Numerical Analysis
MATH 420–01
Spring 2022

Instructor: Barton Willis, PhD, Professor of Mathematics
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Office Hours: Monday, Wednesday, and Friday 10:00 A M – 11:00 A M, Tuesday and Thursday 9:30 A M– 11:00 A M, and by appointment.

Important Dates

First Homework due .... **4 February**
Exam 1 ....**24 February**
Exam 2 ....**31 March**
Exam 3 ....**5 April**
Final exam .... **Wednesday 17 May 2022 from 8:00 AM–10:00 PM**

Class meeting times

This class meets Monday, Wednesday, and Friday from 9:05 P M – 9:55 P M in Discovery Hall, room 383.

Final Exam

The final exam will be comprehensive and it will be given on Wednesday 17 May 2022from 8:00 A M– 10:00 P M in Discovery Hall, room 383.

Course Objectives

On completion of this course, students will

(a) understand IEEE arithmetic and know the rules for accurate computation.

(b) understand the concepts of linear and quadratic convergence and use these concepts to analyze the efficiency of an algorithm.

(c) develop an understanding of the algorithms for solving linear and nonlinear equations, interpolation, quadrature, least squares methods, and solution of differential equations.

(d) be able to use a programming language and graphical tools to solve problems numerically.

Catalog description

MATH 420 (Numerical Analysis, 3 credit hours) Principles of error analysis and accurate computation; rates of convergence, the solution of linear and nonlinear equations, interpolation and least squares, numerical integration, and numerical solution of differential equations.

Prerequisite

To be in this class, you must have already earned a passing grade in Calculus II (UNK's MATH 202). [1]

Course Resources

1. Our textbook is *First Semester in Numerical Analysis with Julia,* by Giray Ökten. This is an open-source textbook that can be legally downloaded, printed, and used without payment.[2]

2. A free account on UNL's supercomputer.

3. Class notes that are written on the board or distributed via Canvas.

4. Reliable Internet access.

5. An Internet connected computer (not just a phone or tablet)

6. Pencils, erasers, notebook for note taking. Colored pens or pencils are nice for note taking.

Gradiung

Your course grade will be based on weekly in class work, three midterm exams, and a comprehensive final exam; specifically:

Homework *15 ten point assignments* . . . . 150 (total)
Mid-term Exams 1,2, and 3 *100 points each* . . . . 300 (total)
Comprehensive Final exam . . . . 150 (total)

The following table shows the *minimum* number of points (out of 600) that are required for each of the twelve letter grades D- through A+. For example, a point total of 520 points will earn you a grade of B+, and a point total of 540 points will earn you a grade of A-. If you earn a point total of 359 or less, you a failing course grade.

D-	 360	B-	 480
D	 380	B	 500
D+	 400	B+	 520
C-	 420	A-	 540
C	 440	A	 560
C+	 460	A+	 588

Policies

1. All work you turn in for a grade must be your own. If you need assistance in completing a homework assignment, you may ask me for help but nobody else. Googling for answers, seeking help from the Learning Commons or other faculty members, or using solution keys from previous terms (either from UNK or other universities) is also prohibited. Each homework assignment you turn in for a grade must include the statement:

> "I have neither given nor received unauthorized assistance on this assignment."

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[1] The catalog gives the prerequisite as MATH 260–eventually this will change to MATH 202.

[2] https://open.umn.edu/opentextbooks/textbooks/first-semester-in-numerical-analysis-with-julia.

Using unauthorized materials while taking a test will earn you a failing course grade. Each exam will specify what resources are allowed.

2. The final examination will be *comprehensive*. It will be given on Wednesday 5 May from 8:00 am to 10:00 am.

3. Generally, weekly problem sets are due at 11:59 pm local time each Saturday. If you have an extended illness that keeps you from completing the homework, contact me immediately. Since homework is turned in electronically, requests to turn in homework late (due to minor illness or absences) will generally be declined.

4. The course calendar may change. Changes to the schedule can be made in class, but not noted anywhere else. It is your responsibility to learn of changes to the schedule.

5. If you have questions about how your work has been graded, *immediately* ask me for an explanation.

6. This class has *no option for extra credit.*

7. For pedagogical reasons, our class notes will sometimes differ in notation, style, and level of abstraction from the textbook.

Students with Disabilities or Those Who are Pregnant

It is the policy of the University of Nebraska at Kearney to provide flexible and individualized reasonable accommodation to students with documented disabilities. To receive accommodation services for a disability, students must be registered with UNK Disabilities Services for Students Office, 172 Memorial Student Affairs Building, 308-865-8988 or by email unkdso@unk.edu

It is the policy of the University of Nebraska at Kearney to provide flexible and individualized reasonable accommodation to students who are pregnant. To receive accommodation services due to pregnancy, students must contact Cindy Ference in Student Health, 308-865-8219. The following link provides information for students and faculty regarding pregnancy rights: `http://www.nwlc.org/resource/pregnant-and-parenting-students-rights-faqs-college-and-graduate-students`

Reporting Student Sexual Harassment, Sexual Violence or Sexual Assault

Reporting allegations of rape, domestic violence, dating violence, sexual assault, sexual harassment, and stalking enables the University to promptly provide support to the impacted student(s), and to take appropriate action to prevent a recurrence of such sexual misconduct and protect the campus community. Confidentiality will be respected to the greatest degree possible. Any student who believes she or he may be the victim of sexual misconduct is encouraged to report to one or more of the following resources:

1. Local Domestic Violence, Sexual Assault Advocacy Agency 308-237-2599

2. Campus Police (or Security) 308-865-8911

3. Title IX Coordinator 308-865-8655

   Retaliation against the student making the report, whether by students or University employees, will not be tolerated.

Course Calendar

We will try to adhere to the following schedule, but we will modify it if needed. The exam dates will only be changed for a compelling reason; we won't delay an exam because we are behind the schedule. Neither will an exam date be moved forward because we are ahead of the schedule.

Section numbers for Chapter 6 are from *Tea Time Numerical Analysis.*

Homework assignments are due at 23:59 local time on Saturday on the week they are assigned. Homework assignments 1 and 2 are due on Saturday 6 February 2022, for example.

Week	Week	Section(s)	Topic(s)
1	1/25	§1.2	Introduction to Julia
2	2/1	§1.1	Floating point numbers & calculus tools **HW 1 , HW 2**
3	2/8	§2.1	Errors and convergence rates **HW 3**
4	2/15	§2.2 – §2.7	Root Finding **HW 4**
5	2/22	§2.2–§2.7	Root Finding **Exam 1, 26 February**
6	3/1		Linear equations **HW 5**
7	3/8	§3.1–§3.4	Interpolation **HW 6**
8	3/15	§3.1 – §3.4	Interpolation **HW 7**
9	3/22	§4.1–§4.2	Numerical integration **HW 8**
10	3/29	§4.3 –§4.4	Gaussian integration & multiple integrals **Exam 2, 2 April**
11	4/5	§5.1–§5.2	Discrete & continuous least squares **HW 9**
12	4/12	§5.3	Orthogonal polynomials and least squares **HW 10**
13	4/19		Differential equations **Exam 3, 23 April**
14	4/26		Differential equations
15	5/		**Final Exam, Wednesday 5 May, 8:00 am–10:00 am**