NUMERICAL METHODS – (MA6459)

FREQUENTLY ASKED QUESTIONS

UNIT-I

SOLUTION OF EQUATIONS AND EIGENVALUES PROBLEMS

PART-A

1. Write down the condition for convergence of Newton-Raphson method for f(x) = 0. (M/J-16)(N/D-14)
2. Find the inverse of $A = \begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Gauss-Jordon method. (M/J-16)(N/D-14)
3. What is the condition for convergence in Fixed point Iteration method? (M/J-16)
4. Name the two methods to solve a system of linear simultaneous equations. (M/J-16)
5. Interpret Newton-Raphson method geometrically. (M/J-15)
6. Which of the iterative methods for solving linear system of equations converge faster? Why? (M/J-15)
7. What is the criterion for the convergence of Newton-Raphson method? (N/D-15)
8. Give two direct methods to solve a system of linear equations. (N/D-15)
9. Derive Newton's algorithm for finding the p^{th} root of a number N, where N>0. (N/D-15)
10. Explain the procedure involved in the Gauss Jordan elimination method. (N/D-15)
11. Derive a formula to find the value of $\sqrt{N}$, where N is a real number, by Newton's method.(N/D-16) (A/M-15)
12. Which of the iteration method for solving linear system of equation converges faster? Why? (N/D-16)
13. Interpret Newton-Raphson method graphically. (A/M-15)
14. Which of the iterative methods for solving linear system of equations converge faster? Why?
15. Write the procedure involved in Gauss Jordan elimination method. (A/M-15)(R-08)
16. Evaluate $\sqrt{15}$ using Newton - Raphson's formula. (M/J-14)
17. Using Gauss elimination method Solve : 5x+4y = 15; 3x+7y = 12. (M/J-14)
18. Solve by Newton's method, correct to 6 decimal places. (N/D-12)
19. Solve for a positive root of $x - \cos x = 0$ by False-position method. (N/D-12)
20. Solve the system of equations x-2y=0; 2x+y=5 by Gaussian elimination method. (M/J-06)

PART-B

UNIT-I

1. Find a root of $xlog_{10}x - 1.2 = 0$ using Newton Raphson method correct to three decimal places. (N/D-16) (Reg-13)
2. Solve by Gauss Seidal method, the following system:
   20x+y-2z=17 , 3x+20y-z=-18 , 2x-3y+20z=25 . (N/D-16) (Reg-13)
3. Find the dominant Eigen values of $A=\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ using the power method.

(N/D-16) (Reg-13)

4. Apply Gauss Jordan method, find the solution of the following system :
   2x-y+3z=8 , -x+2y+z=4 , 3x+y-4z=0 . (N/D-16) (Reg-13)
5. Apply Gauss-Seidal method to solve the system of equations
   20x+y-2z=17; 3x+20y-z=-18; 2x-3y+20z=25. (M/J-16) (Reg-08)
6. Find by Newton-Raphson method a positive root of the equation 3x-cos x-1=0.
   (M/J-16) (Reg-08)
7. Find the numerically largest eigen value of A=$\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$and the corresponding eigen vector.(M/J-16) (Reg-08)
8. Using Gauss-Jordan method to solve 2x-y+3z=8; -x+2y+z=4; 3x+y-4z=0.
   (M/J-16) (Reg-08)
9. Find the approximate root of $xe^x = 3$by Newton's method correct to three decimal places.
   (M/J-16) (Reg-13)
10. Using Gauss-Jordan method solve the given system of equations:
    10x+y+z=12; 2x+10y+z=13; x+y+5z=7. (M/J-16) (Reg-13)
11. Solve the following system of equations using Jacobi's iteration method.
    20x+y-2z=17; 3x+20y-z=-18; 2x-3y+20z=2. (M/J-16) (Reg-13)
12. Using power method find the dominant eigen value and the corresponding eigen vector for the matrix. A=$\begin{bmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{bmatrix}$ (M/J-16) (Reg-13)
13. Solve $e^x - 3x = 0$ by the method of fixed point iteration. (N/D-15)(Reg-08)
14. Solve the following system by Gauss-Seidal iterative procedure :
15. 10x-5y-2z=3; 4x-10y+3z=-3; x+6y+10z=-3 (N/D-15)(Reg-08)
16. Using Gauss-Jordan method, find the inverse of A=$\begin{bmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & -8 \end{bmatrix}$(N/D-15)(Reg-08)
17. Using power method, find all the eigenvalues of A=$\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$(N/D-15)(Reg-08)
18. Find the largest eigenvalue and the corresponding eigenvector of a matrix$\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$
    (N/D-15)(Reg-13)
19. Using Gauss Jordan method find the inverse of a matrix $\begin{bmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{bmatrix}$(N/D-15)(Reg-13)
20. Apply Gauss-Seidal method to solve the equations
    28x+4y-z=32; x+3y+10z=24; 2x+17y+4z=35 (N/D-15)(Reg-13)
21. Find the root of $4x - e^x = 0$ that lies between 2 and 3 by Newton-Raphson method.
    (N/D-15)(Reg-13)

22. Using Newton Raphson method find the real root of $f(x) = 3x + \sin(x) - e^x = 0$ by choosing initial approximation $x_0 = 0.5$ (A/M-15)(Reg-13)
23. Determine the largest eigen value and the corresponding eigen vector of the matrix $A=\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ (A/M-15)(Reg-13)
24. Apply Graeffe's method to find all the roots of the equation $x^3 - 2x^2 - 5x + 6 = 0$ by squaring thrice. (A/M-15)(Reg-13)
25. Solve the following system of equations, starting with the initial vector of [0,0,0] using Gauss-Seidal method. $6x_1 - 2x_2 + x_3 = 11; -2x_1 + 7x_2 + 2x_3 = 5;$ $x_1 + 2x_2 - 5x_3 = -1;$ (A/M-15)(Reg-13)

UNIT-II (PART-A)
INTERPOLATION AND APPROXIMATION

1. State Newton's forward difference formula for equal intervals. (M/J-16)
2. Find the divided differences of $(x) = x^3 - x^2 + 3x + 8$for the arguments 0,1,4,5. (M/J-16)
3. Construct a table of divided difference for the given data: (M/J-16)

X	654	658	659	661
Y	2.8156	2.8182	2.8189	2.8202

4. Write down the Newton's forward difference interpolation formula for equal intervals. (M/J-16)
5. Show that $\Delta\left(\frac{1}{a}\right) = -\frac{1}{abcd}$. (N/D-15) (A/M-15)
6. Derive Newton's forward difference formula by using operator method. (N/D-15)
7. For cubic splines, what are the 4n conditions required to evaluate the unknowns. (N/D-15)
8. Construct the divided difference table for the data (0, 1), (1, 4),(3, 40) and (4, 85). (N/D-15)
9. Given $y_0 = 3, y_1 = 12, y_2 = 81, y_3 = 200, y_4 = 100.$ $Find \Delta^4 y_0$. (N/D-15)
10. Distinguish between Newton divided difference interpolation and Lagrange's interpolation. (N/D-15)
11. Using Lagrange's interpolation formula find y value when x=1 from the following data:

X:	0	-1	2	3
Y:	-8	3	1	12

(N/D-16)

12. State Newton's forward formula and Backward formula. (N/D-16)(N/D-14)
13. Given $y_0 = 3, y_1 = 12, y_2 = 81, y_3 = 200, y_4 = 100$ find $\Delta^4 y_0$. (A/M-15)
14. What are the advantages of cubic spline fitting? (A/M-15)
15. Find the second degree polynomial through the points (0, 2), (2, 1),(1,0) using Lagrange's formula (N/D-14).
16. Find the second divided differences with arguments a,b,c, if f(x) $=\frac{1}{a}$. (M/J-14)
17. Define Cubic Spline. (M/J-14)

18. State Newton divided difference interpolation formula for unequal intervals. (N/D-12)
19. Find the divided difference of $(x) = x^3 + x + 2$ for the arguments 1,3. (N/D-12)
20. Find the divided difference of $(x) = x^2 + x + 2$ for the arguments 1,3,6,11. (N/D-10)
21. Using divided differences, show that $(x, x) = f'(x)$ through the limiting process. (N/D-10)
22. What is a natural cubic spline? (M/J-10)
23. What are then^{th} divided differences of a polynomial of the n^{th}degree? (M/J-10)
24. Define Δ, ∇, E.(M/J-11)
25. Find the sixth term in the sequence 8, 12, 19, 29, 42,… (M/J-11)

UNIT-II (PART-B)

1. Find an approximate polynomial for f(x) using Lagrange's interpolation for the following data: (N/D-16) (Reg-13)

x:	0	1	2	5
y=f(x)	2	3	12	147

2. Find the value of y at x=21 from the data given below : (N/D-16) (Reg-13)

x :	20	23	26	29
y :	0.3420	0.3907	0.4384	0.4848

2. Given the tables: (N/D-16) (Reg-13)

x :	5	7	11	13	17
y=f(x) :	150	392	1452	2366	5202

Evaluate f(9) using Newton's divided difference formula.

3. Fit a cubic spline from the given table : (N/D-16) (Reg-13)

x :	1	2	3
f(x) :	-8	-1	18

Compute y(1.5) and y'(1) using cubic spline.(N/D-16) (Reg-13)

4. From the given table compute the value of $sin\ 38^{\circ}$. (M/J-16)(Reg-13)

x :	0	10	20	30	40
y=sin x	0	0.17365	0.34202	0.5	0.64279

5. Using Lagrange's formula find the value of $log_{10}323.5$ for the given data : (M/J-16)(Reg-13)

x :	321.0	322.8	324.2	325.0
$log_{10}x$	2.50651	2.50893	2.51081	2.51188

6. Find the cubic polynomial from the following table using Newton's divided difference formula and hence find f(4).(M/J-16)(Reg-13)

x :	0	1	2	5
y= f(x)	2	3	12	147

7. Find the cubic splines for the following table :(M/J-16)(Reg-13)

x :	1	2	3
y:	-6	-1	16

Hence evaluate y(1.5) and $y'(2)$.

8. Find the natural cubic spline to fit the data : (M/J-16)(Reg-08)(16)

x :	0	1	2
y:	-1	3	29

Hence find f(0.5) and f(1.5).

9. The following table gives the values of density of saturated water for various temperatures of saturated steam.

Temperature:	100	150	200	250	300
Density :	958	917	865	799	712

Find by interpolation, the density when the temperature is 275° .(M/J-16)(Reg-08)

10. Use Lagrange's formula to find the value of y at x=6 from the following data : (M/J-16)(Reg-08)

x :	3	7	9	10
y= f(x)	168	120	72	63

11. Using Lagrange's interpolation find the interpolated value for the x=3 of the table.

(A/M-15)(Reg-13)

x :	3.2	2.7	1.0	4.8
y= f(x)	22.0	17.8	14.2	38.3

12. The table gives the distance in nautrical miles of the visible horizon for the given heights in feet above the earth's surface.(A/M-15)(Reg-13)

X=height	100	150	200	250	300	350	400
Y=distance	10.63	13.03	15.04	16.81	18.42	19.9	21.27

Find the value of y when x=218 ft using Newton's forward interpolation formula.

13. Employ a third order Newton polynomial to estimate l_{n2} with the four point's given in table.(A/M-15)(Reg-13)

x:	1	4	6	5
y= f(x)	0	1.386294	1.791759	1.609438

14. The following values of x and y are given in table :(A/M-15)(Reg-13)

x :	1	2	3	4
y= f(x)	1	2	5	11

Find the cubic splines and evaluate y(1.5).

15. Using Lagrange's interpolation formula calculate the profit in the year 2000 from the following data:(N/D-15,R-13)

Year	1997	1999	2001	2002
Profit in lakhs	43	65	159	248

16. Using Newton's forward interpolation formula, find the cubic polynomial which takes the following values: (N/D-15,R-13))

x :	0	1	2	3
y= f(x)	1	2	1	10

17. The following values of x and y are given : (N/D-15,R-13)

x :	1	2	3	4
y= f(x)	1	2	5	11

Find the cubic splines and evaluate y(1.5).

18. Find the Lagrange polynomial f(x) satisfying the following data :

x :	1	3	5	7
y= f(x)	24	120	336	720

And hence find f(4). (N/D-15, R-08)

19. From the following table :

x :	1	2	3
y:	-8	-1	18

Compute y(1.5) and $y'(1)$, using cubic spline. (N/D-15, R-08)

20. Using Newton's divided difference formula determine f(3) from the data :

x :	0	1	2	4	5
f(x) :	1	14	15	5	6

21. From the following data, find θ at x=43 and x=84.

x :	40	50	60	70	80	90
f(x):	184	204	226	250	276	304

Also express θinterms of x. (N/D-15, R-08)

UNIT-III (PART-A)
NUMERICAL DIFFERENTIATION AND INTERGRATION

1. Write down the general quadrature formula for equidistance ordinates. (M/J-16)
2. Write down the forward difference formulae to compute the first two derivates at $x = x_0$. (M/J-16)
3. Write down the expression for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$ by Newton's backward difference formula. (M/J-16)
4. Taking h=0.5, evaluate $\int_1^2 \frac{dx}{1+x^2}$ using Trapezoidal rule. (M/J-16)(M/J-14)
5. State two point Gaussian quadrature formula. (N/D-15)(N/D-12)
6. Evaluate $\int_{\frac{1}{2}}^{1} \frac{1}{x} dx$ by Trapezoidal rule, dividing the range into 4 equal parts. (N/D-15)
7. Find y'(0) from the following table.(A/M-15)

x	0	1	2	3	4	5
y	4	8	15	7	6	2

8. Using two point Gaussian quadrature formula evaluate $I = \frac{\pi}{4}\int_{-1}^{1} \sin\frac{\pi t+\pi}{4}$ dt. (N/D-15)
9. Apply two point Gaussian quadrature formula to evaluate $\int_0^2 e^{-x^2} dx$ (N/D-15)
10. Under what condition Simpson's $\frac{3}{8}$ rule can be applied and state the formula. (N/D-15)
11. Compare Trapezoidal rule and Simpson's 1/3 rule for evaluating numerical integration. (N/D-16)
12. Change the limits of $\int_0^{\frac{\pi}{2}} \sin x \, dx$ into $(-1, 1)$ (N/D-16)
13. Distinguish between Newton-divided difference interpolation and Lagrange's interpolation. (A/M-15)
14. What are the errors in Trapezoidal and Simpson's rules of numerical integration. (A/M-15)
15. State three point Gaussian quadrature formula. (A/M-15)
16. State the local error term in Simpson's 1/3 rule. (N/D-14)
17. State Romberg's integration formula to find the value of I= $\int_a^b f(x)dx$ for first two integrals. (N/D-14)
18. Write down the expression for $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = x_n$ by Newton's backward difference formula. (M/J-14)
19. State Trapezoidal rule. (N/D-12)
20. A curve passing through the points (1,0), (2,1) and (4,5) Find the slope of the curve at x=3.

UNIT-III (PART-B)

1. The population of a certain town is shown in the following table.

Year :	1931	1941	1951	1961	1971
Population (in thousands) :	40.6	60.8	79.9	103.6	132.7

Find the rate of growth of the population in the year 1945. (N/D-16) (Reg-13)

2. Evaluate $\int_0^1 \frac{1}{1+x} dx$ using Romberg's method and hence find the value of log 2. (N/D-16) (Reg-13)

3. The velocity V of a particle at a distance S from a point on its path is given by the table. (N/D-16) (Reg-13)

S(ft) :	0	10	20	30	40	50	60
V(ft./sec) :	47	58	64	65	61	52	38

Estimate the time taken to travel 60 feet by using Simpson's 1/3 rule. (N/D-16)

4. Evaluate $\int_1^{1.4} \int_2^{2.4} \frac{1}{xy} dxdy$ using Trapezoidal rule by taking h=k=0.1 and verify with actual integration. (N/D-16) (Reg-13)

5. Find the first and second derivatives of the function tabulated below at x=1.5 (M/J-16)(Reg-13)

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

6. Find the value of log $2^{1/3}$ from $\int_0^1 \frac{x^2}{1+x^3} dx$ using Simpson's 1/3 rule with h=0.25. (M/J-16)(Reg-13)

7. Evaluate $\int_1^2 \frac{1}{1+x^3} dx$ using Gauss 3 point formula. (M/J-16)(Reg-13)

8. Evaluate $\int_0^{\pi/2} \int_{\pi/2}^{\pi} \cos(x+y)\, dxdy$ by using Trapezoidal rule by taking h=k=$\frac{\pi}{4}$ (M/J-16)(Reg-13)

9. Find f'(x) at x=1.5 and x=4.0 from the following data using Newton's formulae for differentiation. (M/J-16) (Reg-08)

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

10. Compute $\int_0^{\pi/2} \sin x \, dx$ using Simpson's 3/8 rule. (M/J-16) (Reg-08)

11. Evaluate $\int_0^2 \int_0^1 4xy \, dx dy$ using Simpson's rule by taking $h=\frac{1}{4}$ and $k=\frac{1}{2}$

12. Find f'(3) and f''(3) for the following data : (N/D-15) (Reg-08)

x:	3.0	3.2	3.4	3.6	3.8	4.0
f(x):	-14	-10.032	-5.296	-.256	6.672	14

13. Evaluate $\int_1^2 \int_3^4 \frac{dx dy}{(x+y)^2}$ taking h=k=0.5 by both Trapezoidal rule and Simpson's rule. (N/D-15) (Reg-08)

14. Evaluate $\int_0^2 \frac{x^2+2x+1}{1+(x+1)^4} dx$ by Gaussian three point formula. (N/D-15) (Reg-08)

15. Using Romberg's method, evaluate $I=\int_0^1 \frac{dx}{1+x}$ correct to three decimal places and hence evaluate the value of $\log_e^2$. (N/D-15) (Reg-08)

16. Using Trapezoidal rule evaluate $\int_0^1 \int_0^1 \frac{dx dy}{x+y+1}$ with h=0.5 along x-direction and k=0.25 along y-direction.(N/D-15)(Reg-13)

17. Find $f'(10)$ from the following data : (N/D-15)(Reg-13)

x:	3	5	11	27	34
y:	-13	23	899	17315	35606

18. Using Romberg's method to evaluate $\int_0^1 \frac{dx}{1+x^2}$ correct to 4 decimal places. (N/D-15)(Reg-13)
Also compute the same integral using three point Gaussian quadrature formula. Comment on the obtained values by comparing with the exact values of the integral which is equal to $\frac{\pi}{4}$. (16M)(N/D-15)(Reg-13)

19. The velocity v (km/min) of a moped which starts from rest, is given at fixed intervals of time t (min) as follows : (A/M-15) (Reg-13)

t:	**0**	**2**	**4**	**6**	**8**	**10**	**12**
v:	**0**	**10**	**18**	**25**	**29**	**32**	**20**

(i) Estimate approximately the distance covered in 12 minutes, by Simpson's 1/3 rule.
(ii) Estimate the acceleration at t=2 seconds.

20. Given that

x:	**1.0**	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**
y:	**7.989**	**8.403**	**8.781**	**9.129**	**9.451**	**9.750**	**10.031**

Find $\frac{dy}{dx}$at x=1.1.(A/M-15) (Reg-13)

21. Use the Romberg method to get an improved estimate of the integral from x=1.8 to x=3.4 from the data in table with h=0.4 (A/M-15) (Reg-13)

x:	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3	3.2	3.4	3.6	3.8
f(x):	4.953	6.050	7.389	9.025	11.023	13.464	16.445	20.056	24.533	29.964	36.598	44.701

UNIT-IV

INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS

PART A

1. Find $(0.1) if \frac{dy}{dx} = 1 + y, y(0) = 1$ using Taylor series method. (M/J-16)
2. State the fourth order Runge-Kutta algorithm . (M/J-16)
3. Write down the improve Euler's formula for first order differential equation. (M/J-16)
4. How many values are needed to use Milne's predictor-corrector formula prior to the required value? (M/J-16)
5. Find by Taylor's series method, the value of y at $x = 0.1$ $from$ $\frac{dy}{dx} = y^2 + x, (0) = 1.$
6. Distinguish between single step methods and multi-step methods. (A/M-2015)
7. Using Euler's method, find y(0.1) given that $\frac{dy}{dx} = x + y$, y(0)=1. (N/D-15)(N/D-14)
8. State Adam's Predictor-Corrector formulae.
9. State the disadvantages of Taylor series method. (N/D-15)(A/M-14)
10. Using Euler's method find y(0.1), given that $\frac{dy}{dx} = x + y$, y(0)=1. (N/D-15)
11. Compare Single-step method and Multi-step method. (N/D-16)
12. Write down the Milne's predictor and corrector formulas. (N/D-16)
13. Using two point Gaussian quadrature formula, evaluate I=$\frac{\pi}{4}\int_{-1}^{1} sin\left(\frac{\pi t+\pi}{4}\right) dt$. (A/M-15)
14. Find the Taylor series method, the value of y at x=0.1 from $\frac{dy}{dx} = y^2 + x, (0) = 1.$ (A/M-15)
15. State the advantages of RK-method over Taylor series method. (A/M-15)
16. Using Euler's method find y(0.2), given that $\frac{dy}{dx} = x + y$, y(0)=1 with h=0.2. (A/M-15)
17. State the Milne's predictor-corrector formula. (N/D-14)(A/M-14)(N/D-12)
18. State modified Euler's method to solve $\frac{dy}{dx} = f(x, y)$ with $y(x_0) = y_0$.(N/D-12)
19. What are the merits and demerits of the Taylors series method of solution? (M/J-11)
20. If $I_1 = 0.775, I_2 = 0.7828$, Find I using Romberg's method. (M/J-11)

UNIT-IV (PART B)

1. Find the value of y at x=0.1 from $\frac{d}{dx} = x^2y - 1, y(0) = 1$ by Taylor's series method. (N/D-16) (Reg-13)
2. Solve $(1 + x)\frac{dy}{dx} = -y^2, \quad y(0) = 1$by Modified Euler's method by choosing h=0.1, find y(0.1) and y(0.2). (N/D-16) (Reg-13)
3. Using Runge-Kutta method of fourth order, solve$\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$, y(0)=1 at x=0.2. (N/D-16) (Reg-13)
4. Given $\frac{d}{dx} = x - y^2, \quad y(0) = 0, \quad y(0.2) = 0.02, \quad y(0.4) = 0.0795$ *and* $(0.6) = 0.1762$.Compute y(0.8) using Milne's method. (N/D-16) (Reg-13)
5. Using Adam's Bash-forth 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.(M/J-16)(Reg-08)
6. Using Taylor's series method, find y at x=1.1 by solving the equation $\frac{dy}{dx} = x^2 + y^2; \quad (1) = 2$ carry out the computations upto fourth order derivative.
7. Using Runge-Kutta method of fourth order, find the value of y at x=0.2, 0.4, 0.6 given $\frac{dy}{dx} = x^3 +$, y(0)=2. Also find the value of y at x=0.8 using Milne's predictor and corrector method. (M/J-16)(Reg-08)
8. Using Taylor's series method, compute the value of y(0.2) correct to 3 decimal places from $\frac{dy}{dx} = 1 - 2xy given that (0) = 0$.(M/J-16)(Reg-13)
9. Using modified Euler's method, find y(0.1) and y(0.2) for the given equation $\frac{dy}{dx} = x^2 + y^2; given that (0) = 1$.(M/J-16)(Reg-13)
10. Find the value of y(1.1) using Runge-Kutta method of 4th order for the given equation $\frac{dy}{dx} = y^2 + xy; (1) = 1$.(M/J-16) (Reg-13)
11. Using Adam's Bashforth method, find y(4.0) given that , $\frac{dy}{dx} = \frac{xy}{2}$, y(0)=1, y(0.1)=1.01, y(0.2)=1.022 and y(0.3)=1.023.(M/J-16)(Reg-13)
12. Find the value of y at x=0.1 from $\frac{dy}{dx} = x^2y - 1$, y(0)=1 by Taylor's series method. (N/D-16)(Reg-13)
13. Solve (1+x)$\frac{dy}{dx} = -y^2$by Modified Euler's method by choosing h=0.1, find y(0.1) and y(0.2). (N/D-16)(Reg-13)
14. Using Runge-Kutta method of fourth order, solve$\frac{dy}{dx} = \frac{y^2-x^2}{y^2+x^2}$, y(0)=1 and x=0.2.
15. Given $\frac{dy}{dx} = x - y^2$, 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(N/D-16)(Reg-13)
16. Using Taylor's series method solve$\frac{dy}{dx} = 1 + xy; \quad y(0) = 2$. Find y(0.1), y(0.2), and y(0.3). (N/D-15)(Reg-08)

17. Using Milne's method, find y(4.4) given that $5xy' + y^2 - 2 = 0$, y(4)=1, y(4.1)=1.0049, y(4.2)=1.0097 and y(4.3)=1.0143.(N/D-15)(Reg-08)
18. Find y(0.8) given that $y' = y - x^2$, y(0.6)=1.7379by using Runge-kutta method of order four. Take h=0.1.(N/D-15)(Reg-08)
19. Given $\frac{dy}{dx} = x^2(1+y)$, y(1)=1, y(1.1)=1.233, y(1.2)=1.548, y(1.3)=1.979, evaluate y(1.4) by Adams-Bashforth method.(N/D-15)(Reg-08)
20. Solve the initial value problem $\frac{dy}{dx} = x - y^2$, y(0)=1to find y(0.4) by Adam's Bashworth predictor corrector method and for starting solutions, use the information below. Y(0.1)=0.9117, y(0.2)= 0.8494. Compute y(0.3) using RungeKutta method of fourth order. (A/M-15)(Reg-13)(16)
21. Employ the classical fourth order Runge-Kutta method to integrate $y' = 4e^{0.8t} - 0.5y$ from t=0 to t=1 using a stepsize of 1 with y(0)=2.(A/M-15)(Reg-13)
    Given $\frac{dy}{dx} = xy + y^2; and(0) = 1$, y(0.1)=1.1169, y(0.2)=1.2773, y(0.3)=0.2267, evaluate y(0.4) by Milne's predictor corrector method. (A/M-15)(Reg-13)
22. Determine the value of y(0.4) using Milne's method given $y' = xy + y^2$, $y(0) = 1$. Use Taylor's series method to get the values of y(0.1), y(0.2) and y(0.3). (N/D-15)(Reg-13)(16)
23. Find y(0.1), y(0.2) and y(0.3) from $y' = x + y^2$, $y(0) = 1$ by using RungeKutta method of fourth order and then find y(0.4) by Adam's method. (N/D-15)(Reg-13)

UNIT-V

BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS

PART-A

1. Obtain the finite difference scheme for the differential equation $2y'' + y = 5$.(M/J-16)(M/J-14)
2. Write Liebmann's iteration process. (M/J-16)
3. Write down the diagonal five point formula in the solution of elliptic equations.(M/J-16)
4. Classify the partial differential equation: $\frac{\partial^2 u}{\partial x^2} - 2\frac{\partial^2 u}{\partial x \partial y} + \frac{\partial^2 u}{\partial y^2} = 0$. (A/M-15)
5. Classify the partial differential equation: $\frac{\partial^2 u}{\partial x^2} + 4\frac{\partial^2 u}{\partial x \partial y} + 4\frac{\partial^2 u}{\partial y^2} - \frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0$.(A/M-15)
6. Express $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ in terms of difference approximation. (A/M-15)
7. Write the finite difference approximations for $y'(x), y''(x)$. (N/D-15) (A/M-15)
8. Write the Crank –Nicholson scheme to solve $u_t = \alpha^2 u_{xx}$. (N/D-15)
9. What is the central difference approximation for y''? (N/D-15)(N/D-14)
10. Write down the difference scheme for solving the equation $u_{tt} = \alpha^2 y_{xx}$. (N/D-15)
11. Classify the following equation $u_{xx} + 4u_{xy} + 4u_{yy} - u_x + 2u_y = 0$. (N/D-16)

12. Write down the standard five point formula. (N/D-16)
13. Distinguish between single step methods and multistep methods. (A/M-15)
14. State standard five point formula. (A/M-15)
15. Write down the standard five- point formula to find the numerical solution of Laplace equation. (N/D-14)
16. State whether the Crank – Nicolson's scheme is an explicit or implicit scheme. Justify. (M/J-14)
17. State diagonal five point formula with relevant diagram. (N/D-12)
18. Classify the PDE $u_{xx} = u$. (N/D-12)
19. State the Schmit formula for solving one dimensional heat equation. (M/J-12)
20. State Liebmann's iteration process formulae. (M/J-12)

UNIT-V PART-B

1. Using Bender Schmidt's method solve $u_t = u_{xx}$subject to the condition, u(0, t)=0, u(1, t)=0, u(x, 0)=sin πx, 0<x<1 and h=0.2. Find the value of u upto t=0.1. (N/D-16) (Reg-13)

2. Evaluate the pivotal values of the equation$u_{tt} = 16u_{xx}$taking h=1 upto t=1.25. The boundary conditions areu(0, t)=u(5,t)=$u_t(x, 0) = 0$ and $u(x, 0) = x^2(5 - x)$. (N/D-16) (Reg-13)

3. By Iteration method solve the elliptic equation $u_{xx} + u_{yy} = 0$ over the square region of side 4, satisfying the boundary conditions u(0, y)=0, 0≤y≤4, u(4, y)=12+y, 0≤y≤4, u(x, 0)=3x, 0≤x≤4, u(x, 4)=x^2, 0≤x≤4. By dividing the square into 16 square meshes of side 1 and always correcting the computed values to two places to decimals. Obtain the values of u at 9 interior pivotal points. (N/D-16) (Reg-13) (16)

4. Solve the Laplace's equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$=0 , at the interior points of the square region given below : (M/J-16)(Reg-13)(16)

0 11.1 17.0 19.7 18.6

0		41		42		43	21.9
0		44		45		46	
		47		48		49	21.0
0							17.0
0	8.7		12.1		12.8	9.0	

5. Given that $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, u(0,t)=0, u(4,t)=0 and u(x,0)=$\frac{x}{3}(16 - x^3)$ Find $u_{ij} : i = 1,2,3,4$ *and* $j = 1,2$ by using Crank-Nicholson method. (M/J-16)(Reg-13)(16)

6. Solve $y'' = x + y$ with the boundary conditions y(0)=y(1)=0. (6) (N/D-15)(Reg-13)

   Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, subject to the conditions u(x,0)=sinπx, 0<x<1 u(0,t)=u(1,t)=0 using Bender Schmidt method. (10) (N/D-15)(Reg-13)(10)

7. Solve the elliptic equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$=0 for the following square mesh with boundary values as shown. (N/D-15)(Reg-13)(16)

	0	500	1000	50	0
1000	u_1	u_2	u_3		1000
2000	u_4	u_5	u_6		2000
1000	u_7	u_8	u_9		1000
500	0				0 500 1000

8. Solve $\nabla^2 u = 8x^2y^2$ over the square x=-2, x=2, y=-2, y=2 with u=0 on the boundary and mesh length=1. (16)(M/J-16)(Reg-08)

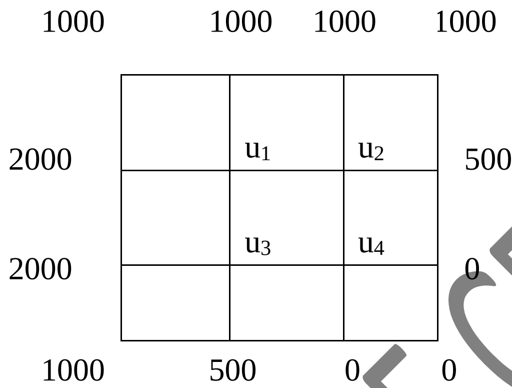
9. Solve $u_{xx} = 32u_t, h = 0.25\ for t \geq 0, 0 < x < 1, u(0,t) = 0, u(x,0) = 0, u(1,t) = t$

   (M/J-16)(Reg-08)

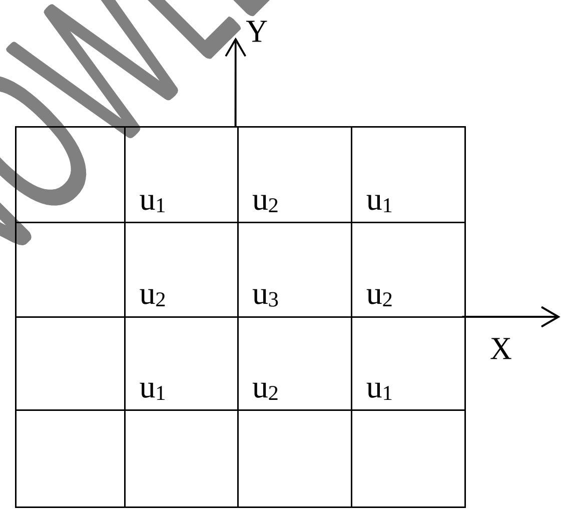
10. Solve $4u_{tt} = u_x\ , u(0,t) = 0, u(4,t) = 0, u(x,0) = x(4-x), u_t(x,0) = 0\ ,$

h=1, upto t=4(M/J-16)(Reg-08)

11. Given the values of u(x, y) on the boundary of the square in fig. evaluate the function u(x,y) satisfying the Laplace equation $\nabla^2 u = 0$ at the pivotal points of this fig. by Gauss Seidel method. (A/M-15)(Reg-13)



12. Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions u(x,0)=sinπx, 0<x<1 u(0,t)=u(1,t)=0 by using Crank-Nicholson method. (A/M-15)(Reg-13) (8)
13. Solve the Poisson's equation $\nabla^2 u = 8x^2y^2$ for the square mesh of fig. with u(x,y)=0 on the boundary and mesh length=1. (16)(A/M-15)(Reg-13)



14. Evaluate the Pivotal values of the equation $u_{tt} = 16u_{xx}$ taking $\Delta x = 1$upto t=1.25. The boundary conditions are u(0,t)=u(5,t)=$u_t(x,0) = 0$ $and u(x,0) = x^2(5-x)$. (A/M-15)(Reg-13)(N/D-16)(Reg-13)

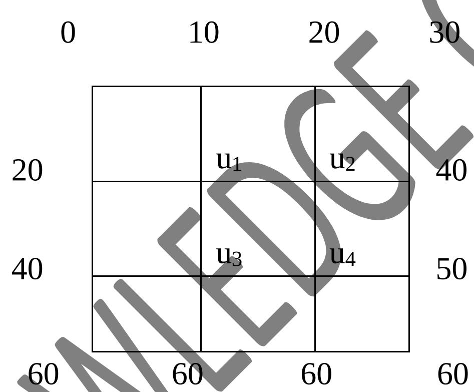
15. Using Bender Schmidt's method solve $u_t = u_{xx}$ subject to the condition, u(0,t)=0, u(1,t)=0,u(x,0)=sinπx, 0<x<1 and h=0.2. Find the value of u upto t=0.1.(A/M-15)(Reg-13)

16. Solve numerically $4u_{tt} = u_{xx}$ with the boundary conditions u(0,t)=0=u(4,t) and the initial conditions $u_t(x, 0) = 0$ and u(x,0)=x(4-x), taking h=1, for 4 time steps.(N/D-15, R-08)

17. Solve $y'' - y = 0$ with y(0)=0, y(1)=1 using finite difference method with h=.2. (N/D-15, R-08)

18. Find the values of the function u(x, t) satisfying the differential equation $4u_{xx} = u_t$ and boundary condition u(0,t)=0=u(8,t) and u(x,0)=$4x - \frac{x^2}{2}$ at the point x=I, x=0,1,2,3,4,5,6,7,8, t=$\frac{1}{8}j$, j=0,1,2,3,4,5. (N/D-15, R-08)

19. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$=0 at the nodal points of the following square grid using the boundary values indicated. (N/D-15, R-08)



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