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

Total Number of Pages: 04 **B.Tech**

PME5J101

5th Semester Regular Examination 2017-18

Optimization in Engineering

BRANCHE: MECH

Time: 3 Hours

Max Marks: 100

Q.CODE: B500

Answer Question No.1 and 2 which are compulsory and any four from the rest.

The figures in the right hand margin indicate marks.

Q1 **Answer the following questions :** **(2 x 10)**

a) Let f(x) denote the objective function of an LPP, then
(a)Max f(x)= -min [-f(x)] (b)Max f(x)= -min [f(-x)]
(c)Max f(x)= -min [f(x)] (d)Max f(x)= min [-f(x)]

b) If in an LPP has two constraints and three variables, the maximum possible basic solution is
2 (b) 3 (c) 4 (d)6

c) In the last simplex table of a maximization LPP, the column corresponding to a variable xj is (-3,-4,-1,0)T and zj –cj = -2 , then this shows that
(a)feasible region of the LPP is bounded
(b) feasible region of the LPP is unbounded in xj direction
(c)solution is unbounded
(d)None of the above

d) If x_j is a basic variable in a simplex table, then the relative cost is
(a) $z_j - c_j > 0$
(b) $z_j - c_j < 0$
(c) $z_j - c_j = 0$
(d)None of the above

e) If in the primal the number of constraints is m and in dual the number of variables is n, then
(a) $m \geq n$
(b) $m \leq n$
(c) m=n
(d)None of the above

f) If the primal has no feasible solution, then its dual has
Unbounded solution
Either unbounded or no feasible solution
No feasible solution
Feasible solution but not optimal solution

g) The set$\{(x_1\ x_2)\ |x_1^2+x_1^2 \leq 2\ \}$ is a
(a) convex set
(b) concave set
(c) open set
(d)None of the above

h) For M/M/1 queueing system, the expected number customers in the system are _____.

i) If the number of arrivals are poisson distributed, then the inter-arrival time is
(a)poisson distributed
(b)exponential distributed
(c)binomial distributed
(d) None of the above

j) For M/M/1 model, the probability that there is no customer in the system is _____.

Q2 **Answer the following questions:** **(2 x 10)**

a) Give the matrix form of representing a general LPP.
b) Define unbounded solution.
c) State the characteristics of canonical form of LPP.
d) What is an integer programming problem?
e) What is the use of duality in linear programming?
f) Explain various steps involved in solving a transportation problem by matrix minima method.
g) Explain traffic intensity in queueing theory.
h) Write short notes on M/M/1 model.
i) What is the basic concept of Golden search method?
j) When Kuhn-Tucker conditions are sufficient for maximization of a nonlinear function f(x)?

Q3 **a)** The postmaster of a local post office wishes to hire extra helpers during the Deepawali season, because of a large increase in the volume of mail handling and delivery. Because of the limited office space and the budgetary condition, the number of temporary helpers must not exceed 10.According to the past experience, men can handle 300 letters and 80 packages per day, on the average, and women can handle 400 letters and 50 packages per day. The post master believes that the daily volume of extra mail and packages will be no less than 3400 and 680 respectively. A man receives Rs.250 a day and a woman receives Rs.220 a day. How many men and women helpers should be hired to keep the pay roll at a minimum? **(10)**
Formulate the above problem into an LPP and solve graphically.

b) Solve by Big-M method **(5)**
Maximize Z= $7x_1 - 4x_2$
Subject to

$$3x_1 + x_2 \geq 5$$
$$2x_1 - x_2 \geq 4$$
$$x_1, x_2 \geq 0$$

Q4 **a)** Use revised simplex method to solve the following LPP **(10)**
Maximize Z= $3x_1 + 2x_2$
Subject to

$$x_1 + 2x_2 \leq 4$$
$$3x_1 + 2x_2 \geq 6$$
$$x_1 + 4x_2 \leq 2$$
$$x_1, x_2, x_3 \geq 0$$

b) Obtain the dual of the following problem **(5)**
Minimize Z= $2x_1 - 4x_2$
Subject to

$$x_1 + 4x_2 + x_3 \leq 3$$
$$2x_1 + x_2 - 5x_2 = 4$$
$$x_1, x_2, x_3 \geq 0$$

Q5 **a)** Find the optimum integer solution of the following integer programming problem **(10)**
Minimize Z= $2x_1 + 3x_2$

Subject to

$$6x_1 - 3x_2 \leq 20$$
$$x_1 + 4x_2 \leq 10$$
$$x_1, x_2 \geq 0 \text{ are integers}$$

b) Obtain the initial solution for the TP using MMM **(5)**

	A	B	C	Supply
P	5	7	9	20
Q	3	9	4	10
5	8	4	3	30
S	6	5	8	40
Demand	50	20	30	100

Q6 **a)** Solve the transportation problem to find the optimum solution by Stepping stone method. **(10)**

Destination

Source	P	Q	R	S	Supply
A	40	25	22	33	10
B	44	35	30	30	30
C	38	38	28	30	70
Demand	40	20	60	30	

b) By using assignment method, find the assignment of jobs to the persons that will result in maximum profit. **(5)**

Job / Person	A	B	C	D
P	10	20	25	20
Q	12	35	15	10
R	33	20	12	26
S	17	23	26	25

Q7 **a)** Solve the following problem by using Kuhn-Tucker conditions so as to **(10)**

Maximize $Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$

Subject to the constraints

$$x_1 + x_2 \leq 2$$
$$2x_1 + 3x_2 \leq 12$$
$$x_1, x_2 \geq 0$$

b) Find the dimension of rectangular parallelepiped with largest volume whose sides are parallel to the coordinate axes to be inscribed in the ellipsoid **(5)**

$$f(x, y, z) = \frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} - 1 = 0$$

Q8 **a)** Solve the quadratic programming problem **(10)**

Maximize $Z = 6 - 6x_1 + 2x_1^2 - 2x_1x_2 + 2x_2^2$

Subject to

$$x_1 + x_2 \leq 2$$

$$x_1, x_2 \geq 0$$

b) In a public telephone booth, the arrivals on an average are 10 per hour. A call on an average takes 5 minutes. If there is just one phone, find the expected number of callers in the booth at any time and the proportion of the time, the booth is expected to be idle? **(5)**

Q9 **a)** Solve the following by using Projected Gradient Method **(10)**
Minimize: $f(x) = 25\,(x_1-3x_2)^2+(x_1-3)^2$

b) Find the minimum of $f(x) = x^2 - 2x$ by Fibonacci search method within the interval **(5)**
$0 \leq x \leq 1.5$ and $\in = 0.25$