|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Course Code** | **Course Title** | **L** | **P** | **U** |
| MA309 | Numerical Analysis | 3 | 0 | 3 |

**Objectives of the course :**

**Objective 1 :** To enable the students to devise algorithms for the numerical solutions of the

mathematical problems.

**Objective 2 :** Toenable the students to discuss the error analysis of different algorithms.

**Course learning outcome:** Upon completion of this course, the student will be able to:

1. Understand the pitfalls of numerical computing.
2. To find the roots of non-linear and transcendental equations.
3. To solve large system of linear equations.
4. To find interpolating polynomials.
5. To compute numerical derivatives and integrations.
6. To compute numerical solution of initial value problems.
7. To find eigen values and eigen vectors of matrices.

|  |  |  |
| --- | --- | --- |
| **Text Books** | **T1** | Applied Numerical Analysis, C.F,Gerald, P.O.Wheatley, Addison-Wesley,6th Edition, 2001. |
| **Reference books** | **R1** | Numerical Analysis and Computational Procedures, S. A. Mollah,2015 |

**Course Contents**

**Unit I :** Types of error and amount of error, Delta operator, nebla operator, differential operator, shift operator and inter relationship.

**Unit II :** Bisection method, Geometrical interpretation of bisection method, Fixed point iteration method, Newton-Raphson method, Geometric interpretation of Newton-Raphson method for the solution of non linear equations and transcendental equations.

**Unit III :** Gauss-Elimination method, Gauss-Jacobi method, Gauss-Seidal method, L-U decomposition method for the solution of large system of linear equations.

**Unit IV :** Lagrange’s interpolation and inverse interpolation, Divided difference interpolation and inverse interpolation for finding interpolating polynomial. Newton’s forward differentiation, Newton’s backward differentiation for numerical differentiation, Trapezoidal Rule, Simpson’s one-third rule, Weddle’s rule for numerical integration.

**Unit V :** Taylor’s method, Euler method, Picard’s method, Runge-Kutta method, for numerical solution of initial value problem. Power method for finding eigen value and eigen vector of matrices.

**LECTURE-WISE PLAN**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture No.** | **Learning outcomes** | **Topics to be covered** | **Books** |
|  |  |  |  |
| 1-2 | Understand the pitfalls of numerical computing. | Types of error and amount of error | T1 |
| 3-5 | Delta operator, nebla operator, differential operator, shift operator and inter relationship | T1 |
| 6-7 | To find the roots of  non-linear and transcendental equations | Bisection method | R1 |
| 8 | Geometrical interpretation of bisection method | R1 |
| 9-10 | Fixed point iteration method | R1 |
| 11-12 | Newton-Raphson method | R1 |
| 13 | Geometric interpretation of Newton-Raphson method | R1 |
| 14-15 | To solve large system of linear equations | Gauss-Elimination method | R1 |
| 16-17 | Gauss-Jacobi method | R1 |
| 18-19 | Gauss-Seidal method | R1 |
| 20-21 | L-U decomposition method | R1 |
| 22-23 | To find interpolating polynomials. | Lagrange’s interpolation and inverse interpolation | R1 |
| 24-25 | Divided difference interpolation and inverse interpolation | R1 |
| 26-27 | To compute numerical derivatives | Newton’s forward differentiation | R1 |
| 28-29 | Newton’s backward differentiation | R1 |
| 30-31 | To compute numerical integration | Trapezoidal Rule | R1 |
| 32-33 | Simpson’s one-third rule | R1 |
| 34-35 | Weddle’s rule | R1 |
| 36-37 | To compute numerical solution of initial value problems | Taylor’s method | R1 |
| 38-39 | Euler method | R1 |
| 40-41 | Picard’s method | R1 |
| 42-43 | Runge-Kutta method | R1 |
| 44-45 | To find eigen values and eigen vectors of matrices | Power method | R1 |

**: Evaluation Scheme :**

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Duration** | **Marks** | **Remarks** |
| **Internal I** |  | 25 |  |
| **Mid Term Examination** |  | 20 | Closed Book |
| **Internal II** |  | 25 |  |
| **Comprehensive Examination** |  | 30 | Closed Book |

1. **Attendance Policy :** A student must normally maintain a minimum of **75% attendance** in the course without which he/she will be disqualified from appearing in the respective examination.
2. **Make-up Policy :**  A student, who misses any component of evolution for genuine reasons, must immediately approach the instructor with a request for make-up examination. **The decision of the instructor in all matters of make-up will be final.**
3. **Chamber Consultation Hours :** During the chamber consultation hours, the student can consult the respective faculty in his or her chamber without any prior appointment.