Q. Code:999856

Reg. No. | | | | | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Third Semester

MA22352 – COMPUTATIONAL METHODS

(Marine Engineering)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Have the fundamental knowledge of solving an algebraic or transcendental equation, linear system of equations.	**3**
CO 2	Appreciate the numerical techniques of interpolation in various intervals.	**3**
CO 3	Apply the numerical techniques of differentiation and integration for engineering problems.	**3**
CO 4	Solve Initial value problems using an appropriate numerical technique.	**3**
CO 5	Solve Boundary value problems using finite difference method.	**3**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Show that the Newton Raphson formula for $\sqrt{N}$ is $x_{n+1}=\frac{1}{2}\left(x_n+\frac{N}{x_n}\right), n=0,1,2,3\ldots$	**1**	**2**
2.	Solve $2x+y=3, 7x-3y=4$ using Gauss Elimination method.	**1**	**2**
3.	Find the largest eigenvalue of $\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$.	**1**	**2**
4.	Solve 5x+4y=15, 3x+7y=12 using Gauss Jordan method.	**1**	**2**
5.	Using Lagrange's formula, fit a polynomial to the following data: X: -1, 1, 2 Y: 7, 5, 15	**2**	**2**
6.	Show that the third order divided difference of $\frac{1}{x}$ for the arguments a, b, c, d is $-\frac{1}{abcd}$.	**2**	**2**
7.	Given f(0) = -2, f(1) = 2 and f(2) = 8. Find the root of the Newton's interpolating polynomial equation f(x) = 0.	**2**	**2**
8.	When is Newton's forward interpolation formula used?	**2**	**2**

9.	Using Simpson's 1/3rd rule, evaluate $\int_0^4 e^x dx$ given $e^0=1, e^1=2.72, e^2=7.39, e^3=20.09, e^4=54.6.$	**3**		**2**
10.	How do you apply the Gaussian quadrature formula if the range is not (-1, 1)?	**3**		**2**
11.	What is the order of the error in the trapezoidal rule and Simpson's 1/3rd rule?	**3**		**2**
12.	While applying Simpson's 1/3rd rule, how many number of subintervals should be there?	**3**		**2**
13.	What is the disadvantage in using the Taylor series method?	**4**		**2**
14.	Using Taylor's series, find y(0.1) correct to 2 decimal places if y(x) satisfies $y' = x+y$, $y(0) =1$.	**4**		**2**
15.	Using Modified Euler's method, compute y (0.1) from $\frac{dy}{dx}=y-\frac{2x}{y}$, y (0) = 1.	**4**		**2**
16.	Given $y'=-y$ and y (0) =1, determine the values of y at x = 0.01 by Euler method.	**4**		**2**
17.	Classify $f_x-f_{yy}=0$.	**5**		**2**
18.	For what value of λ the explicit method of solving the hyperbolic equation $\frac{\partial^2 u}{\partial x^2}=\frac{1}{c^2}\frac{\partial^2 u}{\partial t^2}$ is stable where $\lambda=\frac{c\Delta t}{\Delta x}$?	**5**		**2**
19.	When does the finite difference formula for the solution of the wave equation assume its simplest form?	**5**		**2**
20.	Write down the finite difference form of the equation $\nabla^2 u = f(x, y)$.	**5**		**2**

PART- B (5 x 10 = 50 Marks)

		Marks	CO	RBT LEVEL
21. (a)	Solve using Gaussian elimination method: $x+2y+z=3, 2x+3y+3z=10, 3x-y+2z=13.$	**(10)**	**1**	**3**

(OR)

(b) Using Gauss Jordan method, find the inverse of $\begin{bmatrix} 2 & 6 & 6 \\ 2 & 8 & 6 \\ 2 & 6 & 8 \end{bmatrix}$. **(10) 1 3**

22. (a) The population of a town is given below. Estimate the population increase during the period 1946 to 1976. **(10) 2 3**

Year	1941	1951	1961	1971	1981	1991
Population (in lakhs)	20	24	29	36	46	51

(OR)

(b) Find $f(8)$ and $f(15)$ by Newton's divided difference formula for the following data: **(10) 2 3**

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

23. (a) Find the first two derivatives of $f(x)=(x)^{\frac{1}{3}}$ at x = 50 and x = 56 given in the table below: **(10) 3 3**

x	50	51	52	53	54	55	56
y	3.6840	3.7084	3.7325	3.7563	3.7798	3.8030	3.8259

(OR)

(b) Evaluate $\int_0^2 e^{x^2} dx$ by using Trapezoidal rule by taking 10 number of intervals. **(10) 3 3**

24. (a) Using Taylor's method, Compute y (0.1) and y (0.2) correct to 5 decimal places given $\frac{dy}{dx}=x^2y-1, y(0)=1$. **(10) 4 3**

(OR)

(b) Using Runge-Kutta method of fourth order, find $y(0.8)$ correct to 4 decimal places if $\frac{dy}{dx}=y-x^2 \; given \; y(0.6)=1.7379$. **(10) 4 3**

25. (a) Solve the Poisson equation $\nabla^2 u=-10(x^2+y^2+10)$ over the square mesh with sides $x=0, x=3, y=0, y=3$ given $u=0$ on the boundary and mesh length =1 unit. **(10) 5 3**

(OR)

(b) Solve by Crank-Nicholson implicit finite difference method: **(10) 5 3**

$u_t = u_{xx}$ in $0 < x < 5$, $t \geq 0$ given that u(x,0) = 20, u(0,t) = 0, u(5,t)=100, with h=1 (up to time step)

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Solve using Gauss-Seidel method correct to three decimal places: $10x-5y-2z=3$ $4x-10y+3z=-3$ $x+6y+10z=-3$	**(10)**	1	**3**

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