CptS 430/530 and Math 448/548

Numerical Analysis

Spring 2024

Floyd 145 TuTh 12:05-1:20 pm

Instructor: John Miller

jhmiller@tricity.wsu.edu

Office location: Floyd 134E

Office hours: After class in person

Zoom: Monday-Friday by appointment

TA: Suraiya Akhter

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Office location: Floyd 145

Office hours: Monday and Wednesday 1-4pm by appointment

Class web page can be found at

<http://www.tricity.wsu.edu/~jhmiller>

Objectives: Present the mathematical basis for methods of numerical analysis and introduce students to MATLAB as a software package for numerical analysis.

Access to MATLAB: Available online through the WSU license. Students can create an account at: [https://www.mathworks.com/academia/tah-portal/washington-state-university-40714885.html t](https://www.mathworks.com/academia/tah-portal/washington-state-university-40714885.html%20t)hen go to <https://matlab.mathworks.com/> to use MATLAB online from any device.

Required Textbook**:** “Numerical Mathematics and Computing” 6th Edition by Cheney and Kincaid. Other editions are OK but page numbers are different.

Course content:

Chapter 3: Locating zeros of non-linear functions

Chapters 5&6: Numerical integration

Chapters 10&11: Differential equations

Chapter 2: Floating-point number systems

Chapter 7: Systems of linear equations

Chapter 12: Fitting data by method of linear least squares

Chapter 8: Eigenvalues

Optional supplemental textbook**:** “Essential MATLAB for Scientist and Engineers” 2nd Edition by Hahn

Required assignments: Students will be assigned problems to be solved using MATLAB codes discussed in class.

Projects:

500-level students must define a project (subject to approval by the instructor) that involves numerical analysis and write a report that describes the numerical method, code developed, and results obtained. Project reports are due on the last class before finals week.

Approximate class schedule

|  |  |  |
| --- | --- | --- |
| **Week** | **Topics** | **Notes** |
| 1 | Syllabus, Arrays in MATLAB, graphical method | HW 1 |
| 2 | Newton and Bisection methods | HW 2-3 |
| 3 | Secant method, review for quiz 1 | HW 4 |
| 4 | Quiz1, Trapezoid rule | HW 5 |
| 5 | Error estimation and Simpson rule | HW 6-8 |
| 6 | Gauss and Laguerre quadrature | HW 9-10 |
| 7 | Review for quiz 2, Quiz 2 |  |
| 8 | Floating-point numbers, Euler method | HW 12-12 |
| 9 | MATLAB ode45, systems of ODE | HW 13-14 |
| 10 | Spring break |  |
| 11 | Review for quiz 3, Quiz 3 |  |
| 12 | Gauss elimination and LU factorization | HW 15-16 |
| 13 |  LLS by normal equations and QR factorization | HW 17-18 |
| 14 | Singular value decomposition, eigenvalues | HW 19-20 |
| 15 | Review for quiz 4, Quiz 4 |  |
| 16 | Final exam week |  |

Evaluation of student success:

Students are expected to participate in class discussions and complete homework assignments before testing on related material. 20% penalty on assignments submitted after testing on the related material. On quizzes students will be asked to apply MATLAB codes developed in class to solve problems like the homework assignments.

Average of homework scores and average of quizzes scores have equal weight in determining final grade. The following table will be used to conversion of numerical to letter grades:

|  |  |
| --- | --- |
| Numerical-Grade Range | Letter Grade |
|  91 ≤ Grade  |  A |
|  88 ≤ Grade < 91 |  A- |
|  84 ≤ Grade < 88 |  B+ |
|  81 ≤ Grade < 84 |  B |
|  78 ≤ Grade < 81 |  B- |
|  73 ≤ Grade < 78 |  C+ |
|  70 ≤ Grade < 73 |  C |
|  67 ≤ Grade < 70 |  C- |
|  63 ≤ Grade < 67 |  D+ |
|  60 ≤ Grade < 63 |  D |
|  Grade < 60 |  F |

Nuts and Bolts:

* Syllabus, lecture notes, and assignments are posted on the class web page.
* Unlimited attempts on assignments
* No assignments accepted after the last scheduled class period.
* 20% penalty on assignments submitted after testing on the related material.
* Quizzes are given in class with open book and lecture notes.
* No mid-term or final exam.
* Last quiz **may** be given at the final exam scheduled time.
* Midterm grades are advisory and will not appear on your transcript.
* Attendance will be taken as part of class participation.
* Makeup quizzes will be treated on a case-by-case basis.
* Quizzes must be taken on the assigned date and time unless prior approval for an alternate date and/or time has been given by the instructor.
* Canvas will NOT be used for course management
* Grades available by request to instructor
* Help from instructor available on zoom by request.

Academic Integrity:

Washington State University, a community dedicated to the advancement of knowledge, expects all students to adhere to high expectations of scholarship and the Standards of Conduct for Students. Potential violations of the Standards of Conduct for Students should be referred to the Center for Community Standards. The Center for Community Standards supports students, upholds their rights and responsibilities, and holds them accountable for behavior that doesn’t meet our community expectations.

Academic integrity will be strongly enforced in this course. Students who violate WSU’s Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26- 010(4) will receive a failing grade on the assessment in question, will not have the option to withdraw from the course pending an appeal, and will be reported to the Center for Community Standards.

Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). If you have any questions about what is and is not allowed in this course, you should ask course instructors before proceeding. If you wish to appeal a faculty member's decision relating to academic integrity, please use the form available at communitystandards.wsu.edu. Contact the Center for Community Standards if you would like more specific information about the process please contact Jordyn Creighton, Director for Student Services in Floyd 269. Phone 509.372.7433 jordyn.creighton@wsu.edu

Students with Disabilities:

Reasonable accommodations are available for students with documented disabilities or chronic medical conditions. If you have a disability and need accommodations to fully participate in this class, please contact the Access Center in Floyd 269 to follow published procedures to request accommodations. Students may also call or email the Access Center to schedule an appointment with Gretchen Hormel, the campus Access Advisor. Phone 509.372.7352 email: g.hormel@wsu.edu

<https://tricities.wsu.edu/current-students/access/>

All disability related accommodations are to be approved through the Access Center. It is a university expectation that students with approved accommodations visit with instructors (in person or via Zoom) within two weeks of requesting their accommodations to discuss logistics.

Accommodation for religious observances**:**

Washington State University reasonably accommodates absences allowing for students to take holidays for reasons of faith or conscience or organized activities conducted under the auspices of a religious denomination, church, or religious organization. Reasonable accommodation requires the student to coordinate with the instructor on scheduling examinations or other activities necessary for course completion. Students requesting accommodation must provide written notification within the first two weeks of the beginning of the course and include specific dates for absences. Approved accommodations for absences will not adversely impact student grades. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence. Students who feel they have been treated unfairly in terms of this accommodation may refer to [Academic Regulation 104 - Academic Complaint Procedures](https://catalog.wsu.edu/General/AcademicRegulations/ListBy/104).

Discrimination and Harassment Policy:

WSU is commitment to maintaining an environment free from discrimination, including sexual harassment. This policy applies to all students, faculty, staff, or others having an association with the University.

If you feel you have experienced or have witnessed discriminatory conduct, you can contact the WSU Office of Compliance and Civil Rights (CCR) and/or the WSU Title IX Coordinator at 509-335-8288 to discuss resources, including confidential resources, and reporting options. (Visit <https://ccr.wsu.edu/>for more information). Most WSU employees, including faculty, who have information regarding sexual harassment or sexual misconduct are required to report the information to CCR or a designated Title IX Coordinator or Liaison. Visit [https://ccr.wsu.edu/file-a-](https://ccr.wsu.edu/file-a-complaint/) [complaint/](https://ccr.wsu.edu/file-a-complaint/) for more information.

Student Support Services:

Academic success can be challenging if you have trouble meeting basic needs like safe shelter, sleep, and nutrition. If you have difficulty affording groceries or accessing sufficient food to eat every day, lack a safe and stable place to live, have an emergency, or just need support, I urge you to contact Student Support Services at 509-372-7433 and review the list of services available on the [Student Support Services website](https://tricities.wsu.edu/current-students/support/). If you have a friend who needs support, consider filling out a [Cougar Cares](https://tricities.wsu.edu/current-students/cougarcares/)

Students in Crisis – WSU Tri-Cities resources:

If you or someone you know is in immediate danger, DIAL 911 FIRST!

Student Care Network: <https://tricities.wsu.edu/current-students/cougarcares/> 509-372-7433

WSU Tri-Cities Student Emergency Hardship Fund: <https://tricities.wsu.edu/current-students/student-emergency-hardship-fund/>

WSU Tri-Cities Mental Health Counseling: 509-372-7153

Suicide Prevention Hotline:  800 273-8255

Crisis Text Line:  Text HOME to 741741

WSU Tri-Cities Campus Security: 509-372-7698

WSU Tri-Cities Campus Emergency: 509-372-7234

WSU Tri-Cities Deputy Title IX Director: 509-372-7381

Support, Advocacy, and Resource Center (SARC): 888-846-7273

WSU Health Sciences 24/7 Crisis Line: 509-368-6500

Student Support Services:

The Student Care Network serves the entire WSU system to provide individualized student support, access to resources, and general student assistance. A list of services available on the [Student Support Services website](https://tricities.wsu.edu/current-students/support/). If you have a friend who needs support, consider filling out a [Cougar Cares](https://tricities.wsu.edu/current-students/cougarcares/). You may also make a Student Care Network referral at <https://studentcare.wsu.edu/> or contact the Tri-Cities campus Student Care Co-Chairs in Floyd 269,Vice Chancellor Anna Plemons, aplemons@wsu.edu and Director Jordyn Creighton, jordyn.creighton@wsu.edu

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**Adverse Weather Conditions**. When appropriate campus authorities declare a “Yellow / Delayed or Limited Operations” or “Red / Closed” campus condition (BPPM 50.40‐46), or travel to instructional locations is unsafe, classes may be cancelled or delayed. When a student does not attend due to adverse conditions, the instructor will not penalize the student. See <https://tricities.wsu.edu/alerts/weather/>

**Safety.** Classroom and campus safety are of paramount importance at WSU, and are the shared responsibility of the entire campus population. WSU urges students to follow the “Alert, Assess, Act” protocol for all of emergencies and the “Run, Hide, Fight” response for an active shooter incident. Remain ***ALERT*** (through direct observation or emergency notification), ***ASSESS*** your specific situation, and ***ACT*** in the most appropriate way to assure your own safety (and the safety of others if you are able). Please sign up for emergency alerts on your account at *MyWSU* to receive notification regarding campus emergencies (including campus closures). Click Update Now! Under “Tri-Cities Emergency Info” to register for notification by text message, e-mail, telephone, or any combination of the three. Providing multiple contact methods will help ensure you receive notifications in a timely manner, and your information will NOT be used for any other purpose. The following video to learn about WSU Tri-Cities’ safety and emergency protocols: https://[www.youtube.com/watch?v=WClaZzSvao4&feature=youtu.be](http://www.youtube.com/watch?v=WClaZzSvao4&feature=youtu.be)

**Emergency Evacuations.** If the alarm sounds, everyone must leave the building. Try to stay together. Your instructor will be the last one to exit the room, close the door(s), and direct you to the assembly areas. If any student is unable to evacuate, please notify immediately the evacuation coordinator (who will be wearing a green vest. The assembly areas are:

* 1. East/Floyd/BSEL: the blue emergency pole located directly south of the BSEL sidewalk, parking row 6.
	2. CIC and Collaboration Hall: blue emergency pole in row 1, directly down the diagonal sidewalk from the main entrance.
	3. Wine Science Center: the WSU sign at the corner of University & George Washington Way
	4. ICB: south edge of parking lot
	5. Nursing: southeast corner of parking lot, near Chapala Express
	6. Student Union Building: Rotary Stage