Registration No : | | | | | | | | | | |

Total Number of Pages: 03 **B.Tech**

PEE5H001

5^{th} Semester Regular / Back Examination 2018-19

OPTIMIZATION IN ENGINEERING

BRANCH : ELECTIRCAL

Time : 3 Hours

Max Marks : 100

Q.CODE : E219

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part- I

Q1 Short Answer Type Questions (Answer All-10) **(2 x 10)**

a) Define Basic feasible solution and optimal solution of LPP.

b) Can degeneracy occur in transportation problem? Justify your answer.

c) What are the basic characteristics of queueing phenomena?

d) Write any two difference between simplex and dual simplex method.

e) Differentiate between Fibonacci and golden section search methods.

f) Write the mathematical form of an assignment problem.

g) What are the limitations of Sensitivity Analysis?

h) Explain why Fibonacci search method is called sequential search method.

i) What is non-linear programming?

j) Explain how maximization problem of NLPP can be solved by using Kuhn-Tucker condition.

Part- II

Q2 Focused-Short Answer Type Questions- (Answer Any EIGHT out of TWELVE) **(6 x 8)**

a) A farmer has 500 acres of land on which we can grow paddy, wheat or soybeans. Each acre of paddy costs Rs. 1000/- for preparation, requires 7 man-days of work and yields a profit of Rs.300/.Each acre of wheat cost Rs1200/-.Each acre of soya bean costs Rs.800/-for preparation, requires 6 man-days of work and yields a profit of Rs.300/-.If the farmer has Rs.1,00,000/- for preparation, available 4000 man-days, Formulate LPP model to allocate the number of acres to each group to maximize the total profit.

b) What is duality theory? What are the rules to form a dual problem from primal problem? What are the advantages of duality?

c) Using dual Simplex method, solve LPP:

Maximize $Z = -3X_1 - 2X_2$

Subject to
$X_1 + X_2 \geq 1$
$X_1 + X_2 \leq 7$
$X_1 + 2X_2 \geq 10$
$X_2 \leq 3$
$X_1, X_2 \geq 0$

d) Using Simplex method, solve the following LPP :

Maximize $Z = 3X_1 + 2X_2 + 5X_3$

Subject to
$X_1 + 2X_2 + X_3 \leq 430$
$3X_1 + 2X_3 \leq 260$
$X_1 + 4X_2 \leq 420$
$X_1, X_2, X_3 \geq 0$

e) Solve the following Non–Linear Programming Problem by using Lagrangian multipliers

Maximize $Z = 10X_1 + 4X_2 - X_1^2 + 4X_1X_2 - 5X_2^2$

Subject to $X_1 + X_2 = 0$

$X_1, X_2 \geq 0$.

f) Solve the following integer programming problem using branch-bound method:

Minimize $Z = 3x_1 + 4x_2$

Subject to $7x_1 + 16x_2 \leq 52$

$3x_1 - 2x_2 \leq 18$

$x_1, x_2 \geq 0$ and x_1, x_2 are integers.

g) Solve the following using the projected gradient method ;

Minimize $Z = 25(x_1-3x_2)^{2(} + (x_1-3)^2$

Subject to $x_1 + 2x_2 = 9$

$x_1, x_2 \geq 0$

h) Find the initial basic feasible solution to the following transportation problem by using Least cost Method.

Destination/source	D_1	D_2	D_3	D_4	D_5	**Supply**
S_1	10	2	16	14	10	300
S_2	6	18	12	13	16	500
S_3	8	4	14	12	10	825
S_4	14	22	20	8	18	375
Demand	350	400	250	150	400	

i) Find an optimal solution to an assignment problem with the following cost matrix:

Job/person	**A**	**B**	**C**	**D**
1	2	10	9	7
2	15	4	14	8
3	13	14	16	11
4	4	15	13	9

j) Consider a single server queuing system with Poisson input, exponential service times. Suppose the mean arrival rate is 6 calling units per hour, the expected service time is 0.125 hour and maximum permissible calling units in the system is two. Derive the steady-state probability distribution of the number of calling units in the system, and then calling units in the system, and then calculate the expected number in the system.

k) Solve the following LPP ,by using Big-M method

Maximize $Z = 4x_1 + 5x_2 - 3x_2$

Subject to $x_1 + x_2 + x_3 = 10$

$x_1 - x_2 \geq 1$

$2x_1 + 3x_2 + x_3 \leq 40$

$x_1, x_2, x_3 \geq 0$.

l) Give the mathematical formulation of an assignment problem. How is it solved by the Hungarian method?

Part-III

Long Answer Type Questions (Answer Any TWO out of FOUR)

Q3 Using Revised Simplex method to solve the following LPP : **(16)**

Maximize $Z = 6x_1 - 2x_2 - 3x_3$

Subject to $2x_1 - x_2 + 2x_3 \leq 2$

$x_1 - 3x_3 \leq 4$

$x_1, x_2, x_3 \geq 0$

Q4 Solve the following non-linear programming problem, using the Lagrangean multipliers : **(16)**

Optimize $Z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

Subject to $x_1+x_2+x_3 = 15,$

$2x_1-x_2+2x_3 = 20,$

$x_1, x_2, x_3 \geq 0$

Q5 Solve the following NLPP: By using Kuhn-Tucker conditions **(16)**

Maximize $Z = 7x_1^2+6x_1+5x_2^2$

Subject to $x_1+2x_2 \leq 10$

$x_1-3x_2 \leq 9$

$x_1, x_2 \geq 0.$

Q6 Customers arrive at a one window drive-in bank according to Poisson distribution with mean 8 per hour. Service time per customer is exponential with mean 6 minutes. The space in front of the window, including that for the serviced car can accommodate a maximum of three cars other cars can wait outside this space. **(16)**

a) What is the probability that an arriving customer can drive directly to the space in front of the window?

b) How long is an arriving customer expected to wait before being served?

c) What is the probability that an arriving customer will have to wait outside installed space?