EEC306: COMPUTATIONAL METHODS IN ECE

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Module I **9 Hours**

Design of an Electric Circuit: Kirchhoff's laws to study the steady-state (not time-varying) behaviour of electric circuits. Bracketing Methods: Graphical Methods, bisection Method, the false-position method. Open Methods: Simple fixed-point iteration, the Newton-Raphson method, the secant method, Brent's method, multiple roots, systems of nonlinear equations.

Module II **9 Hours**

Loop and Node Analysis for Networks: Gauss Elimination: Solving small numbers of equations, naive Gauss elimination, pitfalls of elimination methods, techniques for improving solutions, complex systems, nonlinear systems of equations, Gauss-Jordan, Lu decomposition, the matrix inverse, error analysis and system condition.

Module III **9 Hours**

Maximum Power Transfer for a Circuit: Minimum and maximum value in electromagnetics. Optimization: golden-section search, parabolic interpolation, Newton's method, Brent's method. multidimensional unconstrained optimization: direct methods, gradient methods.

Module IV **9 Hours**

Representation of a function by a closed or a complete set of mutually orthogonal functions in analogy between vectors and signals: Fourier approximation, curve fitting with sinusoidal functions, continuous Fourier series, frequency and time domains, Fourier integral and transform, discrete Fourier transform (DFT), fast Fourier transform (FFT), the power spectrum

Module V **9 Hours**

Simulating Transient Current for an Electric Circuit: Euler's method, improvements of Euler's method, Runge-Kutta methods, systems of equations adaptive Runge-Kutta methods, stiffness and multistep methods. **Two-Dimensional Electrostatic Field Problems**: The Laplace equation, solution technique, boundary conditions, the control-volume approach software to solve elliptic equations.

Text Book(s)

1. Steven C. Chapra, Raymond P. Canale, Numerical Methods for Engineers, 6/e, Tata McGraw-Hill, 2012.

References

1. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Methods For Scientific and Engineering Computation, 5/e, New Age International, 2007.