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

Total number of printed pages – 4

B. Tech

HSSM 3302

Sixth Semester (Special / Back) Examination – 2013

OPTIMIZATION IN ENGINEERING

BRANCH : AUTO, CIVIL

QUESTION CODE : E 372

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 feasible region of a LPP.

(b) In simplex method when no variable qualifies to be the leaving basic variable, what happens to the solution ?

(c) Define the role of an artificial variable in big-M method.

(d) Construct the dual of the following Primal problem.

Maximize $Z = 2x_1 + 6x_2 + 9x_3$,

Subject to $x_1 + x_3 \leq 3$

$x_2 + 2x_3 \leq 5$, $x_1 \geq 0$, $x_2 \geq 0$, $x_3 \geq 0$

(e) Write the condition of feasibility of a transportation problem.

(f) Find an optimal solution to an assignment problem with the following cost matrix :

Job/person	A	B	C	D
1	3	12	8	6
2	14	6	12	9
3	16	11	14	12
4	5	14	11	10

P.T.O.

(g) Determine the relative maximum or minimum of the function

$f(x)=x_1+2x_3+x_2x_3-x_1^2-x_2^2-x_3^2$

(h) Write the Mathematical form of Transshipment problem.

(i) Give an application of Duality Theory.

(j) Explain queuing model.

2. Formulate the following problem as LPP and then solve by Simplex method.

A manufacturer can manufacture two different types of products, sheets and tubes.Each unit of sheets of a particular size needs 5kg of raw material A and 2kg of raw material B. Each unit of tubes needs 7kg of raw material A and 1kg of raw material B. Availability of raw material A in the market is 500 kg and that of raw material B is 100kg.Each sheet contributes profit of Rs.100/- and tube contributes profit of Rs.400/-. What is the most suitable product mix for the manufacturer to maximize profit ? 10

3. (a) Solve by big-M method 5

Maximize $Z = 6x_1+4x_2$

Subject to $2x_1+3x_2 \leq 30$

$3x_1+3x_2 \leq 24$

$x_1+x_2 \geq 3$

$x_1 \geq 0, x_2 \geq 0$

(b) Solve by two-phase method 5

Maximize $Z = 2x_1+5x_2+3x_3$

Subject to $x_1-2x_2+x_3 \geq 20$

$2x_1+4x_2+x_3 = 50$

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

4. Solve the following non-linear programming problem :

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

Subject to $x_1 + x_2 \leq 1$

$x_1 \geq 0, x_2 \geq 0$ 10

5. (a) Find the optimal solution to the following transportation problem using any suitable method. 5

Source	A	B	C	D	Supply
1	3	7	6	4	5
2	2	4	3	2	2
3	4	3	8	5	3
Demand	3	3	2	2	

(b) Consider the assignment problem and find the optimal solution 5

Person	job		
	1st	2nd	3rd
A	5	7	4
B	3	6	5
C	2	3	4

6. (a) Set up the transition diagrams for the following queuing system models : 5

(i) M/M/2/4

(ii) M/M/3/3

(b) Minimize the following objective functions using a Golden section search.

Minimize $f(x) = 3x^4 + (x-1)^2$

$4 \geq x \geq 0$ 5

7. (a) Solve by revised simplex method 5

Maximize $Z = 4x_1 - x_2 - 2x_3$

Subject to $2x_1 - 3x_2 + 2x_3 \leq 12$

$-5x_1 + 2x_2 + 3x_3 \geq 4$

$-3x_1 + 2x_3 = 1$

$x_1, x_2, x_3 \geq 0$

(b) Solve by graphical method 5

Maximize $Z = 3x_1 + 4x_2$

Subject to $10x_1 + 3x_2 \geq 30$

$2x_1 + x_2 \geq 6$

$2x_1 + 9x_2 \geq 27$

$x_1, x_2 \geq 0$

8. Find an optimal solution of the following problem using Kuhn-Tucker condition 10

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

Subject to $x_1 + x_2 = 6$

$x_1 \geq 1$

$x_1^2 + x_2^2 \leq 26.$