

JK LakshmiPat University, Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), May 2019
B. Tech (CHE, CE and ME), Semester IV

Roll No.....

MA 405: Engineering Optimization

Time: 3 hours Max. Marks: 100

Instructions to students:

1. Do not write or mark anywhere other than your roll number on question paper.
2. Use of calculator is permitted.

Q.1A Choose the correct answer for the following problems (5 questions @ 1 mark) 05

- i. North west corner rule in transportation problem gives
 - (a) optimal solution
 - (b) initial solution
 - (c) maximum cost
 - (d) minimum profit
- ii. Hungarian method is used in:
 - (a) All transportation Problems (b) Assignment Problems
 - (c) All LPPs (d) None of these
- iii. For a balanced transportation problem;
 - (a) $m = n$ (b) $m \neq n$ (c) Cells = $m + n + 1$ (d) Cells = $m + n - 1$
- iv. Every optimal solution is;
 - (a) feasible (b) basic feasible (c) unbounded (d) (a) and (b) both
- v. Slack of an activity in CPM is also called;
 - (a) Pass (b) Path (c) Float (d) None of the above

Q.1B Fill in the blanks (5 questions @ 1 mark) 05

- i. EOQ term is used in ----- related problems.
- ii. PERT is ----- Techniques.
- iii. Genetic Algorithms are a type of ----- algorithms.
- iv. Dual of dual is a ----- problem.
- v. Big M method is used for ----- inequality constraints.

Q.2A Write down the dual of the following primal LP problem: 05

Minimize $Z = 7x_1 - 3x_2 + 2x_3$

Subject to: $2x_1 + 5x_2 + 4x_3 \leq 2$; $x_1 - x_2 + 2x_3 = 1$; $2x_1 + 3x_3 \geq 4$

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

- .2B** Write down the Kuhn-Tucker conditions to get an optimal solution of the following Non-linear programming problem: 05

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

Subject to: $2x_1 + 3x_2 \leq 6$; $2x_1 + x_2 \leq 4$ and $x_1, x_2 \geq 0$.

- Q.3** Apply MODI method to obtain optimal solution of transportation problem using the following data:

Source	Destination					Supply
	D1	D2	D3	D4	D5	
S1	5	8	6	6	3	8
S2	4	7	7	6	5	5
S3	8	4	6	6	4	9
Demand	4	4	5	4	8	

10

- Q.4** Use dual simplex method to solve the following LP problem: 10

$$\text{Minimize } Z = -2x_1 - x_3$$

Subject to: $x_1 + x_2 - x_3 \geq 5$; $x_1 - 2x_2 + 4x_3 \geq 8$ and $x_1, x_2, x_3 \geq 0$

- Q.5** Solve the following assignment problem using Hungarian method. 10

	I	II	III	IV	V
A	41	72	39	52	25
B	22	29	49	65	81
C	27	39	60	51	40
D	45	50	48	52	37
E	29	40	45	26	30

- Q.6A** Construct a network for the project whose activities and their precedence relationship are given below: 05

Activity	A	B	C	D	E	F	G	H	I	J	K
Immediate Predecessor	-	A	A	C	B,C	D, E	E	G	D, F	I, H	J

- Q.6B** Explain Monte Carlo simulation with the help of real life application. 05

- Q.7** Solve the following LPP using the simplex method. 10

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

Subject to: $30x_1 + 20x_2 \leq 300$; $5x_1 + 10x_2 \leq 110$ and $x_1, x_2 \geq 0$.

- Q.8** The storage of one item costs Rs. 1 per month and the set-up cost is Rs. 25 per run. If the production is instantaneous and the demand is 200 units per month, find the optimal size of the batch and the best time for the replenishment of the inventory. 10

- Q.9** A small project is composed of nine activities whose time estimates are listed in the table below: 20

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Duration (Optimistic)	2	6	1	3	2	6	4
Duration (Most likely)	5	6	7	9	8	9	7
Duration (Pessimistic)	8	6	13	15	14	12	10

- Draw the project network diagram.
- Find the expected duration and variance of each activity.
- Find the critical path and expected project length.
- Calculate the variance and standard deviation of project length. What is the probability that the project will be completed in 4 weeks later than expected?
- If the project due date is 19 weeks, what is the probability of meeting the due date?

OR

- Q.9A** The Marriott Tub Company manufactures two lines of bathtubs, called model A and model B. Every tub requires a certain amount of steel and zinc; the company has available a total of 25,000 pounds of steel and 6,000 pounds of zinc. Each model A bathtub requires a total of 125 pounds of steel and 20 pounds of zinc, and each yields a profit of \$90. Each model B bathtub can be sold for a profit of \$70; it in turn requires 100 pounds of steel and 30 pounds of zinc. 15

- Formulate the above problem as LP problem.
- Find the best production mix of the bathtubs using Graphical method,

- Q.9B** Explain the significance of Nature inspired algorithms and its applications in industries. 5

