ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VI SEMESTER **MATHEMATICS** **TIME: 5 Hrs/Week**

M-A_2-6301(3) **Advanced Numerical Analysis** **Max. Marks: 100**

w.e.f. 2017-2018 **SYLLABUS**

Course Objectives:

To enable the students to

- Find the solution of the first order and second order equation with constant coefficient
- Find the summation of series finite difference techniques
- Find the solution of ordinary differential equation of first order by Euler, Taylor and Runge-Kutta methods
- Derive Least – Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Curve fitting by a sum of exponentials.
- Find the derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formulae, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function.
- Derive Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules from General Quadrature formula and find the Euler – Maclaurin Formula of summation and The Euler transformation.
- Find the solution of linear systems by using Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method, Method of factorization, Solution of Tridiagonal Systems,.

Course Outcomes:

At the end of the course student will

- **CO1:** Acquire basic knowledge in solving interpolation with equal interval problems by various numerical methods. Estimate the missing terms through interpolation methods.
- **CO2:** Develop skills in analyzing the methods of interpolating a given data, properties of interpolation with unequal intervals and derive conclusions, approximate a function using an appropriate numerical method.
- **CO3:** Implement numerical methods for a variety of multidisciplinary applications and a variety of numerical algorithms using appropriate technology.

- **CO4:** Use relevant numerical techniques for interpolation with equal and unequal intervals by using various central difference formulae and code a numerical method in a modern computer language.
- **CO5:** Apply appropriate numerical methods to solve the problem with most accuracy.
- **CO6:** Be able to derive Least – Squares curve fitting procedures, fitting a straight line, fitting a parabola, nonlinear curve fitting, Curve fitting by a sum of exponentials.
- **CO7:** Be able to find the derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formulae, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function.
- **CO8:** Be able to derive Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules from General Quadrature formula and find the Euler – Maclaurin Formula of summation and The Euler transformation.
- **CO9:** Be able to find the solution of linear systems by using Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method, Method of factorization, Solution of Tridiagonal Systems,.
- **CO10:** Be able to find the find the solution of ordinary differential equation of first order by Euler, Taylor and Runge-Kutta methods
- **CO11:** Compare different methods in numerical analysis with accuracy and efficiency of solution

COURSE SYLLABUS:

Unit – I

Curve Fitting: Least – Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Curve fitting by a sum of exponentials.

UNIT- II :

Numerical Differentiation: Derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formula, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function.

UNIT- III :

Numerical Integration: General Quadrature formula on errors, Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules, Euler – Maclaurin Formula of summation and quadrature, The Euler transformation.

UNIT – IV:

Solutions of Simultaneous Linear Systems of Equations: Solution of linear systems – Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method ,Method of factorization, Solution of Tridiagonal Systems,. Iterative methods. Jacobi's method, Gauss-siedal method.

UNIT – V

Numerical Solution of Ordinary Differential Equations: Introduction, Solution by Taylor's Series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge – Kutta methods.

TEXT BOOK : Calculus of Finite Differences And Numerical Analysis by Prof. P.P.Gupta and G.S. Malik – Krishna Prakashan Media (P) Ltd. Meerut (U.P) (2006)

Reference Books :

1. Numerical Analysis by S.S.Sastry, published by Prentice Hall India (Latest Edition).(2015)
2. Numerical Analysis by G. Sankar Rao, published by New Age International Publishers, New – Hyderabad.(2006)
3. Finite Differences and Numerical Analysis by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.(2009)
4. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain.(2002)

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VI SEMESTER **MATHEMATICS** **TIME: 1 Hr / Week**

CLUSTER VIII(A) –2

M 6351 – A- 2 (1) **Advanced Numerical Analysis** **Max. Marks: 50**

w.e.f. 2017-2018 **PRACTICAL SYLLABUS**

OBJECTIVES : To enable the students to

- Know and understand Numerical Methods .
- Distinguish between Numerical differences , integration and classical difference & Integration .
- Apply the knowledge Extensively in Engineering and Statistics.

COURSE :

Unit – I

Curve Fitting: Least – Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Curve fitting by a sum of exponentials.

UNIT- II :

Numerical Differentiation: Derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formula, Stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function.

UNIT- III :

Numerical Integration: General quadrature formula on errors, Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules, Euler – Maclaurin Formula of summation and quadrature, The Euler transformation.

UNIT – IV:

Solutions of simultaneous Linear Systems of Equations: Solution of linear systems – Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method ,Method of factorization, Solution of Tridiagonal Systems,. Iterative methods. Jacobi's method, Gauss-siedal method.

UNIT – V

Numerical solution of ordinary differential equations: Introduction, Solution by Taylor's Series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge – Kutta methods.

TEXT BOOK : Calculus of Finite Differences And Numerical Analysis by Prof. P.P.Gupta and G.S. Malik – Krishna Prakashan Media (P) Ltd. Meerut (U.P) (2006)

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4. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain.(2002)