Hall Ticket No | | | | | | | | | | | Question Paper Code: AHS012

IINSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER -I

B. Tech V Semester End Examinations (Regular), December– 2019

Regulations: IARE-R16

OPTIMIZATION TECHNIQUES

(Common to CSE/IT/EEE)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. a) Discuss various the applications of OR and the various steps used in solving Operations Research problems. **[7M]**

b) Solve the given problem by using Graphical method **[7M]**

Maximize $Z = 20x_1 + 10x_2$

S $15x_1 + 6x_2 \leq 3000$

$3x_1 + 4x_2 \leq 1300$

$x_1 + 2x_2 \leq 500$

2. a) Use penalty BIG M Method to solve the following Linear Programming Problem. **[7M]**

Minimize Z = 5x1 + 3x2

State that 2x1 + 4x2 ≤ 12

2x1 + 2x2 = 10

5x1 + 2x2 ≥ 10

b) Use- Two phase simple method to solve to solve the following Linear Programming Problem.

Minimize: $Z = x_1 + x_2$

State that $2x_1 + x_2 \geq 4$

$x_1 + 7x_2 \geq 7$

and $x_1, x_2 \geq 0$

UNIT – II

3. a) A travelling salesman has to visit five cities. He wishes to start from a particular city, visit each city once and then returns to his starting point. The travelling cost in ('000) of each city from a particular city is given **[7M]**

	A	**B**	**C**	**D**	**E**
A	A	2	5	7	1
B	6	α	3	8	2
C	8	7	α	4	7
D	12	4	6	α	5
E	1	3	2	8	A

What should be the sequence of visit of the salesman so that the cost is minimum?

b) The following table provides all the necessary information on the availability of supply to each warehouse, the requirement of each market and the unit transportation cost in RS from each warehouse to each market is given below

	P	Q	R	S	Supply
A	6	3	5	4	**22**
B	5	9	2	7	**15**
C	5	7	8	9	**8**
Demand	**7**	**12**	**17**	**9**	**45**

The shipping clerk of the shipping agency has worked out the following schedule, based on his own experience 12 units from A to Q, 1 unit from A to R, 9 units from A to S, 15 units from B to R, 7 Units from C to P, and 1 unit from C to R.

i). Check and see if the clerk has an optimal solution

ii). Find the optimal schedule and minimize total transportation cost.

4. a) A manufacturing company has three plants X, Y, Z. which supply to the distributors A,B,C,D,E. Monthly plan capacities are 80, 50 and 90 units respectively. Monthly requirement of distributors are 40, 40, 50, 40 and 80 units resp. unit of transportations costs are given below in rupees. Determine an optimal distribution for the company in order to minimize the total transportation cost. **[7M]**

From	**To**				
	A	**B**	**C**	**D**	**E**
X	5	8	6	6	3
Y	4	7	7	6	6
Z	8	4	6	6	3

b) A computer contains 10,000 resistors when any resistor fails it is replaced. The cost of replacing a resistor individually is Rs 1only. If all the resistors are replaced at the same time, the cost per resistor would be reduced to 35 paisa. The percentage of surviving resistors say S(t) at the end of month ‘t’ and the probability of failure p (t) during the month ‘t’ are as follows. **[7M]**

T	0	1	2	3	4	5	6
S(t)	100	97	90	70	30	15	0
P(t)	-	0.03	0.07	0.20	0.40	0.15	0.15

What is the optimal replacement plan?

UNIT – III

5. a) Find an optimal sequence for the following sequence problems of four jobs and five machines, when passing is not allowed. Its processing time (in hours) is given below. **[7M]**

Jobs	Machines				
	M1	M2	M3	M4	M5
A	7	5	2	3	9
B	6	6	4	5	10
C	5	4	5	6	8
D	8	3	3	2	6

b) Solve the game whose payoff matrix is given below **[7M]**

		Payer B			
		B1	B2	B3	B4
Player A	A1	3	2	4	0
	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8

6. a) In a certain game playershave three possible courses of action L, M and N, while B has two possible choices P and Q. Payments to be made according tothe choice made. **[7M]**

Choices	Payments.
L,P	A pays B Rs.3
L,Q	B pays A Rs. 3
M,P	A pays B Rs.2
M,Q	B pays A Rs.4
N,P	B pays A Rs.2
N,Q	B pays A Rs.3

What are the best strategies for players A and B in this game? What is the value of the game for A and B?

b) Two players P and Q play the game. Each of them has to choose one of the three colors: White (W), Black (B) and Red (R) independently of the other. Thereafter the colors are compared. If both P and Q has chosen white (W,W), neither wins anything If player P selects white and Player Q black (W, B), player P loses Rs.2/- or player Q wins the same amount and so on. The complete payoff table is shown below. Find the optimum strategies for P and Q and the value of the game. **[7M]**

Q

		W	B	R
P	W	0	–2	7
	B	2	5	6
	R	3	–3	8

UNIT – IV

7. a) Solve the following given Linear Programming problem by using Dynamic Programming technique. **[7M]**

Maximize $5x + 9y$ subject to

$-x + 3y \leq 3$,

$5x + 3y \leq 27$ and both x and y are ≥ 0.

b) In a cargo-loading problem, there are four items of different weight per unit and value as shown below. The maximum cargo load is restricted to 17 units. How many units of each item is loaded to maximize the value? **[7M]**

Item (i)	*Weight (w_1)*	*Value (v_1)*
1	1	1
2	3	5
3	4	7
4	6	11

8. a) A vessel is to be loaded with stocks of 3 items. Each item 'i' has a weight of w_i and a value of v_i. The maximum cargo weight the vessel can take is 5 and the details of the three items are as follows: **[7M]**

j	w_j	v_j
1	1	30
2	3	80
3	2	65

Develop the recursive equation for the above case and find the most valuable cargo load without exceeding the maximum cargo weight by using dynamic programming.

b) Minimize $a^2 + b^2 + c^2$, subject to $a + b + c = 10$ when **[7M]**

i). a, b, c are non-negative,

ii). a, b, c are non-negative integers.

UNIT – V

9. a) What is the major disadvantage associate with a solution technique based upon direct use of full quadratic approximations to all functions in the nonlinear program? **[7M]**

b) Outline an implementation of a successive Lagrangian QP algorithm that would employ the more conservative step adjustment strategy of the Griffith and Stewart SLP algorithm. Discuss the advantages and disadvantages relative to the penalty function strategy. **[7M]**

10. a) Compare the treatment of inequality constraints in the GRG and CVM algorithms. How do the methods of estimating multiplier values differ? **[7M]**

b) Suppose the CVM algorithm were employed with a problem involving a quadratic objective function and quadratic inequality constraints. How manyiterations are likely to be required to solve the problem, assuming exact arithmetic? What assumptions about the problem are likely to be necessary in making this estimate? **[7M]**

INSTITUTE OF AERONAUTICAL ENGINEERING

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I. COURSE OBJECTIVES:

The course should enable the students to:

S.No	Description
I	Learn fundamentals of linear programming through optimization.
II	Understand theory of optimization methods and algorithms developed for solving various types of optimization problems.
III	Apply the mathematical results and numerical techniques of optimization theory to concrete Engineering Problems.
IV	Understand and apply optimization techniques to industrial applications
V	Apply the dynamic programming and quadratic approximation to electrical and electronic problems and applications.

II. COURSE LEARNING OUTCOMES:

Students who complete the course will have demonstrated the ability to do the following

AHS012.01	Explain the various characteristics and phases of linear programming.
AHS012.02	Formulate the various linear programming problems by using graphical and simplex methods
AHS012.03	Understand the artificial variable techniques like two phase and Big-M methods.
AHS012.04	Explain Transportation problem and the formulation of the problem by using optimal solution.
AHS012.05	Solve the assignment problems by using optimal solutions and the variance of assignment problems.
AHS012.06	Describe the travelling sales man problem.
AHS012.07	Explain the sequencing and the types of sequencing methods.
AHS012.08	Use n jobs through two machines and n jobs through three machines to solve an appropriate problem.
AHS012.09	Use two jobs through m machines to solve an appropriate problem.
AHS012.10	Understand theory of games and the terminologies used in theory of games concept.
AHS012.11	Determine appropriate technique to solve to a given problem.
AHS012.12	Solve the problems by using dominance principle and Graphical method.
AHS012.13	Understand the Bellman's principle of optimality.
AHS012.14	Describe heuristic problem-solving methods.
AHS012.15	Understand the mapping of real-world problems to algorithmic solutions.
AHS012.16	List out the various applications of dynamic programming.
AHS012.17	Define the shortest path problem with approximate solutions.
AHS012.18	Explain the linear programming problem with approximate solutions.
AHS012.19	Define the various quadratic approximation methods for solving constraint problems.

AHS012.20	Explain the direct quadratic approximation for solving the constraint problems.
AHS012.21	Explain the quadratic approximation method by using lagrangian function.
AHS012.22	Describe the variable metric methods for constrained optimization.

MAPPING OF SEMESTER END EXAMINATION TO COURSE LEARNING OUTCOMES

SEE Question No.		Course learning Outcomes		Blooms Taxonomy Level
1	a	AHS012.01	Explain the various characteristics and phases of linear programming..	Understand
	b	AHS012.02	Formulate the various linear programming problems by using graphical and simplex methods	Understand
2	a	AHS012.03	Understand the artificial variable techniques like two phase and Big-M methods.	Remember
	b	AHS012.02	Formulate the various linear programming problems by using graphical and simplex methods	Understand
3	a	AHS012.06	Describe the travelling sales man problem.	Understand
	b	AHS012.04	Explain Transportation problem and the formulation of the problem by using optimal solution.	Understand
4	a	AHS012.05	Solve the assignment problems by using optimal solutions and the variance of assignment problems.	Remember
	b	AHS012.05	Solve the assignment problems by using optimal solutions and the variance of assignment problems.	Understand
5	a	AHS012.08	Use n jobs through two machines and n jobs through three machines to solve an appropriate problem.	Remember
	b	AHS012.08	Use n jobs through two machines and n jobs through three machines to solve an appropriate problem.	Remember
6	a	AHS012.10	Determine appropriate technique to solve to a given problem.	Understand
	b	AHS012.11	Determine appropriate technique to solve to a given problem.	Remember
7	a	AHS012.15	List out the various applications of dynamic programming.	Remember
	b	AHS012.17	Define the shortest path problem with approximate solutions.	Understand
8	a	AHS012.18	Explain the linear programming problem with approximate solutions..	Remember
	b	AHS012.18	Explain the linear programming problem with approximate solutions.	Understand
9	a	AHS012.19	Define the various quadratic approximation methods for solving constraint problems	Understand
	b	AHS012.21	Explain the quadratic approximation method by using lagrangian function.	Remember
10	a	AHS012.20	Explain the direct quadratic approximation for solving the constraint problems.	Understand
	b	AHS012.22	Describe the variable metric methods for constrained optimization.	Understand

HOD, CSE