Registration no:

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

HSSM3302

5th Semester Regular / Back Examination 2016-17
OPTIMIZATION IN ENGINEERING

BRANCH(S): CSE, EEE, ELECTRICAL, ENV, FASHION, FAT, IT, ITE, MANUFAC, MANUTECH, METTA, MINERAL, MINING, MME, PLASTIC, TEXTILE

Time: 3 Hours

Max Marks: 70

Q.CODE: Y232

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

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

a) What do you mean by degenerate basic feasible solution of a L.L.P ?

b) Does a quadratic programming problem differ from a L.P.P ? Justify.

c) Write the steps to find the initial basic feasible solution by North-West corner rule.

d) Define convex set and convex function.

e) Define an unsymmetrical dual problem.

f) State the importance of Branch and Bound technique.

g) Write the difference between simplex method and dual simplex method to solve a LPP.

h) How can one know that a stationary point is a maxima or minima?

i) What are the limitations of sensitivity analysis ?

j) Write Kuhn-Tucker conditions.

Q2 **a)** A company makes two kinds of leather belts, belt A and belt B. Belt A is a high quqlity belt and belt B is of lower quality.The respective profits are Rs.4 and Rs.3 per belt. The production of each of type A requires twice as much time as a belt of type B, and if all belts were of type B, the company could make 1,000 belts per day. The supply of leather is sufficient for only 800 belts per day (both A and B combined). Belt A requires a fancy buckle and only 400 of these are available per day. There are only 700 buckles a day available for belt B. What should be the daily production of each type of belt? Formulate this problem as an Linear programming model . **(5)**

b) Solve the following LPP by dual simplex method : **(5)**

Maximize $z = -2x_1 - x_3$

Subject to $x_1 + x_2 - x_3 \geq 5$

$x_1 - 2x_2 + 4x_3 \geq 8$

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

Q3 **a)** Use big-M method to solve the following LPP : **(5)**

$$\text{Maximize } z = 2x_1 + 3x_2 + 4x_3$$

$$\text{Subject to } \quad 3x_1 + x_2 + 4x_3 \le 600;$$

$$2x_1 + 4x_2 + 2x_3 \ge 480;$$

$$2x_1 + 3x_2 + 3x_3 = 540;$$

$$\text{and} \quad x_1, x_2, x_3 \ge 0.$$

b) Define a convex set and show that the set of all feasible solutions of a L.P.P is a convex set. **(5)**

Q4 **a)** Solve the integer programming problem **(5)**

$$\text{Maximize} \quad z = 3x_1 + 4x_2$$

$$\text{subject to} \quad 7x_1 + 16x_2 \le 52;$$

$$3x_1 - 2x_2 \le 18;$$

$$\text{and} \quad x_1, x_2 \ge 0 \text{ and integers}$$

by using Branch-Bound method.

b) An airline's organisation has one reservation clerk on duty in its local branch at any given time. The clerk handles information regarding passenger reservation and flight timings. Assume that the number of customers arriving during any given period is poisson distributed with an arrival rate of eight per hour and that the reservation clerk can serve a customer in six minutes on an average, with an expoentially distributed service time. **(5)**

(i) What is the probability that the system is busy?
(ii) What is the average time a customer spends in the system?
(iii) What is the average length of the queue ?
(iv) What is the number of customers in the system?

Q5 **a)** A city corporation has decided to carry out road repair on main four arteries of the city. The government agreed to make a special grant of Rs. 50 lakhs towards the cost with a condition that the repairs must be done at the lowest cost and quickest time. If condition warrant, then a supplementary token grant also be considered favourably. The corporation has floated tenders and 5 contractors have sent in their bids. In order to expedite work, one road will be awarded to only one contractor. **(5)**

Cost of Repairs(Rs. Lakhs)

Contractor ↓/ Roads →	**R_1**	**R_{217}**	**R_3**	**R_4**
C_1	9	14	19	15

C_2	7	17	20	19
C_3	9	18	21	18
C_4	10	12	18	19
C_5	10	15	21	16

Find the best way of assigning the repair work to the contractors and the costs.

b) Solve the following non-linear Programming problem **(5)**

Maximize $z = 10x_1 - x_1^2 + 10x_2 - x_2^2$

subject to $x_1 + x_2 \le 8$;

$-x_1 + x_2 \le 5$;

and $x_1, x_2 \ge 0$ by using Kuhn-Tucker conditions.

Q6 **a)** Maximize $f(x) = -3x^2 + 21.6x + 1.0$ by Fibonacci search method with a minimum resolution of 0.50 over six functional evaluations. The optimal value of $f(x)$ is assumed to be in the range $25 \ge x \ge 0$. **(5)**

b) Solve the non-linear programming problem **(5)**

Maximize $z = 2x_1^2 + x_2^2 + 3x_3^2 + 10x_1 + 8x_2 + 6x_3 - 100$

subject to $x_1 + x_2 + x_3 = 20$;

and $x_1, x_2, x_3 \ge 0$ by using Lagrangian multipliers.

Q7 By applying Wolfe's method solve the quadratic programming problem: **(10)**

Maximize $z = 2x_1 + x_2 - x_1^2$

subject to $2x_1 + 3x_2 \le 6$;

$2x_1 + x_2 \le 4$;

and $x_1, x_2 \ge 0$.

Q8 **Write short notes on any two:** **(5 x 2)**

a) Simplex method.
b) Transportation problem
c) Genetic Algorithm.
d) Project Gradient method with equality constraints.