

C.U.SHAH UNIVERSITY

Summer Examination-2019

Subject Name : Engineering Mathematics - 3

Subject Code : 4TE03EMT2

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) The period of $\sin pt$ is
 (A) 2π (B) $\frac{2\pi}{p}$ (C) $\frac{\pi}{p}$ (D) None of these
- b) If the Fourier series expansion of $f(x) = |x|$ in $(-\pi, \pi)$, the value of b_n equal to
 (A) 0 (B) π (C) 2π (D) $\frac{\pi}{2}$
- c) Fourier expansion of an odd 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 e^{2t+3} is
 (A) $\frac{e^3}{s-2}$ ($s > 2$) (B) $\frac{e^2}{s-3}$ (C) $\frac{1}{s-\log 2}$ (D) $\frac{1}{s-2}$
- f) Laplace transform of $\frac{\sin t}{t}$ is
 (A) $\cot^{-1} \frac{1}{s}$ (B) $\tan^{-1} s$ (C) $\tan^{-1} \frac{1}{s}$ (D) $\sin^{-1} s$
- g) The C.F. of the differential equation $(D^3 + 2D^2 + D) = x^2$ is
 (A) $y = c_1 + (c_2x + c_3)e^{2x}$ (B) $y = c_1 + (c_2 + c_3x)e^{-x}$
 (C) $y = c_1 + (c_2x + c_3)e^x$ (D) None of these
- h) The P. I of $(D+1)^2 y = e^{-x}$ is



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

- i) The P. I of $(D^2 + 1)y = \cosh 3x$ is
 (A) $\frac{1}{10}\cosh 3x$ (B) $\frac{1}{10}\sinh 3x$ (C) $\frac{1}{5}\cosh 3x$ (D) None of these
- j) Eliminating arbitrary constants a and b from $z = (x+a)(x+b)$, the partial differential equation formed is
 (A) $z = \frac{p}{q}$ (B) $z = p+q$ (C) $z = pq$ (D) None of these
- k) The general solution of the equation $z = px + qy + p^2q^2$ is
 (A) $z = ax + by + c$ (B) $z = ax + by + a^2 + b^2$ (C) $z = ax + by - a^2b^2$
 (D) $z = ax + by + a^2b^2$
- l) Particular integral of $(D^2 - D'^2)z = \cos(x+y)$ is
 (A) $\frac{x}{2}\cos(x+y)$ (B) $x\sin(x+y)$ (C) $x\cos(x+y)$ (D) $\frac{x}{2}\sin(x+y)$
- m) The order of convergence in Newton-Raphson method is
 (A) 1 (B) 3 (C) 0 (D) 2
- n) The Bisection method for finding the root of an equation $f(x)$ is
 (A) $x_{n+1} = \frac{1}{2}(x_n + x_{n-1})$ (B) $x_{n+1} = \frac{1}{2}(x_n - x_{n-1})$ (C) $x_{n+1} = (x_n + x_{n-1})$
 (D) None of these

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

- Q-2 Attempt all questions (14)**
- a) One real root of the equation $e^{-x} - x = 0$ lies between 0 and 1. Find the root using Bisection 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) Expand $f(x)$ in Fourier series in the interval $(0, 2\pi)$ if (5)
- $$f(x) = \begin{cases} -\pi, & 0 < x < \pi \\ x - \pi, & \pi < x < 2\pi \end{cases}$$
- b) Find a Fourier series with period 3 to represent $f(x) = 2x - x^2$ in the range $(0, 3)$. (5)
- c) Find the root of the equation $\cos x - 3x + 1 = 0$ correct to three decimal positions using False position 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 $L^{-1} \left\{ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right\}$. (5)

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

Q-5 Attempt all questions (14)

a) Evaluate: $L^{-1} \left[\frac{2s^2 - 4}{(s+1)(s-2)(s-3)} \right]$ (5)

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

c) Solve: $(y^2 + z^2)p - xyq - xz = 0$ (4)

Q-6 Attempt all questions (14)

a) Solve: $(D^2 - 2D + 1)y = xe^{-x} \sin x$ (5)

b) Obtain a cosine series for the function $f(x) = e^x$ 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) Using the method of variation of parameters, (5)

Solve: $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$

b) Solve: $x^3 \frac{d^3 y}{dx^3} + 2x^2 \frac{d^2 y}{dx^2} + 2y = 10 \left(x + \frac{1}{x} \right)$ (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) Solve by the method of separation of variables (7)

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

b) The following table gives the variations of periodic current $i = f(t)$ 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.

