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College of Education
Department of Physics
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Postgraduate Course Syllabus
Computational Physics with MATLAB

1. Introduction to Matlab
1.1 Vector and Matrix Assignment
1.2 Mathematical Operations
1.3 Functions
1.4 Programming
1.5 Graphics
1.6 writing m- file

2. Non-linear Equations
2.1 Iterative Methods
2.2 Bisection
2.3 Newton-Raphson's Method .

3. Numerical Integration
3.1 Newton-Cotes Quadrature
3.2 Adaptive Integration
3.3 Gaussian Quadrature
3.4 Orthogonal polynomials, Legendre
3.5 Integration points and weights with orthogonal polynomials
3.6 General integration intervals for Gauss-Legendre
3.7 Other orthogonal polynomials
3.8 Applications to selected integrals
3.9 Treatment of Singular Integrals

4. Differential equations
4.1 Introduction
4.2 Ordinary differential equations
4.3 Finite difference methods
4.4 Improvements of Euler's algorithm, higher-order methods
4.5 Predictor-Corrector methods
4.6 Runge-Kutta methods

5. Partial differential equations
5.1 Introduction
5.2 Diffusion equation
5.3.1Explicit Scheme
5.4 Implicit Scheme.

5.5 Crank-Nicolson scheme
5.6 Solution for the One-dimensional Diffusion Equation
5.7 Laplace's and Poisson's Equations
5.8.Shrodenger Equation.
5.9 Wave Equation in two Dimensions .
5.10 Heat Equation
5.11 Reaction Diffusion Equations
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6. Deterministic Chaos
6.1 Lorenz System
6.2 Chaotic Time Series Forecasting

7. Bose-Einstein condensation and Diffusion.
7.1 Diffusion
7.2 Bose-Einstein Condensation in Atoms .

8. Computational Nanotechnology
8.1 Introduction
8.2 Read data from computerize device

References:
1. Numerical Analysis with Matlab by Steven T. Karris
2. Numerical Analysis for Scientists and Engineers with Matlab by Steiven Charpa
3. Numerical Methods with MATLAB by Jann Kiuasalass