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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. - 2014

Engineering Mathematics – III

(Common to all Branches)

Time: 3 hrs Max. Marks: 100

Note: *i) Answer **FIVE** full questions, selecting **ONE** full question from each Unit.*
ii) Assume suitable missing data if any.

Unit - I

1. a. The following data gives the melting point of an alloy of lead and Zinc, where t is the temperature in ºC and P is the percentage of lead in the alloy. 6

P (%)	60	70	80	90
t	226	250	276	304

Find the melting point of the alloy containing 84% of lead. Using Newton's interpolation formula.

b. Using Lagrange's formula, evaluate f (9) from the following table. 7

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

c. Using Newton's divided difference formula, find f (8) and f (15) from the following data. 7

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

2 a. Given 6

x	1.0	1.2	1.4	1.6	1.8	2.0
y	2.72	3.32	4.06	4.96	6.05	7.39

Find y′ and y" at x = 1.2

b. Using Simpson's $3/8^{th}$ rule, evaluate $\int_0^{0.3} \sqrt{1-8x^3}\,dx$ taking 7 ordinates. 7

c. Evaluate $\int_0^1 \frac{x\,dx}{1+x^2}$ by using Weddle's rule .Hence find the value of log2. 7

Unit - II

3 a. Find the Fourier expansion for the function $f(x)=\left(\frac{\pi-x}{2}\right)^2$ in (0, 2π) 6

b. Obtain the Fourier series of $f(x)=\begin{cases}-\pi, & -\pi<x<0\\ x, & 0<x<\pi\end{cases}$ and hence deduce that $\frac{\pi^2}{8}=\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$ 7

c. Obtain the Fourier expansion of $f(x)=\begin{cases}l-x, & 0<x<l\\ 0, & l<x<2l\end{cases}$ over [0.2l] 7

4 a. Obtain the Fourier series for the function $f(x)=\begin{cases}\pi x, & in \quad 0\le x\le 1\\ \pi(2-x), & in \quad 1<x<2\end{cases}$ over the interval (0, 2) 6

b. Expand the function $f(x)=x(\pi-x)$ over the interval (0, π) in half – range Fourier cosine series and hence deduce that $\sum_{n=1}^{\infty}\frac{1}{n^2}=\frac{\pi^2}{6}$ 7

Contd...2

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

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$	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 $f(x)=\begin{cases}1-|x|, & for\ |x|\le 1\\ 0, & for\ |x|>1\end{cases}$ and hence deduce $\int_0^\infty \frac{\sin^2 t}{t^2}dt=\frac{\pi}{2}$ 6

b. Find the Fourier sine transform of $f(x)=e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x\sin mx}{1+x^2}dx,$ m > 0 7

c. Obtain the Fourier cosine transform of the function $f(x)=\begin{cases}4x, & 0<x<1\\ 4-x, & 1<x<4\\ 0, & x>4\end{cases}$ 7

6 a. Obtain the Z-transform of $\sin(3n+5)+(n+1)^2$ 6

b. Find the inverse Z-transform of $\frac{4z^2-2z}{(z-1)(z-2)^2}$ 7

c. Using Z-transforms solve $u_{n+2}+4u_{n+1}+3u_n=3^n$ with $u_0 = 0$, $u_1 = 1$ 7

Unit - IV

7 a. Form the partial differential equation by eliminating the arbitrary function in $z=y^2+2f\left(\frac{1}{x}+\log y\right)$ 6

b. Solve $(y+z)p+(z+x)q=x+y$ 7

c. Solve by the method of separation of variables $\frac{\partial u}{\partial x}=2\frac{\partial u}{\partial t}+u,$ where $u(x, 0) = 6e^{-3x}$ 7

8 a. Find the various possible solutions of two dimensional Laplace equations $u_{xx}+u_{yy}=0$ by the method of separation of variables. 10

b. Solve the wave equation $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$ given that u(0, t) = 0, u(1, t) = 0, $\frac{\partial u}{\partial t}=0$ when t = 0 and $u(x, 0) = u_0\sin\left(\frac{\pi x}{l}\right)$ 10

Unit - V

9 a. Examine the convergence of series: $\frac{\sqrt{2}-1}{3^3-1}+\frac{\sqrt{3}-1}{4^3-1}+\frac{\sqrt{4}-1}{5^3-1}+\ldots\ldots\ldots..$ 6

b. Discuss the nature of the series: $\frac{1}{2}.x+\frac{1.3}{2.4}x^2+\frac{1.3.5}{2.4.6}x^3+\ldots\ldots...(x>0)$ 7

c. Discuss the nature of series : $\frac{x}{1.2}-\frac{x^2}{2.3}+\frac{x^3}{3.4}-\frac{x^4}{4.5}+\ldots\ldots...(x>0)$ 7

10. a. Solve y'' + xy′ + y = 0 in series: 6

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

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

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