

# C.U.SHAH UNIVERSITY

## Winter Examination-2018

Subject Name : Engineering Mathematics - III

Subject Code : 4TE03EMT1

Branch: B. Tech (All)

Semester : 3

Date : 27/11/2018

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)  $2\pi$  (B)  $\frac{2\pi}{p}$  (C)  $\frac{\pi}{p}$  (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)  $\pi$  (C) 0 (D)  $2\pi$
- c) Fourier expansion of an even 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) 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
- e) 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)  $\sin^{-1} s$
- f) 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)  $e^{-4t} \frac{t^6}{5!}$
- g)  $\frac{1}{D-a} X$ , (Where  $X = k$  is constant) equal to  
 (A)  $-\frac{k}{a}$  (B)  $\frac{k}{a}$  (C)  $ka$  (D)  $-ka$
- h) The C. F. of the differential equation  $(D^3 + 2D^2 + D)y = x^2$  is



- (A)  $c_1 + (c_2x + c_3)e^{2x}$  (B)  $c_1 + (c_2 + c_3x)e^{-x}$  (C)  $c_1 + (c_2x + c_3)e^x$   
 (D) None of these

i) 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)  $\frac{x^2}{2}e^x$

j) Eliminating arbitrary function from a and b from  $z = (x+a)(y+b)$ , 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) The solution of  $\frac{\partial^3 z}{\partial x^3} = 0$  is

- (A)  $z = f_1(y) + xf_2(y) + x^2f_3(y)$  (B)  $z = (1+x+x^2)f(y)$   
 (C)  $z = f_1(x) + yf_2(x) + y^2f_3(x)$  (D)  $z = (1+y+y^2)f(x)$

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) Evaluate  $\sqrt{12}$  correct to three decimal places using Newton-Raphson method. **(5)**  
 b) One real root of the equation  $e^{-x} - x = 0$  lies between 0 and 1. Find the root using Bisection method. **(5)**  
 c) Evaluate:  $L(t e^{2t} \cos 3t)$  **(4)**

**Q-3**

**Attempt all questions**

**(14)**

- a) Find a Fourier series with period 3 to represent  $f(x) = 2x - x^2$  in the range  $(0, 3)$ . **(5)**  
 b) If  $f(x) = x, \quad 0 < x < \frac{\pi}{2}$  **(5)**  
 $= \pi - x, \quad \frac{\pi}{2} < x < \pi$

then show that  $f(x) = \frac{\pi}{4} - \frac{2}{\pi} \left( \frac{\cos 2x}{1^2} + \frac{\cos 6x}{3^2} + \frac{\cos 10x}{5^2} + \dots \right)$ .

- c) One real root of the equation  $x^3 - 4x + 1 = 0$  lies between 1 and 2. Find the root correct to three significant digits using Secant method. **(4)**

**Q-4**

**Attempt all questions**

**(14)**

- a) Using Laplace transform method solve: **(5)**



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

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

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

**Q-5**

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

c) Solve:  $\frac{\partial^2z}{\partial x\partial y}=x^3+y^3$  (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) Evaluate:  $L\left(\frac{\cos 2t-\cos 3t}{t}\right)$  (4)

**Q-7**

**Attempt all questions**

(14)

a) Using the method of variation of parameters, Solve:  $y''-6y'+9y=\frac{e^{3x}}{x^2}$  (5)

b) Solve:  $x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10\left(x+\frac{1}{x}\right)$  (5)

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

**Q-8**

**Attempt all questions**

(14)

a) 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.  $f(x)=f(x+2\pi)$  (7)

$x^\circ$	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

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

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

