Enrollment No: _____   Exam Seat No: _____

C.U. SHAH UNIVERSITY
Winter Examination-2021

Subject Name : Engineering Mathematics - 3

Subject Code : 4TE03EMT2   **Branch: B.Tech (CE, Electrical)**

Semester: 3   **Date: 10/01/2022**   **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) The rate of convergence of Newton-Raphson method is_____.   (01)
(a) 1   (b) 2   (c) 3   (d) 4

b) The Newton-Raphson method fails when   (01)
(a) $f'(x)$ is negative (b) $f'(x)$ is too large (c) $f'(x)$ is zero (d) never fails

c) If $f(-x) = -f(x)$ then f is   (01)
(a) Even function   (b) Odd function
(c) (a) and (b) both   (d) None of these

d) If the function $f(x)$ is even then which of the following is/are zero?   (01)
(a) a_0 (b) a_n (c) b_n (d) (a) and (b) both

e) Laplace transform of e^{2t+3} is   (01)
(a) $\frac{e^3}{s-2}$ (b) $\frac{e^2}{s-3}$ (c) $\frac{1}{s-\log 2}$ (d) $\frac{1}{s-2}$

f) _____ is the period of $\sin x$.   (01)
(a) 2π (b) $\frac{\pi}{n}$ (c) $\frac{2\pi}{n}$ (d) None of these

g) Find the complementary function of $\frac{d^2y}{dx^2} - 4y + 4 = 0$ (01)
(a) $c_1 e^{2x} + c_2 e^{2x}$ (b) $c_1 e^{2x} + c_2 e^{-2x}$ (c) $(c_1 + xc_2)e^{2x}$ (d) $c_1 + xc_2)e^{-2x}$

h) Find the degree of a given differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right) + y = 0$ (01)
(a)   1   (b)   2   (c)   3   (d)   0

i) Find the Wronskian $W(x, e^x)$ (01)
(a) $e^x(x+1)$ (b) $e^{-x}(x+1)$ (c) $e^x(x-1)$ (d) $e^{-x}(x-1)$

j) Classify the following partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ (01)
(a) elliptic   (b) parabolic   (c) hyperbolic (d) none

k) Which is the form of one-dimensional wave equation   (01)
(a) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ (b) $\frac{\partial^2 u}{\partial x^2} = \frac{1}{a^2}\frac{\partial u}{\partial t}$ (c) $\frac{\partial^2 u}{\partial x^2} = \frac{1}{a^2}\frac{\partial^2 u}{\partial t^2}$ (d) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x,y)$

l) Find the complementary function of $(D^2 - D'^2)z = 0$ (01)
(a) $\emptyset_1(y - x) + \emptyset_2(y + 2x)$ (b) $\emptyset_1(y - x) + \emptyset_2(y + x)$
(c) $\emptyset_1(y - 2x) + \emptyset_2(y + x)$ (d) $\emptyset_1(y - 2x) + \emptyset_2(y + 2x)$

m) Find the $L\{t^4\}$ (01)
(a) $\frac{24}{s^4}$ (b) $\frac{24}{s^5}$ (c) $\frac{16}{s^4}$ (d) $\frac{16}{s^5}$

n) Find the $L^{-1}\left\{\frac{1}{s^2+\omega^2}\right\}$ (01)

(a) $\frac{1}{\omega} sin\omega t$ (b)) $\frac{1}{\omega^2} sin\omega t$ (c) $\frac{1}{\omega} cos\omega t$ (d) $\frac{1}{\omega^2} cos\omega t$

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

Q-2	**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 Newton-Raphson method	(05)
c)	Find the root of the equation $x^3 - x - 11 = 0$ using bisection method upto fourth approximation	(04)

Q-3	**Attempt all questions**	**(14)**
a)	Expand $f(x) = x^2$, when $-\pi < x < \pi$, in a Fourier series of periodicity 2π. Hence deduce that $\sum_{n=1}^{\infty} \left(\frac{1}{n^2}\right) = \frac{\pi^2}{6}$.	(05)
b)	Find Fourier series of $f(x) = \begin{cases} 0 \; ; \; -1 < x < 0 \\ 1 \; ; \; 0 < x < 1 \end{cases}$ with periodicity 2.	(05)
c)	Find half range Fourier cosine series of $f(x) = x$ in $0 < x < \pi$.	(04)

Q-4	**Attempt all questions**	**(14)**
a)	Solve the equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = e^x$.	(05)
b)	Solve:$(D^2 - 4D + 3)y = 10\, e^{2x}cos3x$	(05)
c)	Solve:$\frac{d^4y}{dx^4} - 625y = 0$	(04)

Q-5	**Attempt all questions**	**(14)**
a)	Solve by method of variable separable $4\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 3z$ subject to $z = e^{-5y}$ when $x = 0$.	(06)
b)	Find P.D.E by eliminating arbitrary function $\emptyset$ and φ from $z = \emptyset(x + iy) + \varphi(x - iy)$ where $i^2 = -1$	(05)
c)	Find a complementary function of $\frac{\partial^2 z}{\partial x^2} - 6\frac{\partial^2 z}{\partial x\partial y} + 5\frac{\partial^2 z}{\partial y^2} = 0$.	(03)

Q-6	**Attempt all questions**	**(14)**
a)	Find the $L\left\{\frac{cos2t - cos3t}{t}\right\}$.	(05)
b)	Find the inverse Laplace transformation of $\frac{s^2 - s + 2}{s(s+2)(s+3)}$	(05)
c)	Find the Laplace transformation of $f(t) = \sin 2t \cdot \sin 3t$.	(04)

Q-7	**Attempt all questions**	**(14)**
a)	Find the positive root of $x = cosx$ correct to three decimal places using bisection method.	(05)
b)	Find $L^{-1}\left\{\log\left(1 + \frac{\omega^2}{s^2}\right)\right\}$.	(05)
c)	Classify the following differential equation $(1 + x^2)f_{xx} + (5 + 2x^2)f_{xy} + (4 + x^2)f_{yy} = 0$.	(04)

Q-8	**Attempt all questions**	**(14)**
a)	Expand $f(x) = x \sin x$ in a Fourier series in the interval $0 \le x \le 2\pi$.	(07)
b)	Solve $\frac{d^2y}{dx^2} + 4y = tan2x$ by using method of variation parameters	(07)