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

(An Autonomous Institution affiliated to VTU, Belgaum)

Third Semester, B. E. – Make-up Examination; Jan/Feb - 2015

Engineering Mathematics – III

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions choosing at least **ONE** full question from each unit.*
Use of statistical table is allowed.

Unit - I

1. a. From the following table, Find the number of students who obtained less than 45 marks and between 41 and 45 marks. Using Newton's forward formula. 7

Marks	30 - 40	40 - 50	50 - 60	60 - 70	70 - 80
No. of Students	31	42	51	35	31

b. Using Newton's divided difference formula. Find an interpolating polynomial *y = f(x)* for the following data. 7

x	2	4	5	6	8	10
f(x)	10	96	196	350	868	1746

Hence find f(3)

c. Use Lagrange's interpolation formula to Find f(4) given 6

x	0	2	3	6
f(x)	-4	2	14	156

2 a. Find y′(2) and y″(4.5), given that 7

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

b. Evaluate $\int_2^8 \frac{dx}{\log_{10} x}$ by using Simpson's $1/3$ rd rule (taking 6 equal parts). 7

c. Evaluate $\int_0^{\pi/2} \sqrt{\cos x}\,dx$ by using Weddle's rule. 6

Unit - II

3 a. Find the Fourier series for the function $f(x) = x - x^2$ in $-\pi < x < \pi$ 7

b. Find the Fourier series of f(x) given by $f(x) = \begin{cases} x, & in\ 0 \le x \le \pi \\ 2\pi - x, & in\ \pi \le x \le 2\pi \end{cases}$ 7

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

c. Obtain the Fourier series of the function $f(x) = 2x - x^2$ in $0 < x < 3$ 6

4 a. Find the Fourier series for the function $f(x) = \begin{cases} 2, & for\ -2 < x < 0 \\ x, & for\ 0 < x < 2 \end{cases}$ over [-2, 2] 7

b. Find the half range cosine series for the function $f(x) = (x-1)^2$ in $0 < x < 1$ 7

Contd….2

c. Express y as a Fourier series upto the first harmonic from the following data. 6

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 complex Fourier transform of
$f(x)=\begin{cases}1 & \text{for } |x|\le 1\\ 0, & \text{for } |x|>1\end{cases}$ Hence deduce that $\int_0^\infty \frac{\sin x}{x}dx=\frac{\pi}{2}$ 7

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. Solve the integral equation $\int_0^\infty f(x)\cos\alpha x\,dx=\begin{cases}1-\alpha, & 0\le x\le 1\\ 0, & x>1\end{cases}$ and hence deduce that
$\int_0^\infty \frac{\sin^2 x}{x^2}dx=\frac{\pi}{2}$ 6

6 a. Find the Z-transform of $\cos n\theta$ and $\sin n\theta$ and hence deduce Z-transform of $a^n\cos n\theta$ and $a^n\sin n\theta$ 7

b. Compute the inverse Z-transforms of $\frac{2z^2+3z}{(z+2)(z-4)}$ 7

c. Solve the difference equation $y_{n+2}-5y_{n+1}+6y_n=1$, with $y_0=0$, $y_1=1$ by using Z-Transform. 6

Unit - IV

7 a. Form the partial differential equation by eliminating the arbitrary functions from $z=yf(x)+x\phi(y)$ 7

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

c. Solve $x(y^2-z^2)p+y(z^2-x^2)q=z(x^2-y^2)$ 6

8 a. Find the various possible solutions of the one dimensional wave equation $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}=0$ by the method of separation of variables. 10

b. Solve the heat equation $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$ given that $u(0,t)=0,\ u(l,t)=0$ and $u(x,0)=\frac{100x}{l}$ 10

Unit -V

9 a. Test for convergence or divergence of (i) $\sum_{n=1}^{\infty}\sqrt{n+1}-\sqrt{n}$. (ii) $\sum_{n=1}^{\infty}\left(1-\frac{3}{n}\right)^{n^2}$. 7

b. Find the nature of the series $\frac{1}{2}x+\frac{1.3}{2.4}x^2+\frac{1.3.5}{2.4.6}x^3+.........$ 7

c. Discuss the nature of the series $1-\frac{1}{2\sqrt{2}}+\frac{1}{3\sqrt{3}}-\frac{1}{4\sqrt{4}}+......$
for i) Convergence ii) absolute convergence iii) Conditional convergence 6

10. a. Obtain the series solution of the equation $\frac{d^2y}{dx^2}+x\frac{dy}{dx}+y=0$ 7

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

c. Express f(x) = x^3+2x^2-4x+5 in terms of Legendre's polynomials. 6

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