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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code: U4M23

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2023

Fourth Semester

Civil Engineering

21UMA423 - Numerical Methods

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1.	Order of convergence of Newton’s method is ________			CO1-U
	(a) 4	(b) 1	(c) 2	(d) 3
2.	When Gauss Elimination method is used to solve AX=B, A is transferred in a _______ matrix			CO1- U
	(a) lower triangular	(b) upper triangular	(c) square	(d) zero
3.	In Cubic Spline, M_0=M_n= ________			CO2- U
	(a) 1	(b)n	(c)3	(d) 0
4.	In Cubic Spline, M_0=M_n= ________			CO2- U
	(a) 1	(b)n	(c)3	(d) 0
5.	Trapezoidal rule is so called, because it approximates the integral by the sum of _______trapezoids			CO3- U
	(a) n	(b)n+1	(c)n-1	(d) 2n
6.	Gaussian three point quadrature formula is exact for polynomials up to degree _______			CO3- U
	(a) 1	(b)2	(c)3	(d) 5
7.	Predictor-Corrector methods are ________ starting methods			CO4- U
	(a) self	(b)not self	(c)identity	(d) None of these

8.	_____ prior values are required to predict the next value in Milne's method			CO4- U
	(a) 1	(b)2	(c)3	(d) 4
9.	PDE of second order, if $B^2-4AC= 0$ then			CO6- U
	(a) parabolic	(b)elliptic	(c)hyperbolic	(d) None of these
10.	$u_{xx}+u_{yy}=0$ is a _________ equation			CO5- U
	(a) Laplace	(b)Poisson	(c)heat	(d) wave
	PART – B (5 x 2= 10Marks)			
11.	Compare Gauss Elimination and Gauss Jordan Methods			CO1- U
12.	Form the divided difference table for the following data			CO2- App

x	2	5	10
y	5	29	109

13.	Using two –point Gaussian quadrature formula find $\int_{-1}^{1}\frac{1}{1+x^2}dx$			CO3- App
14.	Using Euler's method find y(0.1) given $\frac{dy}{dx}$ $=1+ y^2$, y(0) =0			CO4- App
15.	Classify $u_{xx}-2u_{xy}+u_{yy}=0$			CO6- U
	PART – C (5 x 16= 80Marks)			
16.	(a)	(i) Solve the equation $e^x -3x = 0$ by iteration method	CO1-App	(8)
		(ii) Solve x + 2y +z = 8, 2x + 3y +4z = 20, 4x + y + 2z =12 using Gauss Elimination method	CO1-App	(8)
		Or		
	(b)	(i) Using Power method find numerically largest Eigen value and the corresponding Eigen vector of the matrix $\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{pmatrix}$	CO1 -App	(8)
		(ii) Solve 27x + 6y – z = 85, 6x + 15y +2z = 72, x + y + 54z =110	CO1-App	(8)

<table>
<tr><td></td><td></td><td>using Gauss Seidel method</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>17.</td><td>(a)</td><td>Using Lagrange’s interpolation formula calculate f(10) for the following data
<table>
<tr><td>X</td><td>5</td><td>6</td><td>9</td><td>11</td></tr>
<tr><td>Y</td><td>12</td><td>13</td><td>14</td><td>16</td></tr>
</table></td><td>CO2-App</td><td>(8)</td></tr>
<tr><td></td><td></td><td>(ii) Using Newton’s divided difference formula calculate f(3) satisfying the following data:
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>5</td></tr>
<tr><td>y</td><td>2</td><td>3</td><td>12</td><td>147</td></tr>
</table></td><td>CO2- App</td><td>(8)</td></tr>
<tr><td></td><td></td><td>Or</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i) Using Newton’s backward interpolation formula calculate f(4) from the following data :
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>y</td><td>1</td><td>2</td><td>1</td><td>10</td></tr>
</table></td><td>CO2- App</td><td>(8)</td></tr>
<tr><td></td><td></td><td>(ii) Using cubic spline function calculate f(1.5) for the following data
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>y</td><td>-8</td><td>-1</td><td>18</td></tr>
</table></td><td>CO2- App</td><td>(8)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>18.</td><td>(a)</td><td>(i) Compute the first and second derivatives of y at x = 1 from
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>y</td><td>1</td><td>8</td><td>27</td><td>64</td></tr>
</table></td><td>CO3- App</td><td>(8)</td></tr>
</table>

		(ii) Evaluate $\int_0^6 \frac{1}{1+x^2}dx$ with 6 equal intervals by (a) Trapezoidal rule (b) Simpson's $\frac{1}{3}$ rule.	CO3- App	(8)
		Or		
	(b)	(i) Evaluate $\int_0^1 \frac{1}{1+x^2}dx$ using Romberg's method correct to 4 decimal places.	CO3- App	(8)
		(ii) Evaluate $\int_0^1\int_0^1 e^{(x+y)}dxdy$ using Trapezoidal rule by taking h=k=0.5	CO3- App	(8)
19.	(a)	(i) Using Taylor's series method find $y(1.1)$ given $y' = x + y$ with $y(1) = 0$	CO4- App	(8)
		(ii) Given $\frac{dy}{dx}$ =1+ y^2, y(0) =0 , y(0.2) = 0.2027 , y(0.4) =0.4228, y(0.6) = 0.684 evaluate y(0.8) by Milne's Method	CO4- App	(8)
		Or		
	(b)	(i) Using R-K method of fourth order, find $y(0.1)$ for the initial value problem $\frac{dy}{dx} = x + y^2$ with $y(0) = 1$	CO4- App	(8)
		(ii) Using Adam's Bash forth Predictor-Corrector method, find y(4.4) given that $5xy' + y^2 = 2$, $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$ and $y(4.3) = 1.0143$	CO4- App	(8)
20.	(a)	(i) Solve $\frac{\partial^2 u}{\partial x^2} = 2\frac{\partial u}{\partial t}$, u(0,t) = 0 , u(4,t) = 0 , u(x,0) = x(4 - x) . Take h = 1 and find the values of u up to t = 5 using Bender-	CO5- App	(8)

		Schmidt’s difference equation		
		(ii) Using Crank-Nicholson’s difference equation to solve $\frac{\partial^2 u}{\partial x^2} = 16\frac{\partial u}{\partial t}$ u(0,t) = 0 , u(1,t) = 100t , u(x,0) = 0 compute u for one time step function with h=0.25	CO5- App	(8)
		Or		
	(b)	Solve $\nabla^2 \mathbf{u} = \mathbf{-10(x^2 + y^2 + 10)}$ over the square mesh with sides $\mathbf{x = 0, x = 3, y = 0, y = 3}$ with u=0 on the boundary and mesh length 1 unit.	CO5- App	(16)