ROWAN UNIVERSITY
Department of Mathematics

Syllabus
1701.332 - Introduction to Numerical Analysis

CATALOG DESCRIPTION:

1701.332 Numerical Analysis 3 s.h.
(Prerequisites: 0701.102 Introduction to Programming and 1701.131 Calculus II, and 1701.210 Linear Algebra)
This course includes: elements of error analysis, real roots of an equation, polynomial approximation by finite difference and least square methods, interpolation, quadrature, numerical solution of ordinary differential equations, and numerical solutions of systems of linear equations. The student should expect to program a computer in addition to using a graphics calculator.

OBJECTIVES:

The purpose of numerical analysis is two-fold: (1) to find acceptable approximate solutions when exact solutions are either impossible or so arduous and time-consuming as to be impractical, and (2) to devise alternate methods of solution better suited to the capabilities of computers.

While this course will involve the student in considerable computation in order to apply techniques and obtain acceptable answers, the main emphasis will be on the underlying theory. It will be necessary to draw upon a good bit of calculus, linear algebra, computer science and other branches of mathematics during the course.

CONTENT:

1. Errors in Computation

2. Finding Roots of Equations by Approximation

   2.1 Graphical and other rough methods
   2.2 Methods of refinement, false position, iteration
   2.3 Newton-Raphson method

3. Finite Differences and Polynomial Approximations

   3.1 Finite differences, definition and theorems

3.2 Approximating polynomials, Gregory-Newton formula

3.3 Interpolation and extrapolation of tables

3.4 Error Analysis

4. Finite Integration

4.1 Finite integrals, definition and theorems

4.2 Summation of series

4.3 Quadrature formulas, Trapezoidal, Simpson, Weddle rules.

4.4 Richardson Extrapolation and Romberg Integration

5. Solutions of Systems of Equations

5.1 Scaled Gaussian Elimination

5.2 The Gauss-Seidel and Jacobi Iterative Methods

Additional topics may be selected, as time permits, from:

Approximation by Least Square Method
Numerical Solution of Differential Equations
Fractal and Chaos

TEXTS: The following might be possible texts for this course:

1. Burden, R.L. and Faires, D.F., Numerical Analysis, 5th ed. PWS-Kent, Boston, MA.

2. Cheney, Ward and Kincaid, David, Numerical Analysis and Computing, 2nd ed., Brooks/Cole, Pacific Grove, CA.

3. Marion, M.J., Numerical Analysis, A Practical Approach, Macmillian, New York, NY.

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