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

Total number of printed pages – 3

B. Tech

HSSM 3302 (New)

Sixth Semester (Back) Examination – 2013

OPTIMIZATION IN ENGINEERING

BRANCH : AUTO, CSE, ENV, FASHION, IT, MECH, MINERAL, MINING, MME, PLASTIC, TEXTILE

QUESTION CODE : B301

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) Define LPP and basic solution of a LPP.

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

   Maximize $z = 5x_1 + 3x_2$

   subject to $2x_1 + 3x_2 + x_3 \geq 2$

   $x_1 + x_2 + 7x_3 = 1$ and $x_1, x_2 \geq 0$

   (c) What is the importance of sensitivity analysis ?

   (d) What is degeneracy of a transportation problem ? How it is solved ?

   (e) What is a transshipment problem ?

   (f) Write the basic structure of a queueing model.

   (g) What is queue capacity and queue discipline ?

   (h) Explain the role of Lagrange multiplier.

   (i) Write the mathematical form of an assignment problem.

   (j) Explain one problem where genetic algorithm is used.

2. (a) Solve the following LPP using Big M method : 5

   Minimize $z = 10x_1 + 15x_2 + 20x_3$

   Subject to $2x_1 + 4x_2 + 6x_3 \geq 24$

   $3x_1 + 9x_2 + 6x_3 \geq 30$

   $x_1, x_2, x_3 \geq 0$

P.T.O.

(b) Using dual simplex method to solve the LPP : 5

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

Subject to $2x_1 - x_2 + x_3 \geq 4$

$x_1 + x_2 + 2x_3 \leq 8$

$x_2 - x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$

3. Consider the problem : 10

Maximum $Z = 2x_1 - 5x_3$

Subject to $x_1 + x_3 \leq 20$

$2x_1 + x_2 + 6x_3 \leq 6$

$x_1 - x_2 + 3x_3 = 0$

$x_1, x_2, x_3 \geq 0$

(a) Write the dual from the standard form.

(b) Solve the primal and hence find the solution to the dual.

(c) Suppose that the coefficient of x_2 and x_3 in the objective function are changed from (2, –5) to (1, 1), find the new solution.

4. (a) Find the initial basic feasible solution to the following transportation problem using Vogel approximation method. 5

Destination / source	D1	D2	D3	D4	Supply
S1	42	27	24	35	100
S2	46	37	32	32	60
S3	40	40	30	32	140
Demand	80	40	120	60	

(b) Solve the following Assignment problem : 5

Job/persons	A	B	C	D	E
1	30	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

5. (a) Customers arrive at a sales counter manned by a single person according to a Poisson process with a man rate of 20 per hour. The time required to serve a customer has an exponential distribution with a mean of 100 seconds. Find the average waiting time of a customer. 5

(b) At what average rate must a clerk in a supermarket work in order to ensure a probability of 0.90 that a customer will not have to wait longer than 12 min. Customers arrive at the counter in Poisson fashion with mean rate of 15 per hour. Service time has exponential distribution. 5

6. Solve the following quadratic programming problem : 10

Minimize $z = x_1^2 - x_1x_2 + 3x_2^2 - 4x_2 + 4$

Subject to $x_1 + x_2 \leq 1$

$x_1, x_2 \geq 0$

7. Solve the following : 10

Optimize $Z = 2x_1 + 3x_2 - (x_1^2 - x_2^2 - x_3^2)$

Subject to $x_1 + x_2 \leq 1$

$2x_1 + 3x_2 \leq 6$

$x_1, x_2 \geq 0$

using Kuhn-Tucker conditions.

8. Write notes on : 5×2

(a) Fibonacci and Golden section search

(b) Genetic Algorithm.