



End Term (Even) Semester Examination May-June 2025

Roll no.....

Name of the Program and semester: B-Tech ECE, IVth Sem

Name of the Course: Operation Research

Course Code: HSMC 401

Time: 3 hours

Maximum Marks: 100

Note:

- (i) All the questions are compulsory.
- (ii) Answer any two sub questions from a, b and c in each main question.
- (iii) Total marks for each question is 20 (twenty).
- (iv) Each sub-question carries 10 marks.

Q1.

CO1 (2X10=20 Marks)

- a. What are the key features that define Operations Research as a problem-solving approach? Explain with suitable example.
- b. Write the historical background of OR in at least 350 words.
- c. Write the algorithm for simplex method. Solve the following LPP by Simplex method

$$\begin{aligned} \text{Max } Z &= 3x_1 + 5x_2 + 4x_3 \\ \text{Subject to} \quad &2x_1 + 3x_2 \leq 8 \\ &2x_2 + 5x_3 \leq 10 \\ &3x_1 + 2x_2 + 4x_3 \leq 15 \\ \text{And} \quad &x_1, x_2, x_3 \geq 0. \end{aligned}$$

Q2.

CO2 (2X10=20 Marks)

- a. Solve the following transportation problem, also obtain optimal cost.

	D1	D2	D3	D4	a_i
O1	6	1	9	3	70
O2	11	5	2	8	50
O3	10	12	4	7	80
b_j	85	35	50	45	

- b. A small garments making unit has five tailors stitching five different types of garments. All the five tailors are capable of stitching all the five types of garments. The output per day per tailor and the profit (in rupees) for each type of garment are given below:

		Garments				
		1	2	3	4	5
Tailors	A	7	9	4	8	6
	B	4	9	5	7	8
	C	8	5	2	9	8
	D	6	5	8	10	10
	E	7	8	10	9	9
Profit per garments		2	3	2	3	4

- (i) Which type of garment should be assigned to which tailor in order to maximize profit assuming that there are no constraints?
- (ii) If tailor D is absent for a specified period and no other substitute tailor is available, what should be the optimal assignment.



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- c. Find the sequence that minimize the total elapsed time require to complete the jobs. Also calculate idle time for each machine

JOB →	A	B	C	D
Machine M ₁	18	17	11	20
Machine M ₂	8	6	5	4
Machine M ₃	7	9	8	3
Machine M ₄	2	6	5	4
Machine M ₅	10	8	7	8
Machine M ₆	25	19	15	12

Q3.

CO3 (2X10=20 Marks)

- a. Define project and write its characteristics. Also explain the different phase of project.
- b. Write the rules of network construction. Tasks A, B, C, ..., H, I, constitute a project. The precedence relationships are $A < D$; $A < E$; $B < F$; $D < F$; $C < G$; $C < H$; $F < I$; $G < I$. Draw a network to represent the project and find the minimum time of completion of the project when time, in days, of each task is as follows:

Task	A	B	C	D	E	F	G	H	I
Time	8	10	8	10	16	17	18	14	9

Also identify critical path.

- c. The time estimates (in days) for the activities of a PERT network are given below. Construct the network diagram and determine the critical path and probabilities of meeting the scheduled dates for the specified events. Tabulate the results and determine the variance for each event.

Activity	t_o	t_m	t_p
1-2	2	4	12
1-3	2	4	25
2-11	1	5	8
3-4	1	3	6
3-5	1	4	9
3-6	2	5	12
3-7	2	3	5
4-8	5	6	14
5-12	3	6	9
6-9	4	6	10
7-10	4	5	7
8-11	2	4	6
9-12	1	2	4
10-12	1	4	8
11-12	3	4	11

Q4.

CO4 (2X10=20 Marks)

- a. Obtain the steady state probability for the generalized Poisson queuing model. Also find the average number of units in the system and average queue length.
- b. Solve the following game after reducing it by dominance method:



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		Player B			
Player A	6	4	8	0	
	6	8	4	8	
	8	4	8	0	
	0	8	0	16	

c. Define the followings:

- (i) Mixed Strategy
- (ii) Pure Strategy
- (iii) Two-person zero sum game
- (iv) Saddle point
- (v) Dominance Rule

Q5.

CO5 (2X10=20 Marks)

- a. How do deterioration rates affect holding and ordering costs in inventory systems? Explain.
- b. Derive the model to determine the optimal inventory level of spare parts for equipment with random failure rates?
- c. Classify the inventory models in details.