

Math 340 * Fall 2014 * Prof. Victor Matveev

Course Title:	Applied Numerical Methods
Textbook:	Elementary Numerical Analysis (3 rd Ed) K. Atkinson & W. Han, J Weiley and Sons (2003) ISBN-10:_0471433373; ISBN-13: 978-0471433378
Prerequisites:	Math 211 or Math 213, and CS 101 or CS 113 or CS 115 or Math 240 (all with a grade of C or better)

Course Learning Objectives:

- Students will demonstrate the ability to apply numerical techniques to approximate solutions of linear and nonlinear equations.
- Students will demonstrate the ability to apply numerical techniques to approximate areas under curves, as well as integrals and derivatives of functions of one variable.
- Students will demonstrate the ability to apply numerical techniques to approximate and interpolate function values.
- Students will demonstrate the ability to communicate advantages and disadvantages of various numerical techniques and evaluate appropriateness of specific numerical methods for solving mathematical problems.
- Students will demonstrate the ability to apply numerical techniques to approximate solutions of ordinary differential equations and analyze the stability of these techniques.
- Students will demonstrate the ability to translate these numerical problems into a computational algorithm using a high-level programming language such as MATLAB (Mathworks, Inc.).

Course Outcomes:

- Students will develop an understanding of the role of computation as a tool in real-world problem-solving.
- Students will develop an understanding of how computation is used to solve the most common mathematical problems frequently arising in engineering, science and technology.
- Students will develop an understanding of computational algorithms that are used to approximate numerical solutions of mathematical problems.
- Students will be prepared to apply their knowledge of numerical techniques in their further study of advanced topics in mathematics as well as science and engineering.

Course Assessment:

- The assessment of objectives will be achieved through homework assignments, MATLAB laboratory assignments, quizzes, and common examinations with common grading.

MATH 340 Course Outline

Lecture	Sections	Topic
1 (9-2)	1.1	Introduction: background material, MATLAB, Taylor Polynomials
2 (9-5)	1.2	Errors in Taylor Polynomials
3 (9-9)	1.3	Evaluating Polynomials
4 (9-12)	2.1	Floating Point Numbers
5 (9-16)	2.2	Numerical Errors
6 (9-19)	2.3-2.4	Error Propagation
7 (9-23)	3.1	The Bisection Method
8 (9-26)	3.2	Newton's Method
9 (9-30)	3.3	Secant method
10 (10-3)	3.4	Fixed Point Iteration
11 (10-7)	3.5	Ill-behaving root-finding problems
12 (10-10)	4.1	Interpolation: Polynomial Interpolation
13 (10-14)	Exam Review	
14 (10-17)	Midterm Examination	
15 (10-21)	4.2	Polynomial Interpolation
16 (10-24)	4.3	Spline Interpolation
17 (10-28)	5.1	Numerical Integration: Trapezoidal & Simpson's Rule
18 (10-31)	5.2	Error Formulas

19 (11-4)	8.3.2	Numerical Integration: Richardson Extrapolation
20 (11-7)	5.3	Gaussian Quadrature
21 (11-11)	5.4	Numerical Differentiation
22 (11-14)	8.1	Review of Ordinary Differential Equations
23 (11-18)	8.2	Euler's Method
24 (11-21)	8.3	Convergence Theory
25 (11-26)	8.4	Stability & Implicit methods
26 (12-2)	8.5	Taylor and Runge-Kutta Methods
27 (12-5)	8.7	Systems of Differential Equations
28 (12-9)	Final Exam Review	

Grading Policy

Assignment Weighting	
HW & Quizzes	22 %
Lab Projects	22 %
Midterm exam	24 %
Final Exam	32 %

Tentative Grading Scale	
A	88 -- 100
B+	82 -- 87
B	75 – 81
C+	68 – 74
C	62 – 67
D	56 – 61
F	0 – 55

Course Policies

- **Email:** it is important that you regularly check your NJIT email account for class assignments and announcements from your instructor. Rutgers students should email the instructor their preferred email address at the start of the semester.
- **Homework and Quizzes:** Homework problem sets will be emailed by the instructor once a week. Homework is due on the assigned date; late homework is not accepted. Quizzes are given about once per week, and will be announced at least one day in advance.
- **MATLAB Laboratory Assignments:** these assignments will be sent each week few days before the Lab class.