B.E. Civil Engineering (CBCS Pattern) Third Semester

3BECE001 - Engineering Mathematics - III

P. Pages : 2 **GUG/W/18/11476**

Time : Three Hours * 3 5 6 1 * 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 $F(x) = \frac{(\pi - x)^2}{4}$, $0 < x < 2\pi$ **8**

b) The function $F(x) = |\sin x|$, $-\pi < x < \pi$ & hence find the Fourier series for F(x). Hence show that $\frac{1}{2} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)(2n+1)}$ **8**

OR

2. a) Find the half-range cosine series for $F(x) = \sin\left(\frac{\pi x}{\ell}\right)$ in the interval $0 < x < \ell$. **8**

b) Obtain Fourier series for the function **8**

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

3. a) Solve $xq = yp + x e^{(x^2+y^2)}$ **4**

b) Solve $(x^2 - y^2 - yz)p + (x^2 - y^2 - zx)q = z(x-y)$ 5

c) Solve $\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial y^2} = \frac{4x}{y^2} - \frac{y}{x^2}$ **7**

OR

4. a) Solve $(D^2 - 3DD' + 2D'^2)z = \sin(x+3y) + xy^2$ **8**

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 the method of separation of variables. **8**

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

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b) Find the characteristic equations of the matrix $A = \begin{bmatrix} 1 & 3 & 7 \\ 4 & 2 & 3 \\ 1 & 2 & 1 \end{bmatrix}$ show that the equation is satisfied by A & hence find A^{-1}. **8**

OR

6. a) Reduce the matrix $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ to the diagonal form. **8**

b) Use Sylvester's theorem to show that $\sec^2 A - \tan^2 A = I$ where $A = \begin{bmatrix} 2 & 4 \\ 3 & 1 \end{bmatrix}$ **8**

7. a) Use Newton - Raphson method to find a real root of the equation $x \log_{10} x = 1.2$ correct upto four decimal places. **8**

b) Solve the system of equation by using Crout's method. **8**
$2x + 4y - 2z = 14,\ x + 3y - 4z = 16,\ -x + 2y + 3z = 1$

OR

8. a) Find a real root of the equation $3x - \sqrt{1 + \sin x} = 0$ correct upto four decimal places by using iteration method. **8**

b) Solve the system of equations $4x + y - z = 13,\ 3x + 5y + 2z = 21,\ 2x + y + 6z = 14$ by using Gauss Seidel method. **8**

9. a) Use Taylor's series method to solve $\frac{dy}{dx} = 1 + xy,\ y(0) = 1$ find y(0.1) & y(0.2) correct to four decimal places. **8**

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

OR

10. a) Use Runge-Kutta Fourth order method to find y(0.2) & y(0.4) if $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, y(0) = 1 take h = 0.2. **8**

b) Given $\frac{dy}{dx} = \frac{x + y}{xy}$ given y(1) = 1 Use Euler's modified method to find y(1.2) with step of 0.1. **8**

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