University of Sistan and

Baluchestan

Department of Mechanical Engineering

Numerical Analysis

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COURSE OUTLINE

The important topics covered in this course are polynomial and piecewise polynomial (spline) interpolation, numerical integration and numerical differentiation, approximate solutions of differential equations, direct and iterative solution of a system of linear equations and eigenvalue problems.

The theory behind various methods is rigorously discussed. Emphasis is on comparison of various methods and their implementation using a computer.

COURSE DETAIL

Module No.	Topic/s	Lectures
1	**Polynomial and piecewisepolynomial Interpolation:** • Divided Difference, Lagrange and Newton Form	2
2	**Numerical Integration:** • Some Basic Rules, Gaussian Integration, Composite Rules • Adaptive Quadrature, Romberg integration	2 1
3	**Numerical Differentiation**	2
4	**Vector and Matrix Norms**	2

5	**Solution of System of Linear Equations:** • Gauss Elimination Method, Partial Pivoting • Jacobi and GaussSeidel Methods • QR factorization using reflectors	 1 1 1
6	**Eigenvalue Problem:** • Basic properties: • Eigenvalue location: • Power Method and its variants:	 1 1 1
7	**Initial Value Problems:** • Single step methods such as Euler's Method, RungeKutta Methods, Taylor series method • Multistep methods such as AdamsBashforth method, Milne's method • PredictorCorrector Formula: AdamMoulton method	 1 1 1

PREREQUISITES

Basic Course in Calculus / Real Analysis

REFERENCES

1. S. D. Conte and Carl de Boor, Elementary Numerical Analysis, An Algorithmic Approach, MacgrawHill International Editions, 1981.
2. K. E. Atkinson, An Introduction to Numerical Analysis, John Wiley & Sons, paperback, 1989.

ADDITIONAL READINGS

D. S. Watkins, Fundamentals of Matrix Computations, John Wiley & Sons, 1991