

EE 701 COMPUTER METHODS IN ELECTRICAL ENGINEERING [3-0-0:3]

Computational Methods

Mathematical modelling and problem solving, Round off and truncation error, Roots of Equations, Curve fitting – regression, interpolation and approximation, Fourier analysis, Numerical integration and differentiation, Ordinary Differential Equations: Initial Value and Boundary Value Problems.

Finite Difference Method – Finite Difference schemes, Finite differencing of Parabolic, Hyperbolic and Elliptic PDEs, treatment of irregular boundaries, accuracy and stability of FD solutions, Application, Limitations and Error analysis. Finite Element Method – Variational and Galerkin Methods, shape functions, lower and higher order elements, vector elements, 2D and 3D finite elements, Solution of electromagnetic equation, efficient finite element computations, Application, Limitations and Error analysis.

Soft Computing

Artificial Neural Network Algorithm: Introduction, Comparison of Neural Techniques and AI, Artificial Neuron Structure, Adaline, ANN Learning, Back-Propagation Learning, Properties & Limitations. Fuzzy Algorithm Approach: Introduction, Uncertainty and Information., Types of Uncertainty, Fuzzy Logic- Introduction, Properties of Fuzzy Sets, Fuzzy Cartesian Product, shape & defining Membership Functions, Defuzzification, Rule Based System.

Optimisation Techniques

Stationary points - maxima, minima and saddle points; Functions of single and two variables; Global Optimum; Convexity and concavity of functions of one and two variables; Optimization of function of one variable and multiple variables; Gradient vectors; Lagrangian function.

Genetic Algorithms: Introduction, Effect of Crossover Probability on GA Performance, Effect of Mutation Probability on GA Performance, Main Components of GA, Variants, Applications of Genetic Algorithms in Load Forecasting. Introduction to the Particle swarm optimization (PSO): Parameter selection, Neighbourhoods and topologies, Convergence, Hybridization, Alleviate premature convergence, Simplifications, Multi-objective optimization, Binary, discrete, and combinatorial

References

1. J.H. Mathews, K.D. Fink, “Numerical Methods using MATLAB” 3rd Edition, Prentice Hall 1999
2. Steven C. Chapra, “Applied Numerical methods with MATLAB”, 3rd Edition, Tata-Magraw Hill, 2012
3. P. Zhou, Numerical Analysis of Electromagnetic Fields, Springer, 2012
4. D K Chaturvedi, “Soft Computing - Techniques and its Applications in Electrical Engineering”, Springer-Verlag Berlin Heidelberg.
5. S.S. Rao, “Engineering Optimisation: Theory and Practice”, John Wiley & Sons., 4th Edition, 2009
6. Edwin K P Chong, Stanislaw H Zak, “An Introduction to Optimization”, 4th Edition, John Wiley, 2001