

# 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)

