3E1416

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B. Tech. (Sem. III) (Main / Back) Examination, February - 2012
Automobile Engg.
3AE6 Advanced Engineering Mathematics (Common for ME / PI)

Time : 3 Hours] [Total Marks : 80

[Min. Passing Marks : 24

Instructions to Candidates :

*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 the Fourier series for the function $f(x)=x+x^2$ in the interval $-\pi<x<\pi$. Hence show that

$$\frac{\pi^2}{6}=1+\frac{1}{2^2}+\frac{1}{3^2}+\ldots\ldots\ldots\ldots$$

8

(b) Obtain the expansions for y from the following table upto the first harmonic :

x :	0	1	2	3	4	5
y :	9	18	24	28	26	20

8

OR

1 (a) Find half-range cosine series for the function

$$f(x)=\begin{cases} kx & 0\le x\le \ell/2 \\ k(\ell-x) & \frac{\ell}{2}\le x\le \ell \end{cases}$$

8

(b) A tightly stretched string with fixed end points $x=0$ and $x=\ell$ is initially in a position given by

$$y = y_0 \sin^3 \frac{\pi x}{\ell}$$

It is released from rest from this position. Find the displacement $y(x,t)$. 8

UNIT - II

2 (a) Find the inverse Laplace transform of $\log \frac{s+2}{s+1}$. 8

(b) Use Laplace transform to solve

$$\frac{d^2 y}{dt^2} + 9y = \cos 2t$$

given that $y(0)=1$ and $y\left(\frac{\pi}{2}\right) = -1$.

OR

2 (a) Apply convolution theorem to obtain

$$L^{-1}\left[\frac{s^2}{\left(s^2+4\right)\left(s^2+9\right)}\right]$$

8

(b) Use Laplace transform to solve $\frac{d^3 y}{dt^3} - 3\frac{d^2 y}{dt^2} + 3\frac{dy}{dt} - y = t^2 e^t$, given that $y(0)=1$, $y'(0)=0$ and $y''(0)=-2$. 8

UNIT - III

3 (a) Find the value of $J_{5/2}(x)$ in terms of sine and cosine of x. 8

(b) Show that

$$\int_{-1}^{1} x\, P_n(x)\, P_{n-1}(x)\, dx = \frac{2n}{(2n-1)(2n+1)}$$

8

OR

3 (a) Show that

$$\frac{d}{dx}\left[xJ_n(x)J_{n+1}(x)\right]=x\left[J_n^2(x)-J_{n+1}^2(x)\right]$$

8

(b) Use Rodrigue's formula to evaluate $P_4(x)$ and $P_5(x)$.

8

UNIT - IV

4 (a) (i) Define the operators Δ, ∇, δ and E and show that $\Delta = E\nabla$.

4

(ii) Find the real root of the equation $x^3-5x-3=0$ by Newton Raphson Method, correct upto four places of decimal.

4

(b) Given that

x:	0.0	0.2	0.4	0.6	0.8
y:	0.399	0.391	0.368	0.333	0.290

Evaluate $y(0.25)$, $y(0.45)$ and $y(0.65)$.

8

OR

4 (a) (i) Use Regula-falsi method to solve $x^3-3x-5=0$ correct upto four places of decimal.

4

(ii) Find $(\Delta-\nabla)x^2$, where h is the interval of differencing.

4

(b) Use Lagrange's interpolation formula, to find y in terms of x, for the given table :

x:	1	2	4	5
y:	8	24	44	50

8

UNIT - V

5 (a) Solve the given system of equations

$$20x+y-2z=17$$

$$3x+20y-z=-18$$

$$2x-3y+20z=25$$

using Gauss - Seidel iterative method. 8

(b) Given that :

x:	0	0.1	0.2	0.3	0.4	0.5	0.6
$f(x)$:	0	1.2	4.9	11.2	20.2	32.0	46.7

Calculate $f'(x)$ at $x=0.1$, at $x=0.3$ and at $x=0.5$. 8

OR

5 (a) Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ using,

(i) Trapezoidal rule,

(ii) Simpson's $\frac{1}{3}$rd rule and

(iii) Simpson's $\frac{3}{8}$th rule. 8

(b) Use Runge-Kutta fourth order method to solve $\frac{dy}{dx}=x+y^2$ to obtain $y(0\cdot2)$ and $y(0\cdot4)$, given that $y=1$ when $x=0$. 8