

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 _____. 01
- (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 01
- (a) Even function (b) Odd function
(c) (a) and (b) both (d) None of these
- c)** The operator ' D ' means 01
- (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? 01
- (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 _____. 01
- (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 _____. 01
- (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 01
- (a) Opposite quadrant (b) X-axis
(c) Y-axis (d) None of these
- h)** Laplace transform of e^{2t+3} is 01
- (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) $\sqrt{\frac{\pi}{s}}$ (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) $3 \cos h(4t)$
- l) 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 π . 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

θ°	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

