Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

MCA INTEGRATED– SEMESTER-IV EXAMINATION –SUMMER-2020

Subject Code:2648602 Date:05-11-2019

Subject Name: Operations Research (OR)

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)** What is Linear Programming? Explain the basic components of an LP model. Also state its assumptions. **07**

(b) The ABC Company has been a producer of picture tubes for television sets and certain printed circuits for radios. The company has just expanded in to full scale production and marketing of AM and AM-FM radios. It has built a new plant that can operate 48 hours per week. Production of an AM radio in the new plant will require 2 hours and production of an AM-FM radio will require 3 hours. Each AM radio will contribute Rs. 40 to profits while an AM-FM radio will contribute Rs. 80 to profits. The marketing department, after extensive research has determined that a maximum of 15 AM radios and 10 AM-FM radios can be sold each week. **07**

Q.2 **(a)** Construct the dual of the problem. **07**

Max $z = 6x_1 + 4x_2 + 6x_3 + x_4$

subject to the constraints

(i) $4x_1 + 4x_2 + 4x_3 + 8x_4 = 21$

(ii) $3x_1 + 17x_2 + 80x_3 + 2x_4 \leq 48$

Where $x_1, x_2 \geq 0$ and x_3, x_4 are unrestricted.

(b) Solve the following LP problem using Simplex method: **07**

Maximize $Z = x_1 - x_2 + 3x_3$

subject to the constraints

$x_1 + x_2 + x_3 \leq 10$

$2x_1 - x_3 \leq 2$

$2x_1 - 2x_2 + 3x_3 \leq 0$

and $x_1, x_2, x_3 \geq 0$.

OR

(b) Solve the following LP problem using Big-M method. **07**

Max $Z = 3x_1 - x_2$

Subject to the constraints

(i) $2x_1 + x_2 \leq 2$,

(ii) $x_1 + 3x_2 \geq 3$,

(iii) $x_2 \leq 4$ Where $x_1, x_2 \geq 0$

Q.3 **(a)** Solve the following assignment problem: **07**

	1	2	3	4	5
A	41	72	39	52	25
B	22	29	49	65	81
C	27	39	60	51	40
D	45	50	48	52	37
E	29	40	45	26	30

Minimize the total cost.

(b) **07**

Determine an initial basic feasible solution to the following transportation problem using Least Cost Method.

Origins	Destinations				Availability
	D_1	D_2	D_3	D_4	
O_1	5	3	6	2	19
O_2	4	7	9	1	37
O_3	3	4	7	5	34
Demand	16	18	31	25	90

OR

Q.3 **(a)** Define: Simulation. State the advantages and disadvantages of simulation. **07**

(b) Define: Two- person zero- sum game, Saddle point.For the game with payoff matrix: **07**

Player A	Player B			
	B_1	B_2	B_3	B_4
A_1	3	−5	0	6
A_2	−4	−2	1	2
A_3	5	4	2	3

Determine the best strategies for players A and B and the value of the game. Is this game (i) fair? (ii) Strictly determinable?

Q.4 **(a)** Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially, with mean 3 minutes. Find: **07**

1. The probability that an arrival finds that four persons are waiting for their turn.
2. The average number of persons waiting and making telephone calls.
3. The average length of the queue that is formed time to time.

(b) Describe the characteristics of Calling Population (input source) of a Queuing System. What do you understand by Queue Discipline? **07**

OR

Q.4 **(a)** 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 of replacement of the machine.

(b) An engineering company is offered a material handling equipment A. It is priced at Rs. 60,000 including cost of installation. The costs for operation and maintenance are estimated to be Rs. 10,000 for each of the first five years, increasing every year by Rs. 3,000 in the sixth and subsequent years. The company expects a return of 10% on all its investment. What is the optimal replacement period? **07**

Q.5 **(a)** Explain different type of Inventory Cost. **07**

(b) Draw the network diagram for the following activities and find the critical path and total float. **07**

Job	Job Time (days)	Immediate Predecessors
A	13	–
B	8	A
C	10	B
D	9	C
E	11	B
F	10	E
G	8	D, F
H	6	E
I	7	H
J	14	G, I
K	18	J

OR

Q.5 **(a)** Four jobs 1, 2, 3 and 4 are to be processed on each of the four machines A, B, C and D in the order ABCD. The processing time in minutes are given the following table. Find the minimum total elapsed time when passing is not allowed. Also, find the idle time for each machine. **07**

Job	:	1	2	3	4
Machine A	:	58	30	28	64
Machine B	:	14	10	12	16
Machine C	:	14	18	16	12
Machine D	:	48	32	44	42

(b) What is the main objective of sequencing problem? State the assumptions generally made while dealing with sequencing problems. **07**

****