Enrolment No. /Seat No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA – SEMESTER III- EXAMINATION –WINTER-2024

Subject Code:639406 **Date: 22/11/2024**

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.**
4. **Use of simple calculators and non-programmable scientific calculators are permitted.**

Q.1 (a) Explain simplex method in detail. 07

(b) Write the applications of operations research. 07

Q.2 (a) What is Linear Programming? Explain the basic components of an LP model. Also state its assumption. 07

(b) Solve the following LPP using simplex method. 07

Max $Z = 15x_1 + 6x_2 + 9x_3 + 2x_4$

Subject to, $2x_1 + x_2 + 5x_3 + 6x_4 \leq 20$

$3x_1 + x_2 + 3x_3 + 25x_4 \leq 24$

$7x_1 + x_4 \leq 70$

$x_1, x_2, x_3, x_4 \geq 0$

OR

(b) State and discuss similarities and differences between Transportation problem and Assignment Problem. 07

Q.3 (a) Solve the following transportation problem using Vogel's Approximation Method. 07

	D1	D2	D3	D4	D5	Supply
S1	5	8	6	6	3	8
S2	4	7	7	6	5	5
S3	8	4	6	6	4	9
Demand	4	4	5	4	8	

(b) A department of a company has five employees with five jobs to be performed. The time (in hours) that each man takes to perform each job is given in the effectiveness matrix. 07

	Employee				
Job	I	II	III	IV	V
A	10	5	13	15	16
B	3	9	18	13	6
C	10	7	2	2	2
D	7	11	9	7	12
E	7	9	10	4	12

How should the jobs be allocated, one per employee, so as to minimize the total man-hours?

OR

Q.3 (a) Explain in detail the Hungarian method to solve an assignment problem with suitable example. 07

(b) Discuss the fields of application for queuing theory. Explain queue discipline and its various forms. 07

Q.4 (a) We have five jobs, each of which must be processed on the two machines A and B, in the order AB. Processing times in hours are given in the table below: 07

JOB	1	2	3	4	5
Machine A	10	2	18	6	20
Machine B	4	12	14	16	18

Determine a sequence for the five jobs that will minimize the elapsed time T.

(b) The data collected in running a machine, the cost of which is Rs 60,000 are given below: 07

YEAR	1	2	3	4	5
Resale value (Rs)	42,000	30,000	20,400	14,400	9,650
Cost of spares (Rs)	4,000	4,270	4,880	5,700	6,800
Cost of labour (Rs)	14,000	16,000	18,000	21,000	25,000

Determine the optimum period for replacement of the machine.

OR

Q.4 (a) Explain with suitable examples the different costs that are involved in the inventory problems. 07

(b) What is Replacement? Explain the types of failures with example. 07

Q.5 (a) The following information in an inventory problem is available: 07
Annual demand 2,400 units
Unit price (Rs) 2.40
Ordering cost (Rs) 4.00
Storage cost (Rs) 20% p.a.
Find the EOQ.

(b) Trucks at a single platform weigh-bridge arrive according to Poisson probability distribution. The time required to weigh the truck follows an exponential probability distribution. The mean arrival rate is 12 trucks per day, and the mean service rate is 18 trucks per day. 07
Determine the following:
1. What is the probability that no trucks are in the system?
2. What is the average number of trucks waiting for service?
3. What is the average time a truck waits for weighing service to begin?
4. What is the probability that an arriving truck will have to wait for service?

OR

Q.5 (a) Describe the PERT/CPM network components and rules for network construction. 07

(b) Explain Johnson's procedure (steps) for processing n jobs through two machines. 07

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