

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), November 2016

B. Tech (Civil), Semester VI

Roll No.....

COURSE CODE: MA 621

Time: 3 hours

Max. Marks: 100

COURSE NAME: Engineering Optimization

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.

Q.1A Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. The first step in simulation is to;
(a) set up possible courses of action for testing (b) construct a numerical model
(c) validate the model (d) define the problem
- ii. Graphical method is used generally for which of the following sequencing problems?
(a) n jobs 2 machines (b) n jobs k machines
(c) 2 jobs k machines (d) both (b) and (c)
- iii. One can find the initial basic feasible solution by using.....
(a) VAM (b) MODI (c) optimal test (d) None of these
- iv. If the primal variable x_j is unrestricted in sign, then the corresponding dual constraint will hold with the;
(a) ' $\leq$ ' sign (b) ' $\geq$ ' sign (c) '=' sign (d) None of these
- v. Motion Film is the example of
(a) Iconic (b) Symbolic (c) both (a) and (b) (d) None of these
- vi. In which of the following methods, it is not necessary to calculate all the entries in the simplex table for each iteration;
(a) Dual simplex method (b) Revised simplex method
(c) Two phase method (d) None of these
- vii. KT conditions are used for
(a) DPP (b) LPP (c) NLPP (d) None of these
- viii. Dual problem statement is formulated with help of information available in another statement called
(a) primal problem (b) prime problem (c) optimal problem (d) primal constants
- ix. An objective function is maximized when it is a function
(a) passive (b) profit (c) cost (d) None of these
- x. The assignment problem is a special case of;
(a) non-linear programming problem (b) a transportation problem
(c) a quadratic programming problem (d) none of these

Q.2 Short answer type questions (4 questions @ 2.5 marks)

10

Q.2A Write the dual of

$$\text{Min } Z = 3x_1 - 2x_2 + x_3$$

$$\text{s. to. } 2x_1 - 3x_2 + x_3 \leq 5; 4x_1 - 2x_2 \geq 9; -8x_1 + 4x_2 + 3x_3 = 8$$

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

Q.2B Define optimization then explain the engineering applications of optimization.

Q.2C Distinguish between Non-linear Programming Problem and Integer Programming.

Q.2D What is model? Explain the importance of modelling in optimization with the help of an example.

Q.3A Formulate the given transportation problem

05

	R ₁	R ₂	R ₃	R ₄	R ₅	Supply
X ₁₁	X ₁₁	X ₁₂	X ₁₃	X ₁₄	X ₁₅	50
1	9	13	36	51		
X ₂₁	X ₂₁	X ₂₂	X ₂₃	X ₂₄	X ₂₅	100
24	12	16	20	1		
X ₃₁	X ₃₁	X ₃₂	X ₃₃	X ₃₄	X ₃₅	150
14	35	1	23	26		
Demand	100	70	50	40	40	

Q.3B Use dynamic programming to show that $\sum_{i=1}^n p_i \log p_i$ subject to the constraint $\sum_{i=1}^n p_i = 1$, for all 'i' is minimum.

05

Q.4A Solve the following game

05

		Player B			
		1	2	3	4
Player A	1	3	3	4	0
	2	5	4	3	7

Q.4B State goal programming. Also, formulate one application as Linear Goal Programming in your words.

05

Q.5A Solve the following IPP:

05

$$\text{Max. } Z = x_1 + x_2$$

$$\text{s.t. } x_1 + 16x_2 \leq 2$$

$$4x_1 + 4x_2 \leq 8$$

$$x_1, x_2 \geq 0 \text{ and are integers.}$$

Q.5B Use dynamic programming technique to solve following LPP

05

$$\text{Max. } Z = x_1 + 9x_2 \text{ subject to the constraints}$$

$$2x_1 + x_2 \leq 25, x_2 \leq 11 \text{ and } x_1, x_2 \geq 0$$

Q.6A Solve the following assignment problem.

	1	2	3	4
A	10	12	19	11
B	5	10	7	8
C	12	14	13	11
D	8	15	11	9

Q.7A Use the method of Lagrangian multipliers to solve the NLPP

$$\text{Minimize } Z = x_1^2 + x_2^2 + x_3^2$$

$$\text{Subject to: } x_1 + x_2 + 3x_3 = 2, 5x_1 + 2x_2 + x_3 = 5 \text{ and } x_1, x_2, x_3 \geq 0$$

Q.7B Using u-v method, find the optimal solution for transportation problem

	R1	R2	R3	R4	R5	Supply
1	9	13	36	51	50	
24	12	16	20	1	100	
14	35	1	23	26	150	
Demand	100	70	50	40	40	

OR

Q.7B Write down the Kuhn-Tucker conditions to get an optimal solution of the following Non-linear programming problem:

$$\text{Minimize } Z = x_1 + 3x_2 - x_1^2 - 2x_2^2$$

$$\text{Subject to: } x_1 + x_2 \leq 6, 5x_1 - 2x_2 \leq 10 \text{ and } x_1, x_2 \geq 0$$

Q.8A Solve the following LPP using the dual simplex method.

$$\text{Minimize } Z = 2x_1 + 3x_2 + 5x_3$$

$$\text{Subject to: } x_1 + 2x_2 + 3x_3 \geq 2; 2x_1 - x_2 + x_3 \geq 3 \text{ and } x_1, x_2, x_3 \geq 0.$$

Q.9A Use revised simplex method to solve the following:

$$\text{Minimize } Z = x_1 + x_2 + x_3$$

$$\text{s. to. } 2x_1 - 3x_2 + 2x_3 + x_4 \leq 2$$

$$-5x_1 + 2x_2 + 3x_3 \geq 4$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

Q.9B A small project is composed of nine activities whose time estimates are listed in the table below:

Activity	1-2	2-3	2-4	2-5	3-7	4-6	5-6	6-7	7-8
Duration (Optimistic)	2	8	4	4	3	7	3	2	2
Duration (Most likely)	5	11	7	9	5	10	7	3	4
Duration (Pessimistic)	8	20	16	20	13	13	17	10	6

(a) Draw the project network diagram.

(b) Calculate the variance and standard deviation of project length. What is the probability that the project will be completed in 40 days?

OR

Q.9B Dr J. K. Singha and Co. manufacture two types of products A and B. According

to past experience, production of either A or B requires an average of one hour in the plant. The plant has normal production capacity of 400 hours a month. The marketing department of the firm reports that because of limited market, the maximum number of A or B that can be sold in a month are \$ 800 and \$ 400 respectively. The manager of firm has set the following goals arranged in the order of

P1: He wants to avoid any underutilization of normal production capacity.

P2: He wants to sell maximum possible units of A and B. Since the net profit from the sale of product is twice the amount from that of product B.

P3: He wants to minimize the overtime operation of the plant as much as possible.

Formulate this as a goal programming and solve it.