

Numerical Analysis

Spring/2024

Professor:	James A. Knisely, Ph.D.
Office:	Alumni 64
Office Hours:	MWF 8:00-8:50 a.m. TTH 8:30-9:45 a.m. Other times by appointment.
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Communication Policy:	For class questions that all students might benefit from, please use the class specific MS Teams team. For other types of questions or notifications, please use the chat feature of MS Teams or email. Most questions involving short answers are responded to within four hours, others within 24 hours. Please email or message if you desire a meeting so that a location can be agreed upon that allows for privacy and help.
Classroom/Meets:	AL 303 / TTH 1:30 - 2:45 p.m.
Credit/Load:	3/3
Textbook(s):	Numerical Methods For Engineers by Steven C. Chapra and Raymond P. Canale. ISBN:0-07-243193-8 Mathematica, JupyterHub, Excel, and Python are among the tools that will be used in this course.

Catalog Description:

Will solve interesting problems from upper level mathematics or computer science by programming one's own solution or by using a standard mathematical program like *Mathematica* or *Maple*.

Course Context:

Computational Math/Numerical Analysis is an advanced elective that can be taken by strong students majoring in mathematics, computer science, and engineering. It fulfils the following Math and CpS program goals.

Mathematics Major Goal	Computer Science Major Goal
MM1. Graduates will exhibit maturity in the development and implementation of mathematical procedures.	CS1. Design and implement solutions to practical problems
MM2. Exhibit independent and abstract thought and make judgments about the value of innovative developments from a Biblical world view.	CS2. Use appropriate technology as a tool to solve problems in various domains
MM3. Display understanding of what constitutes mathematics, including its role within the framework of Biblical Truth.	CS3. Create efficient solutions at the appropriate abstraction level
MM4. Provide a solid foundation for graduate studies in mathematics.	CS8. Demonstrate understanding of fundamental concepts in the student's discipline

Course Goals:

The goals this course are to increase your knowledge of scientific computing, specifically in these areas:

- Floating-point arithmetic
- Error, stability, convergence

- Iterative solutions for finding roots (Newton's Method)
- Linear algebra
- Curve fitting; function approximation
- Numerical differentiation and integration (Simpson's Rule)
- Differential equations

Course Objectives:

The student will be able to

1. Demonstrate the algorithms and techniques discussed in each section. *Evaluated in the homework and each chapter test.*
2. Discuss the strengths and weaknesses of competing algorithms used to solve problems in a particular section. *Evaluated in each chapter test and the final exam.*
3. Define error, stability, machine precision concepts and the inexactness of computational approximations. *Evaluated in the first section test.*
4. Identify the sources of inexactness in computational approximations. *Evaluated in the first section test*
5. Design, code, test, and debug programs that implement numerical methods. *Evaluated in the two programs.*
6. Present the solution to a problem to the class. *Evaluated in the class presentation.*

Course Requirements:

The grade for this class will be based upon the following categories:

Category	Points	Description
Tests	400	There will be three section tests.
Homework	192	There will be homework assigned for each chapter.
Programs		There will be two programs assigned. Their grades will be included in the homework grade.
Presentation	60	Each student will present two problems to the class.
Final	150	The final exam is cumulative, but 75% will be based upon material covered since the last test.

Cell Phones and Laptops:

Cell phones are not permitted to be out during class. Make sure they are muted and do not ring during class. There is little reason why a laptop should be used during a math class. You should have pencil, paper, and your textbook out and ready to use in class. If for some reason you have a legitimate need of a laptop in class, please see me and we will discuss this need.

Academic Penalty for Absences:

For planned absences, you are expected to notify me a week ahead of time; you can do so by e-mailing me. Scheduled tests should be taken before your planned absence; please contact me to make arrangements for doing so. For absences due to incapacitating illness or emergency, you should contact me as soon as you realize you will not be in class in order to make arrangements for making up any tests without penalty. In other circumstances, tests must be made up within one week of your return, with a 10 percent grade penalty for that test. Each subsequent missed test will result in an additional 10 percent penalty. The lowest quiz grade will be dropped when calculating final grades. Missed quizzes due to absence of any kind will not be made up.

Academic Integrity:

You are expected to uphold the school standard of conduct relating to academic honesty: [School standard of conduct](#) – The link can be found on the [BJU Policies](#) page.

You must assume full responsibility for the content and integrity of the academic work you submit. The guiding principle of academic integrity is that your submitted work; examinations, reports, and projects must be your own work. Misrepresenting your work is unethical in any setting. In an academic setting, it is a breach of the university policies.

Copyright Policy:

Copyright-2020 (Knisely) as to this syllabus and all lectures. Students are prohibited from selling (or being paid for taking) notes during the course to, or by any person, or commercial firm, without the express written permission of the professor teaching the course.

Lecture Schedule:

- [2024 Spring Schedule \(schedule.pdf\)](#)