

# C. U. SHAH UNIVERSITY

## Winter Examination-2020

**Subject Name : Engineering Mathematics - III**

**Subject Code : 4TE03EMT1/4TE03EMT2**

**Branch: B.Tech (All)**

**Semester: 3**

**Date: 08/03/2021**

**Time: 11:00 To 02:00**

**Marks: 70**

**Instructions:**

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

- Q-1      Attempt the following questions:      (14)**
- a)** If  $f(D)y = X$  is given linear differential equation then its general solution is \_\_\_\_\_.  
 (a)  $y(x) = C.F + P.I$       (b) Solution of  $f(D) = 0$   
 (c)  $y(x) = P.I$       (d) None of these
- b)** If  $f(-x) = -f(x)$  then  $f$  is \_\_\_\_\_  
 (a) Even function (b) Odd function  
 (c) (a) and (b) both (d) None of these
- c)** The operator ' $D$ ' means \_\_\_\_\_  
 (a) Degree of equation (b) Order of equation  
 (c)  $\frac{d}{dx}$  (d) None of these
- d)** If the function  $f(x)$  is odd then which of the following is/are zero?  
 (a)  $a_0$       (b)  $a_n$       (c)  $b_n$       (d) (a) and (b) both
- e)** If roots of auxiliary equation are  $m_1 = 1$  and  $m_2 = -2$  then its C.F is \_\_\_\_\_.  
 (a)  $c_1 e^x + c_2 e^{-2x}$       (b)  $c_1 e^x + c_2 e^{-x}$   
 (c)  $c_1 e^{-x} + c_2 e^{-2x}$       (d)  $c_1 e^{2x} + c_2 e^{-2x}$
- f)** If the differential equation is  $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = 0$  then roots of auxiliary equation is/are \_\_\_\_\_.  
 (a)  $m_1 = 1, m_2 = -2$  (b)  $m_1 = -1, m_2 = -1$   
 (c)  $m_1 = 1, m_2 = 1$  (d)  $m_1 = 2, m_2 = -1$
- g)** The graph of odd function is symmetric about \_\_\_\_\_  
 (a) Opposite quadrant      (b) X-axis  
 (c) Y-axis      (d) None of these
- h)** Laplace transform of  $e^{2t+3}$  is \_\_\_\_\_  
 (a)  $\frac{e^3}{s-2}$  ( $s > 2$ )      (b)  $\frac{e^2}{s-3}$



- (c)  $\frac{1}{s-\log 2}$  (d)  $\frac{1}{s-2}$
- i) Laplace transform of  $t^{-\frac{1}{2}}$  is 01  
 (a)  $\frac{\pi}{\sqrt{2}}$  (b)  $\sqrt{\left(\frac{\pi}{s}\right)}$  (c)  $\frac{\sqrt{\pi}}{s}$  (d) None of these
- j)  $L(\sin at) = \frac{\quad}{\quad}$  01  
 (a)  $\frac{a}{s^2+a^2}$  (b)  $\frac{s}{s^2+a^2}$  (c)  $\frac{-s}{s^2+a^2}$  (d)  $\frac{-a}{s^2+a^2}$
- k)  $L^{-1}\left(\frac{12}{s^2-9}\right) = \frac{\quad}{\quad}$  01  
 (a)  $3 \sin h(4t)$  (b)  $4 \sin h(3t)$   
 (c)  $4 \cos h(4t)$  (d)  $3 \cos h(4t)$
- D) Which of the following is the partial differential equation of  $z = ax + by + ab$  by eliminating arbitrary constant. 01  
 (a)  $z = px + qy + pq$  (b)  $z = pz - qy + pq$   
 (c)  $z = px + qy - pq$  (d)  $z = px - qy - pq$
- m) The rate of convergence of Newton – Raphson method is 01  
 (a) First order (b) Second order (c) Third order (d) None
- n) Solution of  $(D^2 - 1)y = 0$  is 01  
 (a)  $y = (c_1 + c_2)e^x$  (b)  $y = c_1e^{-x} + c_2e^x$   
 (c)  $y = (c_1 + c_2x)e^x$  (d) None of these

**Attempt any four questions from Q-2 to Q-8.**

- Q-2 Attempt all questions [14]**
- a. Find the root of equation  $x^3 - 3x - 5 = 0$  using bisection method correct up to three decimal places. 05
- b. Find real root of equation  $xe^x - 3 = 0$ , Which lies between 0.8 and 0.9 correct to three decimal places using False position method. 05
- c. Find the root of equation by using Newton-Raphson method  $2x - \tan x = 0, x > 0$ . 04

- Q-3 Attempt all questions [14]**
- a. Expand  $f(x) = x \sin x$  in a Fourier series in the interval  $0 \leq x \leq 2\pi$ . 06
- b. Express  $f(x) = x + x^2$  as a Fourier series with period 2 in the range  $-1 < x < 1$ . 06
- c. State Dirichlet's condition for Fourier series. 02

- Q-4 Attempt all questions [14]**
- a. Find the Fourier cosine series corresponding to the function  $f(x) = \pi - x$  defined in the interval 0 to  $\pi$ . 05
- b. Prove that  $\int_0^\infty \frac{e^{-at} - e^{-bt}}{t} dt = \log \frac{b}{a}$  05
- c. Find Laplace transform of the function  $f(t) = \begin{cases} \frac{t}{T}, & 0 < t < T \\ 0, & t > T \end{cases}$ . 04



- Q-5** **Attempt all questions** [14]
- a. Solve:  $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = \cos 2x$  05
- b. Find  $L\left(\frac{\cos at - \cos bt}{t}\right)$  05
- c. Find a root of the equation  $x^3 - 9x + 1 = 0$ , correct to three decimal places using False position method. 04

- Q-6** **Attempt all questions** [14]
- a. Solve the given differential equation by using Laplace transform  $y'' + 4y = 0, y(0) = 2, y'(0) = 8$ . 07
- b. Solve:  $(D^2 - 7D + 10)y = 5x + 7$  05
- c. Write down general form of linear differential equation in higher order. 02

- Q-7** **Attempt all questions** [14]
- a. Solve:  $\frac{d^3y}{dx^3} - 7\left(\frac{dy}{dx}\right) - 6y = 0$ . 05
- b. Find inverse Laplace transform by using convolution theorem  $L^{-1}\left\{\frac{s}{s^2+a^2}\right\}$  05
- c. Find:  $L(e^{4t} \sin 2t \cos t)$  04

- Q-8** **Attempt all questions** [14]
- a. Obtain the first three terms in the Fourier cosine series for  $y$ , where  $y$  is given in the following table: 07

$\theta^\circ$	0	60	120	180	240	300
$y$	4	8	15	7	6	2

- b. Solve the equation  $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$ , given  $u(x, 0) = 6e^{-3x}$ . 07

