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

001 : Engineering Mathematics-III (Transform & Discrete Mathematics)

P. Pages : 3 **GUG/W/22/13714**

Time : Three Hours * 2 9 8 4 * Max. Marks : 80

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

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

$$f(x)=\begin{cases} \pi x, & 0\le x\le 1 \\ \pi(2-x), & 1\le x\le 2 \end{cases}$$

Hence show that

$$\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+.....$$

b) Find the Fourier series for $f(x)=x\sin x,\ -\pi<x<\pi$ **8**

OR

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

b) If **8**

$$f(x)=\begin{cases} mx, & 0<x<\dfrac{L}{2} \\ m(L-x), & \dfrac{L}{2}<x<L \end{cases}$$

Then show that

$$f(x)=\frac{mL}{4}-\frac{8mL}{\pi^2}\left[\frac{1}{2^2}\cdot\cos\left(\frac{2\pi x}{L}\right)+\frac{1}{6^2}\cdot\cos\left(\frac{6\pi x}{L}\right)+.....\right]$$

3. a) Solve **8**

$$\left(x^2-y^2-yz\right)p+\left(x^2-y^2-zx\right)q=z(x-y)$$

b) Solve **8**

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

OR

4. a) Solve **8**

$$\left(D^2-DD'-2D'^2\right)z=x\cos y+e^{4x+2y}$$

b) **8**

Solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial y} + 2u$ given that $u = 0$, $\frac{\partial u}{\partial x} = 1 + e^{-3y}$ when $x = 0$ for all values of y using method of separation of variables.

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

$$A = \begin{bmatrix} 1 & 3 & 3 \\ 1 & 3 & 4 \\ 1 & 4 & 3 \end{bmatrix}$$

by using partitioning method

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

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

Verify that $B^{-1}AB$ is diagonal form

OR

6. a) Verify Cayley-Hamilton theorem for given matrix. **8**

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

& hence find the matrix represented by

$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + Z$

b) **8**

If $A = \begin{bmatrix} \cos\alpha & \sin\alpha \\ -\sin\alpha & \cos\alpha \end{bmatrix}$

Find A^n By using Sylvester's Theorem

7. a) Find the real root of the equations. **8**

$x + \log_{10} x - 3.375 = 0$ by using Newton-Raphson method correct upto four Decimal places.

b) Solve **8**

$-9x + 3y + 4z + 100 = 0$, $x - 7y + 3z + 80 = 0$ $2x + 3y - 5z + 60 = 0$ By using Gauss-Seidal method.

OR

8. a) Solve **8**

$x + 2y + z + 2u = 6$, $-6x + 6y + 12z + 6u = 36$

$3x + 3y - 3z + 4u = -1$, $2x - y + z + 2u = 10$

By using Gauss-Jordan method

b) Solve **8**

$2x-6y+8z=24, \qquad 5x+4y-3z=2$

$3x+y+2z=16$

By using Crout's method.

9. a) If $\frac{dy}{dx}=\frac{1}{2}\left(y^2+xy^2\right)$ given that y (0) = 1. Find the series solution upto four terms by using Taylor's series method & find y (0.1). **8**

b) Solve $\frac{dy}{dx}=x+\left|\sqrt{y}\right|$ given that $y(0)=1$ for range $0\le x\le 0.4$ taking $h=0.2$ by using Euler's modified method. **8**

OR

10. a) If $\frac{dy}{dx}=\frac{y-x}{y+x}$ given that y(0) = 1 taking h = 0.1 find y (0.2) By using Runge-Kutta method. **8**

b) If $\frac{dy}{dx}=1+xy^2$ & $y(0)=1,\ y(0.1)=1.105, y(0.2)=1.223,\ y(0.3)=1.355$ find y (0.4) & y(0.5) By using Milne's predictor corrector method. **8**

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