

C.U.SHAH UNIVERSITY

Winter Examination-2015

Subject Name : Engineering Mathematics - III

Subject Code :4TE03EMT1

Branch : B.Tech (All)

Semester : 3

Date :01/12/2015

Time :2:30 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) State Dirichlet's conditions for Fourier series. (02)
 - b) Find Laplace transform of $L(\cos h at \sin at)$. (02)
 - c) State second shifting theorem for Laplace transform. (02)
 - d) Eliminate the arbitrary function from the equation $z = xy + f(x^2 + y^2)$. (02)
 - e) Define Transcendental equation and give an example of it. (02)
 - f) Write the convergence criteria of Newton – Raphson method. (02)
 - g) Find P.I. of $(D + 1)^2 y = e^{-x}$. (02)

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

- Q-2 Attempt all questions (14)**
- a) Find the Fourier series of the function $f(x) = \begin{cases} -k & \text{if } -\pi < x < 0 \\ k & \text{if } 0 < x < \pi \end{cases}$ with $f(x + 2\pi) = f(x)$. (05)
 - b) Find inverse Laplace transform of $\frac{4s+5}{(s-1)^2(s+2)}$. (05)
 - c) Find Laplace transform of (a) $t^2 \sin 4t$ (b) $\frac{\sin t}{t}$. (04)

- Q-3 Attempt all questions (14)**
- a) Solve $\frac{d^2x}{dt^2} + 2 \frac{dx}{dt} + 5x = e^{-t} \sin t, x(0) = 0, x'(0) = 1$. (07)
 - 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. $f(x) = f(x + 2\pi)$ (07)

x^0	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



Q-4 Attempt all questions (14)

a) Using Laplace transform solve $\ddot{x} + 4\dot{x} + 13x = 2\delta(t)$, where at $t = 0$, $x(0) = 2$ and $\dot{x}(0) = 0$. (05)

b) Find Fourier series of $f(x) = \begin{cases} 0 & \text{if } 0 < x < l \\ a & \text{if } l < x < 2l \end{cases}$ with $f(x + 2l) = f(x)$. (05)

c) Express $f(x) = c - x$ when $0 < x < c$ as a half – range cosine series with period $2c$. (04)

Q-5 Attempt all questions (14)

a) Solve: $\frac{d^3x}{dt^3} - 3\frac{d^2x}{dt^2} + 9\frac{dx}{dt} - 27x = \cos 3t$. (05)

b) Solve: $(D^4 - 1)y = e^x \cos x$. (05)

c) Show that the frequency of free vibration in a closed electrical circuit with induction L and capacity C in series is $\frac{30}{\pi\sqrt{LC}}$. (04)

Q-6 Attempt all questions (14)

a) Solve: $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = \log x \sin(\log x)$. (05)

b) Using the method of variation of parameters solve $y'' - 6y' + 9y = \frac{e^{3x}}{x^2}$. (05)

c) Using convolution theorem find Laplace inverse transform of $\frac{1}{s^2(s-1)}$. (04)

Q-7 Attempt all questions (14)

a) Solve $\frac{y^2z}{x} \frac{\partial z}{\partial x} + xz \frac{\partial z}{\partial y} = y^2$. (05)

b) Solve by the method of separation of variables $4 \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$, given that $u = 3e^{-y} - e^{-5y}$ when $x = 0$. (05)

c) Find $\sqrt{10}$ correct to three decimal places by using Newton – Raphson iteration formula. (04)

Q-8 Attempt all questions (14)

a) Using Bisection method, find the root of $2 \sin x - x = 0$. (05)

b) Using RegulaFalsi method find real root of $x \log_{10} x - 1.2 = 0$ correct to four decimal places. (05)

c) Solve: $y^2p - xyq = x(z - 2y)$. (04)

