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

001 / BSC-CE301 - Mathematics-III (Transform & Discrete Mathematics)

P. Pages : 2 **GUG/S/25/13714**

Time : Three Hours * 2 1 8 9 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. All questions are compulsory.
3. Non programmable calculator is permitted.

1. a) Find Fourier series for the function $f(x) = x^2; -\pi \le x \le \pi$. Hence find the sum **8**

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots.$$

b) Find half range sine series for the function. **8**

$$f(x) = \begin{cases} x; & 0 \le x \le 2 \\ 4 - x; & 2 \le x \le 4 \end{cases}$$

OR

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

b) Find the Fourier series for $f(x) = \begin{cases} -\pi; & -\pi < x < 0 \\ x; & 0 < x < 11 \end{cases}$ **8**

Also show that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots..$

3. a) Solve p.d. equation $\left(x^2 - y^2 - z^2\right)p + 2xyq = 2xz$ **4**

b) Solve $(mz - ny)\frac{\partial z}{\partial x} + (nx - lz)\frac{\partial z}{\partial y} + mx - ly = 0$ **4**

c) Solve $\left(D^3 - 7DD'^2 - 6D'^3\right)z = \sin(x + 2y) + x^2y$. **8**

OR

4. a) Solve $\left(D^2 + 3DD' + 2D'^2\right)z = 24xy$. **8**

b) Solve the equation $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, given $u(x, 0) = 6e^{-3x}$, by Method of variable. **8**

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

b) Verify Cayley-Hamilton theorem for the matrix. **8**
$A=\begin{bmatrix}1 & 1 & 3\\ 1 & 3 & -3\\ -2 & -4 & -4\end{bmatrix}$ and hence find A^{-1}.

OR

6. a) If $M=\begin{bmatrix}2 & 1\\ 3 & 4\end{bmatrix}$, then find the matrix represented by M^2-3M+I by Sylvester's theorem. **8**

b) Find a matrix B which reduces $A=\begin{bmatrix}6 & -2 & 2\\ -2 & 3 & -1\\ 2 & -1 & 3\end{bmatrix}$ To a diagonal form by transformation **8**
$B^{-1}AB$. Hence Find diagonal form of A.

7. a) Find by Newton-Raphson method the root of the equation $e^x-4x=0$ nearer to 2, correct to three decimal places. **8**

b) Using Regul-Falsi method, find the roots of the following Equations correct to third decimal place. **8**

OR

8. a) Apply Crout's method to solve the equations. **8**
$3x+2y+7z=4, 2x+3y+z=5, 3x+4y+z=7$.

b) Solve by Gauss-Seidal method. **8**
$6x-3y+z=11, x-7y+z=10, 2x+y-8z=-15$

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

b) Use modified Euler's method to solve equation $\frac{dy}{dx}=x+y$ for x=0.1, given that **8**
$y(0)=1,\ h=0.05$.

OR

10. a) Solve $\frac{dy}{dx}=1+xy^2, y(0)=1, y(0.1)=1.105, y(0.2)=1.223, Y(0.3)=1.355$, find $y(0.4)$. **8**

b) Solve $\frac{dy}{dx}=x+z, \frac{dz}{dx}=x-y^2$ for x = 0.1, given that $y(0)=2,\ z(0)=1$ by Runge-Kutta method. **8**

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