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

Total number of printed pages – 4

B. Tech.

HSSM 3302

Sixth Semester Examination – 2013

OPTIMIZATION IN ENGINEERING

BRANCH : MECHANIICAL

QUESTION CODE : A 162

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) Explain the followings with reference to LPP :

      (i) entering variable

      (ii) leaving variable

   (b) What is the concept of two-phase simplex method ?

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

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

   (e) Can degeneracy occur in transportation problem ? Justify your answer.

   (f) What are the basic characteristics of queueing phenomena ?

   (g) What do you mean by transient and steady state of a queueing system ?

   (h) Is it correct to say that in a quadratic programming the objective function and the constraints both should be quadratic ? If not, give your own comment.

   (i) Differentiate between constraint and unconstraint optimization giving example in each case.

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

P.T.O.

2. (a) A farmer has 500 acres of land on which he can grow paddy, wheat or soybeans. Each acre of paddy costs Rs.1000/- for preparation, requires 7 man-days of work and yields a profit of Rs..300/-Each acre of wheat costs Rs1200/- for preparation, requires 9 man-days of work and yields a profit of Rs800/-. Each acre of soybean costs Rs. 800/- for preparation, requires 6 man-days of work and yields a profit of Rs. 300/-. If the farmer has Rs. 1,00,000/- for preparation, available 4000 man-days, Formulate the LP model to allocate the number of acres to each crop to maximize the total profit. 5

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

Maximize $Z = 3x_1 + 2x_2$

Subject to $-2x_1 + 3x_2 \leq 9$

$3x_1 - 2x_2 \geq 20$

$x_1, x_2 \geq 0$

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

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

Subject to $3x_1 - x_2 + 2x_3 \geq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$x_1, x_2, x_3 \geq 0.$

(b) Write the steps involved in two-phase simplex method. 4

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

Minimize $Z = 4x_1 + 5x_2 - 3x_3$

Subject to $x_1 + x_2 + x_3 = 10$

$x_1 - x_2 \geq 1$

$2x_1 + 3x_2 + x_3 \leq 40$

$x_1, x_2, x_3 \geq 0$

5. (a) Obtain an initial basic feasible solution of the following transportation problem by using Least Cost Rule. 6

Source/Destination	D1	D2	D3	D4	D5	Availability
S1	1	2	6	2	3	800
S2	3	4	5	8	1	600
S3	3	1	1	2	6	200
S4	4	7	3	5	4	400
Requirement	400	100	700	300	500	

(b) What is duality theory ? What are the rules to form a dual problem from the primal problem ? What are the advantages of duality ? 4

6. (a) One office has one typist. Since the typing work varies in length (the number of pages to be typed), the typing rate is distributed approximately a Poisson distribution with mean service rate of 8 letters per hour. The letter arrives at a rate of 5 per hour during the entire 8-hour working day. If the type writer cost the office Rs. 50 per hour, determine 5

(i) the percent time that the arriving letter has to wait for typing

(ii) average system time

(iii) average cost due to waiting on the part of the typewriter (remaining idle)

(b) Vehicles arrive at one-window drive according to Poisson distribution with mean of 10 minutes. The service time per vehicle is exponential with mean of 6 minutes. The space in front of the window can accommodate only three vehicles including the serviced one. Other vehicles have to wait outside this space. Calculate

(i) probability that an arriving vehicle can drive directly to the space in front of the window

(ii) probability that an arriving vehicle will have to wait outside the directed space. 5

7. (a) Solve the following Non-linear programming problem by using Lagrangian multipliers 5

Maximize $Z = 10x_1 + 4x_2 - x_1^2 + 4x_1x_2 - 5x_2^2$

Subject to $x_1 + x_2 = 0$

$x_1, x_2 \geq 0$

(b) Solve the following NLPP using Kuhn-Tucker conditions 5

Maximize $Z = 2x_1^2 - 7x_2^2 + 12x_1x_2$

Subject to $2x_1 + 5x_2 \leq 98$

$x_1, x_2 \geq 0$

8. Solve the following quadratic programming 10

Minimize $Z = -4x_1 + x_1^2 - 2x_1x_2 + 2x_x^2$

Subject to $2x_1 + x_2 \geq 6$

$x_1 - 4x_2 \geq 0$

$x_1, x_2 \geq 0$