Total No. of Questions : 4]

SEAT No. :

PA-422

[Total No. of Pages : 3

[5931]-4
S.E. (Civil)
ENGINEERING MATHEMATICS - III
(2019 Pattern) (Semester - I) (207001)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) *Attempt Q.1 or Q.2 and Q.3 or Q.4.*
2) *Use of electronic pocket calculator is allowed.*
3) *Assume suitable data, if necessary.*
4) *Neat diagrams must be drawn wherever necessary.*
5) *Figures to the right indicate full marks.*

Q1) a) Solve any two **[10]**

i) $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}-3y=x^2\log x$

ii) $\frac{d^2y}{dx^2}+y=x\sin x$ by applying the method of variation of parameters.

iii) $\left(D^2+5D+6\right)y=e^{-2x}+x^2$

b) The deflection of a strut of length l with one end ($x = 0$) built in and the other supported and subjected to end thrust P satisfies the equation

$$\frac{d^2y}{dx^2}+a^2y=\frac{a^2R}{P}\left(l-x\right)$$ **[5]**

Prove that the deflection curve is $y=\frac{R}{P}\left(\frac{\sin ax}{a}-l\cos ax+l-x\right)$

where $al = \tan al$.

OR

Q2) a) Solve any two **[10]**

i) $\frac{dx}{x^2-y^2-z^2}=\frac{dy}{2xy}=\frac{dz}{2xz}$

P.T.O.

ii) $\frac{dx}{dt}=3x+8y,\ \frac{dy}{dt}=-x-3y$ if $x(0)=6$ and $y(0)=-2$

iii) $\left(\mathrm{D}^2+3\mathrm{D}+2\right)y=xe^x+\cos x$

b) The differential equation for the elastic curve of a beam is $\mathrm{EI}\frac{d^2y}{dx^2}=\frac{\mathrm{W}}{2}x-\mathrm{P}y$ where E, I, W and P are constants. Assume the beam to be positioned horizontally with one end at $x = 0$ and the other end at $x = l$. With $y(0) = 0$ and $\left(\frac{dy}{dx}\right)x=\frac{l}{2}=0,$ show that the deflection at the centre is $\frac{\mathrm{W}}{2\mathrm{P}}\left(\frac{1}{n}\tan\frac{nl}{2}-\frac{l}{2}\right)$ where $n^2=\frac{\mathrm{P}}{\mathrm{EI}}$ **[5]**

Q3) a) Solve the following system by Cholesky method **[5]**

$$\begin{aligned}2x-y&=1\\-x+3y+z&=0\\y+2z&=0\end{aligned}$$

b) Use Runge Kutta fourth order Method to solve $\frac{dy}{dx}=\sqrt{x^2+y}$ to find y at $x = 0.4$, given $y(0) = 1$, take $h = 0.2$. **[5]**

c) Solve by Jacobi's Iteration method system of equations. **[5]**

$$\begin{aligned}20x_1+x_2-2x_3&=17\\3x_1+20x_2-x_3&=-18\\2x_1-3x_2+20x_3&=25\end{aligned}$$

OR

Q4) a) Solve the following system using Gauss Seidel Method **[5]**

$$\begin{aligned}20x+y-2z&=17\\3x+20y-z&=-18\\2x-3y+20z&=25\end{aligned}$$

b) Use modified Euler's Method to solve **[5]**

$\frac{dy}{dx} = \log(x+y);\ y(1) = 2$ for $x = 1.2$ and $x = 1.4$ by taking $h = 0.2$.

c) Solve the equation $\frac{dy}{dx} = 1 + y^2$ is tabulated as **[5]**

x	0	0.2	0.4	0.6
y	0	0.2027	0.4228	0.6841

Use Adam-Moulton method to find y at $x = 0.8$ taking $h = 0.2$.