

C.U.SHAH UNIVERSITY

Summer Examination-2019

Subject Name : Engineering Mathematics – III

Subject Code : 4TE03EMT1

Branch: B.Tech (All)

Semester : 3

Date : 11/03/2019

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) One of the Dirichlet's condition is function $f(x)$ should be
(A) single valued (B) multi valued (C) real valued (D) None of these
- b) If $f(x) = x$ is represented by Fourier series in $(-\pi, \pi)$ then a_0 equal to
(A) $\pi/2$ (B) π (C) 0 (D) 2π
- c) In the Fourier series expansion of $f(x) = x^3$ in $(-1, 1)$
(A) only sine terms are present (B) both sine and cosine terms are present
(C) only cosine terms are present (D) constant term is present
- d) Laplace transform of C^{r+1} is
(A) $\frac{1}{S-C}$ (B) $\frac{C^1}{S-\log C}$ ($S > \log C$) (C) $\frac{C^2}{S+\log C}$
(D) None of these
- e) $L^{-1}\left(\frac{12}{s^2-9}\right) = \underline{\hspace{2cm}}$
(A) $3\sinh 4t$ (B) $4\sinh 3t$ (C) $4\cosh 3t$ (D) $3\cosh 4t$
- f) Inverse Laplace transform of 1 is
(A) 1 (B) $\delta(t)$ (C) $\delta(t-1)$ (D) $u(t)$
- g) The C. F. of the differential equation $(D^2 - 3D + 2)y = e^{2x}$ 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 $(D^2 + a^2)y = \sin ax$ is
(A) $-\frac{x}{2a} \cos ax$ (B) $\frac{x}{2a} \cos ax$ (C) $-\frac{ax}{2} \cos ax$ (D) None of these
- i) The P. I of $(D-a)y = X$, (where $X = k$ is constant) equal to
(A) $-\frac{k}{a}$ (B) $\frac{k}{a}$ (C) ka (D) $-ka$
- j) The solution of $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial y^2} = 0$ is
(A) $z = f_1(y+x) + f_2(x-y)$ (B) $z = f_1(y+x) + f_2(y-x)$



- (C) $z = f(x^2 - y^2)$ (D) None of these
- k) Eliminating arbitrary function from $z = f(x^2 + y^2)$, the partial differential equation formed is
 (A) $xq = yp$ (B) $xp = yq$ (C) $z = pq$ (D) None of these
- l) The general solution of the equation $xp + yq = z$ is
 (A) $F\left(\frac{x}{y}, \frac{y}{z}\right) = 0$ (B) $F(xy, x + y) = 0$ (C) $F\left(\frac{y}{x}, \frac{z}{y}\right) = 0$
 (D) None of these
- m) The order of convergence in Bisection method is
 (A) linear (B) quadratic (C) zero (D) None of these
- n) The criterion for convergence for solving $f(x) = 0$ by the Newton – Raphson method is
 (A) $\left| \{f'(x)\}^2 \right| > |f(x) \cdot f''(x)|$ (B) $\left| \{f'(x)\}^2 \right| < |f(x) \cdot f''(x)|$
 (C) $\left| \{f'(x)\}^2 \right| = |f(x) \cdot f''(x)|$ (D) None of these

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

Q-2 Attempt all questions (14)

- a) Given that one of the roots of the non-linear equation $x^3 - 2x - 5 = 0$ lies in the interval (1.75, 2.5). Find the root correct to four significant digits using False position method. (5)
- b) Using Newton-Raphson method, find the root of $f(x) = \sin x + \cos x$ correct to three decimal places. (5)
- c) Evaluate: $L(t e^{2t} \cos 3t)$ (4)

Q-3 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 $-\pi \leq x \leq \pi$. (5)
- b) Obtain Fourier series for the function $f(x) = \begin{cases} \pi x, & 0 \leq x \leq 1 \\ \pi(2-x), & 1 \leq x \leq 2 \end{cases}$ (5)
- c) Given that one root of the equation $x^3 - 4x + 1 = 0$ lies between 1 and 2. Find the root correct to 3 significant digits using Secant method. (4)

Q-4 Attempt all questions (14)

- a) Solve $y'' + y = t$, $y(\pi) = 0$, $y'(0) = 1$ (5)
- b) Using convolution theorem, evaluate $L^{-1} \left\{ \frac{s}{(s^2 + 4)^2} \right\}$. (5)
- c) Solve: $pz - qz = z^2 + (x + y)^2$ (4)

Q-5 Attempt all questions (14)

- a) Evaluate: $L^{-1} \left(\frac{s}{s^4 + s^2 + 1} \right)$ (5)



b) Solve: $\frac{d^3y}{dx^3} + y = 3 + e^{-x} + 5e^{2x}$ (5)

c) Solve: $\frac{\partial^2 z}{\partial x^2} - 4 \frac{\partial^2 z}{\partial y^2} = \cos 2x \cos 2y$ (4)

Q-6 Attempt all questions (14)

a) Solve: $(D^2 - 1)y = \cosh x \cos x$ (5)

b) Obtain a half – range sine series to represent $f(x) = lx - x^2$ in the range $(0, l)$. (5)

c) Solve: $L\left(\frac{e^{-at} - e^{-bt}}{t}\right)$ (4)

Q-7 Attempt all questions (14)

a) Solve by the method of variation of parameters: $\frac{d^2y}{dx^2} + a^2y = \sec ax$ (5)

b) Solve: $(x+1)^2 \frac{d^2y}{dx^2} + (x+1) \frac{dy}{dx} + y = 2 \cos[\log(1+x)]$ (5)

c) Solve: $\frac{\partial^2 z}{\partial x^2} - 2 \frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = e^{x+4y}$ (4)

Q-8 Attempt all questions (14)

a) Using the method of separation of variables, solve $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u$, given (7)

$u(x, 0) = 6e^{-3x}$

b) The following table gives the variations of periodic current $t = f(t)$ amperes over a period T sec. (7)

t (sec) :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
i (A) :	1.98	1.30	1.05	1.30	-0.88	-0.5	1.98

Show, by harmonic analysis, that there is a direct current part of 0.75 amp. in the variable current and obtain the amplitude of the first harmonic.

