Module Code	MA 1032	Module Title	Numerical Analysis			
Credits	03	Hours/Week	Lectures	3	Pre – requisites	MA 1013
			Lab/Assignments	0		

Learning Outcomes

After completing this module, the students should be able to

- understand the basic concepts of numerical methods including error analysis , methods for solving non – linear equations, methods for solving liner systems, approximations of functions, derivatives and integrals
- practically apply these methods in engineering problems

Outline Syllabus

- **Modeling, Computers, and Error Analysis**
  - Mathematical Modeling and Engineering Problem Solving
  - Programming and Software
  - Approximations and Round-Off Errors
  - Truncation Errors and the Taylor Series
- **Roots of Equations**
  - Bracketing Methods (bisection, false-position, incremental searches etc.)
  - Open Methods (fixed- point iteration, Newton-Raphson, Secant method, etc.)
  - Roots of Polynomials
  - Case Studies: Roots of Equations
- **Liner Algebraic Equations**
  - Gauss Elimination
  - LU Decomposition and Matrix Invention
  - Special Matrices and Gauss-Seidel
  - Case Studies: Liner Algebraic Equations
- **Optimization**
  - One-Dimensional Unconstrained Optimization (golden-section search, quadratic interpolation, Newton's method etc.
  - Multidimensional Unconstrained Optimization (direct and gradient methods, etc.)
  - Constrained Optimization (liner programming, non-linear constrained optimization etc.)
  - Case Studies: Optimization
- **Curve Fitting**
  - Least- Squares Regression (linear, non-linear, polynomial, multiple-linear regression etc.)
  - Interpolation (Newton's divided difference, Lagrange polynomials, inverse interpolation etc.)
  - Fourier Approximation
  - Case Studies : Curve Fitting
- **Numerical Differentiation & Integration**
  - Newton – Cotes Integration Formulas (trapezoidal rule, Simpson's rule, unequal segment etc.)
  - Integration of Equations
  - Numerical Differentiation
  - Case Studies: Numerical Differentiation & Integration

Note: Only for CS students