

Course ID: ACT1

Programing Linear Algebra & Numerical Techniques in OCTAVE

Syllabus

Part I: Linear algebra

Introduction to Octave. Guidelines to octave environment, Building arrays and vectors, Plotting graphs, Octave scripting, Basic matrix operations, Complex numbers, Introduction to Matrices: Definitions of matrices, sub-matrices, square matrices, lower and upper triangular matrices, diagonal matrices, identity matrices, symmetric matrices, skew-symmetric matrices. Matrix Operations: Matrix transpose, addition, multiplication. Linear Systems: Definition, homogeneous systems, elementary row operations.

Vector Algebra: Linear combination, Linear independence, vector space, vector subspaces, dimension and basis of a vector space, null space, determinant, inverse and rank of matrices. Eigen analysis of Matrices: Eigenvalues and eigenvectors, characteristic equation, matrix diagonalization. Applications of eigenvalue and eigenvectors in solid mechanics, vibration and control theory.

Part II: Numerical Methods

Introduction to Numerical Methods: Numerical errors, absolute and relative errors, stability and convergence of numerical algorithms. Computation of Zeros: Bisection method, Newton method. Numerical Integration: trapezoidal rule, Simpson's 1/3 rule and Simpson's 3/8 rule. Numerical Solutions to Ordinary Differential Equations: Taylor series method, Euler method, Runge-Kutta method. Practical applications (Based on the engineering stream).

Expected outcomes

At the end of the course :

- **Students will be introduced to abstract mathematical thinking. A link between abstract and visualized concepts will be established. All practical examples are based on the respective engineering streams.**

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- Students will be relieved of the drudgery of doing arithmetic, so that he/she is free to concentrate on concepts.
- Students will be provided with a tool for learning mathematics by investigating ideas and exploring patterns, and for implementing mathematical models.
- Students will know how to collect and use data for their projects and reports.
- Students will know the three basic components of linear algebra (theory, computation and applications). The proper balance of these components will give the mathematics students the tools they need as well as the motivation to acquire these tools. The interest of the students will be stimulated by a wide variety of selected real-life applications.
- Students will be ensured that they appreciate the utility and beauty of the tools of matrix and linear algebra, as well as understanding the mechanics. The tools of matrix and linear algebra will be fundamental in their professional work

Deliverables

- GNU-Octave Software & Octave codes.
- Free international text book on linear algebra by Prof. Gilbert Strang (MIT,USA)
- Certificate of participation and certificate of coordination from TIERA, CET-TBI

Course details

- Duration: 5 days (3-4 Hrs a day)
- Fees: Rs. 4999/- (inclusive of all taxes)
- Grading will be done based on the attendance and the marks scored in the objective test
- Suitable for all engineering streams as per the KTU syllabus