(b) Find the optimum strategies and the value of the game for 2 x 5 payoff matrix given below. Solve by graphical method: (10M) CO3

		Player B				
		1	2	3	4	5
Player A	I	-1	3	-2	-2	5
	II	4	2	3	3	2

UNIT – IV

8. With the help of the following data: CO4
   (i) Draw the Network diagram and
   (ii) Identify the critical path and its length

Activity	1-2	1-3	2-4	3-4	4-5	5-6	3-5	5-7	6-7
Duration (in days)	6	8	7	12	3	5	7	9	10

(OR)

9. Customers arrive service facility to get the required service. The inter-arrival and service times are constant and are 1.8 and 4 minutes respectively. Simulate the system for 14 minutes. Determine the average waiting time of a customer and idle time of the service facility by simulation. CO4

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F-2

Hall Ticket Number:

CE/EC415(MEOL1) (R20)

B.TECH. DEGREE EXAMINATION, DECEMBER-2024

Semester VII [Fourth Year] (Regular & Supplementary)

OPERATIONS RESEARCH

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Explain about degeneracy in linear programming. CO1
   (b) Discuss the role artificial variables in LP problems. CO1
   (c) Define slack variable. CO1
   (d) What do you understand by a balanced and unbalanced transportation problem? CO2
   (e) List the methods for obtaining starting feasible solution for transportation problem. CO2
   (f) What is an assignment problem? CO2
   (g) Define the term balking in queuing theory. CO3
   (h) What is a queuing problem? CO3
   (i) Define saddle point in game theory. CO3
   (j) Define mixed strategy. CO3
   (k) Define critical activity. CO4
   (l) What are the three time estimates used in PERT? CO4
   (m) Define simulation. CO4
   (n) List the advantages of simulation. CO4

UNIT – I

2. (a) Describe about the mathematical formulation of LP problem. (7M) CO1

(b) Solve the following using Simplex method: (7M) CO1

Maximize $Z = 2x_1 + x_2$,

subjected to $4x_1 + 3x_2 \leq 12$

$4x_1 + x_2 \leq 8$

$4x_1 - x_2 \leq 8$

and $x_1, x_2 \geq 0$

(OR)

3. Solve the following LP Problem by dual simplex method. CO1

Minimize $Z = 10\,x_1 + 6\,x_2 + 2\,x_3$

subject to $-x_1 + x_2 + x_3 \geq 1$

$3\,x_1 + x_2 - x_3 \geq 2$

and $x_1, x_2, x_3 \geq 0$

UNIT – II

4. Find the optimal solution for the following transportation problem. Cell entries represent unit transportation cost in rupees. CO2

Source	Destination					Supply
	1	2	3	4	5	
1	5	10	9	1	6	500
2	6	3	6	3	2	500
3	8	9	7	4	8	300
Demand	100	200	300	400	300	

(OR)

5. (a) Describe the mathematical LP formulation of assignment problem. (4M) CO2

(b) A company has 5 jobs to be done. The following matrix shows the return in rupees on assigning i^{th} machine to the j^{th} job. Assign the five jobs to the five machines so as to maximize the total return: (10M) CO2

Job / Machine	1	2	3	4	5
1	5	11	10	12	4
2	2	4	6	3	5
3	3	12	5	14	6
4	6	14	4	11	7
5	7	9	8	12	5

UNIT – III

6. (a) Explain about the characteristics of queuing models. (6M) CO3

(b) A self-service store employs one cashier at its counter. Nine customers arrive on an average every five minutes, while the cashier can serve 10 customers in 5 minutes. Assuming Poisson arrivals and exponential service times find (8M) CO3

(i) Average number of customers in the system.

(ii) Average time that a customer spends in the system.

(iii) Average time that a customer waits in the queue before being served.

(iv) Utilization factor.

(OR)

7. (a) Define Dominance. Explain about the dominance rule for rows and columns. (4M) CO3

Activity		A	B	C	D	E	F	G	H	I	J
Predecessor		-	-	-	A	A	A	B,C	C	D	E,G
Duration (Weeks)	T_o	4	1	2	1	1	1	1	4	2	6
	T_m	4	2	5	4	2	5	2	4	2	7
	T_p	10	9	14	7	3	9	9	4	8	8

(i) Find the critical path and the expected project completion time.

(ii) What is the probability of completing the project on or before 35 weeks?

(OR)

9. A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 mopeds to 204 mopeds whose probability distribution is as given below:

Production per day	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

The finished mopeds are transported in a specially designed three storeyed lorry that can accommodate only 200 mopeds. Using the following 10 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, simulate the process to find out: CO4

(i) What will be the average number of mopeds, waiting in the factory?

(ii) What will be the average number of empty spaces on the lorry?

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F-2

Hall Ticket Number:

CE/EC415(MEOL1) (R20)

B.TECH. DEGREE EXAMINATION, DECEMBER-2023

Semester VII [Fourth Year] (Regular)

OPERATIONS RESEARCH

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) Explain slack and artificial variables. CO1
   (b) Explain the feasibility condition in simplex method. CO1
   (c) List the applications of operations research. CO1
   (d) List the conditions to be fulfilled for the application of dual simplex method. CO1
   (e) Explain how to resolve degeneracy in transportation problem. CO2
   (f) What is the necessary condition for a TP to have a solution? CO2
   (g) How to solve an unbalanced maximization Assignment problem? CO2
   (h) Define Balking. CO3
   (i) Explain queue discipline. CO3
   (j) What is a payoff matrix? CO3
   (k) Explain the rules for drawing network diagram. CO4
   (l) What is the distribution followed by PERT Times? CO4
   (m) What is simulation? CO4
   (n) List the steps in Monte-Carlo simulation. CO4

UNIT – I

2. A firm makes two types of furniture chairs and tables. The contribution for each product as calculated by the accounting department is Rs. 20 per chair and Rs. 30 per table. Both the products are processed on three machines M1, M2 and M3. The time required in hours by each product and the total time available in hours per week on

each machine are as follows: CO1

Machine	Chair	Table	Available time
M1	3	3	36
M2	5	2	50
M3	2	6	60

Formulate and solve the LPP to maximize contribution.

(OR)

3. (a) Solve the following LPP by simplex method (10M) CO1

Max $Z = 8x_1 + 12x_2 + 3x_3$

Subject to conditions

$x_1 + 8x_2 + 2x_3 \leq 90$

$6x_2 + 12x_3 \leq 84$

$x_1, x_2, x_3 \geq 0$

(b) Explain various assumptions in linear programming. (4M) CO1

UNIT – II

4. A company has 3 plants at location A, B and C which supply to warehouse located at D, E, F, G and H. Monthly plant capacities are 800, 500 and 900 units respectively. Monthly warehouse requirements are 400, 400, 500, 400 and 500 units respectively. Unit transportations (In Rs) are given below. Determine an optimal solution for the company in order to minimize the total transportation cost. CO2

	D	E	F	G	H
A	4	7	6	5	3
B	5	8	7	5	4
C	8	4	6	5	5

(OR)

5. Solve the following assignment problem. CO2

	A	B	C	D	E
I	22	9	28	12	12
II	28	9	26	15	4
III	20	21	32	9	4
IV	36	36	36	36	36
V	22	12	16	9	0

UNIT – III

6. (a) An airline is planning to open a satellite ticket desk in a new shopping plaza, staffed by one ticket agent. It is estimated that requests for tickets and information will average 15 per hour and requests will have a Poisson distribution. Service time is assumed to be exponentially distributed. Previous experience with similar satellite operations suggest that mean service time should average about 3 minutes per request. Determine each of the following: (7M) CO3

(i) System utilization

(ii) Percentage of time the server (agent) will be idle.

(iii) The expected number of customers waiting to be served.

(iv) The average time customers will spend in the system.

(b) Explain the operating characteristics of a queuing system. (7M) CO3

(OR)

7. (a) Solve the following game whose payoff matrix is: (10M) CO3

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

(b) Define and explain saddle point. (4M) CO3

UNIT – IV

8. (a) Distinguish between PERT and CPM. (4M) CO4

(b) Construct a project network with expected duration and variance of each activity from the following table: (10M) CO4