***U.S.N*** | | | | | | | | | | |

# 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 - 2017**

**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 missing values in the following table : 6

| $x$ | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| $u(x)$ | 8 | ? | 64 | ? | 216 |

b. Find the number of students who have obtained 7

i) Less than 45 marks ii) Between 40 and 45 marks using the following data.

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

c. Using Newton's general interpolation formula, fit an interpolating polynomial for the data : 7

| $x$ | -3 | 0 | 1 | 3 |
|---|---|---|---|---|
| $f(x)$ | 2 | 1 | 0 | -1 |

2 a. Use Lagrange's interpolation formula, find $f(10)$, using the following data : 6

| $x$: | 5 | 6 | 9 | 11 |
|---|---|---|---|---|
| $y$: | 12 | 13 | 14 | 16 |

b. Use Stirling's interpolation formula to find $Y_{35}$, given $Y_{20} = 512$, $Y_{30} = 439$, $Y_{40} = 346$ and $Y_{50} = 243$. 7

c. Find $f(2.5)$ by using Bessel's interpolation formula given that : 7

| $x$ | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| $f(x)$ | 7.4720 | 7.5854 | 7.6922 | 7.8119 | 7.9252 |

**UNIT - II**

3 a. Given the data : 6

| $x$ | 0 | 2 | 4 | 6 | 8 |
|---|---|---|---|---|---|
| $f(x)$ | 7 | 13 | 43 | 145 | 367 |

Compute $f'(7)$.

b. Find $f'(6)$ and $f''(6)$ from the following data : 7

| $x$ | 0 | 2 | 3 | 4 | 7 | 9 |
|---|---|---|---|---|---|---|
| $f(x)$ | 4 | 26 | 58 | 112 | 466 | 922 |

Using Newton's divided difference formula.

Contd.....2

c. Find the maximum and minimum value of *y* from the following data : 7

| *x* | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| *y* | 0 | -0.25 | 2 | 15.75 | 56 |

4 a. Use Boole's formula to evaluate $\int_1^5 e^{1/x}dx$, taking $h = 1$. 6

b. Use Simpson's $\left(\frac{3}{8}\right)^{th}$ rule, evaluate $\int_0^{0.3}\sqrt{1-8x^3}dx$ by considering three equal intervals. 7

c. Using Weddle's rule, evaluate taking 6 equal parts, $\int_4^{5.2}\log_e x dx$. 7

## UNIT - III

5 a. Find the Fourier series of $f(x)$,if $f(x)=\begin{cases} x, & 0\le x\le\pi \\ 2\pi-x, & \pi\le x\le 2\pi \end{cases}$ 6

b. Expand $f(x)=x-x^2$ in terms of Fourier series valid in $-\pi < x < \pi$. 7

c. Find the half-range cosine series of $f(x)=(x-1)^2$ valid in $0\le x\le 1$. Hence, deduce that, 7

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

6 a. Obtain the complex form of the Fourier series for $f(x)=x$ in $-\pi \le x\le \pi$. 6

b. Obtain the Fourier series of $f(x)=|x|$ in $[-l,l]$. 7

c. Express *y* as a Fourier series upto second harmonics, given : 7

| *x* | 0 | $\pi/3$ | $2\pi/3$ | $\pi$ | $4\pi/3$ | $5\pi/3$ | $2\pi$ |
|---|---|---|---|---|---|---|---|
| *y* | 1.98 | 1.30 | 1.05 | 1.30 | -0.88 | -0.25 | 1.98 |

## UNIT - IV

7 a. Find the Fourier transform of, $f(x)=\begin{cases} 1, & \text{for } |x|\le 1 \\ 0, & \text{for } |x|>1 \end{cases}$ and hence evaluate $\int_0^\infty\left(\frac{\sin x}{x}\right)dx$. 6

b. Find the Fourier sine transform of $e^{-|x|}$. Hence show that: $\int_0^\infty \frac{x\sin mx}{1+x^2}dx=\frac{\pi}{2}e^{-m},\ m>0$. 7

c. Show that $f(x)=xe^{-x^2/2}$ is self-reciprocal under Fourier cosine transform. 7

8 a. Find the Z-transforms of $\cos n\theta$ and $\sin n\theta$. 6

b. Obtain the inverse Z -transforms of $\frac{z^3-20z}{(z-2)^3(z-4)}$. 7

c. Solve, $y_{n+2}-4y_n=0$ with $y_0=0$, and $y_1=2$, using Z -transforms. 7

Contd.....3

**UNIT - V**

9 a. Form the partial differential equation by eliminating the arbitrary function in $f\left(x^2+y^2, z-xy\right)=0.$ 6

b. Solve $\left(\partial u/\partial x\right)=2\left(\partial u/\partial t\right)+u$ with $u(x,0)=6e^{-3x}$, by using the method of separation of variables. 7

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

10 a. Obtain the various possible solutions of $\frac{\partial^2 u}{\partial t^2}=C^2\frac{\partial^2 u}{\partial x^2}$, by the method of separation of variable. 10

b. Solve the heat equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ with boundary conditions, $u(x,0)=3\sin n\pi x$ *and* $u(0,t)=0=u(1,t).$ 10

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