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

Total Number of Pages : 02 **B.Tech**

PME5J101

5th Semester Regular / Back Examination 2019-20

OPTIMIZATION IN ENGINEERING

BRANCH : MECH

Max Marks : 100

Time : 3 Hours

Q.CODE : HRB414

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

a) State degenerate basic feasible solution.

b) Write the canonical form of general linear programming problem.

c) What is pseudo optimal solution?

d) Write the value of golden ratio.

e) What is looping in a transportation problem?

f) State positive definiteness of a matrix.

g) Write the function $f(x, y) = 18xy + 5y^2$, is convex or concave or neither.

h) What are the limitations of sensitivity analysis?

i) What is an Integer Programming problem?

j) What are the different types of queuing discipline?

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Develop solution of the following linear programming problem graphically
Maximize $Z = 2x + y$,
Subject to $x + 2y \leq 10, x + y \leq 6, x - y \leq 2, x - 2y \leq 1$
$x, y \geq 0$.

b) Develop the solution of the following problem by using Simplex method:
Maximize $Z = 10x_1 + 15x_2 + 20x_3$,
Subject to $2x_1 + 4x_2 + 6x_3 \leq 24, 3x_1 + 9x_2 + 6x_3 \leq 30$,
$x_1, x_2, x_3 \geq 0$.

c) Write short notes on Hungarian method.

d) Analyze the solution of the given linear programming problem by Big-M method:
Maximize $Z = 2x + y$,
Subject to $x + y \geq 15,\ 2x + 3y \geq 24$,
$x, y \geq 0$.

e) Solve the given Integer Programming problem by branch and bound algorithm:
Maximize $z = 5x + 7y$,
Subject to $-2x + 3y \leq 6, 6x + y \leq 30$,
$x, y \geq 0$ andintegers.

f) Explain briefly the various steps involved in Stepping Stone method.

g) Calculate the relative maximum and relative minimum of the following function $f(x) = x^3 - 3x + 3$.

h) Discuss various steps involved in Fibonacci method.

i) Evaluate an initial basic feasible solution to the following transportation problem by Vogel's Approximation method,in which the cells contain transportation cost in rupees,

		To				**Available**
		7	6	4	5	9	40
From		8	5	6	7	8	30
		6	8	9	6	5	20
		5	7	7	8	6	10
Demand		30	30	15	20	5	

j) Solve the following assignment problem. The matrix entries are processing times in hours.

		Operator				
		1	**2**	**3**	**4**	**5**
	1	20	22	35	22	18
	2	4	26	24	24	7
	3	23	14	17	19	19
Job	**4**	17	15	16	18	15
	5	16	19	21	19	25

k) Solve the given nonlinear programming problem by using Lagrange Multiplier Method:
Maximize $Z = 4x_1 - 2x_1^2 + 6x_2 - 2x_2^2 - 2x_1x_2$,
Subject to $x_1 + 2x_2 = 2$,
$x_1, x_2 \geq 0$.

l) Write short notes on M/M/1 model.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Discuss Revised Simplex method to solve the given problem **(16)**
Minimize $z = x_1 + 2x_2 + 3x_3 - x_4$,
Subject to $x_1 + 2x_2 + 3x_3 = 15, 2x_1 + x_2 + 5x_3 = 20, x_1 + 2x_2 + x_3 + x_4 = 10$
$x_1, x_2, x_3, x_4 \geq 0$.

Q4 Minimize $f(x) = 4x^3 + x^2 - 7x + 14$ within [0,1] using Golden Section Search method with $n = 8$. **(16)**

Q5 Discuss various steps involved in order to solve the given nonlinear optimization problem by using Kuhn-Tucker method: **(16)**
Maximize $f(x, y) = -x^2 + 4x + 6y - y^2$,
Subject to $x + y \leq 2, 2x + 3y \leq 12$,
$x, y \geq 0$.

Q6 **a)** Describe the Characteristics of the Queuing system. **(5)**

b) In a store with one server, 9 customers arrive on a average of 5 minutes. Service is done for 10 customers in 5 minutes, **(6)**
Find (i) The average number of customers in the system.
(ii) The average Queue length.
(iii) The average time a customer spends in the store.

c) Discuss limitations of Queuing model. **(5)**