

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), April-May 2016

B. Tech (Civil), Semester VI

Roll No.....

COURSE CODE: MA 621

Time: 3 hours

Max. Marks: 100

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. Which of the following is not the PERT event ;
(a) site investigation started (b) sessional work completed (c) works started from Jaipur (d) class is being attended
 - ii. If the total supply is less than the total demand, a dummy source (row) is included in the cost matrix with.....
(a) dummy demand (b) dummy supply (c) zero cost (d) both A and B
 - iii. A constraint that does not affect the feasible region is a
(a) non-negativity constraint (b) redundant constraint (c) standard constraint (d) slack constraint
 - iv. Which of the following is an example of a game theory strategy?
(a) You scratch my back and I'll scratch yours (b) If the shoe fits, wear it (c) Monkey see, monkey do (d) None of these
 - v. To solve assignment problem we use
(a) simplex algorithm (b) transportation algorithm (c) hungarian algorithm (d) None of these
 - vi. An activity (i,j) is said to be critical if
(a) $E_i=L_i$ (b) $E_j=L_j$ (c) both (a) and (b) (d) None of these
 - vii. In primal-dual solutions, dual problem solution can be obtained by solving other problems classified as
(a) unrestricted problem (b) original problem (c) double problem (d) restricted problem
 - viii. Optimization simply helps in improving the.....of the solution but does not result in a perfect solution.
(a) quality (b) clarity (c) look (d) None of these
 - ix. The assignment model is a special case of the _____ model.
(a) maximum-flow (b) transportation (c) shortest-route (d) None of these
 - x. The shipping company manager wants to determine the best routes for the trucks to take to reach their destinations. The problem can be solved using the
(a) shortest route solution technique (b) minimum spanning tree solution method (c) maximal flow solution method (d) None of these
- Q.2 Short answer type questions (4 questions @ 2.5 marks) 10
- Q.2A Draw a network for the following project and number accordingly



A is the start event and K is the end event, A precedes event B, J is the successor event to F, C and D are the successor events to B, B is the preceding event to G, E and F occur after event C, E precedes F, C restrains the occurrence of G and G precedes H, H precedes J and K succeeds J, F restrains the occurrence of H.

Q.2B State the distinguish between Linear Programing Problem and Goal Programing.

Q.2C Solve the following game:

Player B

		Strategy 3	Strategy 4
Player A	Strategy 1	-3	3
	Strategy 2	-2	4

Q.2D Write the dual of

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

$$\text{s. to. } 2x_1 + 4x_2 \leq 160; x_1 - x_2 = 30; x_1 \geq 10$$

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

Q.3A A construction manager has 5 civil engineers and 5 projects. Considering the capabilities of the civil engineers and nature of project, the construction manager estimates of work per month for each civil engineer in each project would be as follows:

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		Projects				
		A	B	C	D	E
Civil Engineer	1	32	38	40	28	40
	2	40	24	28	21	36
	3	41	27	33	30	37
	4	22	38	41	36	36
	5	29	33	40	35	39

How should manager allocate the projects one to each civil engineer so as to minimize the total manhours?

Q.3B Use dynamic programing technique to solve

05

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

$$x_1 + x_2 + x_3 \geq 15 \text{ and } x_1, x_2, x_3 \geq 0$$

Q.4A A contractor has been assigned the excavation of work of a canal and a head works on a project. In order to ensure a balanced progress on the entire work the management has imposed certain conditions on his working. The excavation of the canal is more profitable than that of the head works, but he has to abide by the conditions of contract. In addition, he has his own limitations on manpower and equipment. It is desired to find the optimum amount of excavation on the two works which he should undertake so that his profits are maximized and he satisfies the constraints of the contract and of the resources. These constrained are:

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- The difference in the quantity of earthwork done on the two works does not exceed 2 units in a day.
- The difference b/w quantity of a canal excavation and of twice the

head works excavation does not exceed 1 unit in a day.

- (iii) Each unit of canal excavation done in a day requires one unit of manpower and one unit of machine; and each unit of head works excavation requires 2 units of manpower and one unit of machine.

Maximum available manpower is 10 units and machine 6 units.

The contractor stipulates a profit of 2 units for each unit of canal excavation and half of this for each unit of head works excavation. Formulate the given problem.

- Q.4B Use the method of Lagrangian multipliers to solve the NLPP 05

$$\text{Maximize } Z = 6x_1 + 8x_2 - x_1^2 - x_2^2$$

$$\text{Subject to: } 4x_1 + 3x_2 = 16, 3x_1 + 5x_2 = 15 \text{ and } x_1, x_2 \geq 0$$

- Q.5A Explain optimization with the help of example. Discuss advantages and disadvantages of optimization. 05

- Q.5B Use graphical method to find optimal strategies for both persons and value of the game whose payoff matrix is given as: 05

Player A	Player B	
	1	-3
	3	5
	-1	6
	4	1
	2	2
	-5	0

- Q.6A Solve the following IPP: 05

$$\text{Max. } Z = 2x_1 + 3x_2$$

$$\text{s.t. } 6x_1 + 5x_2 \leq 25, x_1 + 3x_2 \leq 10$$

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

- Q.7A Use dynamic programming to solve the following LPP 05

$$\text{Max. } Z = x_1 + 9x_2$$

$$\text{s. to } 2x_1 + x_2 \leq 25$$

$$x_2 \leq 11$$

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

- Q.7B A small maintenance of road project consists of the following jobs whose precedence relations are identified by their node 10

Job (i,j)	1-2	2-3	2-4	3-5	3-6	4-6	4-7	5-8	6-8	7-8
Duration (Days)	2	3	5	4	1	6	2	8	7	4

Find critical path and its duration. Also, find earliest start, earliest finish, latest start, and latest finish for each activity.

OR

- Q.7B Solve the following using dual simplex method: 10

$$\text{Minimize } Z = 2x_1 + 2x_2 + 4x_3$$

$$\text{s. to. } 2x_1 + 23 + 5x_3 \geq 2$$

$$3x_1 + x_2 + 7x_3 \leq 3$$

$$x_1 + 4x_2 + 6x_3 \leq 5$$



and $x_1, x_2, x_3 \geq 0$

- Q.8A State the Kuhn-Tucker conditions. Write down the Kuhn-Tucker conditions to get an optimal solution of the following Non-linear programming problem: 10

$$\text{Maximize } Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$$

Subject to: $x_1 + x_2 \leq 2, 2x_1 + 3x_2 \leq 12$ and $x_1, x_2 \geq 0$

- Q.9A A manufacturing company has four warehouses located in the following four cities as Mumbai, Nagpur, Delhi and Bangalore. Their capacities and requirements are shown in Table below: 10

Warehouse Location	Capacity (Tonnes)	Company	Demand (Tonnes)
Mumbai	90	CMS	120
Nagpur	50	Bharat	100
Delhi	80	Janta	110
Bangalore	60	-	-

The following railroad shipping costs per tonne (in hundred rupees) have been determined:

From \ TO	CMS	Bharat	Janta
Mumbai	7	10	5
Nagpur	12	9	4
Delhi	7	3	11
Bangalore	9	5	7

Because of railroad construction, shipments are temporarily prohibited from warehouse to company. Find optimum distribution for manufacturing company.

- Q.9B A firm is engaged in producing two products A and B which yield a unit profit of Rs. 400 and Rs. 300 respectively. Both of these require a certain raw material whose supply is limited to 300 kg per month. The raw material requirement is 1 kg/unit of each product. Further it is known that 1 unit of A requires 2 hours of processing while each unit of B needs one hour. The firm has normal processing capacity of 400 hours per month. The marketing deptt. has stated that according to the prevailing conditions which is likely to continue in the foreseeable future, The max number of units A and B which can be sold each month is Rs. 150 and Rs 350 respectively. The manager of the firm has set the following goals: 10

Goal I: Avoid underutilization of normal productive capacity.

Goal II: Sell the maximum number of units of products A and B.

Goal III: Minimize overtime of processing time.

Formulate this as a goal programming and solve it.

OR

- Q.9B Use revised simplex method to solve the following: 10

$$\text{Maximise } Z = 6x_1 + 3x_2 + 4x_3 - 2x_4 + x_5$$

$$\text{s. to. } 2x_1 + 3x_2 + 3x_3 + x_4 = 10$$

$$x_1 + 2x_2 + x_3 + x_5 = 8$$

$$\text{and } x_1, x_2, x_3, x_4, x_5 \geq 0$$