Registration no: | | | | | | | | | | |

Total Number of Pages: 03 **B.TECH**

HSSM3302

5th Semester Regular / Back Examination 2015-16

OPTIMIZATION IN ENGINEERING

BRANCH: CSE,FAT,IT,MANUFACT,MANUTECH,MM,MME,PLASTIC,TEXTILE

Time: 3 Hours

Max marks: 70

Q.CODE: T498

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) Define basic feasible solution and optimal solution of a LPP.

b) What is the difference between balanced transportation problem and unbalanced transportation problem?

c) How can one detect infinite number of optimal solutions of a linear programming problem in simplex method?

d) Write the difference between simplex method and dual simplex method to solve a LPP.

e) What do you mean by queue discipline? Write the different forms of queue discipline.

f) Explain the concept of Fibonacci search method.

g) What is the importance of Lagrange multipliers in non-linear programming?

h) Write the necessary and sufficient conditions of Kuhn-Tucker for an absolute maximum of $f(x)$ at a point.

i) Show that the Hessian matrix of $f(x_1, x_2, x_3) = -7x_1^2 - 10x_2^2 - x_3^2 + 4x_1x_2 - 2x_1x_3 + 4x_2x_3$ is negative-definte.

j) How can one know that a stationary point is a maxima or minima?

Q2 **a)** Use Simplex method to solve the following LPP **(5)**

Minimize $z = x_1 - 3x_2 + 2x_3$

Subject to $3x_1 - x_2 + 3x_3 \le 7$

$-2x_1 + 4x_2 \le 12$

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

And $x_1, x_2 \text{and } x_3 \ge 0$.

b) A tax consulting firm has four service stations in its office to receive people who have problems and complaints about their income, wealth and sales taxes. Arrivals average 100 persons in a 10 hour service day. Each tax advisor spends an irregular amount of time servicing the arrivals which have been found to have an exponential distribution. The average service time is 20 minutes. Calculate : **(5)**

(i)average number of customers waiting to be serviced.

(ii)average time a customer spends in the system.

(iii)the probability that a customer has to wait before he gets service.

Q3 **a)** Hindustan construction company needs 3,3,4 and 5 million cubic feet of fill at four earthen dam-sites in Punjab. It can transfer the fill from three mounds A,B and C where 2,6 and 7 million cubic feet of feel is available respectively. Costs of transporting one million cubic feet of fill from mounds to the four sites in lakhs are given in the table. **(5)**

	I	II	III	IV	$a_i \downarrow$
A	15	10	17	18	2
B	16	13	12	13	6
C	12	17	20	11	7
$b_j \rightarrow$	3	3	4	5	

Find the initial basic feasible solution of the Transportation problem by using Vogel's Approximation method and hence solve the problem for minimum cost ?

b) Solve the following LPP by dual simplex method : **(5)**

Maximize $z = -2x_1 - x_3$

Subject to $x_1 + x_2 - x_3 \geq 5$

$x_1 - 2x_2 + 4x_3 \geq 8$

And $x_1, x_2 \text{and } x_3 \geq 0$.

Q4 Apply Wolfe's method for solving the quadratic programming problem: **(10)**

Maximize $z = 4x_1 + 6x_2 - 2x_1^2 - 2x_2^2 - 2x_1x_2$

subject to $x_1 + 2x_2 \leq 4$;

and $x_1, x_2 \geq 0$.

Q5 a) Using Revised simplex method solve the following LPP : **(5)**

Maximize $z = x_1 + 2x_2$

subject to $x_1 + x_2 \leq 3$;

$x_1 + 2x_2 \leq 5$;

$3x_1 + x_2 \leq 6$;

And $x_1, x_2 \geq 0$.

b) Solve the integer programming problem **(5)**

Minimize $z = 3x_1 + 4x_2$

subject to $7x_1 + 16x_2 \leq 52$;

$3x_1 - 2x_2 \leq 18$

And $x_1, x_2 \geq 0$ and integers.

using Branch-Bound method.

Q6 a) Use Kuhn-Tucker conditions to solve the following non-linear Programming problem: **(5)**

Maximize $z = 7x_1^2 - 6x_1 + 5x_2^2$

subject to $x_1 + 2x_2 \leq 10$;

$x_1 - 3x_2 \leq 9$;

And $x_1, x_2 \geq 0$.

b) Five men A,B,C,D and E are available to do five different jobs I,II,III,IV and V. From past records, the time(in hours) that each man takes to do each job is known and given in the following table : **(5)**

	I	II	III	IV	V
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

Find the assignment of men to jobs that will minimize the total time taken.

Q7 **a)** Solve the non-linear programming problem **(5)**

Maximize $z = 4x_1 + 9x_2 - x_1^2 - x_2^2$

subject to $4x_1 + 3x_2 = 15$;

$3x_1 + 5x_2 = 14$;

And $x_1, x_2 \geq 0$.

by using Lagrangian multipliers.

b) Maximize the function $f(x) = -3x^2 + 21.6x + 1.0$, with a minimum resolution of 0.50 over six functional evaluations. The optimal value of $f(x)$ is assumed to lie in the range $25 \geq x \geq 0$. **(5)**

Q8 Write short notes on any two of the following : **(5 x 2)**

a) Sensitivity analysis.

b) Golden search method.

c) Primal-Dual Problem.

d) Project Gradient method