# VALLIAMMAI ENGINEERING COLLEGE

**S.R.M. Nagar, Kattankulathur - 603203**

## DEPARTMENT OF MATHEMATICS

## QUESTION BANK

## IV SEMESTER
**(Common to B. E- Civil, EEE, EIE**

## MA6459 – NUMERICAL METHODS

**Regulation – 2013**

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***Prepared by***


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**SRM Nagar, Kattankulathur – 603203.**

**DEPARTMENT OF MATHEMATICS**

**SUBJECT : MA6459 – NUMERICAL METHODS**
**SEM / YEAR: IV / II year B.E. (COMMON TO CIVIL , EEE, & EIE DEPARTMENTS)**

**UNIT I - SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS:** Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

| Q.No. | Question | BT Level | Competence |
|---|---|---|---|
| | **PART – A** | | |
| 1. | Describe the merits of Newton's method of iterations. | **BTL -1** | Remembering |
| 2. | State the General Newton's- Raphson Method. | **BTL -1** | Remembering |
| 3. | State the Newton Raphson formula and the criteria for convergence. | **BTL -1** | Remembering |
| 4. | Solve by Gauss Elimination method $x + y = 2$ and $2x + 3y = 5$ | **BTL -3** | Applying |
| 5. | State the condition for Convergence of Iteration method. | **BTL -1** | Remembering |
| 6. | Calculate the root of $e^x - 3x = 0$ in $1 < x < 1.1$ by Iteration method. | **BTL -3** | Applying |
| 7. | Distinguish the advantages of iterative methods over direct method of solving a system of linear algebraic equations. | **BTL -2** | Understanding |
| 8. | Find the positive root of $x^2 - 2x - 3 = 0$ using fixed point iteration method starting with 0.4 as first approximation. | **BTL -2** | Understanding |
| 9. | Solve by Gauss seidel method $2x-y=3$, $2x+25y=15$. | **BTL -2** | Understanding |
| 10 | Give an example of transcendental and algebraic equation | **BTL -1** | Remembering |
| 11. | Find the inverse of $A = \begin{pmatrix} 1 & 3 \\ 2 & 7 \end{pmatrix}$ Jordan method. | **BTL -2** | Understanding |
| 12. | State the condition for the convergence of Gauss Seidel iteration method for solving a system of linear equation. | **BTL -1** | Remembering |
| 13. | Compare Gauss Elimination, Gauss Jordan method. | **BTL -4** | Analyzing |
| 14. | Can we apply iteration method to find the root of the equation $2x - \cos x = 5 \ in \left[0, \frac{\pi}{2}\right]$? | **BTL -3** | Applying |
| 15. | On what type of equations Newton's method can be applicable – Justify. | **BTL -4** | Analyzing |
| 16. | Compare Gauss seidel method, Gauss Jacobi method. | **BTL -4** | Analyzing |
| 17. | Which of the iterative methods is used for solving linear system of equations it converges fast? Why? | **BTL -6** | Creating |
| 18. | Evaluate an iterative formula for $1/N$ ,where N is a positive number by using Newton – Raphson method. | **BTL -5** | Evaluating |

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|---|---|---|---|
| 19. | Find the dominant eigen value of $A=\begin{pmatrix}2 & 3\\ 5 & 4\end{pmatrix}$ by power method upto 1 decimal place accuracy. Start with $X^{(0)}=\begin{pmatrix}1\\ 1\end{pmatrix}$ | **BTL -5** | Evaluating |
| 20. | Find the inverse of A = $\begin{pmatrix}4 & 1\\ 1 & 3\end{pmatrix}$ by Power method. | **BTL -3** | Applying |
| | PART – B | | |
| 1.(a) | Find the positive real root of 2x – $\log_{10}$ x - 6 = 0 using Newton – Raphson method. | **BTL -3** | Applying |
| 1. (b) | Evaluate the inverse of the matrix $\begin{pmatrix}1 & 1 & 3\\ 1 & 3 & -3\\ -2 & -4 & -4\end{pmatrix}$ using Gauss Jordan method. | **BTL -5** | Evaluating |
| 2. (a) | Find the dominant eigen value and vector of A = $\begin{pmatrix}1 & 6 & 1\\ 1 & 2 & 0\\ 0 & 0 & 3\end{pmatrix}$ using Power method. | **BTL -3** | Applying |
| 2.(b) | Find the inverse of the matrix $\begin{pmatrix}1 & 2 & -1\\ 4 & 1 & 0\\ 2 & -1 & 3\end{pmatrix}$ using Gauss Jordan method. | **BTL -3** | Applying |
| 3. (a) | Evaluate the positive real root of $2x^3$ -3x – 6 =0 using Iteration method. | **BTL -5** | Evaluating |
| 3.(b) | Solve by Gauss Jordan method 3x + 4y + 5z =18 ; 2x –y + 8z = 13 ; 5x -2y + 7z = 20 | **BTL -3** | Applying |
| 4. (a) | Apply Gauss seidel method to solve the system of equations 20x + y -2z = 17 ; 3x + 20y - z = -18 ; 2x - 3 y +20z = 25. | **BTL -2** | Understanding |
| 4.(b) | Analyze the iterative formula to find $\sqrt{N}$ where N is positive integer using Newton's method and hence find $\sqrt{11}$ . | **BTL -4** | Analyzing |
| 5. (a) | Solve by Gauss Elimination method 10 x + y + z =12 ; 2x + 10y +z = 13 ; x + y + 5z =7. | **BTL -3** | Applying |
| 5.(b) | Find the positive r root of $\cos x = 3x - 1$ correct to 3 decimal places using fixed point iteration method. | **BTL -3** | Applying |
| 6. (a) | Estimate the inverse of the matrix $\begin{pmatrix}1 & 1 & 2\\ 1 & 2 & 3\\ 2 & 3 & 1\end{pmatrix}$ using Gauss Jordan method. | **BTL -2** | Understanding |
| 6.(b) | Apply Gauss seidel method to solve system of equations x – 2y +5z = 12 ; 5x + 2y - z = 6 ; 2x + 6 y – 3z = 5 (upto 4 iterations) | **BTL -3** | Applying |
| 7. (a) | By Gauss seidel method to solve system of equations x + y + 54z = 110 ; 27x + 6y –z = 85 ; 6x + 15y – 2z =72. | **BTL -4** | Analyzing |
| 7. (b) | Using Newton's method find the iterative formula to find $\sqrt{N}$ where N is positive integer and hence find $\sqrt{142}$ . | **BTL -1** | Remembering |
| 8. (a) | Using Gauss Jordan method to solve 2x-y+3z = 8 ; -x+2y+z = 4; 3x+y-4z = 0. | **BTL -3** | Applying |

| | | | |
|---|---|---|---|
| 8.(b) | Find the largest Eigen value and Eigen vector of $A = \begin{pmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{pmatrix}$ using Power method. | **BTL -3** | Applying |
| 9. (a) | Evaluate by Gauss Elimination method x + 2y -5z = -9 ; 3x - y + 2z = 5 ; 2x + 3y - z = 3.. | **BTL -5** | Evaluating |
| 9.(b) | Find the real root of f(x) = 3x+sin x - $e^x$ = 0 using Newton - Raphson method by using initial approximation $x_0$ = 0.5. | **BTL -3** | Applying |
| 10.(a) | Evaluate the dominant Eigen value and vector of $A = \begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ using Power method. | **BTL -5** | Evaluating |
| 10.(b) | Using Newton-Raphson method , Establish the formula and also to calculate the square root of N. Find the square root of 5 correct to 4 places of decimals. | **BTL -1** | Remembering |
| 11.(a) | Apply Gauss seidel method to solve system of equations $6x_1 - 2x_2 + x_3 = 11$; $-2x_1 + 7x_2 + 2x_3 = 5$; $x_1 + 2x_2 - 5x_3 = -1$, with the initial vector of( 0 , 0 , 0 ). | **BTL -4** | Analyzing |
| 11.(b) | Using Power method , Identify all the eigen values of $\boldsymbol{A} = \begin{pmatrix} \mathbf{5} & \mathbf{0} & \mathbf{1} \\ \mathbf{0} & \mathbf{-2} & \mathbf{0} \\ \mathbf{1} & \mathbf{0} & \mathbf{5} \end{pmatrix}$ | **BTL -6** | Creating |
| 12.(a) | Solve the system of equations by Gauss elimination method $\boldsymbol{x + 2y + z = 3}$ ; $\boldsymbol{2x + 3y + 3z = 10}$ ; $\boldsymbol{3x - y + 2z = 13}$ | **BTL -3** | Applying |
| 12.(b) | By using N-R method, find the root of $\boldsymbol{x^4 - x - 10 = 0}$ , which is nearer to $\boldsymbol{x = 2}$ , correct upto 3 decimal places. | **BTL -4** | Analyzing |
| 13.(a) | Apply Gauss Jordan method to solve the equations $\boldsymbol{x + y + z = 9}$, $\boldsymbol{2x - 3y + 4z = 13}$ , $\boldsymbol{3x + 4y + 5z = 40}$ | **BTL -2** | Understanding |
| 13.(b) | Using Gauss-Jordan method, find the inverse of the matrix $\begin{pmatrix} \mathbf{8} & \mathbf{-4} & \mathbf{0} \\ \mathbf{-4} & \mathbf{8} & \mathbf{-4} \\ \mathbf{0} & \mathbf{-4} & \mathbf{8} \end{pmatrix}$ | **BTL -3** | Applying |
| 14.(a) | Solve using Gauss-Seidal method $\boldsymbol{8x - 3y + 2z = 20}$, $\boldsymbol{4x + 11y - z = 33}$, $\boldsymbol{6x + 3y + 12z = 35}$ . | **BTL -3** | Applying |
| 14.(b) | Determine the largest eigenvalue and the corresponding eigenvectors of the matrix $\begin{pmatrix} \mathbf{1} & \mathbf{3} & \mathbf{-1} \\ \mathbf{3} & \mathbf{2} & \mathbf{4} \\ \mathbf{-1} & \mathbf{4} & \mathbf{10} \end{pmatrix}$ | **BTL -2** | Understanding |

**UNIT -II INTERPOLATION AND APPROXIMATIOIN:** Interpolation with unequal intervals - Lagrange's interpolation – Newton‟s divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton‟s forward and backward difference formulae.

| **Q.No.** | **Question** | **BT Level** | **Competence** |
|---|---|---|---|
| | **PART – A** | | |
| 1. | Write the Lagrange's interpolation formula for unequal intervals. | **BTL -1** | Remembering |
| 2. | Define inverse Lagrange's interpolation formula. | **BTL -1** | Remembering |
| 3. | Write the Lagrange's formula for y, if three sets of values $(\boldsymbol{x_0}, \boldsymbol{y_0})$, $(\boldsymbol{x_1}, \boldsymbol{y_1})$, $(\boldsymbol{x_2}\ \ \boldsymbol{y_2})$ are given? . | **BTL -1** | Remembering |

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|---|---|---|---|
| 4. | Create the divided difference table for the following data ( 0,1) , ( 1,4) , ( 3,40) and ( 4,85) . | **BTL -6** | Creating |
| 5. | Write the divided differences with arguments a , b , c if $f(x) = 1/x^2$. | **BTL -1** | Remembering |
| 6. | Find the polynomial through (0, 0) (1 , 1 ) and ( 2 ,20) using Lagrange's method. | **BTL -1** | Remembering |
| 7. | Estimate the divided differences of $\boldsymbol{f(x) = x^3 + x + 2}$ for the arguments 1, 3, 6, 11 . | **BTL -2** | Understanding |
| 8. | Estimate the interpolating polynomial for the given data:<br>x : 2 5 7 8<br>f(x) : 1 2 3 4 | **BTL -2** | Understanding |
| 9. | Create the divided difference table for the following data<br>X : 4 5 7 10 11 13<br>f(x) : 48 100 294 900 1210 2028 . | **BTL -6** | Creating |
| 10. | Estimate f(a, b) and f(a, b, c) using divided differences , if f(x) = 1/x. | **BTL -2** | Understanding |
| 11. | Identify the cubic Spline S(x) which is commonly used for interpolation. | **BTL -2** | Understanding |
| 12. | Find $\Delta^4 y_0$, given $y_0 = 3$, $y_1 = 12$, $y_2 = 81$, $y_3 = 200$ $y_4 = 100$ | **BTL -3** | Applying |
| 13. | Define cubic spline. | **BTL -1** | Remembering |
| 14. | Write any two applications of Newton's backward difference formula? | **BTL -1** | Remembering |
| 15. | Write the nature of $n^{th}$ divided differences of a polynomial. | **BTL -1** | Remembering |
| 16. | Give the condition for a spline to be cubic. | **BTL -2** | Understanding |
| 17. | Find y, when x = 0.5 given x : 0 1 2<br>y: 2 3 12 | **BTL -4** | Analyzing |
| 18. | Evaluate y (0.5) given x : 0 1 4<br>y: 4 3 24 | **BTL -5** | Evaluating |
| 19. | Write Newton's forward formula up to 3rd finite differences. | **BTL -1** | Remembering |
| 20. | Prove that the divided differences are symmetrical in their arguments. | **BTL -2** | Understanding |

**PART –B**

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|---|---|---|---|
| 1.(a) | Write the polynomial f(x) and hence find f(5), Using Lagrange's method,<br>x: 1 3 4 6<br>y: -3 0 30 132 | **BTL -3** | Applying |
| 1. (b) | Using Newton's divided difference formula from the following table, Find f(1) from the following<br>x: -4 -1 0 2 5<br>f(x): 1245 33 5 9 1335 | **BTL -3** | Applying |
| 2. (a) | Using Newton's divided difference formula From the following table, find f (8) x: 3 7 9 10<br>F(x): 168 120 72 63 | **BTL -3** | Applying |
| 2.(b) | Evaluate f(1) using Lagrange's method<br>x: -1 0 2 3<br>y: -8 3 1 12 | **BTL -5** | Evaluating |
| 3. (a) | Evaluate f(2),f(8) and f(15) from the following table using Newton's divided difference formula<br>x: 4 5 7 10 11 13 | **BTL -5** | Evaluating |

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|---|---|---|---|
| | y: 48 100 294 900 1210 2028 | | |
| 3.(b) | Find third order Newton polynomial to estimate $\boldsymbol{l_{n2}}$ with the 4 points given in table<br>X: 1, 4, 6, 5<br>f(x): 0, 1.386294, 1.791759, 1.609438 | **BTL -3** | Applying |
| 4. (a) | Use Lagrange's formula to find the value of y at x= 6 from the following data:<br>X: 3, 7, 9, 10<br>Y: 168, 120, 72, 63 | **BTL -2** | Understanding |
| 4.(b) | Find the natural cubic spline for the function given by<br>x: 0, 1, 2<br>f(x): 1, 2, 33 | **BTL -4** | Analyzing |
| 5. (a) | Estimate x when y = 20 from the following table using Lagrange's method<br>x: 1 2 3 4<br>y: 1 8 27 64 | **BTL -3** | Applying |
| 5.(b) | Find the interpolated value for x = 3 of the given using Lagrange's interpolation<br>x: 3.2 2.7 1.0 4.8<br>f(x): 22.0 17.8 14.2 38.3 | **BTL -3** | Applying |
| 6. (a) | Express f(x) as a polynomial using Newton's divided difference method x : 0 2 3 6 9 10<br>f(x): 3 7 24 207 714 983 | **BTL -3** | Applying |
| 6.(b) | Obtain root of f(x)=0 by Lagrange's Inverse interpolation formula given that f(30)=-30, f(34)=-13, f(38)=3, f(42)=18 | **BTL -2** | Understanding |
| 7. (a) | Find the natural spline x: 0 1 2 3<br>y: 1 2 1 10 | **BTL -2** | Understanding |
| 7. (b) | Calculate y(0.5) and y'(1) given that $M_0 = M_2 = 0$ using Cubic Spline<br>x: 0 1 2<br>y: -5 -4 3 | **BTL -3** | Applying |
| 8. (a) | Evaluate y (1.5), using Cubic Spline to the following data<br>x: 1 2 3 4<br>y: 1 2 5 11 | **BTL -5** | Evaluating |
| 8.(b) | Using Newton's forward interpolation formula find the value of 1955 from the following table x: 1951 1961 1971 1981<br>y: 35 42 58 84 | **BTL -3** | Applying |
| 9. (a) | Evaluate f(7.5) from the following table Using Newton's backward formula<br>X : 1 2 3 4 5 6 7 8<br>Y : 1 8 27 64 125 216 343 512 | **BTL -5** | Evaluating |
| 9.(b) | Using Suitable Newton's f interpolation formula find the value of y(46) from the following<br>X: 45 50 55 60 65<br>Y: 114.84 96.16 83.32 74.48 68.48 | **BTL -4** | Analyzing |
| 10.(a) | Identify the polynomial of degree 3 from the following using Newton's formula<br>X: 0 1 2 3 4 5 6 7 | **BTL -3** | Applying |

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| | Y: 1 2 4 7 11 16 22 29 | | |
| 10.(b) | The table gives the distance in nautical miles of visible horizon for heights in feet above earth's surface.<br>X = Height : 100 150 200 250 300 350 400<br>Y=Distance: 10.63 13.03 15.04 16.81 18.42 19.9 21.2<br>Evaluate the values of y when x = 218 using Newton's forward interpolation formula. | **BTL -5** | Evaluating |
| 11.(a) | Find the number of students who obtain marks between 40 and 45, using Newton's formula<br>Marks : 30 - 40 40 -50 50 – 60 60 – 70 70 - 80<br>No of students : 31 42 51 35 31 | **BTL -3** | Applying |
| 11.(b) | The following table gives the values of density of saturated water for various temperature of saturated steam. Find density at T = 125<br>Temp T °C: 100, 150, 200, 250, 300<br>Density hg/m³: 958, 917, 865, 799, 712 | **BTL -4** | Analyzing |
| 12.(a) | Using divided difference table find f(x) which takes the values as follows .<br>x : 0 1 3 4<br>f(x): 1 4 40 85 | **BTL -5** | Evaluating |
| 12.(b) | Calculate the pressure t = 142 and t =175, from the following data taken from steam table, Using suitable formula.<br>Temp : 140 150 160 170 180<br>Pressure: 3.685 4.854 6.302 8.076 10.225 | **BTL -4** | Analyzing |
| 13.(a) | Determine by Lagrange's interpolation method, the No. of patients over 40 years using the following data<br>Age (over x years) : 30 35 45 55<br>Number(y)patients: 148 96 68 34 | **BTL -3** | Applying |
| 13.(b) | The population of a town is as follows<br>Year (x): 1941 1951 1961 1971 1981 1991<br>Population in lakhs (y): 20 24 29 36 46 51<br>Estimate the population increase during the period 1946 to 1976. | **BTL -4** | Analyzing |
| 14.(a) | Using Newton's Forward interpolation formula find the Polynomial f(x) to the following data, and find f(2)<br>x : 0 5 10 15<br>f(x): 14 397 1444 3584 | **BTL -3** | Applying |
| 14.(b) | Find the value of y at x= 6 by Newton's divided difference formula for the data:<br>x: -1, 0, 2, 3, 7, 10<br>y: -11, 1, 1, 1, 141, 561 | **BTL -3** | Applying |

**UNIT – III NUMERICAL DIFFERENTIATION AND INTEGRATION:** Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson‟s 1/3 rule – Romberg‟s method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson‟s 1/3 rules.

| Q.No. | Question | BT Level | Competence |
|---|---|---|---|

| PART – A | | | |
|---|---|---|---|
| 1. | Write the formula for $\frac{dy}{dx}$ at $x=x_0$ by forward difference operator. | **BTL -1** | Remembering |
| 2. | State Newton's backward differentiation formula to find $\left(\frac{dy}{dx}\right)_{x=x_n}$ and $\left(\frac{d^2y}{dx^2}\right)_{x=x_n}$ | **BTL -1** | Remembering |
| 3. | Find $\frac{dy}{dx}$ at x=50 from the following table:<br>X: 50, 51, 52<br>Y: 3.6840, 3.7084, 3.7325 | **BTL -2** | Understanding |
| 4. | Write down the Gaussian quadrature 3 point formula. | **BTL -1** | Remembering |
| 5. | State the formula for trapezoidal rule of integration. | **BTL -1** | Remembering |
| 6. | State Simpson's one third rule. | **BTL -1** | Remembering |
| 7. | State the formula for 2 – point Gaussian quadrature. | **BTL -1** | Remembering |
| 8. | Write down the trapezoidal double integration formula. | **BTL -2** | Understanding |
| 9. | When numerical differentiation applicable? | **BTL -2** | Understanding |
| 10. | Write down the order of the errors of trapezoidal rule. | **BTL -1** | Remembering |
| 11. | Find y '(0)from the following table X : 0 1 2 3 4 5<br>Y: 4 8 15 7 6 2 | **BTL -2** | Understanding |
| 12. | Apply Simpson's 1 /3 rd rule to find $\int_0^4 e^x dx$ given that $e^0 = 1, e^1 = 2.72, e^2 = 7.39, e^3 = 20.09, e^4 = 54.6$ . | **BTL -3** | Applying |
| 13. | Calculate $\int_1^4 f(x)dx$ from the table by Simpson's 1/3 rd rule<br>x : 1 2 3 4<br>f(x): 1 8 27 64 | **BTL -3** | Applying |
| 14. | Write down the Simpson's 1/3rd rule for double integration formula. | **BTL -3** | Applying |
| 15. | Compare trapezoidal rule and Simpson's one third rule. | **BTL -4** | Analyzing |
| 16. | Using two point Gaussian quadrature formula , evaluate $\int_{-1}^{1} 3x^2 + 5x^4\, dx$ | **BTL -5** | Evaluating |
| 17. | In numerical integration , what should be the number of intervals to apply Simpson's one – third rule and trapezoidal rule – Justify | **BTL -2** | Understanding |
| 18. | State Romberg's integration formula to find the value of $I = \int_a^b f(x)dx$ using h & h / 2. | **BTL -1** | Remembering |
| 19. | Using two point Gaussian quadrature formula , evaluate $\int_{-1}^{1} \frac{1}{1+x^2}dx$ . | **BTL -5** | Evaluating |
| 20. | Give the order and error of Simpson's one third rule. | **BTL -1** | Remembering |
| **PART –B** | | | |
| 1.(a) | Evaluate $\int_0^6 \frac{1}{1+x^2}dx$, using trapezoidal and Simpson's 1/3rd rules. | **BTL -5** | Evaluating |
| 1. (b) | A Jet fighters position on an air craft carries runway was timed during landing<br>t ,sec : 1.0 1.1 1.2 1.3 1.4 1.5 1.6<br>y , m : 7.989 8.403 8.781 9.129 9.451 9.750 10.03 | **BTL -2** | Understanding |

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| | where y is the distance from end of carrier estimate the velocity and acceleration at t = 1.0 , t = 1.6 | | |
| 2. (a) | Using 3-point Gaussian quadrature , Evaluate $\int_0^5 \log_{10}(1+x)dx$ . | **BTL -5** | Evaluating |
| 2.(b) | Obtain first and second derivative of y at x = 0.96 from the data<br>x : 0.96 0.98 1 1.02 1.04<br>y : 0.7825 0.7739 0.7651 0.7563 0.7473 | **BTL -2** | Understanding |
| 3. (a) | Using the given data find f ` ( 5 )and f ` (6) by suitable formula<br>x : 0 2 3 4 79<br>f (x) : 426 58 112 466 992 | **BTL -4** | Analyzing |
| 3.(b) | Using backward difference, find y'(2.2) and y''(2.2) from the following table<br>x : 1.4 1.6 1.8 2.0 2.2<br>y : 4.0552 4.9530 6.0496 7.3891 9.0250 | **BTL -3** | Applying |
| 4. (a) | The table given below reveals the velocity of the body during the time t specified. Find its acceleration at t =1.1<br>t : 1.0 1.1 1.2 1.3 1.4<br>v: 43.1 47.7 52.1 56.4 60.8 | **BTL -2** | Understanding |
| 4.(b) | Evaluate $\int_1^{1.4}\int_2^{2.4} \frac{1}{xy}\,dx\,dy$ by using, Simpson's 1/3rd rule, justify | **BTL -4** | Analyzing |
| 5. (a) | Apply Gaussian three point formula to find $\int_3^7 \frac{dx}{1+x^2}$ | **BTL -3** | Applying |
| 5.(b) | Evaluate $\int_0^1\int_0^1 \frac{dx\,dy}{1+xy}$ using, Simpson's 1/3 rd rule, given that h=k= 0.25. | **BTL -4** | Analyzing |
| 6. (a) | By dividing the range into 10 equal parts , evaluate $\int_0^{\pi} \sin x dx$ using Simpson's 1/3 rule. | **BTL -2** | Understanding |
| 6.(b) | By Gaussian three point formula to estimate $\int_{0.2}^{1.5} e^{-r^2} dr$ | **BTL -2** | Understanding |
| 7. (a) | A curve passes through the points (0, 18), (1,10) , (3,-18) and (6,90). Find the slope of the curve at x=2. | **BTL -3** | Applying |
| 7. (b) | Evaluate $\int_1^2\int_1^2 \frac{dx\,dy}{x+y}$ h = k = 0.25 using trapezoidal, Simpson's rule, and justify. | **BTL -4** | Analyzing |
| 8. (a) | Find the first and second derivatives of the function $f(x) = x^3 - 9x - 14$ at x = 3.0 using the values given below<br>x : 3.0 3.2 3.4 3.6 3.8 4<br>f(x): -14 -10.03 -5.296 -0.256 -6.672 14 | **BTL -4** | Analyzing |
| 8.(b) | Find the value of f ` (8) from the table given below<br>x : 6 7 9 12<br>f (x) : 1.556 1.690 1.908 2.158 using suitable formula. | **BTL - 3** | Applying |
| 9. (a) | Evaluate $\int_2^{2.6}\int_4^{4.4} xy\,dx\,dy$ using Simpson's 1/3 rd rule, given that | **BTL -5** | Evaluating |

<table>
<tr><td></td><td>h=0.2, k=0.3.</td><td></td><td></td></tr>
<tr><td>9.(b)</td><td>A river is 80 meter wide the depth d in meters at a distance x meters from one bank is given below. Calculate the area of the cross section of the river using Simpson rule.<br>x : 0 10 20 30 40 50 60 70 80<br>d : 0 4 7 9 12 15 14 8 3</td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>10.(a)</td><td>Use the Romberg method to get an improved estimate of the integral from x = 1.8 to x = 3.4 from the data in the table with h = 0.4.<br>x : 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0 3.2 3.4 3.6 3.8<br>Y: 4.953 6.050 7.389 9.025 11.023 13.464 16.445 20.056 24.533 29.964 36.598 44.701</td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>10.(b)</td><td>The Velocity v( km/ min) of a moped which starts from rest, is given at fixed intervals of time (min) as follows.<br>T : 0 2 4 6 8 10 12<br>V : 4 6 16 34 60 94 131<br>Estimate approximate distance covered in 12 minutes, by Simpson’s 1 / 3 rd rule, also find the acceleration at t = 2 seconds.</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>11.(a)</td><td>Apply Gaussian three point formula to find $\int_1^2 \frac{dx}{1+x^3}$</td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>11.(b)</td><td>Calculate $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 1.35 from the following data:
<table>
<tr><td>X</td><td>1.1</td><td>1.2</td><td>1.3</td><td>1.4</td><td>1.5</td><td>1.6</td></tr>
<tr><td>f(x)</td><td>-1.62628</td><td>0.15584</td><td>2.45256</td><td>5.39168</td><td>9.125</td><td>13.83072</td></tr>
</table></td><td>BTL -5</td><td>Evaluating</td></tr>
<tr><td>12.(a)</td><td>The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds . Find the Initial acceleration using the entire data
<table>
<tr><td>Time (sec)</td><td>0</td><td>5</td><td>10</td><td>15</td><td>20</td></tr>
<tr><td>Velocity(m/sec)</td><td>0</td><td>3</td><td>14</td><td>69</td><td>228</td></tr>
</table></td><td>BTL -3</td><td>Applying</td></tr>
<tr><td>12.(b)</td><td>From the following table, find the value of x for which y is minimum.
<table>
<tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Y</td><td>2</td><td>-0.25</td><td>0</td><td>-0.25</td><td>2</td><td>15.75</td><td>56</td></tr>
</table></td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>13.(a)</td><td>Using the following data, find f’(5), f’’(5) and the maximum value of f(x).
<table>
<tr><td>X</td><td>0</td><td>2</td><td>3</td><td>4</td><td>7</td><td>9</td></tr>
<tr><td>f(x)</td><td>4</td><td>26</td><td>58</td><td>112</td><td>466</td><td>922</td></tr>
</table></td><td>BTL -4</td><td>Analyzing</td></tr>
<tr><td>13.(b)</td><td>Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule with h=0.2, hence obtain an approximate value of π .</td><td>BTL -5</td><td>Evaluating</td></tr>
<tr><td>14.(a)</td><td>Evaluate $\int_0^1 e^{-x^2}\,dx$ by dividing the range into 4 equal parts using (a) Trapezoidal rule (b) Simpson’s 1/3 rd rule.</td><td>BTL -5</td><td>Evaluating</td></tr>
</table>

| | | | |
|---|---|---|---|
| 14.(b) | The following table gives the values of $y = \frac{1}{1+x^2}$. Take h=0.5, 0.25, 0.125 and use Romberg's method to compute $\int_0^1 \frac{dx}{1+x^2}$. Hence deduce an approximate value of $\pi$.<br>X: 0, 0.125, 0.25, 0.375, 0.5, 0.675, 0.75, 0.875, 1<br>Y: 1, 0.9846, 0.9412, 0.8767, 0.8, 0.7191, 0.64, 0.5664, 0.5 | **BTL -5** | Evaluating |

| X | 0 | 0.125 | 0.25 | 0.375 | 0.5 | 0.675 | 0.75 | 0.875 | 1 |
|---|---|---|---|---|---|---|---|---|---|
| Y | 1 | 0.9846 | 0.9412 | 0.8767 | 0.8 | 0.7191 | 0.64 | 0.5664 | 0.5 |

**UNIT – IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS**

Single Step methods - Taylor"s series method - Euler"s method - Modified Euler"s method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne"s and Adams-Bash forth predictor corrector methods for solving first order equations.

| Q.No. | Question | BT Level | Competence |
|---|---|---|---|
| 1. | Examine the terms initial and final value problems. | **BTL -2** | Understanding |
| 2. | Estimate $y(0.2)$ given that $y' = x + y, y(0) = 1$, using Euler's method. | **BTL -2** | Understanding |
| 3. | Using Euler's method, compute y(0.1) given $\frac{dy}{dx} = 1 - y$, y(0) = 0 | **BTL -2** | Understanding |
| 4. | Define initial value problems. | **BTL -1** | Remembering |
| 5. | Give Euler's iteration formula for ordinary differential equation. | **BTL -1** | Evaluating |
| 6. | Estimate $y(1.25)$ if $\frac{dy}{dx} = x^2 + y^2$, $y(1) = 1$ taking $h = 0.25$, using Euler's method. | **BTL -2** | Understanding |
| 7. | Write the Euler's modified formula for solving $\frac{dy}{dx} = f(x, y), y(x_0) = y_0$ | **BTL -1** | Remembering |
| 8. | Using modified Euler's method to find y (0.4) given $y' = xy, y(0) = 1$ | **BTL -2** | Understanding |
| 9. | Find y(0.1), if $\frac{dy}{dx} = y^2 + x$ given $y(0) = 1$, by Taylor series method. | **BTL -3** | Applying |
| 10. | Using Taylor series formula to find y ($x_1$) for solving $\frac{dy}{dx} = f(x, y), y(x_0) = y_0$. | **BTL -2** | Understanding |
| 11. | Using Taylor's series up to $x^3$ terms for $2y' + y = x + 1$, $y(0) = 1$. | **BTL -3** | Applying |
| 12. | Using Taylor series for the function $\frac{dy}{dx} = x + y$ when $y(1) = 0$ find $y$ at $x = 1.2$ with $h = 0.1$. | **BTL -3** | Applying |
| 13. | Explain Runge – Kutta method of order 4 for solving initial value problems in ordinary differential equation. | **BTL -1** | Remembering |
| 14. | Find y(0.4) given $y' = xy, y(0) = 1$, using R-K method of fourth order | **BTL -3** | Applying |
| 15. | Using fourth order Runge – Kutta method to find y (0.1) given $\frac{dy}{dx} = x + y$ y (0) = 1, h = 0.1 | **BTL -2** | Understanding |

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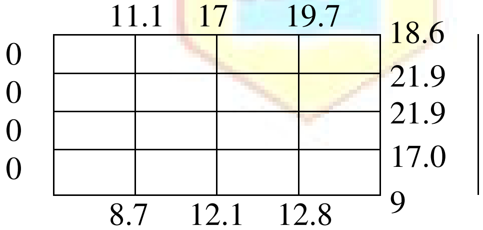
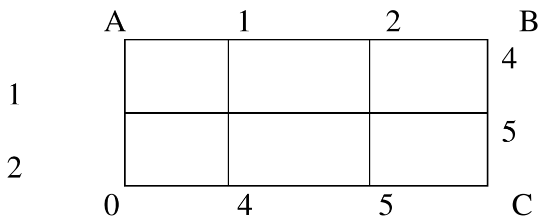
|---|---|---|---|
| 16. | State Adam- Bashforth predictor and corrector formulae to solve first order ordinary differential equations. | **BTL -2** | Understanding |
| 17. | State Milne's predictor corrector formula. | **BTL -2** | Understanding |
| 18. | Write predictor corrector method? | **BTL -1** | Remembering |
| 19. | Explain one step methods and multi step methods. | **BTL -1** | Remembering |
| 20. | Prepare the multi-step methods available for solving ordinary differential equation. | **BTL -4** | Analyzing |
| | **PART –B** | | |
| 1.(a) | Apply modified Euler method to find y(0.2) given $y' = y - x^2 + 1$, y(0) = 0.5. | **BTL -3** | Applying |
| 1. (b) | Using Runge-kutta method of $4^{th}$ order solve the following equation taking each step h = 0.1 for $\frac{dy}{dx} = \left[\frac{4x}{y} - x.y\right]$ given y(0) = 3.calculate y at x = 0.1 and 0.2. | **BTL -3** | Applying |
| 2. (a) | Using Taylor series method find y at x = 0.1 given $\frac{dy}{dx} = 2y + 3e^x$, y(0) = 0. | **BTL -3** | Applying |
| 2.(b) | Examine 2y' –x – y = 0 given y(0) = 2 , y(0.5) = 2.636, y(1) = 3.595, y(1.5) = 4.968 to get y(2) by Adam's method. | **BTL -4** | Analyzing |
| 3. (a) | Using Taylor series method find correct to 4 decimal places the value of y(0.1) given $\frac{dy}{dx} = x^2 + y^2$ y(0) =1. | **BTL -3** | Applying |
| 3.(b) | By Adam's method, find y (0.6) given $\frac{dy}{dx} = x + y$, y (0) = 1 using h = 0.2 if y(-0.2) = .8373, y(0.2) = 1.2427, and y(0.4) = 1.5834. | **BTL -2** | Understanding |
| 4. (a) | By Euler modified method for the function $\frac{dy}{dx} = \log_{10}(x + y)$, y(0) = 2 find the values of y(0.2) y(0.4) and y(0.6) by taking h = 0.2. | **BTL -3** | Applying |
| 4.(b) | Find y(2) by Milne's method $\frac{dy}{dx} = \frac{1}{2}(x + y)$, given y(0) = 2 , y(0.5) = 2.636, y(1.0) = 3.595 and y(1.5) = 4.968. | **BTL -3** | Applying |
| 5. (a) | Apply Milne's method find y(0.4) given $\frac{dy}{dx} = xy + y^2$, y(0) =1 ,using Taylor series method find y(0.1) , y(0.2) andy(0.3) | **BTL -3** | Applying |
| 5.(b) | Interpret y(0.1) and y(0.2) given $\frac{dy}{dx} = x^2 + y^2$ y(0) =1and h = 0.1, using modified Euler methods. | **BTL -3** | Applying |
| 6. (a) | 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 Adam's Bash forth predictor corrector method. | **BTL -5** | Evaluating |
| 6.(b) | Solve the equation y' = x + y, y(0) = 1 for x =( 0.0 ), (0.2), (1.0),using Euler's method . Check your answer with the exact solution. | **BTL -4** | Analyzing |

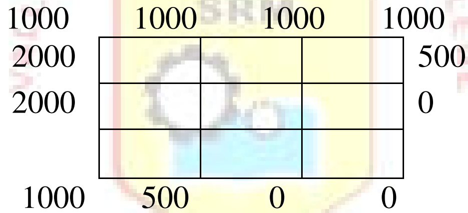
| | | | |
|---|---|---|---|
| 7. (a) | Apply Runge – kutta method of order 4 solve y' = $y-x^2$, with y(0.6) = 1.7379,h=0.1 find y(0.8). | **BTL -3** | Applying |
| 7. (b) | Evaluate the value of y at x = 0.1 and 0.2to 4 decimal places given $\frac{dy}{dx} = x^2 y - 1$ y(0) =1, using Taylor series method | **BTL -5** | Evaluating |
| 8. (a) | Calculate y(0.4) by Milne's predictor – corrector method , Given $\frac{dy}{dx} = \frac{1}{2}(1+x^2)y^2$ and y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12, y( 0.3) = 1.21, | **BTL -5** | Evaluating |
| 8.(b) | Explain the initial value problem $\frac{dy}{dx} = x - y^2$, y(0) = 1. To find y(0.4) by Adam's Bash forth 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 R-K method of fourth order . | **BTL -4** | Analyzing |
| 9. (a) | Find y(4.4) given 5xy' + $y^2$ – 2 = 0given y(4) = 1; y(4.1) =1.0049; y(4.2) = 1.0097 ; and y(4.3) =1.0143. Using Milne's method. | **BTL -4** | Analyzing |
| 9.(b) | Using Modified Euler's method, Determine the value of y at x=1.2, 1.4 and 1.6 to 4 significant figures where $\frac{dy}{dx} = 2 + \sqrt{xy}$ and y(1)=1. | **BTL -5** | Evaluating |
| 10.(a) | Find y(0.4) by Milne's method, Given $\frac{dy}{dx} = xy + y^2$ y(0) =1, y(0.1) = 1.1169, y(0.2) = 1.2773, y(0.3) = 1.5049 | **BTL -3** | Applying |
| 10.(b) | Evaluate $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ given that y(0) = 1 at x = 0.2 and 0.4 ,using Runge-kutta method of 4th order. | **BTL -5** | Evaluating |
| 11.(a) | Using Adam's – Bashforth method, find y(0.4) given $\frac{dy}{dx} = \frac{xy}{2}$ , y(0)=1, y(0.1)=1.01, y(0.2)= 1.022, y(0.3)=1.023. | **BTL -3** | Applying |
| 11.(b) | Given $\frac{dy}{dx} = x^3 + y$ , $y(0) = 2$. (i) Compute y(0.2), y(0.4) and y(0.6) by Runge- Kutta method of 4th order. Hence find y(0.8) by Milne's Predictor –Corrector method taking h= 0.2. | **BTL -5** | Evaluating |
| 12.(a) | Given the initial value problem y'= $x^2$ – y , y(0)=1, find the value of y at x=0.1 by Taylor series method at x=0.2 by modified euler method, at x=0.3 by fourth order Runge-Kutta method at x=0.4, 0.5 by Adam's- Bash forth method. | **BTL -3** | Applying |
| 12.(b) | Solve $\frac{dy}{dx} = 1 - y$ with the initial condition x= 0, y= 0 using Euler's algorithm and tabulate the solutions at x=0.1, 0.2, 0.3, 0.4. Using these results, find y(0.5) using Adam's –Bash forth Predictor and corrector method. | **BTL -3** | Applying |
| 13.(a) | Solve $\frac{dy}{dx} = y^2 + x$ , y(0)=1 (i)By modified Euler method at x=0.1 and x=0.2. (ii)By Fourth order R-K method at x=0.3 (iii)By Milne's Predictor-Corrector method at x= 0.4. | **BTL -3** | Applying |
| 13.(b) | Apply fourth order Runge-kutta method, to find an approximate value of y when x=0.2 and x=0.4 given that y'= x + y , y(0)=1 with h=0.2. | **BTL -3** | Applying |
| 14.(a) | Find y(0.4) by Milne's method,for $y - \frac{2x}{y}$ ,y(0) =1, y(0.1) = 1.0959, y(0.2) = 1.184, compute y(0.3) by Runge Kutta | **BTL -3** | Applying |

| | | | |
|---|---|---|---|
| | method. | | |
| 14.(b) | Using taylor series method, find y at x=0.1 to 0.4 given y'= $x^2$ – y correct to 4 decimals. | **BTL -3** | Applying |

**UNIT- V: BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS :**
Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace‟s and Poisson‟s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

| Q.No. | Question | BT Level | Competence |
|---|---|---|---|
| | **PART – A** | | |
| 1. | Derive explicit finite difference scheme for $u_t = u_{xx}$. | **BTL -1** | Remembering |
| 2. | What is the central difference approximation for $y'$? | **BTL -1** | Remembering |
| 3. | | | |
| 4. | State the finite difference approximation for $\frac{d^2y}{dx^2}$ and state the order of truncation error | **BTL -1** | Remembering |
| 5. | Write down the finite difference scheme for the differential equation $\frac{d^2y}{dx^2} - 3y = 2$ | **BTL -1** | Remembering |
| 6. | Obtain the finite difference scheme for the differential equation 2 $\frac{d^2y}{dx^2} + y = 5$ | **BTL -2** | Understanding |
| 7. | Write down the finite difference scheme for solving y" + x + y =0: y(0) = y(1) = 0. | **BTL -1** | Remembering |
| 8. | Write standard five point formula and diagonal five point formula used in solving Laplace equation $U_{xx} + U_{yy} = 0$ at the point ( iΔx , jΔy) | **BTL -2** | Understanding |
| 9. | Write down the Laplace's equation the standard five point formula | **BTL -1** | Remembering |
| 10. | Write down the diagonal five point formula in Laplace equation | **BTL -1** | Remembering |
| 11. | Write down the two dimensional Laplace's equation and Poisson's equation | **BTL -1** | Remembering |
| 12. | Write down Poisson's equation and its finite difference analogue | **BTL -1** | Remembering |
| 13. | What is the order and error in solving Laplace and Poisson's equation by using finite difference method? | **BTL -2** | Understanding |
| 14. | State the finite difference scheme for solving the Poisson's equation | **BTL -4** | Analyzing |
| 15. | State one dimensional heat equation and its boundary conditions | **BTL -4** | Analyzing |
| 16. | Name at least two numerical methods that are used to solve one dimensional diffusion equation | **BTL -4** | Analyzing |
| 17. | State the implicit finite difference scheme for one dimensional heat equation | **BTL -4** | Analyzing |
| 18. | What is Bender – Schmidt recurrence equation? For what purpose it is used? | **BTL -2** | Understanding |
| 19. | Define difference quotient of a function y (x) | **BTL -1** | Remembering |
| 20. | State the explicit formula for the one dimensional wave equation | **BTL -4** | Analyzing |

| | | | |
|---|---|---|---|
| | with $1 - \lambda^2 a^2 = 0$ where $\lambda = k / h$ and $a^2 = T / m$. (BTL6) | | |
| 20. | Evaluate the explicit finite difference scheme for one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$. | **BTL -5** | Evaluating |
| **PART –B** | | | |
| 1.(a) | Evaluate the pivotal values of the equation $U_{tt} = 16 U_{xx}$ taking $\Delta x = 1$ upto t = 1.25. The boundary conditions are $u(0,t) = u(5,t) = 0$, $u_t(x,0) = 0$ & $u(x,0) = x^2(5-x)$ | **BTL -5** | Evaluating |
| 1. (b) | Solve y” – y = x, 0 < x < 1, given y(0) = y(1) = 0 using finite difference method dividing the interval into 4 equal parts. | **BTL -4** | Analyzing |
| 2. (a) | Solve : $\nabla^2 u = -4(x+y)$ in the region given $0 \le x \le 4$, $0 \le y \le 4$ with all boundaries Kept at $0^o$ and choosing $\Delta x = \Delta y = 1$. Start with zero vector and do 4 Gauss seidel iterations | **BTL -3** | Applying |
| 2.(b) | Solve $y_{tt} = 4y_{xx}$ subject to the condition y(0,t) = 0; y(2,t) = 0; y(x,0) = x(2-x) ; $u_t(x,0) = 0$, Do 4 steps. Find the values upto 2 decimal accuracy. | **BTL -2** | Understanding |
| 3. (a) | Solve the boundary value problem $x^2 y'' - 2y + x = 0$ subject to y(2) =0 = y(3), find y (2.25 ) by finite difference method. | **BTL -2** | Understanding |
| 3.(b) | Solve $25\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$, $\frac{\partial u}{\partial t}(x,0) = 0$ $u(0,t) = 0$, $u(5,t) = 0$ $u(x,0) = \begin{cases} 2x, & 0 \le x \le 2.5 \\ 10-2x, & 2.5 \le x \le 5 \end{cases}$ by the method derived above taking h =1 and for one period of vibration , ( i.e. up to t =2) | **BTL -3** | Applying |
| 4.(a) | Solve the elliptic equation $U_{xx} + U_{yy} = 0$ for the following square mesh with boundary values as shown , using Liebman’s iteration procedure.  | **BTL -3** | Applying |
| 5. (a) | Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the initial conditions $u(0,t) = u(1,t) = 0$, $u(x,0) = \sin \pi x$, $0 \le x \le 1$, using Crank-Nicolson method. | **BTL -4** | Analyzing |
| 6. (a) | Solve the Laplace equation $U_{xx} + U_{yy} = 0$ for the following square mesh with the boundary values as shown in the figure below.  | **BTL -5** | Evaluating |
| 7. (a) | Solve by Crank – Nicholson’s method the equation $16 U_t = U_{xx}$ 0 <x <1 and t > 0subject to u(x , 0) = 0 , u ( 0,t )=0 and | **BTL -3** | Applying |

| | | | |
|---|---|---|---|
| | u (1,t ) =100 t .Compute one time step , taking Δx = ¼ and Δt=1. | | |
| 7. (b) | Solve $U_{xx} + U_{yy} = 0$ over the square region of side 4, satisfying the boundary conditions<br>(i) u (0,y) = 0, $0 \le x \le 4$,<br>(ii) u (4,y) = 12 + y, $0 \le x \le 4$,<br>(iii) u (x, 0) = 3x, $0 \le x \le 4$,<br>(iv) u (x,4) = $x^2$, $0 \le x \le 4$,<br>By dividing the square into 16 square meshes of side 1 and always correcting the computed values to two places of decimals, obtain the values of u at 9 interior pivotal points. | **BTL -2** | Understanding |
| 8. (a) | Solve the equation $\nabla^2 u = -10(x^2+y^2+10)$ over the square mesh with sides x = 0, y = 0 ,x = 3 and y = 3 with u = 0 on the boundary and mesh length is 1. | **BTL -4** | Analyzing |
| 9. (a) | Find the value of u( x, t ) satisfying the parabolic equation $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$ and the boundary conditions u(0,t) = 0 , u(8,t) = 0 and u(x,0) = 4x - $\frac{x^2}{2}$ at x = i, i = 0,1,2….7 and t = 1/8j, j = 0,1,2,3 . | **BTL -3** | Applying |
| 9.(b) | Given the values of u(x, y) on the boundary of the square in figure, evaluate the function u(x,y) satisfying the Laplace equation $U_{xx} + U_{yy} = 0$ at the pivotal points of this figure by Gauss seidel method<br> | **BTL -5** | Evaluating |
| 10.(a) | Solve : $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ , given u ( 0 ,t ) = 0,u(4, t ) =0,u(x ,0)= x(4–x ), taking h = 1 (for 4 times steps) | **BTL -3** | Applying |
| 10.(b) | Solve the Poisson equation $U_{xx} + U_{yy} = -81xy$ , 0<x<1, 0<y<1 given that u(0,y)=0, u(1,y)=100, u(x,0)=0, u(x,1)=100 and h=1/3. | **BTL -3** | Applying |
| 11.(a) | Using Bender Schmidt formula solve : $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ given u(0,t )=0, u ( 5 , t ) =0 , u( x ,0 ) = $x^2$ ( 25 –$x^2$ ) , assuming Δx =1. Find the value of u upto t =5. | **BTL -4** | Analyzing |
| 12.(a) | 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. | **BTL -3** | Applying |
| 13.(a) | Solve by Crank-Nicolson's method $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ For 0<x<1, t>0, u(0,t)=0, u(1,t)=0, U(x,0)=100(x-$x^2$). Compute u for one time step. h=1/4. | **BTL -3** | Applying |
| 13.(b) | $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ subject to the following conditions u(0,t)=0, u(1,t)=0, t>0 and $\frac{\partial u}{\partial t}(x,0) = 0$ $u(x,0) = sin^3 \pi x$ for all in 0≤x≤1. Taking h=1/4. Compute u for 4 time steps. | **BTL -3** | Applying |
| 14. | Solve $U_{xx} + U_{yy} = 0$ in 0≤x≤4 , 0≤y≤4 given that u(0,y)=0, u(4,y)=8+2y, u(x,0)=$x^2$/2, u(x,4)= $x^2$ taking h=k=1. Obtain the | **BTL -3** | Applying |

| | | | |
|---|---|---|---|
| | result correct of 1 decimal. | | |