B.E. Civil Engineering (Model Curriculum) Semester - III

001-Engineering Mathematics-III : Transform & Discrete Mathematics

P. Pages : 3 **GUG/S/23/13714**

Time : Three Hours * 2 4 5 0 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Use of non-programmable calculator is permitted.

1. a) Obtain Fourier series for **8**

$$f(x)=\begin{cases}-\sin\left(\pi x/L\right), & -L<x<0\\ \sin\left(\frac{\pi x}{L}\right), & 0<x<L\end{cases}$$

Hence show that

$$\frac{1}{2}=\frac{1}{1\cdot 3}+\frac{1}{3\cdot 5}+\frac{1}{5\cdot 7}+.....\infty$$

b) If $f(x)=|x|,\ -\pi<x<\pi$ **8**

Then show that

$$f(x)=\frac{\pi}{2}-\frac{4}{\pi}\left[\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+....\infty\right]$$

OR

2. a) Find half Range cosine series for $f(x)=\sin^2 x,\ 0<x<\pi$ **8**

b) If **8**

$$f(x)=\begin{cases}-\pi, & -\pi<x<0\\ x, & 0<x<\pi\end{cases}$$

Then show that

$$f(x)=-\frac{\pi}{4}-\frac{2}{\pi}\left[\frac{\cos x}{1^2}+\frac{\cos 3x}{3^2}+\frac{\cos 5x}{5^2}+.....\infty\right]$$

3. a) Solve **8**

$$px\left(z-2y^2\right)=(z-qy)\left(z-y^2-2x^3\right)$$

b) Solve **8**

$$\left(D^3+D^2D'-DD'^2-D'^3\right)z=e^x\cdot\cos 2y+\sqrt{2x+3y}$$

OR

4. a) Solve **8**

$\left(D^2 + DD'\right)z = \cos x \cdot \cos 2y + \log(2x - 2y)$

b) Solve $4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$ given that $u = 3e^{-y} - e^{-5y}$ when x=0 by using method of separation of variables. **8**

5. a) Find the Inverse of matrix **8**

$$A = \begin{bmatrix} 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \\ 1 & 0 & 0 \end{bmatrix}$$

by using Partitioning method.

b) Find the modal matrix B corresponding to matrix. **8**

$$A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$$

& verify that $B^{-1}AB$ is diagonal form.

OR

6. a) Verify Cayley-Hamilton theorem for given matrix $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ & express **8**

$A^6 - 4A^5 + 8A^4 - 12A^3 + 14A^2$ as a linear polynomial in A.

b) Use Sylvester's theorem to show that $e^A = e^x \begin{bmatrix} \cos h\, x & \sin hx \\ \sin hx & \cos hx \end{bmatrix}$ where $A = \begin{bmatrix} x & x \\ x & x \end{bmatrix}$ **8**

7. a) Find the real root of the equations $x \log_{10}^x - 1.2 = 0$ by using Newton-Raphson method correct upto four Decimal places. **8**

b) Solve $6x + 15y + 2z = 72,\ 27x + 6y - z = 85,\ x + y + 54z = 110$ by using Gauss-Seidal method. **8**

OR

8. a) Solve **8**

$2x + y + 5z + u = 5,\ x + y - 3z + 4u = -1$

$3x + 6y - 2z + u = 8,\ 2x + 2z - 3u = 2$

by using Gauss-Jordan method.

b) Solve $5x + 2y + z = 12,\ \ x + 4y + 2z = 15\ \ x + 2y + 5z = 20$ By using Crout's method. **8**

9. a) If $\frac{dy}{dx} = y\sin x + \cos x$, given that $y(0) = 0$ find series solution upto three terms by using Taylor's series method. **8**

b) Solve $\frac{dy}{dx} = \log(x + y)$ given that $y(0) = 2$ taking h = 0.2 Find y (0.4) By using Euler's modified method. **8**

OR

10. a) If $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given that y=1 when x=0 & h = 0.2 Find y_1 & y_2 by using Runge-Kutta method. **8**

b) If $\frac{dy}{dx} = \frac{1}{2}\left(1 + x^2\right)y^2$ & $y(0) = 1$, $y(0.1) = 1.06$ $y(0.2) = 1.12$, $y(0.3) = 1.21$ find $y(0.4)$ & $y(0.5)$ by using Milne's Predictor corrector method. **8**

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