MA8491 NUMERICAL METHODS

Important 13 Mark Questions

Part-B

1. Apply Gauss Jordan method, find the solution of the following system: 2x-y+3z=8,–x+2y+z=4,3x+y-4z=0.

2. Find the dominant Eigen values of A= $\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ .Using power method.

3. Solve by Gauss – Seidal method the following system: $\mathbf{28x + 4y - z = 32}$; $\mathbf{x + 3y + 10z = 24}$; $\mathbf{2x + 17y + 4z = 35}$

4. Solve the equation $\mathbf{x\log_{10}x = 1.2}$ using Newton-Raphson Method

5. Find the natural cubic spline to fit the data :

x	0	1	2	3
$f(x)$	1	2	33	244

Hence find the value for f(2.5) and $f'(2.5)$

6. From the following data, find θ at x= 84

x	40	50	60	70	80	90
y	184	204	226	250	276	304

7. Using Lagrange interpolation find y(9.5)

x	7	8	9	10
y	3	1	1	9

8. Using Newton's divided difference formula, find $f(x)$ from the following data and hence find $f(4)$.

x	0	1	2	5
$f(x)$	2	3	12	147

9. Using the finite difference method compute $y(0.5)$, given $y'' - 64y + 10 = 0$, $x \in (0,1)$, $y(0) = y(1) = 0$, subdividing the interval into (i) 4 equal parts (ii) 2 equal parts

10. By iteration method solve the elliptic equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial t^2}=0$ over the square region of side 4, satisfying the boundary conditions.
(i)$u(0,y)=0, 0\le y\le 4$ (ii)$u(4,y)=8+2y$, $0\le y\le 4$ (iii)$u(x,o)=\frac{x^2}{2}, 0\le x\le 4$ (iv)$u(x,4)=x^2, 0\le x\le 4$. Compute the values at the interior points correct to one decimal with $h=k=1$.
11. By Crank – Nicholson scheme solve the equation $16\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}, 0<x<1, t>0$, subject to $u(x,0)=u(0,t)=0$ and $u(1,t)=100t$. Compute u for one step in t direction taking $h=\frac{1}{4}$
12. Solve $y''-y=0$ with the boundary conditions $y(0)=0$ and $y(1)=1$ $h=0.2$
13. Solve $\frac{\partial^2 u}{\partial x^2}-2\frac{\partial u}{\partial t}=0$ given $u(0,t)=0, u(4,t)=0, u(x,0)=x(4-x)$. assume h=1. Find the values of u up to t=5.
14. Solve $u_t=u_{xx}$ given $u(0,t)=0, u(5,t)=0, u(x,0)=x^2(25-x^2)$ find u in the range taking h=1 up to 3 seconds using Bender – Schmidt recurrence equation.
15. Evaluate the pivotal value of the equation $u_{tt}=16u_{xx}$ taking h=1 upto t=1.25. The boundary conditions
16. Solve the equation $\frac{\partial^2 u}{\partial x^2}=\frac{\partial^2 u}{\partial t^2}, 0<x<1, t>0$ satisfying the conditions $u(x,0)=0$, $\frac{\partial u}{\partial t}(x,0)=0$, $u(0,t)=0$ and $(l,t)=\frac{1}{2}\sin\pi t$. Compute $u(x,t)$ for 4-time steps by taking $h=\frac{1}{4}$
17. Using Romberg's rule evaluate $\int_0^1\frac{dx}{1+x}$ correct to three decimal places by taking $h=0.5$, 0.25 and 0.125.
18. Using Trapezoidal rule, evaluate $\int_{-1}^{1}\frac{dx}{1+x^2}$ by dividing the range into 8 equal parts.
19. Solve $\int_1^2\frac{dx}{1+x^3}$ using Gauss three-point formula.
20. Find first and second order derivative $f(x)$ at $x=1.5$ and for the following data

x	1.5	2.0	2.5	3.0	3.5	4.0
$y=f(x)$	3.375	7.0	13.625	24.0	38.875	59.0

21. Using Runge – Kutta method of fourth order find y for $x=0.1, 0.2, 0.3$ given that $y'=xy+y^2$, $y(0)=1$. Continue the solution at $x=0.4$ using Milne's method

22. Given that $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$ *and* , $y(0.6) = 0.1762$. Compute y(0.8) using Milne's method.
23. Solve $y' = x - y^2$, $y(0) = 1$ to find $y(0.4)$ by Adam's method starting solutions required are to be obtained using Taylor's method using the value $h = 0.1$
24. Solve $(1 + x)\frac{dy}{dx} = -y^2, y(0) = 1$ by Modified Euler's method by choosing h=0.1,find y(0.1) and y(0.2)