GANPAT UNIVERSITY
B.TECH. SEM. VII MECHATRONIC ENGINEERING
CBCS REGULAR EXAMINATION NOV/DEC-2016 EXAMINATION
2MC704 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 and 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)
        $$Z \, Min = 2X1 + 8X2$$
        $$\text{Subject to } 5X1 + X2 \geq 10$$
        $$2X1 + 2X2 \geq 14$$
        $$X1 + 4X2 \geq 12$$
        $$\text{And} \quad X1, X2 \geq 0$$

OR

Q.1 (A) A firm makes two products X and Y, and has a total production capacity of 9 tonnes (4)
         per day. Both X and Y requires the same production capacity. The firm has a
         permanent contract to supply at least 2 tonnes of X and at least 3 tonnes of Y per day
         to another company. Each tonne of X requires 20 machine hours of production time
         and each tonne of Y requires 50 machine hours of production time. The daily
         maximum possible number of machine hours is 360. All of the firm's output can be
         sold. The profit made is Rs 80 per tonne of X and Rs 120 per tonne of Y. Formulate
         this problem as an LP model and solve it by using graphical method to determine the
         production schedule that yields the maximum profit.

   (B) Solve the following LP problem: (8)
        $$Z \, Max = 3X1 + 2X2 + 5X3$$
        $$\text{Subject to } X1 + 2X2 + X3 \leq 430$$
        $$3X1 + \quad 2X3 \leq 460$$
        $$X1 + \quad 4X3 \leq 420$$
        $$\text{And} \quad X1, X2, X3 \geq 0$$

Q.2 (A) A company has four warehouses a, b, c, and d. it is required to deliver a product from (6)
         these warehouses to three customers A, B and C. the table below shows the costs of
         transporting one unit from warehouses to the customer.

		Warehouses				
		a	b	c	d	No. of Units
Customer	A	8	9	6	3	18
	B	6	11	5	10	20
	C	3	8	7	9	18
No. of Units		15	16	12	13	

Find the optimal transportation routes and cost

(B) A promoter is organizing a sports meeting. The relationship among the activities and time estimates in days are shown below in the table: **(6)**

Activity	Immediate Predecessor	Activity time (days)		
		Optimistic	Most likely	Pessimistic
A	-	3	7	11
B	A	14	21	28
C	A	11	14	17
D	C	2	2	2
E	B	2	3.5	8
F	D, E	10	14	21
G	E	3	4	5
H	E, F	4	4.5	8
I	G, H	1	2	4

i) Draw the network diagram for the project and compute expected completion time of the project.

ii) What should be the due date to have 0.90 probability of project completion?

iii) What is the probability that the length of the critical path does not exceed 56 days?

OR

Q.2 (A) Following table gives a list of various activities and their immediate predecessor involved in installation of CAT scanner in a hospital. **(6)**

Activity	Preceding Activity	Expected Completion Time (days)
A	-	2
B	A	6
C	B	12
D	B	8
E	C	6
F	C	4
G	C	3
H	E, F, G	10
I	H	9
J	D, I	6
K	J	3
L	K	2
M	L	1

i) Construct the network of activities and find the critical path.
ii) For each non-critical activity, find total, free and total float.

(B) A company has received a contract to supply gravel to three new construction projects (6) located in towns A, B and C. The construction engineers have estimated that the required amounts of gravel which will be needed at these construction project are

Project Location	Weekly Requirement (Truckloads)
A	72
B	102
C	41

The company has 3 gravel pits located in towns X, Y and Z. The gravel required by the construction projects can be supplied by three pits. The amount of gravel that can be supplied by each pit is as follows:

Plant	X	Y	Z
Amount available(Truckloads)	76	82	77

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

		Project Location		
		A	B	C
Pit	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) The following table gives the activities in a construction project and also gives other (5) relevant information:

Activity	Preceding Activity	Time (months)		Direct Cost (Rs '000)	
		Normal	Crash	Normal	Crash
A	-	4	3	60	90
B	-	6	4	150	250
C	-	2	1	38	60
D	A	5	3	150	250
E	C	2	2	100	100
F	A	7	5	115	175
G	D, B, E	4	2	100	240

Indirect costs vary as follows:

Months	15	14	13	12	11	10	9	8	7	6
Cost (Rs)	600	500	400	250	175	100	75	50	35	25

a) Draw an arrow diagram for the project.

b) Determine the project duration that will result in minimum total project cost.

(B) Define floats and explain the importance's of floats. (3)

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

Q.4 (A) What is sales forecasting? Explain Multiple regressions method for sales forecasting. (4)
    (B) Define the term Total quality Management? Explain different elements of TQM. (4)
    (C) What is benchmarking? Explain the process of benchmarking. (4)

OR

Q.4 (A) Explain the term "Loading, Dispatching and Scheduling" for PPC. (4)
    (B) Explain the different sampling method. (4)
    (C) A solicitations firm employs typists on hourly piece-rate basis for their daily work. (4) There are five typists and their charges and speed are different according to an understanding only one job was given to one typist and the typist was paid for a full hour. Even if he worked for a fraction of an hour. Find the least lost cost allocation for the following data.

Typist	Rate per hour	No. of pages typed/hours	Jobs	No. of pages
A	5	12	P	199
B	6	14	Q	175
C	3	8	R	145
D	4	10	S	298
E	4	11	T	178

Q.5 (A) Explain the operating characteristic curve. (5)
    (B) What is Quality control? Explain the objective of Quality Control. (3)
    (C) Write down short note on: Just in time (3)

OR

(A) Derive the equation of economic order quantity for purchase model without shortages. (5)

(B) A firm producing paints plans to use simple exponential smoothing to forecast weekly (6) demand (D) and has collected the past data for 15 weeks (W) as shown below.

W	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
D	30	35	20	15	10	10	15	20	30	35	30	10	12	20	30

Compute the forecast value using $\alpha=0.2$ for 16th week, simple moving average may be used for determining forecast of 15th week.

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

(A) Measurement on averages($\bar{X}$) and ranges ($\bar{R}$) from 20 samples each of size 5 gave the following result: X=99.6, R=7.0.Determine the values of the controls limits for drawing a mean chart. (Given that for n=5,mean range=2.32*population S.D)

(B) What is inventory control? Explain the factors affecting to inventory control.

(C) A textile mill buys its raw material from vendor. The annual demand of the raw material is 9000 units. The ordering cost is Rs.100 per order and the carrying cost is 20% of the purchase per unit per month, where the purchase price per unit is Re.1. find the following

- Economic order quantity(EOQ)
- total cost w.r.t EOQ
- number of orders per year
- time between consecutive two orders

	0.	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
.	0.5	0.503989	0.507978	0.511966	0.515953	0.519939	0.523922	0.527903	0.531881	0.535856
.1	0.539828	0.543795	0.547758	0.551717	0.55567	0.559618	0.563559	0.567495	0.571424	0.575345
.2	0.57926	0.583166	0.587064	0.590954	0.594835	0.598706	0.602568	0.60642	0.610261	0.614092
.3	0.617911	0.62172	0.625516	0.6293	0.633072	0.636831	0.640576	0.644309	0.648027	0.651732
.4	0.655422	0.659097	0.662757	0.666402	0.670031	0.673645	0.677242	0.680822	0.684386	0.687933
.5	0.691462	0.694974	0.698468	0.701944	0.705401	0.70884	0.71226	0.715661	0.719043	0.722405
.6	0.725747	0.729069	0.732371	0.735653	0.738914	0.742154	0.745373	0.748571	0.751748	0.754903
.7	0.758036	0.761148	0.764238	0.767305	0.77035	0.773373	0.776373	0.77935	0.782305	0.785236
.8	0.788145	0.79103	0.793892	0.796731	0.799546	0.802337	0.805105	0.80785	0.81057	0.813267
.9	0.81594	0.818589	0.821214	0.823814	0.826391	0.828944	0.831472	0.833977	0.836457	0.838913
.	0.841345	0.843752	0.846136	0.848495	0.85083	0.853141	0.855428	0.85769	0.859929	0.862143
.1	0.864334	0.8665	0.868643	0.870762	0.872857	0.874928	0.876976	0.879	0.881	0.882977
.2	0.88493	0.886861	0.888768	0.890651	0.892512	0.89435	0.896165	0.897958	0.899727	0.901475
.3	0.9032	0.904902	0.906582	0.908241	0.909877	0.911492	0.913085	0.914657	0.916207	0.917736
.4	0.919243	0.92073	0.922196	0.923641	0.925066	0.926471	0.927855	0.929219	0.930563	0.931888
.5	0.933193	0.934478	0.935745	0.936992	0.93822	0.939429	0.94062	0.941792	0.942947	0.944083
.6	0.945201	0.946301	0.947384	0.948449	0.949497	0.950529	0.951543	0.95254	0.953521	0.954486
.7	0.955435	0.956367	0.957284	0.958185	0.95907	0.959941	0.960796	0.961636	0.962462	0.963273
.8	0.96407	0.964852	0.96562	0.966375	0.967116	0.967843	0.968557	0.969258	0.969946	0.970621
.9	0.971283	0.971933	0.972571	0.973197	0.97381	0.974412	0.975002	0.975581	0.976148	0.976705
.	0.97725	0.977784	0.978308	0.978822	0.979325	0.979818	0.980301	0.980774	0.981237	0.981691
.1	0.982136	0.982571	0.982997	0.983414	0.983823	0.984222	0.984614	0.984997	0.985371	0.985738
.2	0.986097	0.986447	0.986791	0.987126	0.987455	0.987776	0.988089	0.988396	0.988696	0.988989
.3	0.989276	0.989556	0.98983	0.990097	0.990358	0.990613	0.990863	0.991106	0.991344	0.991576
.4	0.991802	0.992024	0.99224	0.992451	0.992656	0.992857	0.993053	0.993244	0.993431	0.993613
.5	0.99379	0.993963	0.994132	0.994297	0.994457	0.994614	0.994766	0.994915	0.99506	0.995201
.6	0.995339	0.995473	0.995604	0.995731	0.995855	0.995975	0.996093	0.996207	0.996319	0.996427
.7	0.996533	0.996636	0.996736	0.996833	0.996928	0.99702	0.99711	0.997197	0.997282	0.997365
.8	0.997445	0.997523	0.997599	0.997673	0.997744	0.997814	0.997882	0.997948	0.998012	0.998074
.9	0.998134	0.998193	0.99825	0.998305	0.998359	0.998411	0.998462	0.998511	0.998559	0.998605
.	0.99865	0.998694	0.998736	0.998777	0.998817	0.998856	0.998893	0.99893	0.998965	0.998999
.1	0.999032	0.999065	0.999096	0.999126	0.999155	0.999184	0.999211	0.999238	0.999264	0.999289
.2	0.999313	0.999336	0.999359	0.999381	0.999402	0.999423	0.999443	0.999462	0.999481	0.999499
.3	0.999517	0.999534	0.99955	0.999566	0.999581	0.999596	0.99961	0.999624	0.999638	0.999651
.4	0.999663	0.999675	0.999687	0.999698	0.999709	0.99972	0.99973	0.99974	0.999749	0.999758
.5	0.999767	0.999776	0.999784	0.999792	0.9998	0.999807	0.999815	0.999822	0.999828	0.999835
.6	0.999841	0.999847	0.999853	0.999858	0.999864	0.999869	0.999874	0.999879	0.999883	0.999888
.7	0.999892	0.999896	0.9999	0.999904	0.999908	0.999912	0.999915	0.999918	0.999922	0.999925
.8	0.999928	0.999931	0.999933	0.999936	0.999938	0.999941	0.999943	0.999946	0.999948	0.99995
.9	0.999952	0.999954	0.999956	0.999958	0.999959	0.999961	0.999963	0.999964	0.999966	0.999967

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