Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
MCA – SEMESTER -III EXAMINATION –WINTER-2022

Subject Code: 639406   **Date: 30/12/2022**
Subject Name: Operation Research
Time: 10:30 AM TO 01:00 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)** Define the following   **07**
          (1) Objective function
          (2) Merge event
          (3) Gradual failure
          (4) Dummy activity
          (5) Slack variable
          (6) Optimal solution
          (7) Constraint

    (b) State advantages and applications of Operation Research.   **07**

Q.2 **(a)** Explain various components and assumptions in Linear programming model in detail.   **07**

    (b) For the given LP model, find the optimal solution using simplex method.   **07**
        Maximize $Z=40x_1+35x_2$
          Subjected to,
              $2x_1+3x_2 \le 60,$
              $4x_1+3x_2 \le 96,$
              $x_1, x_2 \ge 0$

OR

    (b) Enlist and explain all the steps of simplex method to solve the Linear Programming problem.   **07**

Q.3 **(a)** Explain Kendall's notation to represent a queuing system in detail.   **07**

    (b) A Mobile phone owner observes that the maintenance/repair costs per year of a phone whose purchase price is Rs 15,000 are as given in the table below.   **07**

Years	1	2	3	4	5	6
Repair cost (Rs)	1500	2400	2700	3750	4500	5250
Resale price (Rs)	10500	7500	4500	3000	1500	750

Determine what time would it be profitable to replace the mobile phone.

OR

Q.3 **(a)** Explain the different inventory cost components associated with inventory control. **07**

(b) What is a Project? Enlist various phases of Project Management? Explain the **07** difference between PERT and CPM.

Q.4 **(a)** Explain Johnson's procedure (steps) for processing n jobs through two machines. **07**

(b) The website development project consists of following set of activities. The **07** relevant activity/task data is as shown in the table below.

Activity	Predecessor activity	Activity completion duration (Hours)
A	-	2
B	A	3
C	B	5
D	B	5
E	D	4
F	B	3
G	F	3
H	C,E,G	2
I	H	5
J	I	2

i. Draw Network diagram.
ii. Indicate critical path and find project duration.

OR

Q.4 **(a)** A packaging department of a manufacturing company has five employees with **07** five packaging jobs to be performed. The time (in hours) that each man takes to perform each job is given in the table as shown below. Assign one job per employee to minimize the total man-hours.

		Employees				
		1	2	3	4	5
	A	10	5	13	15	16
	B	3	9	18	13	6
Jobs	C	10	7	2	2	2
	D	7	11	9	7	12
	E	7	9	10	4	12

(b) What is queue discipline? Enlist the patterns of customer arrivals in a Queuing **07** system? For a queuing system, define the following terms:
(i) Traffic intensity (server utilization factor)
(ii) Customer arrival rate
(iii) Reneging
(iv) Jockeying

Q.5 **(a)** Find the initial basic feasible solution for the Transportation problem given in the **07** transportation table using,
  (1) Northwest corner method
  (2) Least cost method

	D1	D2	D3	D4	Supply capacity
S1	9	6	12	3	20
S2	6	12	15	9	15
S3	9	15	6	18	25
S4	12	9	3	12	40
Demand	30	20	25	25	

(b) Explain in detail the Hungarian method to solve an assignment problem with **07** suitable example.

OR

Q.5 **(a)** What is Transportation problem? Write steps of Vogel's approximation method to **07** find initial basic feasible solution(IBFS) of a Transportation problem.

(b) A computer technician finds that the time spent on his repairing jobs has an **07** exponential distribution with a mean of 30 minutes. If he repairs the computer sets in order which they came in and if the arrival of sets follow a Poisson distribution with and approximate average of 10 computer sets per 8-hour day. What is the technician's expected idle time each day? What is the value of average number of computers sets in the system?

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