SASTRA

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(U/S 3 of the UGC Act, 1956)

II Year B.Tech. – IV Semester
Continuous Internal Assessment - II
MARCH 2023

Course Code: **MAT301R01**
Course Name: **ENGINEERING MATHEMATICS - IV**
Time: 90 Minutes Marks: 50

PART A(5x2=10)

Answer all the questions

1. If F(s) is the Fourier transform of Volkswagen function (Fig1.) then express Fourier transform of the function given in Fig2.

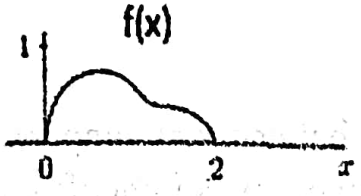

Fig1.

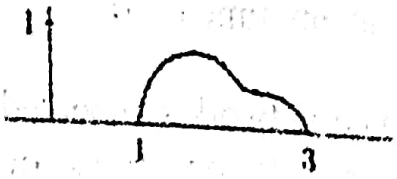

Fig2.

2. A thin membrane of great extent is released from rest in the position $z=f(x,y)$. Write the initial and boundary conditions to study the displacement $z(x,y,t)$ in the subsequent time.

3. A circuit has in series an EMF given by E(t), a resistor of R, and an inductor of L. If the initial current is 0 and the current tends to 0 for all sufficiently large values of x, find the current at time $t > 0$ by Fourier transforms.

4. State the sufficient condition for convergence of the Newton-Raphson method to find a root of single non-linear equation.

5. Describe Gauss-Jordan method for solving linear system of equations.

PART B(4x10=40)

Answer any FOUR questions

6. Apply the Fourier transform to convert a signal expressed in terms of the triangle function $f(x) = \begin{cases} a - |x|; & |x| < a \\ 0; & otherwise \end{cases}$ into a function of frequency $F(s)$. Also find the energy of the signal.

7. Find the Fourier sine transform of Exponential decay function $f(x) = e^{-x}$. Hence find (i) $\int_0^\infty \frac{s}{s^2+1} \sin sx \, ds$

(ii) a continuous solution of the forced differential equation $y'' - y = 0$ assuming that y(0)=10, y(x) and y'(x) tends to 0 for all sufficiently large values of x.

8. A tightly stretched flexible string has its ends fixed at x= 0 and x=l. At time t=0, the string is given a shape defined by $f(x) = kx(l - x)$, where k is a constant and then released from rest. Find the displacement of any point x of the string at any time t > 0.

9. A resistance network connected to a battery that supplies 9V across its terminals. The nodal equations are obtained by Kirchhoff's current law to the respective nodes x, y, z and w

$$-0.035x + 0.005y + 0.02z = -0.09$$

$$0.005x - 0.035y + 0.02w = 0$$

$$0.02x - 0.035z + 0.01w = -0.045$$

$$0.02y + 0.01z - 0.035w = 0$$

Determine the voltages with respect to ground at x, y, z and w by Gauss-Seidel method. Start the Gauss Seidel iteration with the initial set (6, 3, 6, 3).

10. The table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface:

Height (x)	150	200	250	300	350	400
Distance (y)	13.03	15.04	16.81	18.42	19.90	21.27

Find the distance when the height is (a) 160 ft. and (b) 390 ft.

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