Registration no:

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

HSSM3302

5th Semester Regular / Back Examination 2016-17

OPTIMIZATION IN ENGINEERING

BRANCH(S): AEIE, CHEM, ECE, EIE, ETC

Time: 3 Hours

Max Marks: 70

Q.CODE: Y378

Answer Question No.1 and any five from the rest.

The figures in the right hand margin indicate marks.

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

a) State an assignment problem, mathematically.

b) What is the necessity of sensitivity analysis?

c) How can one detect alternative optimal solution of some linear programming problem in simplex method?

d) Find the Hessian matrix of

$$f(x_1, x_2, x_3) = -7x_1^2 - 10x_2^2 - 2x_3^2 + 6x_1x_2 - 4x_1x_3 + 8x_2x_3$$

e) State the importance of Branch and Bound technique.

f) Define Transshipment problem.

g) What do you mean by queue discipline? Write the different forms of queue discipline.

h) What is the importance of Lagrange multipliers in non-linear programming?

i) Define basic feasible solution and optimal solution of a LPP.

j) Write Kuhn-Tucker conditions.

Q2 **a)** Use Simplex method to solve the following LPP **(5)**

$$\text{Maximize } z = 3x_1 + 5x_2 + 4x_3$$

$$\text{Subject to } \quad 2x_1 + 3x_2 \leq 8$$

$$2x_2 + 5x_3 \leq 10$$

$$3x_1 + 2x_2 + 4x_3 \leq 15$$

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

b) Solve the integer programming problem **(5)**

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

$$\text{subject to } \quad 5x_1 + 3x_2 \geq 30;$$

$$x_1 \le 4;$$

$$x_2 \le 6;$$

and $x_1, x_2 \ge 0$ and integers

by using Branch-Bound method.

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

Minimize $z = 5x_1 + 3x_2$

Subject to $2x_1 + 4x_2 \le 12$;

$2x_1 + 2x_2 = 10$;

$5x_1 + 2x_2 \ge 10$

and $x_1, x_2 \ge 0$.

b) A firm has several machines and wants to install its own service facility for the repair of its machines. The average breakdown rate of the machines is 3 per day. The repair time has expoential distribution. The loss incurred due to lost time of an inoperative machine is Rs. 40 per day. There are two repair facilities available. Facility X has an installation cost of Rs.20,000 and facility Y costs Rs. 40,000. The total labour cost per year for the two facilities is Rs. 5,000 and Rs. 8,000 respectively. Facility X can repair 4 machines daily while facility Y can repair 5 machines daily. The life span of both the facilities is 4 years. Which facility should be installed? **(5)**

Q4 a) Solve the following LPP by dual simplex method : **(5)**

Maximize $z = -2x_1 - x_3$

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

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

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

b) A company has 4 warehouses and 6 stores. The cost of shipping one unit from warehouse i to store j is c_{ij} .

If $C = (c_{ij}) = \begin{pmatrix} 7 & 10 & 7 & 4 & 7 & 8 \\ 5 & 1 & 5 & 5 & 3 & 3 \\ 4 & 3 & 7 & 9 & 1 & 9 \\ 4 & 6 & 9 & 0 & 0 & 8 \end{pmatrix}$, and the requirements of the six stores are 4,4,6,2,4,2 and quantities at the warehouses are 5,6,2,9. Find the minimum cost solution.

Q5 **a)** Solve the non-linear programming problem **(5)**

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

subject to $x_1 + x_2 + x_3 = 15$;

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

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

by using Lagrangian multipliers.

b) Show that the dual of the dual linear programming problem is the primal. **(5)**

Q6 **a)** Determine x_1, x_2, x_3 so as to maximize **(5)**

$$z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$$

subject to $x_1 + x_2 \leq 2$;

$2x_1 + 3x_2 \leq 12$;

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

b) Minimize $f(x) = x^4 - 15x^3 + 72x^2 - 1135x$ by Golden section search method. **(5)**
Terminate the search when $|f(x_n) - f(x_{n-1})| \leq 0.50$. The initial range of x is $1 \leq x \leq 15$.

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

Maximize $z = 2x_1 + 3x_2 - 2x_1^2$

subject to $x_1 + 4x_2 \leq 4$;

$x_1 + x_2 \leq 2$;

and $x_1, x_2 \geq 0$.

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

a) Sensitivity analysis
b) Hungarian method
c) Fibonacci search method.
d) Primal-Dual Problem.