B.E. (Civil Engineering) Third Semester (C.B.S.)

Applied Mathematics - III

P. Pages : 3 **NIR/KW/18/3292**

Time : Three Hours * 1 8 5 8 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Use of non programmable calculator is permitted.

1. Sketch the function $f(x) = |\sin x|, -\pi < x < \pi$. Hence obtain Fourier series for $f(x)$. **7**

OR

2. Obtain Half range sine series for $f(x) = \pi x - x^2$ in the interval $(0, \pi)$. **7**

3. a) Solve $y^2 p - xyq = x(z - 2y)$ **6**

b) solve $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = 24xy$ **6**

c) Solve using method of separation of variables **6**
$4\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 3u$, given that $u = 3e^{-y} - e^{-5y}$ when $x = 0$.

OR

4. a) An insulated rod of length ℓ has its ends A and B maintained at 0ºC and 100ºC respectively until steady conditions are reached. If B is then suddenly reduced to 0ºC and maintained at 0ºC, find the temperature at a distance x from A at any time t. **8**

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

c) Solve $\left(D^3 - 3DD'^2 + 2D'^3\right)z = (x + 2y)^{1/2}$ **5**

5. Find the extremals of the functional $\int_1^2 \frac{\sqrt{1 + (dy/dx)^2}}{x}\, dx$, given y (1) = 0, y (2) = 1. **7**

OR

6. Find the curve joining points (0,0) and (1,0) for which the integral. **7**

$\int_0^1 (y'')^2\,dx$ is minimum, if $y(0)=0=y(1),\ y'(0)=a,\ y'(1)=b$

7. a) Find whether given set of vectors are linearly dependent. If so find the relationship between them: **6**

$X_1=[1,2,-1,3],\ X_2=[2,-1,3,2],\ X_3=[-1,8,-9,5]$.

b) Verify Caylay – Hamilton's theorem and hence find A^{-1}, where $A=\begin{bmatrix}1 & 2 & 4\\ 2 & 1 & 2\\ 4 & 2 & 1\end{bmatrix}$ **6**

c) Find modal matrix for $A=\begin{bmatrix}3 & 1 & 4\\ 0 & 2 & 6\\ 0 & 0 & 5\end{bmatrix}$ **6**

OR

8. a) If $A=\begin{bmatrix}3 & 2\\ 2 & 3\end{bmatrix}$, verify $\log_e,\ e^A=A$ by using Sylvester's theorem. **6**

b) Solve $\frac{d^2y}{dt^2}-3\frac{dy}{dt}-10y=0$ given $y(0)=3,\ y'(0)=15$ by matrix method. **6**

c) Reduce the given quadratic form to canonical form by orthogonal Transformation **6**

$3x^2+5y^2+3z^2-2yz+2zx-2xy$.

9. a) Find by Newton – Raphson method, the red root of $3x - \cos x - 1 = 0$. **6**

b) Solve $4x+11y-z=33,\ 6x+3y+12z=36,\ 8x-3y+2z=20$ **6**
by Guass – seidal method.

c) Solve $\frac{\partial y}{\partial x}=-xy^2,\ y=z,$ when $x=0$ to find y (0.2) by Modified Euler's method. **6**
(Take h = 0.1)

OR

10. a) Using Regula – Falsi method, find the root of **6**
$x\log_{10}x-1.2=0$
Correct to three decimal places.

b) Solve $3x+2y+7z=4:\ 2x+3y+z=5$ **6**
$3x+4y+z=7$ by Crout's method.

c) Solve $\frac{\partial y}{\partial x}=x-2y$ by Runge – Kutta method given $y(0)=1,$ to find $y\ (0.2)$. **6**

11. a) A manufacturer produces two types of models M_1 and M_2. Each M_1 model requires 4 hrs of grinding and 2 hrs of polishing where as each M_2 model requires 2 hrs of grinding and 5 hrs of polishing. The manufacturer has 2 grinders and 3 polishers. Each grinder works for 40 hrs a week and each polisher works for 60 hrs a week. Profit as on M_1 model is Rs. 3 and on M_2 model is Rs. 4 Whatever is produced in a week is sold in market. How should the manufacturer allocate his production capacity to the two types of models so that he may make the maximum profit in a week. Formulate the LPP. **6**

b) Solve the given LPP by graphical method. **6**

Max. $z = 3x_1 + 5x_2$

Subject to

$$x_1 + 2x_2 \leq 200$$
$$x_1 + x_2 \leq 150$$
$$x_1 \leq 60$$
$$x_1, x_2 \geq 0$$

OR

12. Using simplex Method, Solve the LPP. **12**

Maximize $z = 10x_1 + x_2 + 2x_3$

Subject to

$$x_1 + x_2 - 2x_3 \leq 10$$
$$4x_1 + x_2 + x_3 \leq 20$$
$$x_1, x_2, x_3 \geq 0$$

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