is question paper contains 4 printed pages]

ır Roll No. : .....

No. of Q. Paper : 608 I

que Paper Code : 32357502

ne of the Course : **B.Sc.(Hons.) Mathematics : DSE - I**

ne of the Paper : Mathematical Modelling & Graph Theory

ıester : V

ıe : 3 Hours ***Maximum Marks : 75***

ructions for Candidates :

(a) Write your Roll No. on the top immediately on receipt of this question paper.

(b) Attempt any **three** parts of each question.

(c) **All** questions are compulsory.

a) Solve the initial value problem using the Laplace transform : 6

$$x^{(3)} + x'' - 6x' = 0;\ x(0) = x''(0) = 1$$

b) (i) Find the inverse Laplace transform of : 2

$$F(s) = \frac{1}{s^2 - 4}.$$

P.T.O.

(ii) Show that :

$$L\{t\sin kt\} = \frac{2sk}{\left(s^2+k^2\right)^2}.$$

(iii) Find the inverse Laplace trans

$$F(s) = \frac{1}{\left(s^2+s-6\right)^2}.$$

(c) Find two linearly independent F series solutions of :

$$6x^2y''+7xy'-\left(x^2+2\right)y=0.$$

(d) Use power series to solve the ini problem :

$$\left(4x^2+16x+17\right)y''-8y=0;\ y(-2)=1,\ y'$$

2. (a) Explain Linear Congruence Metho it to generate 10 random numbe $a = 5, b = 1$ and $c = 8$. Was there cy so, when did it occur ?

(b) Using Monte Carlo Simulation, algorithm to approximate the area u curve $f(x) = \sqrt{x}$, over the interval $\frac{1}{2}$

(c) Using algebraic analysis : 6

Maximize $5x + 3y$

subject to $x + y \leq 6$,

$3x - y \leq 9$,

$x, y \leq 0$.

(d) Using graphical analysis : 6

Minimize $5x + 7y$

subject to $2x + 3y \geq 6$

$3x - y \leq 15$,

$-x + y \leq 4$,

$2x + 5y \leq 27$,

$x, y \geq 0$.

(a) (i) Is it possible to draw a 3-regular graph with 3 vertices ? 3

(ii) Draw the eleven unlabelled simple graphs with four vertices. 3

(b) (i) Define an Eulerian trail and semi-Eulerian trail. Give **one** example for each. 4

(ii) Draw a simple connected graph with degree sequence (1, 1, 2, 3, 3, 4, 4, 6). 2

(c) Prove that there is no knight's tour on a 3×6 chessboard. 6

(d) Prove that a bipartite graph with odd number of vertices is not Hamiltonian. 6

4. (a) Use the factorization :

$$s^4 + 4a^4 = (s^2 - 2as + 2a^2)(s^2 + 2as + 2a^2)$$

and apply inverse Laplace transform to sh that :

$$L^{-1}\left\{\frac{s^2}{s^4 + 4a^4}\right\} = \frac{1}{2a}(\cosh at \sin at + \sinh$$

cos at).

(b) Find the general solutions in power of the following differential equation :

$$y'' + xy' + y = 0.$$

(c) Solve the problem :

Maximize $25x + 30y$

subject to $20x + 30y \leq 690,$

$5x + 4y \leq 120,$

$x, y \geq 0.$

Determine the sensitivity of the optim solution to change in C_1 using the obje tive function $C_1x + 30y$.

(d) Write down a Gray code of 4 – digi binary words.