

| | | | | |
|------------------------------------|-----------------|---|------------------------|----------------------|
| 5th Semester | RBM5D006 | Computational Methods in Bio Medical Engineering | L-T-P 3-0-0 | 3 Credits |
|------------------------------------|-----------------|---|------------------------|----------------------|

Module-I

Approximations - Accuracy and precision, definitions of round off and truncation errors, error propagation. Algebraic equations – Formulation and solution of linear algebraic equations, Gauss elimination method. Introduction to Eigen value Analysis –Eigenvectors and Eigen values, Eigen value problems in Biomedical Engineering.

Module-II

Interpolation methods - Polynomial interpolation: Parametric, functional form.
Piecewise interpolation: Nearest neighbour, linear.
Extrapolation - Suitable applications for extrapolation and accuracy. Approximation, suitable kernels (e.g. B-spline).

Module-III

ODE - systems of coupled ODEs, higher order ODE, Taylor expansion, Explicit/Implicit methods (Forward/Backward Euler)
Implementation of Runge-Kutta method
Derivation and implementation of adaptive step size. Implementation of ODE functions using numerical packages.

Module-IV

Introduction to Finite Element Method - strong form and weak form equations, test and trial functions, discretization, boundary conditions, numerical assembly and solution
Finite Element Method for nonlinear ODEs - Linearization and Newton-Raphson method, numerical assembly and solution.

Books:

1. Robert J. Schilling and Sandra L. Harris, Applied Numerical Methods for Engineers using Matlab and C, Brooks/Cole, Pacific Grove, 2000.
2. Steven C. Chapra and Raymond P Canale, Numerical Methods for Engineers, 5th edition, Tata-Mcgraw Hill, New Delhi, 2007.
3. Gilbert Strang, Computational Science and Engineering, Wellesley-Cambridge Press, Wellesley, 2007.
4. S. P. Venkatesan, Computational Methods in Engineering, Ane Books India, New Delhi, 2014.