|  |  |  |  |
| --- | --- | --- | --- |
|  | **MUTHAYAMMAL ENGINEERING COLLEGE**  **(An Autonomous Institution)**  (Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)  Rasipuram - 637 408, Namakkal Dist., Tamil Nadu. | | |
| **Department of Mathematics**  **Question Bank - Academic Year (2020-21)** | | | |
|  | | | |
| **Course Code & Course Name** | | **:** | **19BSS26 & Numerical Methods** |
| **Name of the Faculty** | | **:** | **P.Jothi** |
| **Year/Sem/Sec** | | **:** | **II / IV / EEE-B** |

**UNIT I: Solution of Equations and Eigen Value Problems**

**Part-A (2 Marks)**

1. State the order of convergence and convergence condition for Newton-Raphson method.
2. What is the order of convergence for fixed point iteration?
3. Solve x+y = 2, 2x+3y = 5 by Gauss Elimination method
4. Distinguish Gauss Elimination method and Gauss Jordan method.
5. Write a sufficient condition for Gauss\_seidal method to converge?
6. Write two iterative methods in solving a set of simultaneous equations.
7. Compare Gauss-Jacobi and Gauss seidal methods.
8. State the basic principle involved for finding A -1 by Gauss – Jordan method?
9. When do we use the power method?
10. Write down the procedure to find the numerically smallest Eigenvalue of a matrix by

power method**.**

**Part-B (16 Marks)**

1. (i) Find the real positive root of  by Newton’s method correct to

6 decimal paces. (8)

(ii) Find a root of  by N.R method correct to three decimal places. (8)

1. (i) Obtain the positive root of using Newton-Rapshon method. (8)

(ii) Solve the following system of equation using Gauss – Seidel method

(8)

1. (i) Solve by Gauss Elimination Method

(8)

(ii) Solve . (8)

by Gauss Elimination Method.

1. Find by power method the largest eigen value and the eigen vector of the matrix (16)
2. Find the dominant eigen value and the corresponding eigen vector of the matrix

(16)

1. Determine the largest Eigenvalue and the corresponding Eigenvector of the matrix using the

power method: A= (16)

**UNIT-II**

**Interpolation and Approximation**

**Part-A (2 Marks)**

1. What is the Lagrange’s formula to find y, if three sets of values (x0 , y0), (x1 , y1) and (x2 , y2) are given
2. What advantage has Lagrange’s formula over Newton?
3. What do you meant by interpolation?
4. Write the Newton’s divided difference interpolation formula.
5. When Newton’s backward interpolation formula is used?
6. When will we use Newton’s forward interpolation formula?
7. What is the error in Newton’s forward interpolation formula?
8. What is the error in Newton’s backward interpolation formula?
9. What is the advantage of Newton’s divided difference method?
10. Write the difference between Newton’s divided difference and Lagrange Interpolation method?

**Part-B (16 Marks)**

1. Using Lagrange’s interpolation formula find y(10) from the following table. (16)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | 5 | 6 | 9 | 11 |
| y | 12 | 13 | 14 | 16 |

1. Using Lagrange’s interpolation formula , find f(x) from the following data and

hence find f(4) (16)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | 0 | 1 | 2 | 5 |
| f(x) | 2 | 3 | 12 | 147 |

1. Using Lagrange’s interpolation , calculate the profit in the year 2000 from the following data

(16)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | 1997 | 1999 | 2001 | 2002 |
| Profit Lakhs Rs. | 43 | 65 | 159 | 248 |

1. Find the function from the following table using Newton’s divided difference formula.

(16)

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

1. Using Newton’s divided difference formula find the values of given from the following table (16)

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

1. Given the values Evaluate f(9) Newton’s divided difference formula. (16)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| x | 5 | 7 | 11 | 13 | 17 |
| f(x) | 150 | 392 | 1452 | 2366 | 5202 |

1. From the following data find y at x=43 and x=84 (16)

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

1. The Population of town is as follows (16)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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

1. The table gives the distance in natural miles of the visible horizon for the given

heights in feet above the earth’s surface (16)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| x=height | 100 | 150 | 200 | 250 | 300 | 350 | 400 |
| y=distance | 10.63 | 13.03 | 15.04 | 16.81 | 18.42 | 19.90 | 21.27 |

Find the values of

**UNIT-III Numerical Differentiation and Integration**

**Part-A (2 Marks)**

1. Write the formula for at using forward difference operator.
2. Using forward differences, the formula for .
3. Using Newton’s backward difference formula, write the formulae for the first and second order derivatives at the end values  upto the fourth order difference term.
4. Why is Trapezoidal rule so called?
5. How the accuracy can be increased in Trapezoidal rule of evaluating a given definite integral?
6. What does Simpson’s rule give exact result?
7. What is the order of error in Trapezoidal formula?
8. What is the order of error in Simpson’s formula?
9. State the local error term in Simpson’s one third rule.
10. State Trapezoidal rule to evaluate .

**Part-B (16 Marks)**

1. Find from the following data using Newton’s formula for

differentiation. (16)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 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 |

1. Find the value of using Newton’s differentiation formula. (16)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| x | 0.35 | 0.4 | 0.45 | 0.5 | 0.55 | 0.6 | 0.65 |
| f(x) | 1.521 | 1.506 | 1.488 | 1.467 | 1.444 | 1.418 | 1.389 |

1. Find f ‘(0) and f ’’(4) from the following data: (16)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| : | 0 | 1 | 2 | 3 | 4 |
| : | 1 | 2.718 | 7.381 | 20.086 | 54.598 |

1. Evaluate by using Trapezoidal rule and Simpson’s rule. (16)
2. The velocity of a particle at a distance from a point on its path is given by the table

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 10 | 20 | 30 | 40 | 50 | 60 |
|  | 47 | 58 | 64 | 65 | 61 | 52 | 38 |

Estimate the time taken to travel 60 meters by Trapezoidal rule Simpson’s rule. (16)

1. Evaluate the following by two-point Gaussian and three-point Gaussian

formula  (16)

1. Evaluate using Trapezoidal rule and Simpson’s rule. (16)
2. Using Trapezoidal rule and Simpson’s rule. evaluate numerically

with along x-direction and along y-direction. (16)

1. Evaluate by Simpson’s rule taking . (16)

**UNIT – IV Initial Value Problems for Ordinary Differential Equations**

**Part-A (2 Marks)**

1. Write down the fourth order Taylor’s Algorithm.
2. State the disadvantage of Taylor’s series method.
3. Write the merits and demerits of the Taylor method of solution.
4. What is the truncation error of Taylor’s series method?
5. Write down Euler’s algorithm to the differential equation .
6. State the special advantage of Runge-Kutta method orver Taylor’s series method.
7. What are the advantages of R-K method over Taylor’s method.
8. How many prior values are required to predict the next value in Milne’s method?
9. What is the error term in Milne’s corrector formula?
10. How many prior values are required to predict the next value in Adam’s method?

**Part-B (16 Marks)**

1. Solve  use Taylor’s series method at x = 0.2 and x = 0.4. (16)
2. Find y(0.1), y(0.2) given using Taylor’s series method. (16)
3. (i) Find y at x=0.25 by Modified Euler’s method given that. (8)

(ii) Find y(0.2), y(0.4) given  ,using Modified Euler’s method. (8)

1. (i)Given, find (i) y(0.1) , y(0.2) by Euler’s method (ii) y(0.3) by Modified Euler’s method. (8)

(ii) Find y(0.2) with h=0.1 from by Runge kutta method . (8)

1. Solve  at x=0.2 given thatusing R.K method of fourth order. (16)
2. Compute y(0.1) , given by using Runge-Kutta method of order method. (16)
3. Find is the solution of given using Milne’s predictor-corrector method. (16)
4. (i) Given  , y(0)=1, y(0.2)=1.12186, y(0.4)=1.46820, y(0.6)=1.73790. Find y(0.8) by Milne’s predictor corrector formula. (8)

(ii) Given , . Use Adam’s methods to estimate . (8)

**Unit – V Boundary Value Problems In Ordinary and**

**Partial Differential Equations**

**Part-A (2 Marks)**

1. State the conditions for the equation. Auxx + Buyy + Cuxy +Dux +Euy + Fu =G where A, B,

C, D, E, F, G are function of x and y to be (i) elliptic (ii) parabolic (iii) hyperbolic

1. State the condition for the equation Auxx+2Buxy+Cuyy=f(ux,uy,x,y) to be

(a)elliptic (b) parabolic(c) hyperbolic when A, B, C are functions of x and y

1. What is the classification of fx-fyy=0?
2. Write the diagonal five-point formula to solve the Laplace’s equation .
3. Write down the standard five point formula to solve Laplace’s equation .
4. Write the difference scheme for solving the Laplace’s equation.
5. What is the number of conditions required to solve the Laplace’s equation?
6. What is the purpose of Leibmann’s process?
7. Define Poisson’s Equation.
8. Mention any two single step methods for solving an ordinary differential equation, subject to initial condition.

**Part-B (16 Marks)**

1. Solve the Laplace equation over the square mesh of side 4 satisffing the boundary conditions: . (16)
2. Derive Bender – Schmidt for solving with the b.cs. and for . Also find corresponding recurrence equation. (16)
3. By finite difference method , solve with thw b.cs (16)

.

1. Solve in . Given that

and taking. Obtain the result

correct to one decimal. (16)

1. Solve the Poisson’s equation for the square mesh of the given figure with on the boundary and mesh length=1. (16)

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

1. Obtain the Crank-nicholson finite difference method by taking . Hence find in the rod for two times steps for the heat equation given . Take . (16)
2. Solve over the square mesh of side 4 units; satisfying the following boundary conditions: (16)

|  |  |  |
| --- | --- | --- |
| **Course Faculty** |  | **HoD** |