

B.E. Civil Engineering Third Semester (Old)
MAT-301 - Applied Mathematics-III / Engineering Mathematics-III

P. Pages : 2

Time : Three Hours



GUG/W/18/1468

Max. Marks : 80

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

- 1.** a) Find the Fourier series for the function $f(x)$ given by **8**

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

Hence prove that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$

- b) Find the Fourier series for the function defined by **8**

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

OR

- 2.** a) Find Fourier series for the function $f(x) = |\cos x|$, $-\pi < x < \pi$. **8**

- b) Find half range cosine series for **8**

$$f(x) = \begin{cases} x, & 0 < x < 4 \\ 8 - x, & 4 < x < 8 \end{cases}$$

- 3.** Solve :

a) $z(p-q) = z^2 + (x+y)^2$ **4**

b) $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ **5**

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

OR

- 4.** a) Solve $\frac{\partial^2 z}{\partial x^2} + 2 \frac{\partial^2 z}{\partial x \cdot \partial y} + \frac{\partial^2 z}{\partial y^2} = x^2 y + \sin(x+2y)$ **8**

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

5. a) 8

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

b) 8

Reduce to diagonal form the matrix $A = \begin{bmatrix} -1 & 1 & 2 \\ 0 & -2 & 1 \\ 0 & 0 & -3 \end{bmatrix}$

OR

6. a) 8

Use Sylvester's theorem to show that $\sin^2 A - \tan^2 A = I$ if $A = \begin{bmatrix} 2 & 4 \\ 3 & 1 \end{bmatrix}$

b) 8

Verify Cayley - Hamilton theorem for the matrix $A = \begin{bmatrix} 3 & 0 & -1 \\ 1 & 2 & 1 \\ 3 & 4 & 0 \end{bmatrix}$ Hence find A^{-1}

7. a) 8

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

b) 8

Solve by Gauss-Seidal method $4x + y - z = 13$, $3x + 5y + 2z = 21$, $2x + y + 6z = 14$.

OR

8. a) 8

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

b) 8

Find the real root of the equations $x \log_{10} x - 1.2 = 0$ correct to four decimal places by Newtons - Raphson method.

9. a) 8

Use Euler's modified method to solve $\frac{dy}{dx} = x + |\sqrt{y}|$ given $y(0) = 1$ for the range $0 \leq x \leq 0.4$ taking step of 0.2.

b) 8

Using Runge - Kutta method to solve $y'' - xy + 4y = 0$ given that $y(0) = 3$, $y'(0) = 0$ for $x = 0.2$.

OR

10. a) 8

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

Find $y(0.4)$ & $y(0.5)$ by Milne's predictor - corrector method.

b) 8

Use Taylor's series method to solve $\frac{dy}{dx} = 3x + y^2$, $y(0) = 1$ find $y(0.1)$ & $y(0.2)$ correct to four decimal places.
