5Kg an it contains two basic **(4)** ingredients B1 and B2. B1 costs Rs. 5 per Kg and B2 costs Rs 8 per Kg. Strength considerations dictate that the brick should contain not more than 4 Kg of B1 and a minimum of 2 Kg of B2. Since the demand for the product is likely to be related to the price of the brick, find out graphically the minimum cost of the brick satisfying the above conditions.

(B) Solve the following LP problem by Big-M Method. **(8)**

$$Z \, Max = 3X_1 + 2X_2$$

Subject to $2X_1 + X_2 \leq 2,$

$$3X_1 + 4X_2 \geq 12$$

And $X_1, X_2 \geq 0$

OR

Q.1 (A) A manufacturing firm produces two machine parts P1 and P2 using Lathe, Milling **(4)** and grinding machines. The different machining times required for each part, the machining times available on different machines and the profit on each machine part are as given below:

Machine	Manufacturing Time Required (min.)		Maximum Time Available per Week (min.)
	P1	P2	
Lathe	10	1.5	2500
Milling	4	10	2000
Grinding	1	1.5	450
Profit per unit (Rs)	50	100	

Determine the number of pieces of P1 and P2 to be manufactured per week to maximize profit.

(B) Solve the following LP problem by Big-M Method. **(8)**

$$Z \, Min = 2X_1 + X_2$$

Subject to $3X_1 + X_2 \quad = 3$

$$4X_1 + 3X_2 \quad \geq 6$$

$$X_1 + 2X_2 \quad \leq 4$$

And $X_1, X_2, X_3 \geq 0$

Q.2 **(A)** Debonair Private Ltd. Is in the business of manufacturing and selling office shirts **(6)** for men. It has four factories located in different parts of the country and the monthly capacities of the factories in thousand are as given below. The shirts are made in a few standard design and colours, and each factory can make all types of shirts in any size subject to the overall of the factory.

Factories	I	II	III	IV
Monthly Capacity	3	4.5	2.5	5

From the factories, the shirts are transported to five warehouses located in five different regions in India. The warehouses in turn supply to the distributors and the retailers. The monthly demand of shirts (in thousands) from the warehouses is as follows:

Warehouses	A	B	C	D	E
Monthly Capacity	3	5	1.5	2	2.5

The cost of transporting a shirt from a factory to a warehouse depends on the distance between them and the cost of transporting a shirt from each factory to each warehouse is given in the table below:

		Warehouse				
		A	B	C	D	E
Factory	I	6	3	4	2	5
	II	11	7	5	10	9
	III	10	7	1	2	8
	IV	12	10	5	3	5

How many shirts are to be produced, in which factory, and how are these to be dispatched to the warehouse so that the total cost involved in transportation is minimized.

   a) Use the North-West corner method to get an initial feasible solution.
   b) Check if the solution obtained in (a) above is an optimal allocation and if not, then find the optimal solution.

(B) The required data for a small project consisting of different activities are given **(6)** below:

Activity	Predecessor Activities	Normal		Crash	
		Duration (days)	Cost (Rs)	Duration (days)	Cost (Rs)
A	-	6	300	5	400
B	-	8	400	6	600
C	A	7	400	6	600
D	B	12	1000	4	1400
E	C	8	800	8	800
F	B	7	400	6	500
G	D, E	5	1000	3	1400
H	F	8	500	5	700

   i)   Draw the network diagram for the project and find the normal and minimum project length.
   ii) If the project is to be completed in 21 days with minimum crash cost which activities should be crashed to how many days?

OR

Q.2 (A) In below transportation problem: (6)

From	To			
		I	II	III	Supply
	A	5	1	7	10
	B	6	4	6	80
	C	3	2	5	15
Demand		75	20	50	

Since there is not enough supply, some of the demands at these destinations may not be satisfied. Suppose there are penalty costs for every unsatisfied demand unit which is given by 5, 3 and 2 for destinations I, II and III respectively. Find the optimal solution.

(B) A publisher is preparing to produce the second edition of a textbook. The activities required and their estimated time are as follows: (6)

Activity	Immediate Predecessor	Activity time (days)		
		Optimistic	Most likely	Pessimistic
A	-	1	3	2
B	A	1	2	1.5
C	B	3	9	5
D	C	4	12	6
E	B	2	7	4
F	D	1	2.5	1.5
G	E	0.5	1.5	1
H	F, G	5	9	6
I	E	2	4	3
J	I	1	2	1.5
K	H, J	0	0	0

i) Draw a PERT network diagram and determine the critical path.
ii) What is probability that the project will be completed within 21 months? 24 months? 27 months?

Q.3 (A) At the end of a cycle of schedules, a transport company has a surplus of one truck in each of the cities 1, 2, 3, 4, 5 and a deficit of one truck in each of the cities A, B, C, D, E and F. The distances (in K.M) between the cities with a surplus and cities with a deficit are given below: (4)

From City	To City					
		A	B	C	D	E	F
	1	80	140	80	100	56	98
	2	48	64	94	126	170	100
	3	56	80	120	100	70	64
	4	99	100	1100	104	80	90
	5	64	80	90	60	60	70

How should the trucks be dispatched so as to minimize the total distance travelled? Which city will not receive a truck?

(B) Find the optimal sequence for the following sequencing problem of four jobs and (4) five machines (when passing in not allowed) of which processing time (in hrs) is as follows.

Job	I	II	III	IV
Machine M_1	6	5	4	7
Machine M_2	4	5	3	2
Machine M_3	1	3	4	2
Machine M_4	2	4	5	1
Machine M_5	8	9	7	5

Find the total elapsed time and idle time of all 5 Machines

(C) Explain the Methodology of Operation Research. (3)

SECTION – II

Q.4 (A) What are the objectives of Inventory Control? Derive an expression for (4) Economic Order Quantity.

(B) Briefly explain each of these terms: (4)

    1.   AOQ   3.   Consumer's Risk

    2.   AQL   4.   Producer's Risk

(C) The number of customer complaints received daily by an organization is given (4) below:

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Complaints	2	3	0	1	9	2	0	0	4	2	0	7	0	2	4

Draw suitable control charts and state whether the no. of complaints is under statistical control. If not, revise the control limits for future.

OR

Q.4 (A) What do you mean acceptance sampling? Explain double sampling plan. (4)

(B) Explain the term "Standardization" for product development point of view. State (4) the advantages and disadvantages of it.

(C) The table shows the successive lots of spindles coming out of machine. The (4) spindles are subject to inspect for burrs, and are inspected in samples of 100 each. Presence of a single or more burrs discriminates the values to be as defective. Compute and construct the control chart and state whether process is under control or not.

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Defectives	1	1	2	1	1	0	1	0	1	2	3	2	1	2	0

Q.5 (A) A chemical firm produces sodium bisulfate in 100-pound bags. Demand for this (4) product is 20 tons per day. The capacity for producing the product is 50 tons per day. Setup costs $100, and storage and handling costs are $5 per ton year. The firm operates 200 days a year. (Note: 1 ton=2000 pound)

    1. How many bags per run are optimal?

    2. What would the average inventory be for this lot size?

    3. Determine the approximate length of a production run in days?

(B) Western Digital Inc sells portable hard disk. Monthly sales for a seven month (4) period were as follows:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul
Sales in 1000 units	19	18	15	20	18	22	20

Forecast August sales volume using each of the following:

1. A naïve approach
2. A five month moving average
3. A weighted moving average using 0.60 for July, 0.30 for June and 0.10 for May
4. Exponential smoothing with a smoothing constant equal to 0.20, assuming a February forecast of 19000.

(C) Write a short note on Quality circle.   (3)

OR

(A) A mail order house uses 18000 boxes a year. Carrying cost isRs. 0.20 per box a   (4)
year, and ordering costs are Rs.32. The following price schedule applies.

Number of boxes	Price per box
1000 to 1999	Rs. 1.25
2000 to 2999	Rs. 1.20
3000 to 3999	Rs. 1.18
4000 to 4999	Rs. 1.15

Determine
1. The optimal order quantity
2. The number of orders per year

(B) A producer believes that the sales of his product for the past ten years are related   (4)
to an economic index and the data for that period is shown in the following table.

Year	Economic Index	Sales in 10000 units
1	104	2
2	100	2.3
3	111	2.1
4	129	2.6
5	126	2.3
6	115	2.4
7	152	2.5
8	161	2.8
9	143	2.6
10	170	3

1. Determine the strength of relationship between the two variables by computing the coefficient of correlation.
2. If the value of economic index for the 11th year is 175, find out the sales for this year.

(C) Define and explain "Scheduling."   (3)

Q.6   **Write short notes on: (Any three)**   (12)

(A) Distinguish between production planning and production control and state their objectives.

(B) Wire a short note on "Total Quality Management."

(C) Write a short note on "Process Capability."

(D) A factory requires 18000 units per year, each costing Rs.27. The cost per order is Rs.150 and the inventory carrying charges working out to 20 percent of the average inventory. Find the economic order quantity and number of orders per year.
Would you accept a 2 percent discount on a minimum supply quantity of 1200 units? Compare the total cost in both the cases.

END OF PAPER