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

Total number of printed pages – 4

B. Tech

HSSM 4301 (Old)

Sixth Semester (Back) Examination – 2013

OPTIMIZATION IN ENGINEERING

BRANCH : AEIE,CHEM,CIVIL,CSE,EC,EEE,ELECTRICAL, ETC, FASHION, IEE, IT, MECH

QUESTION CODE : B368

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 is feasible region ? Is it necessary that it should be always a convex set ?

(b) What are artificial variables ? Why do we need them ?

(c) Explain the concept of degeneracy in simplex method.

(d) What do you mean by unbalanced transportation problem ? How do you handle such situation in order to find a solution?

(e) Do you agree that an assignment problem is a special case of transportation problem ? Explain.

(f) Explain the difference between pure strategy and mixed strategy in a game.

(g) What is traffic intensity in a queuing system? If traffic intensity is 0.3, then what is the percent of time a system remains idle?

(h) Explain the different procedure to solve a problem using dynamic programming.

(i) Explain the concept of branch and bound method in integer programming.

(j) What do you mean by minimum spanning tree in a graph. State two algorithms used to find the minimum spanning tree.

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

Minimize $z = -x_1 + 2x_2$

subject to $-x_1 + 3x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1, x_2 \geq 0$ 4

(b) Using simplex method, solve the following LLP

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

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

$2x_1 + x_2 \leq 3$

$x_2 + 4x_2 + x_4 \leq 3$

$x_1, x_2, x_3, x_4 \geq 0$ 6

3. Write the principle of obtaining dual from the primal. Convert the following primal to dual and solve

Maximize $z = 3x_1 + 5x_2$

Subject to $x_1 + 2x_2 \leq 10$

$-3x_1 + x_2 \leq 10$

$2x_1 - 6x_2 \leq 15$

$x_2 \leq 2$

$x_1, x_2 \geq 0$ 10

4. (a) A product is produced by four factories A, B, C and D. The unit production cost in them are Rs 3, Rs 4, Rs 2 and Rs 5 respectively. Their production capacities are : factory A – 60 units, factory B – 50 units, factory C – 25 units and factory D – 50 units. These factories supply the products to four stores, demand of which are 30, 45, 80 and 30 units respectively. Unit transportation cost in rupees from each factory to each store is given in the following table :

		Store 1	Store 2	Store 3	Store 4
Factories	A	5	6	8	12
	B	10	7	9	8
	C	15	3	7	11
	D	6	8	10	5

Find the transportation matrix and find a basic feasible solution by Vogel's approximation method. 5

(b) Four different jobs are to be done on four different machines. The setup and production times are prohibitively high for changeover. The table below indicates the cost of producing job I on machine j in rupees. 5

Jobs \ Machines	A	B	C	D
1	5	7	11	6
2	8	5	9	6
3	4	7	10	7
4	10	4	8	3

Assign jobs to different machines so that the total cost is minimized

5. (a) Use dynamic programming to solve the following LPP 5

maximize $z = x_1.x_2.x_3$

subject to $x_1 + x_2 + x_3 = 5$

$x_1, x_2, x_3 = 0$

(b) State the Dijkstra's algorithm to find the shortest path from the source node to any other node in a network. How is it different from Floyd's algorithm ? 5

6. (a) Arrival rate of telephone calls at a telephone booth are according to Poisson distribution with an average of 9 minutes between two consecutive arrivals. The length of telephone call is assumed to be exponentially distributed with mean 3 minutes.

(i) Determine the probability that a person arriving at a booth will have to wait.

(ii) Find the average queue length that is formed from time to time.

(iii) Find the fraction of the day that the phone is in use. 5

(b) A company manufactures around 100 items daily. Depending upon the availability of the raw materials and other conditions, the daily production has been varying from 96 mopeds to 104 mopeds, whose probability distribution is given below :

Production/day	96	97	98	99	100	101	102	103	104
Probability :	0.06	0.08	0.12	0.14	0.21	0.14	0.10	0.08	0.07

The finished items are transported in a special lorry, which can accommodate only 100 mopeds. Using the following 15 random numbers 79, 82, 65, 24, 48, 61, 18, 45, 04, 23, 50, 66, 54, and 10 simulate the process to find out the average number of mopeds waiting in the factory. 5

7. (a) Solve the following games by using maxmin (minmax) principle whose pay-off matrix is given below. Include in your answer 5

(i) strategy selection for each player

(ii) the value of game to each player

	Player B strategy			
Player A strategy	B_1	B_2	B_3	B_4
A_1	1	7	3	4
A_2	5	6	4	5
A_3	7	2	0	3

(b) There are six jobs each of which must go through the machines A, B and C in the order ABC. Processing time (in hours) are given in the following table:

Job	1	2	3	4	5	6
Machine A	7	5	7	3	5	1
Machine B	3	6	4	2	2	5
Machine C	6	8	5	9	11	7

Determine a sequence of job that will minimize the elapsed time. 5

8. Write short notes of the followings with one example of practical application in each case : 5×2

(a) Set covering problem

(b) Set partitioning problem.
