Q. P. Code: 27496

(3 Hours)   Max.Marks: 80

N.B.:

(1) Question number 1 is compulsory
(2) Solve any **three** questions from the remaining five questions
(3) Figures to right indicate full marks
(4) Assume suitable data if **necessary**.
(5) Notations carry usual meaning.

Q.1	**Attempt any four**	
(A)	Derive an equation for conventional batch size where consumption is constant and replenishment is instantaneous.	(05)
(B)	Food X contains 6 units of vitamin A per gram and 7 units of vitamin B per gram and costs 12 paisa per gram. Food Y contains 8 units of vitamin A per gram and 12 units of vitamin B per gram and costs 20 paisa per gram. The daily minimum requirement of vitamin A and vitamin B is 100 units and 120 units respectively. Formulate the problem as Linear programming model.	(05)
(C)	How simulation can be used as alternative for analysis of assembly line ? Explain.	(05)
(D)	Assign the four subjects to three professors. Students have to study One subject on their own. The matrix given below indicates the marks score and the objective is to score maximum marks.	(05)

Professors	Subjects			
	S1	S2	S3	S4
P1	60	40	70	50
P2	45	55	65	60
P3	30	35	55	50

(E)	Explain in brief different methods of sensitivity analysis in Linear Programming model.	(05)
Q.2 (A)	Solve the following L.P. problem using Big-M method.	(12)

Maximize $Z = 3X_1 - X_2$

Subject to $2X_1 + X_2 \geq 2$

$X_1 + 3X_2 \leq 3$

$X_2 \leq 4$

$X_1, X_2 \geq 0$

(B)	A self service store employs one cashier at its counter. 8 customers arrive on an	(08)

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average every 5 minutes while the cashier can serve 10 customers in the same time. Assuming Poisson distribution for arrival and exponential distribution for service rate, determine:

- i)   Average number of customer in the system.
- ii) Average number of customer in queue.
- iii) Probability that there is no customer at the counter
- iv) Probability that there are equal to or more than 3 customers in the queue.

Q.3(A)   Solve the following game using dominance property and find the game value.   (10)

	I	II	III	IV
I	3	2	4	0
II	3	4	2	4
III	4	2	4	0
IV	0	4	0	8

(B)   Find the basic feasible solution of the following transportation problem by VAM method. Also find the optimal transportation plan.   (10)

	D1	D2	D3	D4	Available
O1	21	16	25	13	11
O2	17	18	14	23	13
O3	32	27	18	41	19
Requirement	6	10	12	15	

Q.4(A)   There are six jobs, each of which has to go through the machines A, B and C in the order AB and BC. Processing times are given in hours as   (08)

Jobs	1	2	3	4	5	6
Machine A	4	6	3	7	2	3
Machine B	5	2	5	3	5	4
Machine C	1	4	2	4	6	5

Find out the total elapsed time and idle time of each machine.

(B) Solve the following Linear Programming Problem by Simplex method (12)

Minimize $Z = X_1 - 3X_2 + 3X_3$
Subject to
$$3X_1 - X_2 + 2X_3 \leq 7$$
$$2X_1 + 4X_2 \geq -12$$
$$-4X_1 + 3X_2 + 8X_3 \leq 10$$
and $X_1, X_2, X_3 \geq 0$

Q.5(A) A distance network consists of Eleven nodes which are distributed as shown (10)
below. Find the shortest path from Node 1 to Node 11 (Refer Fig 1) and also the
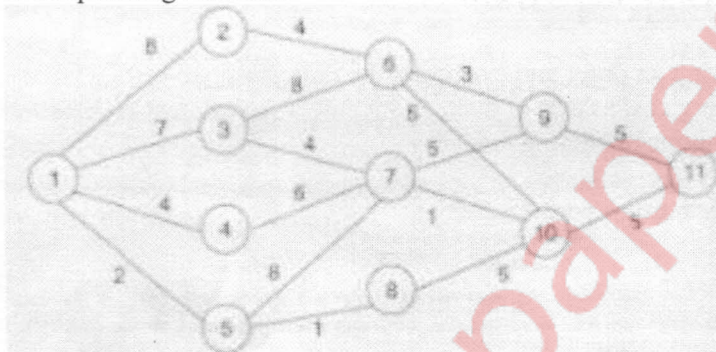corresponding distances

Figure 1

(B) A specific requirement of a company can be met either by Machine A or (10)
Machine B.Machine A costs Rs.10000.The maintenance cost during the first
year of its operation is Rs.2000 and it increases by Rs.800 every year thereafter
up to its fourth year of operation. The maintenance cost during the fifth year is
Rs.6000 and increases by Rs.1000 every year thereafter.
Machine B which has same capacity as that of Machine A, is priced at
Rs.15000.The maintenance cost of the Machine B are estimated at Rs.2000 for
the first year and an equal yearly increment of Rs.750 thereafter.
If the money is worth 15% per year, which machine should be purchased?
(Assume that the scarp value of each of the machines is negligible at any year)

Q.6 (A) Customers arrive at random. Probability of inter arrival time and service time (10)
are given as under

Inter Arrival Time (Minutes)	Probability	Service Time (Minutes)	Probability
1	0.1	1.0	15
2	0.2	1.5	20
3	0.3	2.0	25
4	0.3	2.5	30
5	0.1	3.0	10

Estimate the average waiting time and queue length of customer by using seven

simulations

Random Number: 5887, 4739, 2328, 6997, 3569, 5587, 6952

(B)   A chemical firm buys 2500 units annually of a particular item from a vendor at   (10)
a cost of Rs.3/unit. It has now received a revised price schedule from the vendor
which is as follows:

Order Quantity	Price /Unit
Less than 500 units	Rs.3
Between 500 and 1250 units	Rs.2.90
1250 units or more	Rs.2.85

The cost of placing an order and executing the delivery once is Rs.25
Inventory carrying cost as a % of average inventory investment is 20%
Determine Economics Ordering Quantity

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