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

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

P. Pages : 2 **GUG/W/23/13714**

Time : Three Hours * 7 3 0 0 * Max. Marks : 80

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

1. a) Obtain the Fourier series to represent **8**

$F(x) = \frac{(\pi - x)^2}{4}$, $0 < x < 2\pi$

b) The function $F(x) = |\sin x|, -\pi < x < \pi$ & hence find the Fourier series for F(x). Hence **8**

show that $\frac{1}{2} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)(2n+1)}$

OR

2. a) Find the Fourier Series for $F(x) = e^{-x}$ in $0 < x < 2$. **8**

b) Obtain the Fourier series expansion of the function $F(x) = x \sin x, -\pi < x < \pi$. **8**

3. a) Solve $p + 3q = \tan(y - 3x)$. **4**

b) Solve $\frac{(y-z)}{yz}p + \frac{(z-x)}{zx}q = \frac{x-y}{xy}$ **4**

c) Solve $\left(D^2 + DD' - 6D'^2\right)z = y\cos x - \sin y$ **8**

OR

4. a) Solve $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^3 z}{\partial x\, \partial y^2} + 2\frac{\partial^3 z}{\partial y^3} = \sqrt{x + 2y}$ **8**

b) Solve by method of separation of variables $\frac{\partial u}{\partial x} - 2\frac{\partial u}{\partial y} = u$ with given that **8**

$u = 3e^{-5x} + 2e^{-3x}$ at $y = 0$

5. a) Find the inverse of matrix $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & 1 & 1 \end{bmatrix}$ by partitioning method. **8**

b) Use Sylvester's theorem to verify $\log_e e^A = A$ where $A = \begin{bmatrix} 3 & 2 \\ 2 & 3 \end{bmatrix}$ **8**

OR

6. a) Verify Cayley – Hamilton's theorem for matrix $A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and hence find A^{-1} **8**

b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 5 & 7 & -5 \\ 0 & 4 & -1 \\ 2 & 8 & -3 \end{bmatrix}$. Also write modal matrix and diagonal matrix. **8**

7. a) Find the real root of Equation $x + \log_{10}{}^{x} = 3.375$ correct upto four decimal places by Newton-Raphson method. **8**

b) Solve by Crout's method **8**

$4x + y - z = 13$

$3x + 5y + 2z = 21$

$2x + y + 6z = 14$

OR

8. a) Solve by Gaurs-Seidal method. **8**

$2x - 3y + 20z = 25$

$20x + y - 2z = 17$

$3x + 20y - z = -18$

b) Find the positive real root of the equation $x^4 - x - 10 = 0$ by the method of iterations. Correct to four places of decimals. **8**

9. a) Given $\frac{dy}{dx} = x + y,\ y(0) = 1$. Find y upto four terms by Picard's method and hence find $y(0-1)$ and $y(0-2)$. **8**

b) Solve $10\frac{dy}{dx} = x^2 + y^2, y(0) = 1$ to evaluate y(0.4) in steps of h = 0.2 by Runge-Kutta fourth order method. **8**

OR

10. a) Use Euler's modified method to find y(0.4) given $\frac{dy}{dx} = -xy$ and $y(0) = 1$ taking a step of 0.2. **8**

b) Find y(0.4) and y(0.5) by Milne's predictor corrector method given **8**

$2\frac{dy}{dx} = \left(1 + x^2\right)y^2$ and $y(0) = 1,\ y(0.1) = 1.06,\ y(0.2) = 1.12\ y(0.3) = 1.21.$

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