

(CBGS Course)
(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) Explain inventory model for manufacturing with non instantaneous replenishment and without shortages. (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) A bank has only one typist. Since the typing work varies in length the typing rate is randomly distributed approximating a Poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 6 per hour during the entire 8 hour work day. If the typewriter is valued at Rs. 30 per hour, determine: (05)
- i. Equipment utilization.
 - ii. Average cost due to waiting on the part of typewriter.
- (D) What are different decision criterion for decision making under uncertainty? Explain in brief. (05)
- (E) Assign the four subjects to three faculty members. 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)

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

TURN OVER

Q.2 (A) Solve the following L.P. problem using Big-M method. (12)

$$\text{Maximize } Z = 3X_1 - X_2$$

$$\text{Subject to } 2X_1 + X_2 \geq 2$$

$$X_1 + 3X_2 \leq 3$$

$$X_2 \leq 4$$

$$X_1, X_2 \geq 0$$

(B) A branch of PMK bank has only one typist. Since the typing work varies in length (no. of pages to be typed), the typing rate is randomly distributed approximating a Poisson distribution with mean service rate of 8 letters per hour. The letters arrive at a rate of 5 per hour during the entire 8 hour work day. If the typewriter is valued at Rs.150 per hour, determine (i) Equipment utilization (ii) The percent time that an arriving letter has to wait (iii) Average system time (iv) Average cost due to waiting on the part of typewriter. (08)

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

	I	II	III	IV	V	VI
1	4	2	0	2	1	1
2	4	3	1	3	2	2
3	4	3	7	-5	1	2
4	4	3	4	-1	2	2
5	4	3	3	-2	2	2

(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) Explain the following (08)

- Resource leveling
- Decision tree

TURN OVER

- (B) The time and cost estimates of different activities of a project and their precedence relationship are given below (12)

Activity	Preceding activity	Time (in weeks)		Cost (RS.)	
		Normal	Crash	Normal	Crash
A	-	6	4	10,000	14,000
B	-	4	3	5,000	8,000
C	A	3	2	4,000	5,000
D	B	8	3	1,000	6,000
E	B	14	6	9,000	13,000
F	C,D	8	4	7,000	8,000

Overhead costs amounts to Rs.1, 000 /- per week. Crash the project to optimum extent.

- Q.5(A) Solve the following LPP by Simplex method (10)

$$\begin{aligned} \text{Max } Z &= 6X_1 + 4X_2 \\ \text{Sub to } 4X_1 + 5X_2 &\leq 10 \\ 3X_1 + 2X_2 &\leq 9 \\ 8X_1 + 3X_2 &\leq 12 \text{ and } X_1, X_2 \geq 0 \end{aligned}$$

- (B) A newspaper boy has the following probabilities of selling a magazine: (10)

No. of copies sold	10	11	12	13	14
Probability	0.10	0.15	0.20	0.25	0.30

Cost of copy is 30 paise and sale price is 50 paise. He cannot return unsold copies. How many copies should he order?

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

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

TURN OVER

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 particular item has a demand of 10,000 units/year. The cost of procurement is Rs.100 and the holding cost per unit is Rs2.50 per year. The replacement is instantaneous and no shortages are allowed. Determine: (10)
- The economic lot size
 - The number of orders per year
 - The time between orders
 - The total cost per year if the cost of one unit is Rs.2