

3E1456

Roll No. : _____

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B. Tech. (Sem. III) (Back) Examination, January - 2013
3CE6 Engineering Mathematics

Time : 3 Hours]

[Total Marks : 80

[Min. Passing Marks : 24

*Attempt any five questions, selecting one question from each unit.
 All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

Use of following supporting material is permitted during examination.
 (Mentioned in form No. 205)

1. NIL2. NIL**UNIT - I**

- 1 (a) Find a series of sines and cosines of multiples of x which will represent $f(x)$ in the interval $-\pi < x < \pi$, when

$$f(x) = \begin{cases} 0, & -\pi < x < 0 \\ \frac{\pi x}{4}, & 0 < x < \pi \end{cases}$$

Hence deduce $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$ 8

- (b) Find the z -transform of ne^{-an} , $n \geq 0$. 8

OR

- 1 (a) The following table gives the variations of periodic current over a period :

$t \text{ sec} :$	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
$A \text{ amp} :$	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show by practical harmonic analysis, that there is a direct current of 0.75 amp. in the variable current and obtain the amplitude of the first harmonic.

8



(b) Find the inverse z-transform of $F(z) = \frac{1}{(z-3)(z-2)}$

if is

(i) $|z| < 2$

(ii) $2 < |z| < 3$

8

UNIT - II

2 (a) Find the Laplace transform of $f(t)$ if

$$f(t) = \begin{cases} \cos t & ; 0 < t < 2\pi \\ 0 & ; t > 2\pi \end{cases}$$

8

(b) Use Laplace transform technique to solve

$$(D^2 + 9)y = \cos 2t; \quad y(0) = 1, \quad y\left(\frac{\pi}{2}\right) = -1$$

8

OR

2 (a) Find the Laplace transform of $\frac{\sin^2 t}{t}$ and hence

$$\text{deduce that } \int_0^\infty \frac{\sin^2 t}{t} dt = \frac{\pi}{2}.$$

8

(b) Solve $\frac{\partial u}{\partial t} = 3 \frac{\partial^2 u}{\partial x^2}$.

$$\text{B.C. : } u\left(\frac{\pi}{2}, t\right) = 0, \quad \left(\frac{\partial u}{\partial x}\right)_{x=0} = 0, \quad u(x, 0) = 30 \cos 5x$$

8

UNIT - III

3 (a) Find the Fourier sine transform of $\frac{e^{-ax}}{x}$ and hence

$$\text{deduce the Fourier sine transform of } \frac{1}{x}.$$

8



(b) Solve $\frac{\partial v}{\partial t} = \frac{\partial^2 v}{\partial x^2}$, $x > 0$, $t > 0$

subject to the conditions :

(i) $v = 0$ when $x = 0$, $t > 0$

(ii) $v = \begin{cases} 1 & , 0 < x < 1 \\ 0 & , x \geq 1 \end{cases}$ when $t = 0$

(iii) $v(x, t)$ is bounded $x > 0$, $t > 0$.

8

OR

3 (a) Find the Fourier cosine transform of $f(x)$ if

$$f(x) = \begin{cases} 1 & , 0 < x < a \\ 0 & , x \geq a \end{cases}$$

and hence find the function whose Fourier cosine transform

is $\frac{\sin as}{s}$.

8

(b) The temperature v in the semi infinite rod is determined by the differential equation

$$\frac{\partial v}{\partial t} = k \frac{\partial^2 v}{\partial x^2}$$

under the conditions :

(i) $v = 0$ when $t = 0$, $x \geq 0$

(ii) $\frac{\partial v}{\partial x} = -\mu$, a constant when $x = 0$, $t > 0$.

(iii) $v(x, t) = 0$ and $\frac{\partial v}{\partial x} = 0$; when $x \rightarrow \infty$.

8

UNIT - IV

4 (a) Evaluate $\Delta^6 (ax-1)(bx^2-1)(cx^3-1)$.

6

(b) Find $f(0.015)$, $f(0.055)$, $f'(0.05)$ from the following table :

x :	0.01	0.02	0.03	0.04	0.05	0.06
$f(x)$:	0.1023	0.1047	0.1071	0.1096	0.1122	0.1148

State the formula used.

10

OR



- 4 (a) Use Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rule to evaluate $\int_0^1 \frac{dx}{1+x^2}$

Hence obtain the approximate value of π in each case. 6

- (b) A rod is rotating in a plane. The following table gives the angle θ (in radians) through which the rod has turned for various values of time t (in seconds)

t :	0	0.2	0.4	0.6	0.8	1.0	1.2
θ :	0	0.12	0.49	1.12	2.02	3.20	4.67

Calculate the value of θ when $t=0.1$, $t=1.1$ also find the angular velocity and angular acceleration of the rod when $t=0.6$ seconds. 10

UNIT - V

- 5 (a) Using Picards method solve $\frac{dy}{dx} = x^2 + y^2$ with $x \equiv 0$ when $y=0$ upto the fourth order of approximation. Also find :
(a) $y(0.1)$, (b) $y(0.2)$, (c) $y(0.3)$. 8
- (b) Use Milne's Predictor-Corrector method to solve the equation

$$\frac{dy}{dx} = x - y^2 \quad \text{at } x=0.8, \quad \text{given that } y(0)=0, y(0.2)=0.02, \\ y(0.4)=0.0795, y(0.6)=0.1762. \quad 8$$

OR

- 5 (a) Use Euler's modified method to solve $\frac{dy}{dx} = x + \sqrt{y}$ given that $y=4$ when $x=2$ Compute the value of y when $x=2.6$ with $h=0.2$. 8
- (b) Using Runge-Kutta method of fourth order, find an approximate value of $y(0.2)$ and $y(0.4)$ by solving $\frac{dy}{dx} = -2xy^2$ with $x=0, y=1, h=0.2$. 8

