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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B.E. - Semester End Examination; Dec. - 2015

Engineering Mathematics - III

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*

UNIT - I

1. a. Find the interpolating polynomial for the function $y = f(x)$ given by $f(0) = 1$, $f(1) = 2$, $f(2) = 1$, $f(3) = 10$ by using Netwon's forward formula. 6

b. Given the data 7

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

Find $f(9)$ and $f(18)$ using Newton's divided difference formula.

c. Using Lagrange's interpolation formula find $f(5)$ from the following data: 7

x	1	3	4	6	9
f(x)	-3	9	30	132	156

2 a. Given the data 6

x	-2	-1	0	1	2	3
y	0	0	6	24	60	120

Compute $\left(\frac{dy}{dx}\right)_{x=2}$ and $\left(\frac{d^2y}{dx^2}\right)_{x=4.5}$

b. Evaluate $\int_0^1 \frac{dx}{1+x}$ by applying Simpson's $3/8^{th}$ rule by dividing the interval into six equal parts. Hence deduce the value of $\log_e 2$. 7

c. Evaluate $\int_4^{5.2} \log_e x\, dx$ by using Weddle's rule. 7

UNIT - II

3 a. Find the Fourier series of $x(2\pi - x)$ in the interval $(0, 2\pi)$. 6

b. Find the Fourier series of x^2 in the interval $(-\pi,\pi)$, Hence deduce $\frac{\pi^2}{6} = \sum_{n=1}^{\infty} \frac{1}{n^2}$. 7

c. Find the complex form of the Fourier series of $f(x) = e^{-x}$ in $-1 \le x \le 1$. 7

4 a. Find the Fourier series for the function $f(x) = x(2-x)$ in $[0,2]$. 6

b. Find the half range cosine series for the function $f(x) = \begin{cases} kx, & 0 \le x \le l/2 \\ k(l-x), & l/2 \le x \le l \end{cases}$ 7

Contd….2

c. Find the constant term and first harmonic in the Fourier series for *f(x)* given by the following table. 7

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0

UNIT - III

5 a. Find the Fourier transform of the function 6

$$f(x)=\begin{cases}1-|x|, & |x|\le 1\\ 0, & |x|>1\end{cases}$$

b. Find the Fourier cosine transform of e^{-ax} and hence deduce that $\int_0^\infty \frac{\cos mx}{x^2+a^2}dx=\frac{\pi}{2a}e^{-am}$ 7

c. Solve the integral equation $\int_0^\infty f(x)\cos\alpha x\,dx=\begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}$ 7

6 a. Find the Z-transform of Coshnθ and Sinhnθ 6

b. Compute the inverse Z-transforms of $\frac{3z^2+2z}{(5z-1)(5z+2)}$. 7

c. Using Z-transforms solve the difference equation $y_{n+2}+4y_{n+1}+4y_n=7, \quad \text{with} \quad y_0=1, \quad y_1=2.$ 7

UNIT - IV

7 a. Form the partial differential equation by eliminating the arbitrary functions form $z=f(x+at)+g(x-at)$. 6

b. Solve $\frac{\partial^2 z}{\partial x^2}+z=0,$ given that when x = 0, z = e^y and $\frac{\partial z}{\partial x}=1$ 7

c. Solve $x^2(y-z)p+y^2(z-x)q=z^2(x-y)$. 7

8 a. Find the various possible solutions of the Laplace equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ by the method of separation of variables. 10

b. Solve the wave equation $c^2\frac{\partial^2 u}{\partial x^2}=\frac{\partial^2 u}{\partial t^2}$ $0 < x < \pi$ under the following conditions $u(0, t) = u(\pi,t) = 0$, $u(x,0)=Ax(\pi^2-x^2)$, $\frac{\partial u}{\partial t}(x,0)=0$ 10

UNIT - V

9 a. Test for convergence of the series $\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+........$ 6

b. Test for the convergence of the series $\frac{1}{2\sqrt{1}}+\frac{x^2}{3\sqrt{2}}+\frac{x^4}{4\sqrt{3}}+.........$ 7

c. Test whether the following series $\sum_{n=1}^{\infty}\frac{(-1)^{n-1}}{2n-1}$ is absolutely convergent or conditionally convergent. 7

10. a. Obtain the series solution of the equation $\frac{d^2y}{dx^2}+xy=0$. 6

b. Prove that $J_{1/2}(x)=\sqrt{\frac{2}{\pi x}}\sin x$ and $J_{-1/2}(x)=\sqrt{\frac{2}{\pi x}}\cos x$ 7

c. Express $f(x)=x^4+3x^3-x^2+5x-2$ in terms of Legendre polynomials. 7

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