

155:307 Analysis II – Fall 2015
(Mon-Wed, 10:20-11:40am, FOA)

Instructor: Ioannis (Yannis) P. Androulakis, BME 212, 848-445-6561
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Teaching Assistant Seul-A Bae
Learning Assistants Donald Chawla and Sanchari Chosh
Grader Shishir Vadodaria

Important note Exams are graded by the instructor only. The TA will grade homework problems and the grader quizzes (see below for details)

Office hours: Students are **strongly** encouraged to participate with questions in class and email the instructor with their questions **at any time**. Instructor's formal office hours will be right after class until 1:30pm, unless otherwise noted on specific days.

Description: The course provides an introduction to numerical methods for the solution of a variety of chemical engineering problems. The emphasis is on both the formulation/solution of the problem as well as the analysis of the results.

Course Objectives: The course has three main objectives

1. We will focus on how to formulate a variety of analysis problems
2. We will discuss the underlying characteristics of basic numerical methods
3. We will explore the application of a number of computer implementations of computational methods using Excel and Matlab

Course Contents: SAKAI web-site

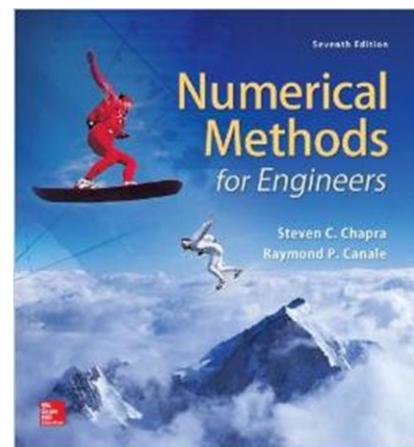
Topics: Elements of statistical inference; Regression, interpolation, root finding and parameter estimation; Solution of systems of linear and non-linear equations; Formulation and solution of optimization problems; Numerical differentiation and integration; Solution of ODEs (Initial and Boundary Value Problems) using finite difference and shooting methods; Introduction to the solution of PDEs

Course Textbook: *Numerical Methods for Engineers*, Chapra and Canale (any relatively recent edition would be fine)

All students are strongly encouraged to review their Matlab skills.

Academic Integrity:

Students are expected to adhere to the *Policy on Academic Integrity* listed within the New Brunswick Undergraduate Catalogue and at <http://academicintegrity.rutgers.edu/>



Students are encouraged to review this policy.

ABET Outcomes and Assessment:

Outcome (a): *an ability to apply knowledge of mathematics, science and engineering*

Outcome (c): *an ability to design a system, component, or process to meet desired needs*

Outcome (e): *an ability to identify, formulate, and solve engineering problems*

Outcome (k): *an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice*

Schedule:

9/2	Introduction
9/8-9-14-17-21-23	Regression (Ch. 17), Interpolation (Ch. 18), (Ch. 20.1) Root Finding (Ch. 5, Ch. 6, Ch. 8.1)
9/28	Review – Hwk #1 Due
9/30	Exam 1
10/5-7-12-14-19-21	Systems of Linear Equations (Ch. 9.1-9.4, 9.6, 9.7, Ch. 12.1) Optimization (Ch. 13, Ch. 14, Ch. 15, Ch. 16.1)
10/26	Review – Hwk #2 Due
10/28	Exam 2
11/2-4-9-11-16-18-23	Integration (Ch. 21, Ch. 22) Differentiation (Ch.23, Ch. 24.1) Initial Value Problems (Ch. 25, Ch.26) Boundary Value Problems (Ch. 27, Ch. 28.1)
11/25	Thanksgiving break – no class
11/30	Review – Hwk #3 Due
12/2	Exam 3
12/7-9	<u>Overview</u> of Finite elements and PDE problems (Ch. 29, 30, 31)
12/9	Hwk #4 Due

Note: quizzes will be on Wednesdays

Assessment: Final grade: 70% based on exams; 25% based on **weekly**, multiple choice, quizzes and 5% based on homework problems. Quizzes will be given at the end of the class. The two worst quizzes will not be counted. If a student misses a quiz there will be no make-ups. A missed quiz gets a zero and a student is allowed to count that quiz towards the discounted ones. Homework problems will be worked in groups and there will be only one submission per group. Group assignments will be discussed in class. The LAs will be holding meetings using the homework problems as guides for the discussion to elaborate on, both, theoretical as well as Matlab/Excel/computer issues. **It is expected that you will be working with the LAs for your homework problems.** My intention is for you to use the problems and the interactions to learn! The exams and quizzes will be based on the theory covered in class whereas the homework problems will emphasize the implementation of appropriate Matlab

functions. Detailed solutions and Matlab implementations to all homework problems will be provided so that students can improve their abilities. **I will provide numerous practice problems for the exams. However, I do not recycle exams** ☺

Learning Assistants: The course will discuss and present implementation computer implementation of the methods presented in class using Matlab and Excel. However, this is not a programming class. Therefore, learning assistants will be working with students in developing homework solution problems which will require, sometimes simple – sometimes more complicated, computer implementations. The interactions with the LA will help students grasp better the theoretical concepts as well as the Matlab and Excel principles needed.

