

BCA 208: Numerical and Statistical Techniques

Teaching Scheme

Lectures: 1 hr/Week

Tutorials: 1 hr/Week

Credits: 2

Examination Scheme

Class Test -6 Marks

Teachers Assessment - 3Marks

Attendance - 6 Marks

End Semester Exam - 35 marks

Prerequisite: - Elementary Mathematics

Course Objectives:

The aim is to teach the student various topics in Numerical Analysis such as solutions of nonlinear equations in one variable, interpolation and approximation, numerical differentiation and integration, direct methods for solving linear systems, numerical solution of ordinary differential equations. Numerical Techniques for finding roots, Bisection method, Newton- Raphson method, numerical integration using Simpson's rules, Newton Cote's quadrature method, solving differential equations, interpolation and extrapolation.

Detailed Syllabus

Unit-1

Transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods.

Unit-2

Interpolation-Finite differences, difference tables, Newton's forward and backward interpolation formulae, Lagrange's and Newton's Divided difference formulae for unequal intervals.

Unit-3

Gauss's interpolation formula, Stirling's formula, Bessel's formula, Laplace-Everett formula.

Unit-4

Numerical Differentiation and Integration, Newton- Cote's quadrature formula, Trapezoidal Rule, Simpson's $1/3^{\text{rd}}$ Rule, Simpson's $3/8^{\text{th}}$ Rule.

Unit-5

Solution of Ordinary differential equations (first order, second order, simultaneous) by Picard's method, Euler's Method, Euler's improved and modified method and fourth orders Runge-Kutta methods.

Unit-6

Solution of system of linear equations by Gauss's Elimination method, Gauss -Seidel method and Triangularization method- Doolittle's method & Crout's method.

Text and Reference Books

1. Numerical Methods for Scientific Engineering Computation , Jain, Iyenger & Jian, New Age International , New Delhi, 2003.
2. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 2006.
3. Advanced Engineering Mathematics, E. Kreysig, John Wiley & Sons, 2005.
4. An Introduction to Numerical Analysis, Devi Prasad, Narosa Publication House, 3rd Edition.
5. Advanced Engineering Mathematics, R.K. Jain & S.R.K. Iyenger, Narosa Publication House, 1st Edition.
6. Calculus of finite differences and numerical analysis, H.C. Saxena, S. Chand Publication, 1st Edition, 2005.

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Course Outcomes:

1. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. Apply numerical methods to obtain approximate solutions to mathematical problems.
3. Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
4. Analyse and evaluate the accuracy of common numerical methods.
5. Implement numerical methods.
6. Write efficient, well