1. Write sufficient condition for convergence of an iterative method for $f(X)=0$. **(AU –A/M 2010)**

2. Write the procedure to find the numerically smallest eigenvalue of a matrix by power method. **(AU –A/M 2010)**

3. What is Newton's algorithm to solve the equations $X^2=12$ **(AU –N/D 2010)**

4. To what kind of a matrix, can the Jacob's method be applied to obtain the eigenvalues of a matrix? **(AU –N/D 2010)**

5. What is the criterion for the convergence in Newton's method? **(AU –A/M 2011), (NOV/DEC 2015)**

6. By Gauss elimination method solve $X+Y=2, \quad 2X+3Y=5$ **(AU –A/M 2011)**

7. Solve $e^X-3X=0$ by the method of iteration. **(AU N/D 2011)**

8. Using Newton's method, find the root between 0 and 1 of $X^3=6X-4$ **(AU N/D 2011)**

9. Staten the order of convergence and the criterion for the convergence in Newton's method. **(AU –A/M 2012)**

10. Give two direct methods to solve a system of linear equation. **(AU –A/M 2012) (NOV/DEC 2015)**

11. Arrive a formula, to find the value of $\sqrt[4]{N}$, where $N \neq 0$, using Newton's method. **(AU –A/M 2012)(cse)**

12. Using Gauss Jordan method find the inverse of the matrix $\begin{pmatrix} 1 & 2 \\ 2 & 3 \end{pmatrix}$ **(AU –A/M 2012)(cse)**

13. Write down the order of convergence and the condition for convergence of fixed point iteration method. **(AU –N/D 2012)**

14. What are the advantages of iterative methods over direct methods for solving a system of linear equations? **(AU –N/D 2012)**

15. Find an iterative formula to find the reciprocal of a given number N $(N \neq 0)$. **(AU –M/J 2013)**

16. What is the use power method? **(AU –M/J 2013)**

17. Evaluate $\sqrt{15}$ using Newton's –Raphson's formula. **(AU –M/J 2014)**

18. Using Gauss elimination method solve : $5x+4y=15, 3x+7y=12$. **(AU –M/J 2014)**

19. Write down the condition for convergence of Newton-Raphson method for $f(X)=0$ **(AU –N/D 2014)**

20. Find the inverse of $A=\begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ by Gauss- Jordan method. **(AU –N/D 2014)**

21. State a sufficient cor

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22. Compare Gaussian elimination method & Gauss-Jordan method.
23. Compare Gauss Jacobi methods and Gauss Seidel methods
24. What type of Eigen value can be obtained using power method?
25. When the iteration method will be useful?
26. Gauss-seidel method is better than Gauss-Jacobi method. Why?
27. What type of Eigen value can be obtained using power method?
28. Locate the negative root of $x^3 - 2x + 5 = 0$, approximately.
29. List any two direct methods in Numerical methods.
30. Evaluate $\sqrt{12}$ applying Newton formula.
31. When Gauss-Elimination method fails?
32. How will you find the smallest Eigen value of a square matrix A?
33. What is the order of convergence for fixed point iteration?
34. What are the elementary transforms?
35. As soon as a new value for a variable is found by iteration it is used immediately in the following equations.
36. Derive Newton's algorithm for finding the p^{th} root of a number N.
37. Why Gauss-Seidel iteration is a method of successive corrections?
38. Determine the largest Eigen value of the matrix $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ correct to 2 decimal places using power method.
39. Are the first iteration values same if the equations $4x + y = 8$ and $2x + 3y = 7$ are solved by Gauss-seidel and Jacobi methods
40. State two differences between direct and iterative methods for solving System of equations.
41. Interpret Newton-Raphson method geometrically **(APR/MAY 2015)**
42. Which of the iterative methods for solving linear system of equations converge faster? Why? **(APR/MAY 2015)**

PART B

1. Solve for a positive root of the equation $X^4 - X - 10 = 0$ using Newton-Raphson method. **(8m) (AU A/M 2010)**
2. Use Gauss-Seidal iterative method to obtain the solution of the equations $9X - Y + 2Z = 9$; $X + 10Y - 2Z = 15$; $2X - 2Y - 13Z = -17$.

   (8m) (AU –A/M 2010)
3. Find the inverse of the matrix by Gauss-Jordan method. $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$

   (8m) (AU A/M 2010)
4. Find the dominant eigenvalue and the corresponding Eigenvector of the matrix .

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$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

5. Find, by power method , the largest eigenvalue and the corresponding eigenvector of a matrix $A = \begin{bmatrix} 1 & 3 & -1 \\ 3 & 2 & 4 \\ -1 & 4 & 10 \end{bmatrix}$ with initial vector $(1 \quad 1 \quad 1)^T$ **(8m) (AU –N/D 2010)**

6. Solve the given system of equations by using Gauss-Seidal iteration method . **(8m) (AU M/J 2014) (AU–N/D 2010) (AU- M/J 2012)**

$$20x + y - 2z = 17,$$
$$3x + 20y - z = -18,$$
$$2x - 3y + 20z = 25.$$

7. Find the inverse of $A = \begin{bmatrix} 4 & 1 & 2 \\ 2 & 3 & -1 \\ 1 & -2 & 2 \end{bmatrix}$ by using Gauss-Jordan Methd. **(8m) (AU –N/D 2010) (AU M/J 2013) (NOV/DEC2015)**

8. Find the smallest positive root of $3x = \sqrt{1 + \sin x}$ correct to three decimal places by iterative method. **(8m) (AU –N/D 2010)**

9. Find the approximate root of $xe^x = 3$ by Newton's method correct to 3 decimal places. **(8m) (AU –A/M 2011)**

10. Apply Gauss-Jordan method to solve the following system of equations $x + y + z = 9, 2x - 3y + 4z = 13, 3x + 4y + 5z = 40.$ **(8m) (AU –A/M 2011)**

11. Solve the following system by Gauss-Seidal method, $x + y + 54z = 110,\ 27x + 6y - z = 85,\ 6x + 15y + 2z = 72.$ **(8m) (AU –A/M 2011)**

12. Using Jacobi's method, find the eigenvalues and eigenvectors for the given matrix $\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}$ **(8m) (AU –A/M 2011)**

13. Using Gauss,Jordan method, find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & 4 \end{bmatrix}$ **(8m) (AU- M/J 2012)**

14. Solve $e^x - 3x = 0$ by the method of fixed point iteration. **(8m) (AU-M/J 2012)**

15. Detemine the largest eigen value and the corresponding eigenvector of the matri[x] $\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \end{bmatrix}$

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16. Solve the equation $x\sin x+\cos x=0$ using Newton-raphson method.

(8m) (AU –M/J 2012)

17. Solve by Gauss- Seidal iterative procedure the system $8x-3y+2z=20,\ 6x+3y+12z=35,\ 4x+11y-z=33$.

(8m) (AU –M/J 2012)

18. Find a real root of the equation $x^3+x^2-1=0$ by iteration method.

(8m) (AU –M/J 2012)

19. Using power method , find the largest eigenvalue and the corresponding eigen vector of the matrix $\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$

(8m) (AU –M/J 2012) (NOV/DEC 2015)

20. Find the Newton's iterative formula to calculate the reciprocal of N and hence find the value of 1/23. **(8m) (AU –N/D 2012)**

21. Using Gauss-jordan mehod, find the inverse of the matix $\begin{bmatrix} 1 & 2 & 6 \\ 2 & 5 & 15 \\ 6 & 15 & 46 \end{bmatrix}$. **(8m) (AU –N/D 2012)**

22. Solve by Gauss- Seidal iterative procedure the system $10x+2y+z=9,\ x+10y-z=-22,\ -2x+3y+10z=22$.

(8m)(AU N/D 2012)

23. Find all the eigenvalues and eigenvectors of the matrix $\begin{bmatrix} 1 & \sqrt{2} & 2 \\ \sqrt{2} & 3 & \sqrt{2} \\ 1 & \sqrt{2} & 1 \end{bmatrix}$ using Jacobi's method. **(8m)(AU –N/D 2012)**

24. Find the positive root of the equation $\cos x-3x+1=0$ by using iterative method.**(8m) (AU M/J 2013)(AU N/D 2014)**

25. Solve by Gauss- Seidal iterative procedure the system $27x+6y-z=85, 6x+15y+2z=72, x+y+54z=110$. **(8m) (AU M/J 2013)**

26. Using Jacobi method find the all eigen values and their corresponding eigen vectors of the matrix $\begin{bmatrix} 2 & 3 \\ 3 & 2 \end{bmatrix}$ **(8m) (AU M/J 2013)**

27. Find the numerically largest eigenvalue of $A=\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ and corresponding eigenvector. **(8m) (AU M/J 2014,AU N/D 2014)**

28. Using Gauss-Jordan method, find the inverse of $\begin{bmatrix} 2 & 2 & 6 \\ 2 & 6 & -6 \\ 4 & -8 & 8 \end{bmatrix}$

(8m) (AU M/J 2014)

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29. Solve the system of equations by Gauss-Jordan method: $5x - y = 9; -x + 5y - z = 4; -y + 5z = -6$ **(8m) (AU M/J 2014)**

30. Using Gauss-Seidel method ,solve the following system of linear equations $4x + 2y + z = 14; x + 5y - z = 10;\ x + y = 8z = 20.$

(8m) (AU M/J 2014)

31. Using Gauss-Jordan method to solve $2x - y + 3z = 8; -x + 2y + z = 4; 3x + y - 4z = 0$

(8m AU N/D 2014)

32. Apply Gauss-seidal method to solve the equations

$28x+4y-z = 32$; $x+3y+10z = 24$;$2x+17y+4z = 35$ **(8m, AU N/D 2015)**

33. Find the root of $4x - e^x = 0$ that lies between 2 and 3 by Newton Raphson method. **(8m, AU N/D 2015)**

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PART-A

1. Form the divided difference table for the data $(0,1),(1,4),(3,40)$ *and* $(4,85)$ **(AU-APR/MAY-2010)(N/D 2015).**
2. Define a cubic spline S(x) which is commonly used for interpolation. **(AU-APR/MAY-2010)**
3. When to use Newton's forward interpolation and when to use Newton's backward interpolation? **(AU-NOV/DEC-2010)**
4. Find the first and second divided differences with arguments a,b,c of the function $f(x)=\frac{1}{x}$ **(AU-NOV/DEC-2010)(AU MAY/JUNE 2014)**
5. Find the divided differences of $f(x)=x^3+x+2$ for the arguments 1,3,6,11. **AU-APR/MAY-2011)**
6. Prove that $\Delta \log(f(x))=\log\left[1+\frac{\Delta f(x)}{f(x)}\right]$ **(AU-APR/MAY-2011)**
7. State Lagrange's interpolation formula for unequal intervals. **(AU-NOV/DEC-2011)**
8. Define cubic spline function.**(AU-NOV/DEC-2011),(AU-NOV/DEC-2012) (AU MAY/JUNE 2014)**
9. For cubic splines, what are the 4n conditions required to evaluate the unknowns. **(AU-APR/MAY -2012) (N/D2015)**
10. Construct the divided difference table for the following data:

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

(AU-APR/MAY -2012)

11. State any two properties of divided differences. **(AU-APR/MAY-2012)(CSE)**
12. Evaluate $\int_{1/2}^{1} \frac{1}{x}\,dx$ by Trapezoidal rule, dividing the range into 4 equal parts. **(AU-APR/MAY-2012)(CSE)**
13. State Newton's backward difference formula. **(AU-NOV/DEC-2012)**
14. Find the second degree polynomial through the point $(0,2),(2,1),(1,0)$ using Lagrange's formula. **(AU-NOV/DEC-2014)**
15. State Newton's backward formula for interpolation. **(AU-NOV/DEC-2014)**
16. What do you meant by interpolation?
17. Find the divided difference of for the arguments 1,3,6,11. **(A.U CBT N/D 2010,A/M 2011)**
18. Given $y_0=2, y_1=4, y_2=8, y_4=32$, find $y_3=?$
19. Write divided difference table for:

X:	0	1	2	4
y:	443	384	397	467

20. Find the divided difference table for the following:

x	0	1	4	5
f(x)	8	11	78	123

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21. What are the nth divided differences of a polynomial of the nth degree? **(AU N/D 2007)**

22. Using Newton backward difference write the formula for first and second order derivatives at the end value $x = x_n$ up to third order. **(A.U CBT N\D 2010) (A.U CBT N\D 2011)**
23. What is the error in Newton's forward interpolation formula.

(A.U M/J 2010)

24. When will you use Newton's backward interpolation formula?
25. What is the relation between divided differences and forward?
26. Write second divided difference of f(x) for three arguments x0, x1, x2.
27. Give the relations betweenthe divided differences and backward differences.

28. Numerical differentiation can be used only when the differences of some order.......
29. What advantage has Lagrange's formula over Newton?
30. What is inverse interpolation? **(AU N/D 2007)**
31. Use Lagrage's formula ,to find the quadratic polynomial that takes these values. **(AU N/D 2005)**

x :	0	1	3
f(x):	0	1	0

Then find y(2).

32. What do you mean by interpolation? **(AU N/D 2006)**
33. Find the polynomial which takes the following values:

x :	0	1	2
f(x):	1	2	1

34. Using Lagrange's interpolation , find the polynomial through(0,0), (1,1), and (2,2). **(AU M/J 2007)**
35. If $f(x)=1/x^2$ find f(a,b) and f(a,b,c) by using divided differences.

(AU M/J 2007)

36. Show that the divided differences are symmetrical in their arguments. **(AU M/J 2007)**
37. Define natural spline.
38. Find a polynomial for the following data by Newton's back ward difference formula.

x :	0	1	2	3
f(x):	-3	2	9	18

39. Newton's forward interpolation formula used only for........... intervals.
40. If y(x)=y, i=0,1,...n write down the formula for the cubic spline polynomial y(x), valid in $x_{i-1}<x<x_i$
41. Given $y_o = 3, y_1 = 12, y_2 = 81, y_3 = 200, y_3 = 100$. Find $\Delta^4 y_0$

(AU A/M 2015)

42. Distinguish between Newton divided difference interpolation and Lagrange,s interpolation. **(AU A/M 2015)**

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PART-B

1. Use Legrang's formula to find a polynomial which takes the values $f(0)=-12, f(1)=0, f(3)=6$ *and* $f(4)=12$. Hence find $f(2)$. **(8m) (AU-APR/MAY-2010)**

2. Find the function $f(x)$ from the following table using Newton's divided difference formula;Also find $f(6)$. **(8m) (AU- APR/MAY-2010)**

$x:$	0	1	2	4	5	7
$f(x):$	0	0	-12	0	600	7308

3. If $f(0)=1, f(1)=2, f(2)=33$ *and* $f(3)=244$. find a cubic spline approximation, assuming $M(0)=M(3)=0$. Also find $f(2.5)$. **(8m) (AU-APR/MAY-2010)**

4. Given the following table, find the number of students whose weight is between 60 and 70 Ibs. **(8m) (AU-APR/MAY2010)**

Weight (in Ibs):	0-40	40-60	60-80	80-100	100-120
Number of students:	250	120	100	70	50

5. Use Lagrange's interpolation formula to fit a polynomial to the given data $f(-1)=-8, f(0)=3, f(2)=1$ *and* $f(3)=12$. Hence find the of $f(1)$. **(8m) (AU-NOV/DEC-2010)**

6. Find the value of $\tan 45°15'$ by using Newton's forward difference interpolation formula for**(8m) (AU-NOV/DEC-2010)**

$x°$	45	46	47	48	49	50
$\tan x°$	1	1.03553	1.0723	1.1106	1.1503	1.9175

7. Find the natural cubic spline approximation for the function $f(x)$ defined by the following data **(16m) ((AU-NOV/DEC-2010)**

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

Hence find the value of $f(2.5)$ *and* $f'(2.5)$

8. Find the expression of $f(x)$ using Lagrange's formula for the following data: **(8m) (AU-APR/MAY-2011)**

$x:$	0	1	4	5
$f(x):$	4	3	24	39

9. Find the cubic spline ap

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from the following data, given that $y_0'' = y_3'' = 0$

(8m) (AU-APR/MAY-2011) (AU N/D 2014)

$x:$	-1	0	1	2
$y:$	-1	1	3	35

10. Find the value of x when y=20 using lagrange's formula from the following table: **(8m) (AU-APR/MAY-2011)**

$x:$	1	2	3	4
$f(x):$	1	8	27	64

11. Given the tables: **(8m) (AU-APR/MAY-2011)**

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

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

12. The population of a town is as follows:

(16m) (AU-NOV/DEC 2011)

x year :	1941	1951	1961	1971	1981	1991
y :Population in thousands	20	24	29	36	46	51

Estimate the population increase during the period 1946 to 1976 .

13. Determine $f(x)$ is a polynomial in x for the following data using Newton's divided difference formula. Also find $f(2)$.

(16m) (AU- NOV/DEC -2011)

$x:$	-4	-1	0	2	5
$f(x):$	1245	35	5	9	1335

14. Find the cubic polynomial which takes the following values . **(8m) (AU-APR/MAY -2012)**

$x:$	0	1	2	3
$y:$	1	2	1	10

15. Derive Newton's backward difference formula by using operator method. **(8m) (AU-APR/MAY -2012)**

16. The followins values of x and y are given

(8m) (AU-APR/MAY -2012)

$x:$	1	2	3	4
$y:$	1	2	5	11

17. Using Lagrange's interpolation, calculate the profit in the year 2000 from the following data: **(8m) (AU-APR/MAY -2012) (AU N/D 2015)**

x year :	1997	1999	2001	2002
Profit in lakhs of Rs:	43	65	159	248

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18. Using Lagrange's interpolation formula find the values of y when $x = 10$, if the values of x and y are given as below:

(8m) (AU-APR/MAY-2012)(CSE)

$x:$	5	6	9	11
$y:$	12	13	14	16

19. From the following table:

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

Compute $y\ (1.5)\ and\ y'(1)$ using cubic spline.

(8m) (AU-APR/MAY-2012)(CSE)(AU M/J 2013)

20. Using Newton's divided differences formula determine f(3) from the data: **(8m) (AU-APR/MAY-2012)(CSE)**

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

21. Using Newton's divided difference formula, find f(x) from the following data and hence find f(4). **(8m) (AU-NOV/DEC-2012)**

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

22. Find the values of y when $x = 5$ using Newton's interpolation formula from the following table: **(8m) (AU-NOV/DEC-2012)**

$x:$	4	6	8	10
$y:$	1	3	8	16

23. Use Lagrange's method to find $\log_{10} 656$ give that $\log_{10} 654 = 2.8156$ $\log_{10} 658 = 2.8182$ $\log_{10} 659 = 2.8189$ *and* $\log_{10} 661 = 2.8202$ **(8m) (AU-NOV/DEC-2012)**

24. Obtain the cubic spline for the following data to find $y\ (0.5)$

(8m) (AU-NOV/DEC-2012)

$x:$	-1	0	1	2
$y:$	-1	1	3	35

25. Find f(3) by Newton's divided difference formula for the following data **(8m) (AU MAY/JUNE 2014)**

$x:$	-4	-1	0	2	5
$y:$	1245	33	5	9	1335

26. Using Lagrange's interpolation formula, find f(2) from the following data: $y\ (0) =$

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(8m) (AU MAY/JUNE 2014)

27. Fit the cubic splines for the following data **(16m) (AU MAY/JUNE 2014)**

x :	1	2	3	4	5
y :	1	0	1	0	1

28. Using Newton's forward interpolation formula, find the cubic polynomial which takes the following value:
(8m) (AU-NOV/DEC- 2014)(AU M/J 2013) .(AU N/D 2015)

x :	0	1	2	3
$f(x)$:	1	2	1	10

29. By using Newton's divided diference formula find f(8), given
(8m) (AU-NOV/DEC-2014)

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

30. Find the polynomial f(x) by using Lagrange's formula and hence find f(3) for the following values of x and y
(8m) (AU-NOV/DEC-2014)

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

31.Use Newton's divided difference formula to find f(x)from following data
(8m) (AU MAY/JUNE 2013)

x :	1	2	7	8
$f(x)$:	1	5	5	4

31. Using Lagrange's interpolation find the interpolated value for x = 3 of the table.**(8m AU A/M 2015)**

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

32. The table gives the distance in nautical miles of the visible horizon for the given heights in feet above the earth's surface. **(8m AU A/M 2015)**

x	100	150	200	250	300	350	400
y	10.63	13.03	15.04	16.81	18.42	19.9	21.27

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

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33. Employ a third order Newton polynomial to estimate l_{n2} with the four points given in table.**(8m, AU A/M 2015)**

X	1	4	6	5
F(X)	0	1.386294	1.791759	1.609438

34. The following values of x and y are given in table:

X	1	2	3	4
y	1	2	5	11

Find the cubic splines and evaluate y(1.5)

(16m, AU N/D 2015) (8m, AU A/M 2015)

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PART-A

1. State the Romberg's integration formula with h_1 and h_2 Furthere obtain the formula when $h_1 = h \ and \ h_2 = \frac{h}{2}$. **(AU- APR/MAY 2010)**
2. Use two-point Gaussain quadrature formula to solve $\int_{-1}^{1} \frac{dx}{1+x^2}$ **(AU-APR/MAY 2010)**
3. Write down the formula for finding the first derivative using Newton's forward difference at $X = X_0$ and Newton's backward difference at $X = X_0$ **(AU- NOV/DDEC 2010)**
4. Evaluate $\int_0^2 e^{-x^2}\, dx$ by two point Gaussain quadrature formula. **(AU-NOV/DDEC 2010)**
5. Write down the Newton-cote's formula for the equidistant ordinates. **(AU-MAY/JUNE 2011)**
6. When do you apply Simpson's 1/3 rule ,and what is the order of the error in Simpson's 1/3 rule. **(AU- MAY/JUNE 2011)**
7. State Simpson's one-third rule.**(AU -MAY/JUNE 2013)(AU-NOV/DEC 2011)**
8. Write down two point Gaussain quadrature formula. **(AU-NOV/DEC 2011)**

   Under what condition, Simpson's 3/8 rule can applied and state the formula. **(AU-MAY/JUNE 2012) (AU N/D 2015)**

9. Apply two point Gaussain quadrature formula to evaluate $\int_{-1}^{1} \frac{dx}{1+x^2}$ **(AU-MAY/JUNE 2012)**
10. Evaluate $\int_{1/2}^{1} \frac{1}{x} dx$ by Trapezoidal rule, dividing the range into 4 equal parts. **(AU-MAY/JUNE 2012)**
11. State three point Gaussain quadrature formula**. (AU-MAY/JUNE 2012)**
12. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule**. (AU-NOV/DEC 2012)**
13. Write down the three point Gaussain quadrature formula to evaluate $\int_{-1}^{1} f(x)\, dx.$ **(AU-NOV/DEC 2012)**
14. Evaluate $\int_0^{\pi} \sin x\, dx$ by Trapezoidal rule by dividing ten equal parts. **(AU-MAY/JUNE 2013)**
15. Write down the expression for $\frac{dx}{dy} \ and \ \frac{d^2y}{d^2x} \ at \ x = x_n$ and by Newton's backward difference formula, **(AU-MAY/JUNE 2014)**
16. Taking $h = 0.5$, evaluate $\int_1^2 \frac{dx}{1+x^2}$ using Trapezoidal rule,**(AU-MAY/JUNE 2014)**
17. State the local error term in Simpson's 1/3 rule . **(AU-NOV/DEC 2012)**
18. State Romberg's integration formula to find the value of $\int_a^b f(x)dx$ for first two intervals. **(AU N/D 2014)**

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19. What is the order of error in Trapezoidal rule. (A.U CBT N\D 2010,CBT A\M 2011)
20. What is the order of error in Simpson's rule.
21. Why is Trapezoidal rule so called?
22. State Simpson's 3/8 rule. (A.U CBT M\J 2010, A.U N\D 2010 CBT A\M 2011)
23. State the local error term in Simpson's one third rule.
24. How the accuracy can be increased in trapezoidal rule of evaluating a given definite integral?
25. What is the local error term in Trapezoidal formula?
26. Find $\int_{-1}^{1}(3x^2+5x^4)dx$ by Gauss-two point formula.**(AU N/D 2010)**
27. State the Trapezoidal rule to evaluate $\int_a^b f(x)dx$ **(AU N/D 2010)**
28. When does Simpson's rule give exact result?**(AU M/J 2006)**
29. What are the error in Trapezoidal and Simpson's rules of numerically integration?**(AU A/M 2003)**
30. Using Trapezoidal rule evaluate $\int_0^{\pi}\sin x\, dx$ by dividing the range into 6 equal parts.**(AU N/D 2004)**
31. Write down the Trapezoidal rule to evaluate $\int_0^6 f(x)dx$ with $h=0.5$ **(AU A/M 2005)**
32. Compare Trapezoidal rule and Simpson's 1/3 rule for evaluating numerically integration.**(AU M/J 2007)**
33. Evaluate $I=\int_0^1 \frac{dt}{1+t}$ by Gaussain formula with two points.**(AU N/D 2007)**
34. If the range is not (-1,1) what is the idea to solve the Gaussain quadrature problems.
35. Apply Gauss two point formula to evaluate $\int_1^2 \frac{2\,dx}{1+x^4}$ **(AU M/J 2011)**
36. State Trapezoidal rule for evaluating $\int_a^b\int_c^d f(x,y)\ dx\ dy$ **(AU M/J 2011)**
37. State Simpson's rule for evaluating $\int_a^b\int_c^d f(x,y)\ dx\ dy$
38. Evaluate $\int_{-1}^{1} e^{-x^2}\cos x\,dx$ Gauss two point quadrature. **(AU M/J 2011)**
39. Define quadrature.
40. Apply two point Gaussian quadrature formula to evaluate $\int_0^2 e^{-x^2}\,dx$ **(AU N/D 2015)**

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PART-B

1. Given the following data, find y'(6) and the maximum value of y(if it exists). **(8m) (AU- APR/MAY 2010)**

x:	0	2	3	4	7	9
Y	4	26	58	112	466	922

2. Evaluate : $\int_1^{1.2}\int_1^{1.4} \frac{dx\,dy}{x+y}$ by trapezoidal formula by taking $h = k = 0.1$ **(8m) (AU- APR/MAY 2010)**

3. Use Romberg's integration to evaluate : $\int_0^1 \frac{dx}{1+x^2}$ **(8m) (AU- APR/MAY 2010)(2011)**

4. The velocity v of a particle at a distance S from a point on Its path is given by the table below: **(8m) (AU APR/MAY 2010)(AU NOV/DCE 2014)**

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

6. From the following table of values of x *and* y, obtain y'(x) and y''(x) for x=16. **(8m) (AU- NOV/DEC 2010)**

x:	15	17	19	21	23	25
Y:	3.873	4.123	4.359	4.583	4.796	5

7. Using Romberg's rule evaluate $\int_0^1 \frac{dx}{1+x}$ correct to three decimal places by taking $h = 0.5,\ 0.25,\ and\ 0.125.$ **(8m) (AU- NOV/DEC 2010)**

8. Find the first derivatives of f(x) at x=2 for the data f(-1)=-21,f(1)=15, f(2)=12 and f(3)=3, using Newton's divided difference formula. **(8m) (AU- NOV/DEC 2010)**

9. Evaluate $\int_1^5\left[\int_1^4 \frac{1}{x+y}\,dx\right]dy$ by Trapezodial rule in x- direction with $h = 1$ and Simpson's one-thrid rule in y-direction with $k = 1$ **(8m) (AU- NOV/DEC 2010)**

10. Find f '(10) from the following data : **(8m) (AU- APR/MAY 2011) (AU N/D 2015)**

x:	3	5	11	27	34
F(x):	-13	23	899	17315	35606

11. Evaluate $\int_1^2 \frac{dx}{1+x^3}$ using Gauss three point formula. **(8m) (AU- APR/MAY 2011)(NOV/DEC 2014)**

12. Evaluate $\int_0^1\int_0^1 \frac{1}{x+y+1}\,dx\,dy$ by using Trapezoidal rule

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taking $h = 0.5$ *and* $k = 0.25$ **(8m) (AU- APR/MAY 2011)(AU NOV/DEC 2014) (AU N/D 2015)**

13. Find the first two derivatives of $(x)^{1/3}$ *at* $x = 50$ and $x = 56$

for the given table : **(16m) (AU- NOV/DEC 2011)**

X:	50	51	52	53	54	55	56
$y = (x)^{1/3}$:	3.6	3.7	3.73	3.75	3.77	3.80	3.82

14. Evaluate $I = \int_0^6 \frac{dx}{1+x}$ by using (i) direct integration

(ii) Trapezoidal rule (ii) Simpson's one-thrid rule

(iii) Simpson's three-eight rule.

(16m) (AU- NOV/DEC 2011)

15. Using Trapezoidal rule, evaluate $\int_1^2 \int_1^2 \frac{1}{x^2 + y^2}\, dx\, dy$ numerically with

$h = 0.2$ along x-direction and $k = 0.25$ along y-direction.

(8m) (AU- APR/MAY 2012)

16. A slider in a machine moves along a fixed straight rod.Its distance x cm along the rod is given below for various values of the time 't' seconds.Find the velocity of the slider when t=1.1 second. **(8m) (AU- APR/MAY 2012)(APR/MAY 2014)(8m, A/M 2015)**

t:	1.0	1.1	1.2	1.3	1.4	1.5	1.6
X:	7.989	8.403	8.781	9.129	9.451	9.750	10.031

17. Use Romberg's to computecorrect to 4 decimal places. Also evaluate the same integral using three-point Gaussain quadrature formula, Comment on the obtained values by comparing with the exact value of the integral which is equal to $\frac{\pi}{4}$.

(16m) (AU- APR/MAY 2012)

18. Evaluate $\int_0^{1/2} \int_0^{1/2} \frac{\sin(xy)}{1+xy}\, dx\, dy$ using Simpson's rule with

$h = 1/4 = k$ **(8m) (AU- APR/MAY 2012) (APR/MAY 2014)**

19. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Romberg's method correct to 4 decimal

Places. Hence deduce an approximate value for π

(8m) (AU- APR/MAY 2012)

20. Use Gaussain three-point formula and evaluate $\int_1^5 \frac{dx}{x}$

(8m) (AU- APR/MAY 2012)

21. Find f '(x) at x=1.5 and x-4.0 from the following data using

Newton's formulae for differentiation. **(8m) (AU- NOV/DEC 2012)**

(8m)(AU-MAY/JUNE 2013)

X:	1.5	2.0	2.5	3.0	3.5	4.0
Y:	3.375	7.0	[illegible]	[illegible]	[illegible]	[illegible]

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22. Compute $\int_0^{\pi/2} \sin x \, dx$ using Simpson's 3/8 rule. **(8m (AU- NOV/DEC 2012)**

23. Evaluate $\int_0^2 \int_0^1 4\, xy \, dx\, dy$ using Simpson's rule by taking $h = 1/4$ *and* $k = 1/2$ **(16m) (AU- NOV/DEC 2012)**

24. Evaluate $\int_0^2 \frac{x^2 + 2x + 1}{1 + (1+x)^2} \, dx$ by Gaussain three-point formula . **(8m)(AU-MAY/JUNE 2013)**

25. Using Trapezoidal rule, evaluate $\int_{-1}^{1} \frac{dx}{1+x^2}$ by taking eight equal interval. **(8m)(AU-MAY/JUNE 2013)**

26. Evaluate $\int_1^{1.4} \int_2^{2.4} \frac{1}{xy} \, dx \, dy$ using Simpson's 1/3 rule. **(8m)(AU-MAY/JUNE 2013)**

27. Evaluate $\int_0^{1/2} \frac{x}{\sin x} \, dx$ correct to three decimal places using Romberg's method. **(8m) (AU- APR/MAY 2014)**

28. Taking h=0.05, evaluate $\int_1^{1.3} \sqrt{x} \, dx$ using Trapezoidal rule and Simpson'se-eight rule. **(8m) (AU- APR/MAY 2012)**

29. Evaluate $\int_0^1 \frac{dx}{1+x}$ and correct to 3 decimal places using Rombер's method and hence find the value of $\log_e 2$ **(8m)(AU N/D 2014).**

30. Find $\frac{dx}{dy}$ *and* $\frac{d^2y}{d^2x}$ *at* $x = 51$, from the following data: **(8m) (AU- NOV/DEC 2012)**

X:	50	60	70	80	90
Y:	19.96	36.65	58.81	77.21	94.61

31. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by using Romberg's method correct to 4 decimal Places. 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 π/4**(16m, AU N/D 2015)**

32. The velocity v(km/min) of a moped which starts from rest, is given at fixed intervals of time t (min) as follows:

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 1/3rd rule.**(8m)**

(ii). Estimate the acceleration at t = 2 seconds **(8m)(AU A/M 2015)**

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33. Use the Romberg's 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

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

34.

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PART-A

1. Use Euler's method to find $y(0.2)\ and\ y(0.4)$ given $\frac{dy}{dx}=x+y, y(0)=1$. **(AU –M/J 2010)**
2. Write the Adam-Bashforth predictor and correct formulae.**(AU-M/J 2010)**
3. Find $y(0.1)$ by using Euler's method given that $\frac{dy}{dx}=x+y, y(0)=1$. **(AU N/D 2010) (AU N/D 2014) (N/D 2015)**
4. What are multi-step methods? How are they better than single step methods? **(AU N/D 2010)**
5. Using Taylor series method find $y(1.1)$ given that $y'=x+y, y(1)=0$ **(AU M/J 2011)**
6. Find $y(0.2)$ for the equation $y'=y+e^x$ given that $y(0)=0$ by using Euler's method. **(AU M/J 2011)**
7. State Euler's method to solve $\frac{dy}{dx}=f(x,y)$ with $y(x_0)=y_0$ **(AU N/D 2011)**
8. State Adam's predictor-corrector formulae. **(AU N/D 2011)(AU M/J 2012) (N/D 2015)**
9. What is the major drawback of Taylor series method? **(AU M/J 2012)**
10. Using Euler's method, find the solution of the initial value problem $\frac{dy}{dx}=\log(x+y), y(0)=2\ at\ x=0.2$ by assuming $h=0.2$ **(AU M/J 2012)**
11. Using Euler's method find $y(0.2)$ from $y'=x+y, y(0)=1$ with $h=0.2$ **(AU M/J 2012)**
12. Find $y(0.1)$ if $\frac{dy}{dx}=1+y, y(0)=1$ using Taylor series method. **(AU N/D 2012)**
13. State the fourth order Runge-kutta algorithm.**(AU N/D 2012)**
14. State Euler's formula.**(AU M/J 2013)**
15. State the advantages and disadvantages of Taylor's series method.**(AU M/J 2014)**
16. State the Milne's predictor and correct formulae. **(AU N/D 2014)((AU M/J 2013)**
17. What is the error of Euler's method.
18. What is the Error in modified Euler's method.
19. Is Euler's method formula,a particular case of second order Runge-kutta method?
20. Why is Runge-kutta method preferred to Taylor series method
21. In the deviation of fourth order Runge-kutta formula, why it is called fourth order.
22. What is the condition to apply Adams Bashoforth method.
23. What do we mean by saying that a method is self-starting? Not self starting?
24. What are the values of $k_1\ and l_1$ to solve $y''+x\,y'+y=0\ y(0)=1, y'(0)=0$ by Range-kutta method of fourth order.
25. How many prior values are required to predict the next value in Adam's method?
26. What is the condition to apply Adams Bashoforth method.

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27. Mention the multistep methods available for solving ordinary differential equation.
28. Write down the fourth order Taylor's algorithm.
29. What are the merits and demerits of the Taylor's series method of solution.?
30. Given $y' = x + y = 0,\ y(0) = 1$. Find $y(0) = 1$ by Taylor's series method.
31. Write the merits and demerits of the Taylor method of solution.**(AU N/D 2006)**
32. Which is better Taylor 's method or Range-Kutta method?**(AU M/J 2007)**
33. What is the truncation error in Taylor's series?**(AU M/J 2010)**
34. State modified Euler algorithm to solve $y'=f(x,y), y(x_0)=y_0$ at $x=x_0+h$**(AU M/J 2010)**
35. Using Modified Euler 's method find y(0.1),if $\frac{dy}{dx} = x^2 + y^2,\ y(0) = 1$. **(AU M/J 2007)**
36. What are the limitationsof Euler's method?
37. Find $y(1.1)$ given $\frac{dy}{dx} = x + y,\ y(1) = 2$ by Euler's method? **(AU M/J 2006)**
38. Find $y(1.1)$ given $\frac{dy}{dx} = x + y,\ y(1) = 0$ by Euler's method? **(AU M/J 2011)**
39. Write down the Range-Kutta formula of fourth order to solve $\frac{dy}{dx} = f(x, y),\ y(x_0) = y_0$ **(AU M/J 2007)**
40. State special advantage of Range-Kutta method over Taylor's series method.**(MU OCT 97)**
41. Find the Taylor's series method, the value of y at x=0.1 from $\frac{dy}{dx} = y^2 + x$, y(0)=1 **(APR/MAY 2015)**
42. Distinguish between single-step methods and multi-step methods **(APR/MAY 2015)**

PART-B

1. Use Taylor's series method to find

   given that $\frac{dy}{dx} = 3e^x + 2y,\ y(0) = 0$,correct to 4 decimal accuracy.

   (8m) (AU –M/J 2010)

2. Use Milne's predictor –correct formula to find $y(0.4)$,given that $\frac{dy}{dx} = \frac{(1+x^2)y^2}{2},\ y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12\ and\ y(0.3) = 1.21$

   (8m) (AU –M/J 2010) (AU NOV /DEC 2011)

3. Use Runga –Kutta method of fourth order to find $y(0.2)$ given that, $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}, y(0) = 1,$ taking $h = 0.2$. **(AU –M/J 2010)**
4. Given $\frac{dy}{dx} = x\ y + y^2,\ y(0) = 1, y(0.1) = 1.1169,$. $y(0.2) = 1.2774\ and\ y(0.3) = 1.5041$. Use Adam's method to estimate $y(0.4)$. **(AU –M/J 2010)**

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5. Find the value of y at $x=0.1,\ 0.2$ given $\frac{dy}{dx}=x^2y-1,\ y(0)=1,$ by Tayor's series method upto four terms.**(8m) (AU N/D 2010) (AU N/D 2014)**
6. Find the values of $y(0.1)$ by Runga –Kutta method of four order given $y''+xy'+y=0, y(0)=1$ *and* $y'(0)=0.$ **(8m)(AU N/D 2011)(AU N/D 2010)**
7. Given $\frac{dy}{dx}=x\ y+y^2,\ y(0)=1, y(0.1)=1.1169,\ y(0.2)=1.2774$ find (i) $y(0.3)$ by Runga –Kutta method of fourth order and (ii) $y(0.4)$ by Milne's method.**(16m) .(AU N/D 2010)**
8. Using Runga-Kutta method of four order, find y for $x=0.1,\ 0.2,\ 0.3$ given that $y'=x\ y+y^2,\ y(0)=1,$ .Continue the solution at $x=0.4$ using Milne's method.**(16m) .(AU M/J 2011)**
9. Solve $y'=x-y^2,\ y(0)=1,$ to find $y(0.4)$ by Adam's method. Starting solution required are to be odtained using Taylor's method using the value $h=0.1$ **.(16m) (AU M/J 2011)**
10. Given that $y''+xy'+y=0, y(0)=1$ *and* $y'(0)=0.$ obtain y for $x=0.1,\ 0.2,\ 0.3$ by Taylor's series method and find the solution for $y(0.4)$ by Milne's method.**(16m)(AU M/J 2012)**
11. Consider the second order initial value problem $y''-2y'+2y=e^{2t}\sin t$ with $y(0)=-0.4$ and $y'(0)-0.6$ using Fourth order Runga-Kutta algorithm find $y(0.2)$ **(16m)(AU M/J 2012)**
12. Solve $y''=xy'-y$. given $y(0)=3$ *and* $y'(0)=0$ to find the value of $y(0.1)$ using Runga –Kutta method of four order. **(8m)(AU M/J 2012)**
13. Using Adam's method find $y(1.4)$ given $y'=x^2(1+y), y(1)=1,\ y(1.1)=1.233,\ y(1.2)=1.548$ *and* $y(1.3)=1.979$ **(8m)(AU M/J 2012)**
14. Using Taylor's series method solve $\frac{dy}{dx}=x^2-y,\ y(0)=1$ *at* $x=0.1,0.2,0.3$ at .Also compare the values with exact solution . **(8m)(AU M/J 2012)**
15. Given $y'=\frac{1}{x+y},\ y(0)=2, y(0.2)=2.0933, y(0.4)=2.1755, y(0,6)=2.2493,$ find $y(0.8)$ using Milne's method. **(8m) (AU M/J 2012)**
16. Using Modified Euler's method , find $y(4.1)$ *and* $y(4.2)$ if $5x\frac{dy}{dx}+y^2-2=0, y(4)=1.$ **(8m)(AU N/D 2012)**
17. Given that $\frac{dy}{dx}=1+y^2,\ y(0,6)=0.6841, y(0.4)=0.2027,\ y(0)=0,$ find $y(-0.2)$ using Milne's method. **(8m)(AU N/D 2012)**
18. Solve for $y(0.1)$ *and* $z(0,1)$ from the simultaneous differential equations $\frac{dy}{dx}=2x+z; \frac{dy}{dx}=y-3z; y(0)=0, z(0)=0.5$ using Ranga-Kutta method of the fourth order. **(16m)(AU N/D 2012)**
19. Using Taylor's series method to find $y(0.1)$ *if* $y'=x^2+y^2, y(0)=1.$
20. Using Runga-Kutta method find $y(0.2)$ *if* $y''=xy'^2-y^2,$ $y(0)=1, y'(0)=0, h=0.2.$ **(8m)(AU M/J 2013)**

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21. Solve $y'=\frac{y-x}{y+x}, y(0)=1$ at $x=0.1$ by taking $h=0.02$ using Euler's method. **(8m)(AU M/J 2013)**

22. Using Adam's method to find $y(2)$ if $y'=(x+y)/2$
$y(0)=2, y(0.5)=2.636, y(1)=3.595, y(1,5)=4.968.$
(8m)(AU M/J 2013)

23. Using Adam's bashforth 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 $y(4.3)=1.0413.$
(8m)(AU M/J 2014)

24. Using Taylor's series method , find y at $x=1.1$ by solving the equation $\frac{dy}{dx}=x^2+y^2; y(1)=2.$ Carryout the computations upto fourth order derivative. **(8m)(AU M/J 2014)**

25. Using Runga-Kutta method of fourth order, find the value of y at $x=0.2, 0.4, 0.6$ given $\frac{dy}{dx}=x^3+y, y(0)=2$ .Also find the value of y at $x=0.8$ using Milne's predictor and corrector method.**(16m)(AU M/J 2014)**

26. Given $5x\frac{dy}{dx}+y^2-2=0, y(4)=1.$
$y(4.1)=1.0049, y(4.2)=1.0097$ and $y(4.3)=1.0413.$ Compute using Milne's method **(8m)(AU N/D 2014)**

27. Solve $y''+xy'+y=0$. given $y(0)=1$ and $y'(0)=0$ to find the value of $y(0.1)$ using Runga –Kutta method of four order.
(8m)(AU N/D 2014)

28. Apply modified Euler's method to find $y(0)=0.2$ and $y'(0)=0.4$ given $y'=x^2+y^2$ $y(0)=0$ by taking $h=0.2$ **(8m)(AU N/D 2014).**

29. Solve the initial value problem $y'=x-y^2$, $y(0)=1$, to find $y(0.4)$ by Adam's Bashforth predictor method and for starting solutions, use the information below.
y(0.1)=0.9117, y(0.2)=0.8494. Compute y(0.3) using Runge-kutta method of fourth order. **(APR/MAY 2015)**

30. Employ the classical fourth order Runge-kutta method to integrate $y'=4e^{0.5t}-0.5y$ from t=0 to t=1 using a stepsize of 1 with y(0)=2. **(APR/MAY 2015)**

31. Given $\frac{dy}{dx}=x\ y+y^2$, $y(0)=1, y(0.1)=1.1169, y(0.2)=1.2773, y(0.3)=0.2267$
Evaluate y(0.4) by Milne's predictor corrector method.
(APR/MAY 2015)

32. Determine the value of y(0.4) using Milne's method given that $\frac{dy}{dx}=x\ y+y^2$, $y(0)=1$. Use Taylor's series method to get the values of y(0.1), y(0.2) and y(0.3). **(N/D 2015)**

33. Find y(0.1), y(0.2) and y(0.3) from $y'=x+y^2$, $y(0)=1$ using fourth order Runge-kutta method and find y(0.4) by Adam's method
(N/D 2015)

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PART-A

1. Write down the explicit finite difference method for solving one dimensional wave equation. **(AU –M/J 2010)**
2. Write down the standard five point formula to find the numerical solution of Laplace equation. **(AU –M/J 2010) (AU N/D 2014)**
3. What is the error for solving Laplace and Possion's equations by finite difference method? **(AU N/D 2010)**
4. Write down the Crank-Nicolson formula to solve parabolic equation**. (AU N/D 2012) (AU N/D 2010)**
5. Classify the partial differential equation $u_{xx} + 2u_{xy} + 4u_{yy} = 0,\ x, y > 0$. **(AU A/M 2011)**
6. In one dimensional wave equation, write down the equation of explicit scheme. **(AU A/M 2011)**
7. Classify the PDE $y_{xx} - x u_{yy} = 0$. **(AU N/D 2011)**
8. State standard Five point formula with relevant diagram. **(AU N/D 2011)**
9. What is the central difference approximation for y''?

   (AU N/D 2014) (AU M/J 2012)
10. Write the difference scheme for solving the Possion equation $\nabla^2 u = f(x, y)$.**(AU M/J 2012)**
11. Write down the finite difference formula for $y'(x)$ *and* $y''(x)$ **(AU M/J 2012)**
12. State the finite difference scheme to solve the equation $y_{tt} = \alpha^2\ y_{xx}$ **(AU M/J 2012)**
13. Obtain the finite difference scheme for the differential equation $2y'' + y = 5$.**(AU M/J 2014) (AU M/J 2013)**
14. Write Liebmann's iteration process. **(AU M/J 2013)**
15. State whether the Crank Nicholson's scheme is an explicit or implicit scheme. Justify. **(AU M/J 2014)**
16. Define a difference quotient.
17. What is the purpose of Liebmann's process?
18. State the five point formula to solve the possion equation $u_{xx} + u_{yy} = 100$.
19. What is the classification of $f_x - f_{yy} = 0$?
20. State Schmidit's explicit formula for solving heat flow equation.
21. Write an explicit formula to solve numerically the heat equation $u_{xx} - a u_t = 0$
22. What is the value of k to solve $\frac{\partial u}{\partial t} = \frac{1}{2} u_{xx}$ by Bender-Schmidt method with $h = 1$ if h and k are the increments of x and t respectively?

23. State the conditions for the equation $Au_{xx}+Bu_{xy}+Cu_{yy}+Du_x+Eu_y+Fu=G$ where A,B,C,D,E,F,G are function of $x\ and\ y$ to be (i) ellipict (ii) parabolic (iii) hyperbolic.

24. State the conditions for the equation $Au_{xx}+2Bu_{xy}+Cu_{yy}=f(u_x,u_y,x,y)$ to be(i) ellipict (ii) parabolic (iii) hyperbolic when A,B,C are function of $x\ and\ y$

25. The equation $yu_{xx}+u_{yy}=0$ is hyperbolic in the region………

26. Give an example of a parabolic equation.

27. Bender-schmidt recurrence scheme is useful to solve……….equation.

28. What is the classification of one dimensional heat flow equation.

29. What type of equations can be solved by using Crank Nicholson's difference formula.

30. Write down the finite difference scheme for differential equation $\frac{d^2y}{dx^2}-3\frac{dx}{dx}=2$

31. For what purpose Bender-schmidt recurrence relation is used?

32. Name at least two numerical methods that are used to solve one dimensional diffusion equation.

33. Write a note on the stability and convergence of the solution of the difference equation corresponding to the hyperbolic equation $u_{tt}=a^2u_{xx}$

34. Write down one dimensional wave equation and its boundary conditions.

35. For what value of λ, the explicit, method of solving the hyperbolic equation $\frac{\partial^2u}{\partial x^2}=\frac{1}{c^2}\frac{\partial^2u}{\partial t^2}$ is stable, where $\lambda=\frac{C\,\Delta t}{\Delta x}$

36. Write down the general and simplest forms of the difference equation corresponding to the hyperbolic equation $u_{tt}=a^2u_{xx}$

37. Write down Bender –schmidt's difference scheme in general form and using suitable value of λ, write the scheme in simplied form. **(AU N/D 2012)**

38. State Crank-Nicolson's difference formula. **(AU N/D 2012)**

39. What is central difference approximation for y"?**(AU N/D 2014)**

40. Write down the standard five-point formula to find the numerically solution of Laplace equation. ?**(AU N/D 2014)**

41. Classify the following equation: $\frac{\partial^2u}{\partial x^2}+4\frac{\partial^2u}{\partial x\partial y}+4\frac{\partial^2u}{\partial y^2}+\frac{\partial u}{\partial x}+2\frac{\partial u}{\partial y}=0$

(APR/MAY 2015)

42. Express $c^2\frac{\partial^2u}{\partial x^2}=\frac{\partial^2u}{\partial t^2}$ in terms of difference equation

(A/M 2015)

PART B

1. Deduce the standard five point formula for $\nabla^2 u = 0$. Hence, solve it over the square region given by the boundary conditions as in the figure below. **(16m) (AU –M/J 2010)(AU M/J 2012)**

2. Obtain the Crank Nicholson's finite difference method by taking $\lambda = \frac{kc^2}{h^2} = 1$.. Hence find $u(x,t)$ in the rod for two times steps for the heat equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, given $u(x,0) = \sin(\pi x), u(0,t) = u(1,t) = 0$ Take $h = 0.2$.. **(16m) (AU –M/J 2010)(AU M/J 2012)**

3. Solve $\nabla^2 u = 8x^2 y^2$ in the square region $-2 \le x, y \le 2$ with $u = 0$. on the boundaries after dividing the region into 16 sub intervals of length 1 unit. **(16m) (AU N/D 2010)(AU N/D 2011)**

4. Solve $u_t = u_{xx}$ in $0 < x < 5, t > 0$ given that $u(0,t) = 0$, $u(5,t) = 0$,. $u(x,0) = x^2(25 - x^2)$ Compute u up to $t = 2$ with $\Delta x = 1$, by using Bender-schmidt formula. **(16m) (AU N/D 2010)**

5. Solve the equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = 0, y = 0, x = 3, y = 3$ with $u = 0$. on boundary with mesh length 1 unit**(16m) (AU M/J 2011)(AU N/D 2012)**

6. Solve $u_t = u_{xx}$ in $0 < x < 5, t > 0$ given that $u(0,t) = 0$, $u(5,t) = 0$,. $u(x,0) = x^2(25 - x^2)$,find u in the range taking $h = 1$ upto 3 seconds using Bender-schmidt formula **.(16m)(AU M/J 2011)**

7. 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.**(16m)(AU N/D 2011)**

8. Solve the equation $y'' = x + y$ with boundary conditions $y(0) = y(1) = 0$ **(8m)(AU M/J 2012) (AU M/J 2014)**

9. Solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, subject to $u(0,t) = u(1,t) = 0$ $u(x,0) = \sin(\pi x)$ $0 < x < 1$ using Bender-schmidt method.**(16m) (AU M/J 2012)**

10. Solve the elliptic equation for the following square mesh with boundary values as shown.**(8m))(AU M/J 2012)**

11. Solve $\frac{\partial u}{\partial t} = \frac{1}{2}\frac{\partial^2 u}{\partial x^2}$, with the conditions $u(0,t) = u(4,t) = 0, u(x,0) = x(4 - x)$ taking $h = 1$ employing Bender-schmidt recurrence equation. Continue the solution through 10 time steps.**(16m) (AU M/J 2012)**

12. Solve the equation $y'' - y = 0$ with boundary conditions $y(0) = 0$ *and* $y(1) = 1$ **(8m)(AU N/D 2012)**

13. 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* $u(1,t) = \frac{1}{2}\sin \pi t$. Compute $u(x,t)$ for 4 time-steps by taking $h = \frac{1}{4}$ **(8m)(AU N/D 2012)**

14. Solve $u_{xx} = 32u_t, h = 0.25, \text{for } t \ge 0, 0 < x < 1, u(0,t), u(x,0) = 0, u(1,t) = t.$ **(8m)(AU M/J 2013)**

15. Solve $4u_{tt} = u_{xx}, u(0,t) = 0, u(4,t) = 0, u(x,0) = x(4-x), u_t(x,0) = 0$ $h = 1$ upto $t = 4$. **(8m)(AU M/J 2013)**

16. Using Bender-schmidt's method solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, given $u(0,t) = u(1,t) = 0$ $u(x,0) = \sin(\pi x)$ $0 < x < 1$ *and* $h = 0.2$. Find the value of u upto $t = 0.1$ **(8m)(AU M/J 2013)**

17. Solve $y'' - y = x$, given $x \in (0,1), y(0) = y(1) = 0$ using finite difference by dividing the interval into four equal parts. **(8m)(AU M/J 2013)**

18. Solve the wave equation. $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$ $0 < x < 1$ $t > 0$, $u(0,t) = u(1,t) = 0$ $t > 0$ $u(x,0) = \begin{cases} 1, & 0 \le x \le 0.5 \\ -1, & 0.5 \le x \le 1 \end{cases}$ *and* $\frac{\partial u}{\partial t}(x,0) = 0$ using $h = k = 0.1$ find u for three time steps. **(8m)(AU M/J 2014)**

19. By iteration method ,solve the elliptic equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ over a square region of side 4, satisfying the boundary conditions.

(16m)(AU N/D 2014)

(i) $u(0,y) = 0$,$0 \le y \le 4$

(ii) $u(4,y) = 12 + y, 0 \le y \le 4$

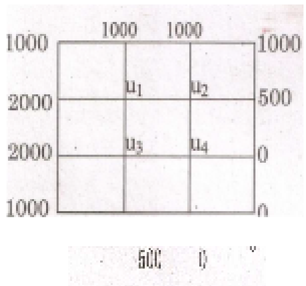
(iii) $u(x,0) = 3x, 0 \le x \le 4$

(iv) $u(x,4) = x^2, 0 \le x \le 4$

By dividing the square into 16 square methods of side 1 and always correcting the computed values to two places of decimals, obtain the values u at 9 interior pivotal points.

20. Solve by Crank-Nicolson's method $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$, $0 < x < 1$,$t > 0$ for given that $u(0,t) = u(1,t) = 0$ *and* $u(x,0) = 100x(1-x)$. Compute u for one time step with $h = \frac{1}{4}$ and $K = \frac{1}{64}$. **(16m)(AU N/D 2014)**

21. 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



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