Enrollment No: ______________________ **Exam Seat No:**______________________

C. U. SHAH UNIVERSITY

Winter Examination-2019

Subject Name : Engineering Mathematics – 3

Subject Code : 4TE03EMT2 **Branch: B. Tech (All)**

Semester : 3 **Date : 13/11/2019** **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) If $f(x)=x$ is represented by Fourier series in $(-\pi,\ \pi)$ then a_0 equal to

(A) $\frac{\pi}{2}$ (B) π (C) 0 (D) 2π

b) If $f(x)=x^2$ is represented by Fourier series in $(-\pi,\ \pi)$ then b_n equal to

(A) $\frac{\pi^2}{3}$ (B) 0 (C) $\frac{2\pi^2}{3}$ (D) $\frac{\pi^2}{6}$

c) Fourier expansion of an even function f(x) in $(-\pi,\ \pi)$ has

(A) only sine terms (B) only cosine terms
(C) both sine and cosine terms (D) None of these

d) Inverse Laplace transform of $\frac{1}{(S+4)^6}$ is

(A) $e^{-6t}\frac{t^4}{4!}$ (B) $e^{-4t}\frac{t^6}{6!}$ (C) $e^{-4t}\frac{t^5}{5!}$ (D) $e^{-4t}\frac{t^6}{5!}$

e) Laplace transform of C^{t+1} is

(A) $\frac{1}{s-c}$ (B) $\frac{c}{s-\log c}$ $(s>\log c)$ (C) $\frac{c^2}{s+\log c}$ (D) none of these

f) Laplace transform of $t\sin at$ is

(A) $\frac{2as}{\left(s^2+a^2\right)^2}$ (B) $\frac{as}{\left(s^2+a^2\right)^2}$ (C) $\frac{2s}{\left(s^2+a^2\right)^2}$ (D) $\frac{2as}{s^2+a^2}$

g) The C. F. of the differential equation $\left(D^2+3D+2\right)y=e^{2x}$ is

(A) $c_1e^{x}+c_2e^{2x}$ (B) $c_1e^{-x}+c_2e^{-2x}$ (C) $c_1e^{-x}+c_2e^{2x}$ (D) $c_1e^{x}+c_2e^{-2x}$

h) The P. I. of $\left(D^2-4\right)y=2^x$ is

(A) $\frac{2^x}{(\log 2)^2+4}$ (B) $\frac{2^x}{(\log 2)^2-4}$ (C) $\frac{2^x}{\log 2-4}$ (D) none of these

i) The P. I. of $(D^2+a^2)y=\sin ax$ is

(A) $-\frac{x}{2a}\cos ax$ (B) $\frac{x}{2a}\cos ax$ (C) $-\frac{ax}{2}\cos ax$ (D) $\frac{ax}{2}\cos ax$

j) Eliminating the arbitrary constants, a and b from $x^2+y^2+(z-c)^2=a^2$, the partial differential equation formed is

(A) $xp=yq$ (B) $xq=yp$ (C) $z=pq$ (D) None of these

k) The general solution of the equation $(y-z)p+(z-x)q=x-y$ is

(A) $F(x^2+y^2+z^2,\ x+y+z)=0$ (B) $F(xyz,\ x^2+y^2+z^2)=0$

(C) $F(xy,\ x^2+y^2+z^2)=0$ (D) none of these

l) Particular integral of $(2D^2-3DD'+D'^2)z=e^{x+2y}$ is

(A) xe^{x+2y} (B) $\frac{1}{2}e^{x+2y}$ (C) $-\frac{x}{2}e^{x+2y}$ (D) $\frac{x^2}{2}e^{x+2y}$

m) Iterative formula for finding the square root of N by Newton-Raphson method is

(A) $x_{i+1}=\frac{1}{2}\left(x_i-\frac{N}{x_i}\right)$ $(i=0,1,2,.....)$ (B) $x_{i+1}=\frac{1}{2}\left(x_i+\frac{N}{x_i}\right)$ $(i=0,1,2,.....)$

(C) $x_{i+1}=x_i(2-Nx_i)$ $(i=0,1,2,.....)$ (D) none of these

n) The interval $[a,\ b]$ on which fixed point iteration will converge for the equation $x=\frac{5}{x^2}+2$ is

(A) $[2.5,\ 3]$ (B) $[2,\ 2.1]$ (C) $[2,\ 3]$ (D) none of these

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

Q-2 **Attempt all questions** **(14)**

a) Perform the five iteration of the Bisection method to obtain a root of the equation $f(x)=\cos x-xe^x$. **(5)**

b) Compute the real root of $x\log_{10}x-1.2=0$ correct to four decimal places using False position method. **(5)**

c) Find the Laplace transform of $f(t)$ defined as $f(t)=\begin{cases} t & ,0<t<4 \\ 5 & ,t>4 \end{cases}$. **(4)**

Q-3 **Attempt all questions** **(14)**

a) Express $f(x)=\frac{1}{4}(\pi-x)^2$ as a Fourier series with period 2π to be valid in the interval 0 to 2π. **(5)**

b) Obtain Fourier series for the function $f(x)=\begin{cases} \pi x, & 0\le x\le 1 \\ \pi(2-x), & 1\le x\le 2 \end{cases}$ **(5)**

c) Evaluate $\sqrt{5}$ correct to three decimal places using Newton-Raphson method. **(4)**

Q-4 **Attempt all questions** **(14)**

a) Using Laplace transform method solve: **(5)**

$y''+3y'+2y=e^{t}, \quad y(0)=1, \; y'(0)=0$

b) Using convolution theorem, evaluate $L^{-1}\left\{\dfrac{s}{\left(s^2+a^2\right)^2}\right\}$. **(5)**

c) Solve: $\dfrac{\partial^2 z}{\partial x \partial y}=x^3+y^3$ **(4)**

Q-5 **Attempt all questions** **(14)**

a) Evaluate: $L^{-1}\left[\dfrac{s+2}{(s+3)(s+1)^3}\right]$ **(5)**

b) Solve: $(D^2-4D+3)y=\sin 3x \cos 2x$ **(5)**

c) Solve: $x^2(y-z)p+y^2(z-x)q=z^2(x-y)$ **(4)**

Q-6 **Attempt all questions** **(14)**

a) Solve: $\left(D^2+5D+4\right)y=x^2+7x+9$ **(5)**

b) **(5)**

If $f(x)=x, \quad 0<x<\dfrac{\pi}{2}$

$=\pi-x, \quad \dfrac{\pi}{2}<x<\pi$

then show that $f(x)=\dfrac{\pi}{4}-\dfrac{2}{\pi}\left(\dfrac{\cos 2x}{1^2}+\dfrac{\cos 6x}{3^2}+\dfrac{\cos 10x}{5^2}+.....\right)$.

c) Solve: $L\left(\dfrac{\cos 2t-\cos 3t}{t}\right)$ **(4)**

Q-7 **Attempt all questions** **(14)**

a) Using the method of variation of parameters, **(5)**

Solve: $y''+4y'+4y=\dfrac{e^{-2x}}{x^2}$

b) Solve: $(2x+3)^2\dfrac{d^2y}{dx^2}-2(2x+3)\dfrac{dy}{dx}-12y=6x$ **(5)**

c) Solve: $\dfrac{\partial^2 z}{\partial x^2}+3\dfrac{\partial^2 z}{\partial x \partial y}+2\dfrac{\partial^2 z}{\partial y^2}=x+y$ **(4)**

Q-8 **Attempt all questions** **(14)**

a) Solve by the method of separation of variables **(7)**

$4\dfrac{\partial u}{\partial x}+\dfrac{\partial u}{\partial y}=3u$, given that $u=3e^{-y}-e^{-5y}$ when $x=0$.

b) Determine the Fourier series up to and including the second harmonic to represent the periodic function $y=f(x)$ defined by the table of values given below. $f(x)=f(x+2\pi)$ **(7)**

x°	0	30	60	90	120	150	180	210	240	270	300	330
$f(x)$	0.5	0.8	1.4	2.0	1.9	1.4	1.2	1.4	1.1	0.5	0.3	0.4