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3E1456

Roll No. : ____________ Total Printed Pages : 4

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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. NIL 2. 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

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

Hence deduce $\dfrac{\pi^2}{8} = \dfrac{1}{1^2} + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \ldots\ldots\ldots\ldots$ 8

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

OR

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

t sec :	0	$\frac{T}{6}$	$\frac{T}{3}$	$\frac{T}{2}$	$\frac{2T}{3}$	$\frac{5T}{6}$	T
A *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

$$(D^2+9)y=\cos 2t;\ y(0)=1,\ y\left(\frac{\pi}{2}\right)=-1$$ 8

OR

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

deduce that $\int_0^\infty \frac{\sin^2 t}{t}\,dt=\frac{\pi}{2}$. 8

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

B.C. : $u\left(\frac{\pi}{2},t\right)=0,\ \left(\frac{\partial u}{\partial x}\right)_{x=0}=0,\ u(x,0)=30\cos 5x$ 8

UNIT - III

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

deduce the Fourier sine transform of $\frac{1}{x}$. 8

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(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 is 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 $x\to\infty$. 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 $x=0$ 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

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