

Registration No. :

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Total number of printed pages – 3

**B. Tech**  
**HSSM 3302**

**Sixth Semester Back Examination – 2015**

**OPTIMIZATION IN ENGINEERING**

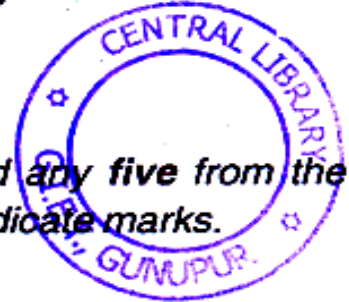
**BRANCH (S) : AUTO, CIVIL**

**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 :

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

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

$$x_1 + x_2 + x_3 \geq 1$$

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

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

(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 avoid the degeneracy ?

(g) What is M/M/1 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

$$\text{Minimize } z = -3x_1 - 2x_2$$

$$\text{subject to } 2x_1 + 3x_2 \geq 30$$

$$3x_1 + 2x_2 \leq 24$$

$$x_1 + x_2 \geq 3$$

$$x_1, x_2 \geq 0$$

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

6

$$\text{Maximize } z = -3x_1 - 2x_2$$

$$\text{subject to } x_1 + x_2 \geq 1$$

$$x_1 + x_2 \leq 7$$

$$x_1 + 2x_2 \geq 10$$

$$x_2 \leq 3$$

$$x_1, x_2 \geq 0$$



3. Consider the following LPP :

10

$$\text{Maximize } Z = 5x_1 + 12x_2 + 4x_3$$

$$\text{subject to } x_1 + 2x_2 + x_3 \leq 5$$

$$2x_1 - x_2 + 3x_3 = 2$$

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

(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 achieve the best marginal increase in the value of the objective function ?

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

10

$$\text{Minimize } Z = 6x_1 - 2x_2 + 3x_3$$

$$\text{subject to } 2x_1 - x_2 + 2x_3 \leq 2$$

$$x_1 + 4x_3 \leq 4$$

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

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  $\epsilon = 0.10$

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  $3x_1 + 2x_2 = 6$

$x_1, x_2 \geq 0$ .

