

# C. U. SHAH UNIVERSITY

## Winter Examination-2022

**Subject Name: Engineering Mathematics - III**

**Subject Code: 4TE03EMT2**

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

**Semester: 3**

**Date: 09/01/2023**

**Time: 02:30 To 05:30**

**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) Find a complementary function of  $(D^2 - 1)y = 0$ . (14)**  
 (a)  $(C_1 + C_2)e^x$  (b)  $(C_1 + C_2)e^{-x}$  (c)  $C_1e^x + C_2e^{-x}$  (d)  $C_1 \cos x + C_2 \sin x$  01
- b) Find the  $L(t^4)$  (14)**  
 (a)  $\frac{24}{s^4}$  (b)  $\frac{24}{s^5}$  (c)  $\frac{16}{s^4}$  (d)  $\frac{16}{s^5}$  01
- c) If  $f(D)y = X$  is given linear differential equation then its general solution is \_\_\_\_\_. (14)**  
 (a)  $y(x) = C.F + P.I$  (b) Solution of  $f(D) = 0$   
 (c)  $y(x) = P.I$  (d) None of these 01
- d) \_\_\_\_\_ is period of  $\sin x$ . (14)**  
 (a)  $\pi$  (b)  $2\pi$  (c)  $\frac{2n}{\pi}$  (d)  $\frac{2\pi}{n}$  01
- e)  $L(\sin at) = \frac{a}{s^2 + a^2}$  (14)**  
 (a)  $\frac{a}{s^2 + a^2}$  (b)  $\frac{s}{s^2 + a^2}$  (c)  $\frac{(-s)}{s^2 + a^2}$  (d)  $\frac{a}{s^2 + a^2}$  01
- f) If  $f(-x) = -f(x)$  then  $f$  is (14)**  
 (a) Even function (b) Odd function (c) Both a and b (d) None of these 01
- g) Find the degree of a given differential equation  $\left\{1 + \left(\frac{dy}{dx}\right)^2\right\}^{\frac{2}{3}} = k \frac{d^2y}{dx^2}$ . (14)**  
 (a) 1 (b) 2 (c) 3 (d) 0 01
- h) If  $f(x) = |\sin x|$ ;  $-2 < x < 2$  then  $b_n =$  \_\_\_\_\_. (14)**  
 (a)  $\frac{\pi}{2}$  (b)  $\pi$  (c)  $\frac{2}{\pi}$  (d) 0 01
- i)  $L^{-1}\left\{\frac{1}{s^2 + a^2}\right\} =$  \_\_\_\_\_. (14)**  
 (a)  $\frac{1}{a} \cos at$  (b)  $\frac{1}{a^2} \sin at$  (c)  $\frac{1}{a} \sin at$  (d)  $\frac{1}{a^2} \cos at$  01



- j) Roots of auxiliary equation of differential equation  $\frac{d^2y}{dx^2} - 4y + 4 = 0$  is 01  
 (a) 1, 1 (b) -1, -1 (c) 2, -2 (d) 2, 2
- k) Newton-Raphson algorithm for finding the square root of N is 01  
 (a)  $x_{n+1} = \frac{1}{2} \left[ x_n + \left( \frac{N}{x_n} \right) \right]$  (b)  $x_{n+1} = \frac{1}{2} \left[ x_n - \left( \frac{N}{x_n} \right) \right]$   
 (c)  $x_{n+1} = \frac{1}{2} \left[ x_n + \left( \frac{2N}{x_n} \right) \right]$  (d)  $x_{n+1} = \frac{1}{2} \left[ 2x_n + \left( \frac{N}{x_n} \right) \right]$
- l) Which of the following is transcendental equation 01  
 (a)  $x - 2 = 0$  (b)  $x^2 - 3x + 6 = 0$   
 (c)  $xe^x - 2 = 0$  (d) None of these
- m) 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)  $z = px - qy - pq$
- n) State First Shifting property for Laplace Transform. 01

### Attempt any four questions from Q-2 to Q-8

- Q-2 Attempt all questions (14)**  
 A Solve the differential equation  $(D^2 - 7D + 10)y = 5x + 7$  05  
 B Solve:  $(D^3 + 3D)y = \cosh 2x \cdot \sinh 3x$  06  
 C Find the complimentary function of  $\frac{d^3y}{dx^3} - 2\frac{d^2y}{dx^2} - \frac{dy}{dx} + 2y = 0$  03
- Q-3 Attempt all questions (14)**  
 A Find the root of the equation  $x^3 - 2x - 5 = 0$  by method of false position correct to three decimal places 05  
 B Solve  $x^3 + 2x^2 + 10x - 20 = 0$  by using Newton-Raphson method. 05  
 C Find the root of the equation  $x^3 - x - 11 = 0$  using bisection method upto fourth approximation 04
- Q-4 Attempt all questions (14)**  
 A Show that  $x^2 = \frac{\pi^2}{3} + 4 \sum_{n=1}^{\infty} (-1)^n \frac{\cos nx}{n^2}$  in the interval  $-\pi \leq x \leq \pi$ . 05  
 B Find a Fourier series with period 3 to represent  $f(x) = 2x - x^2$  in the range (0,3). 05  
 C Evaluate  $\sqrt{15}$  correct to three decimal places using Newton-Raphson method. 04
- Q-5 Attempt all questions (14)**  
 A Solve  $\frac{d^2y}{dx^2} + 4y = \tan 2x$  by using method of variation parameters 07  
 B Expand  $f(x) = x \sin x$  in a Fourier series in the interval  $0 \leq x \leq 2\pi$ . 07
- Q-6 Attempt all questions (14)**  
 A Find  $L \left( \frac{\cos 2t - \cos 3t}{t} \right)$ . 05



- B** Using transform method to solve  $y'' + 3y' + 2y = e^t; y(0) = 1,$  **05**  
 And  $y'(0) = 0$
- C** Evaluate:  $L^{-1}\{\sin^3 2t\}$  **04**
- Q-7** **Attempt all questions** **(14)**
- A** Find the Inverse laplace transform of  $\frac{1}{s(s+a)^3}$ . **05**
- B** Find the Laplace transform of  $f(t) = \sinh at \cdot \sin at$ . **06**
- C** Solve:  $\frac{d^4y}{dx^4} - 625y = 0$ . **03**
- Q-8** **Attempt all questions** **(14)**
- A** Form of partial differential equation by eliminating arbitrary function  $\phi$  and  $\psi$  from  $z = \phi(x + iy) + \phi(x - iy)$ . **05**
- B** Obtain a form of partial differential equation by eliminating arbitrary constant  $a$  and  $b$  from  $z = ax + by + ab$  **05**
- C** Solve:  $(D^3 - 7DD' - 6D'^3)z = 0$ . **04**

