Total number of printed pages – 3

B. Tech

HSSM 3302

Fifth Semester Back Examination – 2014

OPTIMIZATION IN ENGINEERING

BRANCH(S) : AEIE, CHEM, EC, ETC, IEE

QUESTION CODE : L 289

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2 ×10

   (a) Write the mathematical model of linear programming.

   (b) Obtain the dual problem of the following primal LP problem

   Maximize $\quad Z = 3x_1 + 2x_2 + 5x_3$
   Subject to $\quad 2x_1 + 3x_2 \geq 2$
   $\quad\quad\quad\quad x_1 + x_2 + 2x_3 \geq 1$
   $\quad\quad\quad\quad x_1, x_2 \geq 0$

   (c) What is the principle of Big-M method in finding the solution of LPP ?

   (d) Explain sensitivity analysis.

   (e) When degeneracy occur in a Transportation problem ? Explain.

   (f) What do you mean by unbalanced transportation problem ? How do you handle such situation in order to find a solution ?

   (g) Explain the concept of branch and bound method in integer programming.

   (h) What is interarrival time in a queueing system ? What type of probability distribution it follows in Markovian model of queueing system ?

P.T.O.

(i)   What is the advantage of Golden search method over Fibonacci search method ?

(j)   What is a quadratic programming ?

2.   (a)   Using graphical method, solve the following LPP :   4

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

$$\text{Subject to} \quad 10x_1 + 3x_2 \geq 30$$

$$2x_1 + x_2 \geq 6$$

$$2x_1 + 9x_2 \geq 27$$

$$x_1, x_2 \geq 0$$

(b)   Express the following LLP in standard form and solve using simplex method   6

$$\text{Minimize} \quad Z = 5x_1 + 3x_2$$

$$\text{subject to} \quad 2x_1 + x_2 \geq 3$$

$$x_1 + x_2 \geq 2$$

$$x_1, x_2 \geq 0$$

3.   (a)   Using duality, solve the following LPP   5

$$\text{Maximize} \quad Z = 2x_1 + x_2$$

$$\text{Subject to} \quad x_1 + 2x_2 \leq 10$$

$$x_1 + x_2 \leq 6$$

$$x_1 - x_2 \leq 2$$

$$x_1 - 2x_2 \leq 1$$

$$x_1, x_2 \geq 0$$

(b)   Write the steps of branch–bound method to solve the integer programming problem.   5

4.   Solve the following LPP by revised simplex method   10

$$\text{Minimize} \quad Z = -3x_1 + x_2 + x_3$$

$$\text{Subject to} \quad x_1 - 2x_2 + x_3 \leq 11$$

$$-4x_1 + x_2 + 2x_3 \geq 3$$

$$2x_1 - x_3 = -1$$

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

5. (a) Solve the following Transportation problem :   5

Source/Destination	D1	D2	D3	D4	Supply
S1	6	1	9	3	70
S2	11	5	2	8	55
S3	10	12	41	7	70
Demand	85	35	50	45	

(b) Four men are available to do four different jobs. From the past records, the time (in 2 hours) that each men takes to do each job is known and given in the following table. Find the assignment of men to jobs that will minimize the total time taken.   5

Job/persons	A	B	C	D
1	2	3	4	5
2	4	5	6	7
3	7	8	9	8
4	3	5	8	4

6. (a) A barber runs his own salon. It takes him exactly 25 minutes to complete on haircut. Customers arrive in a Poisson fashion at an average rate of one in every 35 minutes. Find   5

    (i) For what percent of time would the barber be idle

    (ii) What is the average time of a customer spent in the shop

(b) Use the Golden section search method to minimize the function   5

$$f(x) = 2(x - 3)^2 + e^{0.5x^2}, 0 \le x \le 100.$$

7. Write the short notes of the followings :   3+3+4

    (a) Lagrange multipliers

    (b) Kuhn-Tucker conditions

    (c) Fibonacci search method

8. Solve the following quadratic programming problem   10

    Minimize $Z = x_1^2 - x_1 x_2 + 3x_2^2 - 4x_2 + 4$

    Subject to $x_1 + x_2 \le 1$

                $x_1, x_2 \ge 0.$