

C.U.SHAH UNIVERSITY

Summer Examination-2016

Subject Name : Engineering Mathematics - III

Subject Code : 4TE03EMT1

Branch : B.Tech(All)

Semester : 3

Date : 19/04/2016

Time : 02:30 To 5:30

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) 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
- c) If $f(x) = x$ is represented by Fourier series in $(-\pi, \pi)$, a_0 equals to
 - (a) $\pi/2$ (b) π (c) 0 (d) 2π
- d) 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) $\frac{1}{s-2}$
- e) Laplace transform of $t^{\frac{-1}{2}}$ is
 - (a) $\frac{\pi}{\sqrt{s}}$ (b) $\sqrt{\frac{\pi}{s}}$ (c) $\frac{\sqrt{\pi}}{s}$ (d) None of these
- 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 $(D^3 + 2D^2 + D) = x^2$ 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 $(D^2 + a^2)y = \sin ax$ 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) equals to



- (a) $-\frac{k}{a}$ (b) $\frac{k}{a}$ (c) ka (d) $-ka$
- 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 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
- 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 Bisection method is
 (a) linear (b) quadratic (c) zero (d) None of these
- n)** The order of convergence in Newton-Raphson method is
 (a) 1 (b) 3 (c) 0 (d) 2

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

Q-2 Attempt all questions (14)

- a)** Obtain a cosine series for the function $f(x) = e^x$ in the range $(0, l)$. (5)
- b)** Evaluate: $L^{-1}\left[\frac{2s^2 - 4}{(s+1)(s-2)(s-3)}\right]$ (5)
- c)** Show that the frequency of free vibrations in a closed electrical circuit with inductance L and capacity C in series is $\frac{30}{\pi\sqrt{LC}}$ cycles/minute. (4)

Q-3 Attempt all questions (14)

- a)** Using convolution theorem, evaluate $L^{-1}\left\{\frac{s^2}{(s^2 + a^2)(s^2 + b^2)}\right\}$. (5)
- b)** Solve: $(D^4 - 1)y = e^x \cos x$ (5)
- c)** Solve: $\frac{\partial^2 z}{\partial x \partial y} = x^3 + y^3$ (4)

Q-4 Attempt all questions (14)

- a)** Solve: $(D^2 - 2D + 1)y = xe^x \sin x$ (5)
- b)** Solve: $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ (5)
- c)** Solve: $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = x + y$ (4)



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

a) Solve by the method of variation of parameters: (5)

$$\frac{d^2y}{dx^2} + a^2y = \sec ax$$

b) Find the positive root of $x^3 + 2x^2 + 10x - 20 = 0$ by Newton-Raphson method. (5)

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

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

a) Expand $f(x)$ in Fourier series in the interval $(0, 2\pi)$ if (7)

$$f(x) = \begin{cases} -\pi, & 0 < x < \pi \\ x - \pi, & \pi < x < 2\pi \end{cases} \text{ and show that } \sum_{r=0}^{\infty} \frac{1}{(2r+1)^2} = \frac{\pi^2}{8} .$$

b) Using the method of separation of variables, (7)

$$\text{solve } \frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u, \text{ given } u(x, 0) = 6e^{-3x}$$

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

a) 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.

b) Using Regula Falsi method, compute the real root of $x \log_{10} x - 1.2 = 0$ correct to five decimal places. (7)

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

a) Using Laplace transform method, solve (7)

$$y'' + 3y' + 2y = e^t, y(0) = 1, y'(0) = 0$$

b) Solve: $(D^2 - 1)y = \cosh x \cos x$ (7)

