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

Total number of printed pages – 3

B. Tech

HSSM 3302

Sixth Semester Back Examination – 2015

OPTIMIZATION IN ENGINEERING

BRANCH (S) : AUTO, CIVIL

QUESTION CODE : M 395

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) What are the functions of surplus and artificial variable in a LPP ?

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

Maximize $z = 3x_1 + 2x_2 + x_3$

Subject to $2x_1 + 3x_2 \geq 2$

$x_1 + x_2 + x_3 \geq 1$

$5x_1 + 2x_2 - 3x_3 \leq 6$

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

(c) Write the basic steps in constructing a Linear Programming model.

(d) What do you mean by integer programming ? What are the different methods to solve an integer programming problem ?

(e) What is the principle of Big-M methods in finding the solution of LPP ?

(f) Define non-degenerate basic feasible solution and degenerate basic feasible solution. How to avoide the degeneracy ?

(g) What is M/M/I model in queuing model ? Explain.

(h) What is Lagrange multipliers ?

(i) Define Hessian matrix, gradient vector.

(j) What is quadratic programming ? Give an example.

P.T.O.

2. (a) Solve the following LLP by graphical method : 4

Minimize $z = -3x_1 - 2x_2$

subject to $2x_1 + 3x_2 \geq 30$

$3x_1 + 2x_2 \leq 24$

$x_1 + x_2 \geq 3$

$x_1, x_2 \geq 0$

(b) Using Simplex method, solve the following LLP : 6

Maximize $z = -3x_1 - 2x_2$

subject to $x_1 + x_2 \geq 1$

$x_1 + x_2 \leq 7$

$x_1 + 2x_2 \geq 10$

$x_2 \leq 3$

$x_1, x_2 \geq 0$

3. Consider the following LPP : 10

Maximize $Z = 5x_1 + 12x_2 + 4x_3$

subject to $x_1 + 2x_2 + x_3 \leq 5$

$2x_1 - x_2 + 3x_3 = 2$

$x_1, x_2, x_3 \geq 0$

(i) Solve using Big-M methods.

(ii) Discuss the effect of changing the requirement vector from $\begin{bmatrix} 5 \\ 2 \end{bmatrix}$ to $\begin{bmatrix} 7 \\ 2 \end{bmatrix}$ on the optimum solution.

(iii) Which resource should be increased and by how much to achive the best marginal increase in the value of the objective function ?

4. Use Revised simplex method to solve the following LPP : 10

Minimize $Z = 6x_1 - 2x_2 + 3x_3$

subject to $2x_1 - x_2 + 2x_3 \leq 2$

$x_1 + 4x_3 \leq 4$

$x_1, x_2, x_3 \geq 0$

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

Destination/Source	D1	D2	D3	D4	Supply
S1	11	20	7	8	50
S2	21	16	20	12	40
S3	8	12	8	9	70
Demand	30	25	35	40	

(b) Four machines are available to assign four jobs. Find the assignment of machines to the job that will result in maximum profit. 5

Machines/jobs	A	B	C	D	
1	42	35	28	21	
2	30	25	20	15	
3	30	25	20	15	
4	24	20	16	12	

6. Using Golden section search method, 10

Minimize $f(x) = 4x\sin x$, $\pi \geq x \geq 0$, taking $\varepsilon = 0.10$

7. Solve the following problem using the projected gradient method : 10

Minimize $f(x) = (x_1 - 3)^2 + (x_2 - 4)^2$

subject to $2x_1 + x_2 = 3$

8. Solve the following non-linear programming problem using Kuhn-Tucker conditions : 10

Maximize $Z = 8x_1 + 10x_2 - x_1^2 - x_2^2$

subject to $3x_1 + 2x_2 = 6$

$x_1, x_2 \geq 0.$