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

Total number of printed pages – 4

B. Tech

HSSM 3302

Sixth Semester Examination – 2013

OPTIMIZATION IN ENGINEERING

BRANCH : CIVIL / AUTO

QUESTION CODE : A 288

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 characteristics of a linear programming problem.

   (b) How do you recognize that an LP problem is unbounded while using the simplex method ?

   (c) What is an artificial variable ? How does it differ from slack/surplus variable ?

   (d) What is sensitivity analysis ? Why do we perform it ?

   (e) Explain why transportation algorithm is not appropriate for solving the assignment problem.

   (f) What do you mean by unbalanced assignment problem ? Explain how it is handled in the solution process.

   (g) What is a Markovian queueing model ?

   (h) Differentiate between Fibonacci and golden section search methods.

   (i) Write the general form of a quadratic programming.

   (j) What are primary uses of Kuhn-Tuker necessary and sufficient conditions ?

P.T.O.

2. (a) One manufacturing company produces pistons, rings and valves for which the profits per unit item are Rs. 15, Rs. 10 and Rs. 8 respectively. It takes one hour of preparatory work, ten hours of machining and two hours of packing and allied formalities for a piston. The corresponding time requirements for rings and valves are 1, 4, 2 and 1, 5, 4 hours respectively. The total number of hours available for preparatory work, machining and packing with allied formalities are 100, 500 and 400 respectively. Formulate the problem in to a LPP so that the company gets the most profitable mix assuming that all items produced can be sold. 5

(b) Using graphical method solve the following LPP : 5

Maximize $Z = 3x_1 + 2x_2$

subject to $2x_1 + x_2 \leq 2$

$3x_1 + 4x_2 \geq 12$

$x_1, x_2 \geq 0$

3. (a) Using simplex method to solve the following LPP : 6

Maximize $Z = 2x_1 + 4x_2 + x_3 + x_4$

subject to $x_1 + 3x_2 + x_4 \leq 4$

$2x_1 + x_2 \leq 3$

$x_2 + 4x_3 + x_4 \leq 3$

$x_1, x_2, x_3, x_4 \geq 0$

(b) Write the various steps involved in a primal-dual formulation. Explain through an example. 4

4. Using Big-M method solve the following LPP : 10

Minimize $Z = 5x_1 - 6x_2 - 7x_3$

subject to $x_1 + 5x_2 - 3x_3 \geq 15$

$5x_1 - 6x_2 + 10x_3 \geq 0$

$x_1 + x_2 + x_3 = 5$

$x_1, x_2, x_3 \geq 0$

5. (a) Obtain an initial basic feasible solution of the following transportation problem by using North-West corner rule : 5

Source/Destination	D1	D2	D3	Availability
S1	6	8	4	14
S2	4	9	8	12
S3	1	2	6	5
Requirement	6	10	15	

(b) Find an optimal assignment of workers to jobs if the completion time (in hours) of different jobs by different workers are given below : 5

Job / Workers	W1	W2	W3	W4
J1	8	7	9	10
J2	7	9	9	8
J3	10	8	7	11
J4	10	6	8	7

6. (a) A road transport company has one reservation clerk on duty at atime. Customers arrive at a rate of 10 per hour and the clerk can solve 12 customers on an average per hour. Find 5

(i) The average number of customers waiting for the service of the clerk.

(ii) The average time a customer has to wait before getting service.

(b) Patients arrive at a clinic according to a poisson distribution at a rate of 30 patients per hour. The clinic has an waiting room which can accommodate maximum 16 patients. Examination time per patient by the doctor is exponential with mean rate of 18 per hour. Find 5

(i) The probability that an arriving patient will not wait.

(ii) The expected waiting time of a patient until he is discharged from the clinic.

7. Solve the following quadratic programming problem : 10

Maximize $Z = 2x_1 + 3x_2 - 2x_2^2$

Subject to $x_1 + 4x_2 \leq 4$

$x_1 - x_2 \leq 2$

$x_1, x_2 \geq 0$

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

Minimize $Z = 4x_1 - x_2^2 - 6$

subject to $26 - x_1^2 - x_2^2 = 0$
