AERE 3610
Computational Techniques for Aerospace Design

3 credits

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Lecture:	TR 11:00am–11:50am, 1302 ATRB – Biosciences Facilities Advanced Teaching and Research Building
Final Exam Period:	Wednesday, May 13, 9:45am-11:45am
Course website:	http://temporallogic.org/courses/AERE3610/
Help email:	3610ta@iastate.edu

Prerequisites:

- AER E 3100, MATH 2670, E M 3240, E M 3450, ENGL 3140.
- Course restricted to AER E juniors and seniors.

Course Goals and Learning Outcomes:

In this course you will be introduced to the fundamentals of C programming, the Linux operating system environment, development of computational tools for aerospace analysis and design, and technical report writing. The emphasis of the course is on learning best practices that form the basis for modern professional engineering. Therefore, the course will use the tools and processes that are most common in industry today, emphasizing good documentation and version control.

Learner Objectives

In this course you will gain hands on experience with scientific computing techniques, tools, and processes for aerospace design. Through projects, classroom discussions, and laboratory sessions, you will have the opportunity to learn to:

- Effectively utilize modern version control with git, via git classroom.
- Utilize Linux/Unix command-line basics to operate in an embedded environment.
- Practice good documentation in a version-controlled environment using LaTeX to maintain high typographical quality of the documents produced. These best practices are particularly focused on documents that are heavy on mathematics or code, but applicable for all other types of documents.
- Write shell scripts in the bash shell to automate repetitive tasks.
- Practice scientific computing using the C programming language, with a focus on understanding how to write generic and robust code to reliably calculate properties of life-sized systems.
- Analyze and draw conclusions about real-world systems using C programming techniques.
- Debug code effectively, with a variety of best-practices including `gdb`.
- Compile and test C code, including setting up `make` files.
- Understand machine representation of numbers and how it effects the results of computation.
- Develop an understanding of basic computer architecture and how to effectively declare, store, and access matrices.
- Explain and solve real-world aerospace problems utilizing the above tools and techniques.

Reading Materials

- **Required Textbook:** *Introduction to Scientific and Technical Computing* by Frank T. Willmore, Eric Jankowski, and Coray Colina. CRC Press, 2017. [`https://www.amazon.com/Introduction-Scientific-Technical-Computing-Willmore/dp/1498745040`]

  - This book is available in the ISU bookstore or online (e.g., amazon.com).
  - Labs will include required reading from this book.

- **Required Textbook:** *The C Programming Language, Second Edition* by Brian W. Kernighan; Dennis M. Ritchie. Prentice Hall, 1988. [`http://proquest.safaribooksonline.com.proxy.lib.iastate.edu/book/programming/c/9780133086249`]

- **Optional Textbook:** *Beginning C, Fifth Edition* by Ivor Horton. Apress, 2013. [`http://proquest.safaribooksonline.com.proxy.lib.iastate.edu/book/programming/c/9781430248811`]

Class Sessions

Class sessions will include lectures, interactive programming/demos, in-class active learning activities, and discussions of the readings/labs. Though visual aids will occasionally accompany the lecture **there are not slides for this course**. Students are encouraged to participate actively in class sessions, take notes, and ask questions interactively throughout the class. Students are encouraged but not required to install the tools covered each week on any laptop computers they choose to bring to class to enable replicating demos.

Laboratory Projects/Homeworks

The following hold for all assignments:

- Each week one laboratory project will be posted to the GitHub classroom via a link in Canvas by Tuesday.

- Lab projects include reading materials and exercises; any exercises not completed during the laboratory session will automatically become homework.

- Students are encouraged to read the labs and any associated reading materials ahead of time.

- It is very important to follow laboratory **submission instructions** exactly as automatic grading scripts will be used; no points will be awarded for assignments that do not comply with the submission format specified to enable grading. For example, if files are named differently than the instructions indicate or located in a different directory, they will *not* be graded and will receive 0 points. Note that any submitted **code that does not compile/run will automatically receive 0 points**; while we make every effort to give partial credit, it is not the burden of the TA/instructor to create a working piece of code out of any incomplete submissions. (Not compiling includes LaTeX documents that do not compile with one `pdflatex` and no errors; no additional inputs such as hitting `Enter` or `CTRL+C` are needed to compile a LaTeX document.)

- Labs will always be due at the same time, one week following distribution, with the possible exception that the last lab may be due as late as the final examination period for the course.

- All assignments submitted must be submitted electronically, and typed and formatted according to the instructions in the lab manual. Handwritten assignments will not be accepted. Submission formats include both code and documentation, where students will be required to use LaTeX to typeset documentation assignments.

- Homework **re-grade requests must be made within one week of receiving a grade** on the relevant homework. After the one week period, the grade on the homework will be fixed unless there is reason to revisit the grade due to substantive suspicion of academic misconduct. It is each student's responsibility to check their grades in GitHub; failure on the part of the student to check grades in time, or desire of the student to re-do the assignment later will *not* result in revisiting a grade after this "grade lock" deadline.

- **Honor Code**: All assignments should be completed in accordance with the Iowa State University Honor Code.

- **Empty Hands Policy**: You may talk about the problems with fellow students and the instructors, but the submission (e.g., code and documentation) must be yours alone. In particular when discussing with fellow students you must strictly follow the "empty hands policy." You cannot leave a discussion meeting with any record of the discussion (hard copy or electronic). All scratch paper must be torn and thrown away, all boards must be erased, and all files must be deleted.

- **All code and reports must be your own work. Copying code or reports, in whole or in part violates both the empty hands policy and the ISU honor code and is considered cheating.** Cheating via copying code or reports and other acts of academic misconduct are subject to consequences including receiving a 0 on the assignment, **receiving a failing grade for the class**, or other penalties defined by the instructor or by ISU.

- You are encouraged to consult other books, papers, or physical published materials in the university library. You may read books or tutorials online, and you are encouraged to search for error messages, but you may not consult people or problem solutions online. You may not search for specific answers, copy code or algorithms from websites, post questions to internet forums, or discuss any assignments on the internet; **this specifically includes sites like chegg and uversity, all AI chatbots**, and any interactive sites like helpdesks whether they are staffed by humans or automation. Doing so will be considered a violation of the Honor Code. Consulting live people on the internet is a violation of the Honor Code, including passively through forums, via emails, or via other interactive channels.

- Plagiarism is considered a violation of the Iowa State University Honor Code. All solutions must be written in your own words, even if the solutions exist in a publication that you reference.

Examinations

There will be three exams in this course. Exams will be taken on paper, with no electronic devices of any kind allowed. Students must bring a writing implement with which to take the exams. Students may also choose to bring to the exam physical (paper) copies of the two course textbooks, and one standard U.S. letter sized page of notes (you may use both sides of the page). Should students opt to bring such a page of notes, it must be turned in with their exam. Each note sheet must be unique; students may not copy note sheets from classmates.

Quizzes will be administered during class and lab periods.

Grading

Grades will be assigned based on performance on the exams, laboratory projects/homeworks, and in-class participation (including quizzes). Unless announced otherwise, all exams will be of equal weight; also all laboratory projects will be of equal weight. The course will be graded as follows:

Grade Component	**Percentage**
Exams	80%
Labs/homeworks	19%
Participation/Quizzes	1%

Attendance is mandatory for both the lectures and labs. Failure to attend a lecture or lab session will result in an automatic 2% score reduction for that week's assignment, for a maximum 6% deduction per week. We may enforce attendance by requiring all students to swipe ISU cards at the beginning and end of class or lab; students may only be excused early from lab sessions if they have submitted that week's lab. Excused absences will be granted ahead of time by permission of the instructor, or, in the case of illness, immediately following the absence with a doctor's note. If you wake up sick the morning of class, please send email notification of your absence before class starts.

Course grades will be assigned as follows; minimum totals for grades may be lowered, but they will not be raised:

		A:	94 to 100	A-: 90 to 93
B+:	87 to 89	B:	84 to 86	B-: 80 to 83
C+:	77 to 79	C:	74 to 76	C-: 70 to 73
D+:	67 to 69	D:	64 to 66	
F:	0 to 63			

Course Policies

Participation and Attendance

Attendance, in both lecture and lab, is **required**. You are expected to participate actively in class, including contributing to discussions and in-class activities. All students are highly encouraged to take notes and ask questions. Quizzes may be conducted during class.

Slip Days

Students have **four slip days** that may be used to delay the due date of any assignment for 24 hours during the semester. The use of a slip day must be explicitly stated in the

README.md file and via email to the TA before the missed deadline. **There are no other extensions in the course (except for the standard extenuating circumstances like severe illness/bereavement/religious observation, see below for university policies); do not request an extension from the professor or TA.** Students are expected to use their slip days wisely to account for sick leave, absences, or other circumstances that may delay completion of an assignment during the semester. Slip days may not be used on the last laboratory assignment because it is due during the final exam period and needs to be graded in accordance with ISU's grading deadlines.

Late Submission Policy

You are expected to submit assignments on the due dates. Assignments will only be accepted after the due date if slip days are used. **No late assignments will be accepted after all slip days are spent.**

The instructor reserves the right to refuse any assignment and give a zero if it does not meet the requirements of the assignment. **All code or LaTeX that does not compile will receive a 0.**

Bug Reports

You may need to send a bug report, e.g., if a program is not working as demonstrated in class. A proper bug report *must always* include the following components:

1. A *concise* statement of the bug. What is the smallest set of commands/code snippet/etc. that triggers the bug?

2. How to reproduce the bug in the fewest steps. Step-by-step, how do we start from a different computer and get to exactly the place where you are looking but not seeing what you expect? (Remember to include exact commands issued and error messages received, along with what you expected to happen instead and why, e.g., because the instructions said something different should happen.)

3. What you tried to do to overcome the bug that didn't work, i.e., why it is a bug vs, e.g., a typo in your command and how you tried to fix it. Remember that information such as screenshots are also helpful.

Re-grades

You may submit a request for a regrade of any lab up to one week after grades for that assignment are posted. The regrade period will be the same week (i.e., same dates) for all students, regardless of any circumstances such as slip day use. **No re-grade requests will be honored later than one week after the initial grade assignment or after the end of the semester.** If you want a re-grade on something:

1. The specific exercise/report must compile. If it does not compile, you will not get a re-grade.

2. You must attempt the exercise. An empty exercise will not get a re-grade.

3. If you want a re-grade, you must email the TAs (3610ta@iastate.edu) with a request and push the new code to GitHub. Please state specifically which exercise(s) you want re-graded and what adjustment you expect.

Computing Equipment
If the computers you are using (either in the lab or the linux VMs/remote servers) are down or misconfigured, please immediately report the problem *with the standard three components of a bug report* by emailing `aeresupport@iastate.edu`. We cannot fix problems if you do not report them! This will generate a trouble ticket which can be tracked and assigned to the best group to resolve the issue.

Electronic Devices

During class sessions, you are encouraged to use laptop and tablet computers for work related to AERE 3610. Please silence cell phones during class and refrain from using electronic devices for non-course-related activities.

Policy on the Use of AI

Use of AI is prohibited. This course focuses on learning foundational disciplinary knowledge. Use of gen AI tools like ChatGPT is prohibited, including drafts, outlines, essays, process work, etc. Using gen AI tools to complete written work, assignments, or other coursework for you constitutes academic misconduct.

ISU Policy on Incomplete Grades
An incomplete mark may *only* be assigned during the semester, when the student is passing at the time of the request, but special circumstances beyond the student's control prevent completion of the course. Note that incomplete grades require an Incomplete Contract, signed in Workday. In general, failing the final exam or project or not submitting course work as a result of inadequate preparation or learning are not valid excuses. **Every lab will have a "grade lock" deadline, after which all grades for that assignment are final and no regrade requests can be submitted, even if the student had an extension on the assignment. Unless an incomplete grade contract has been signed by the professor and accepted by ISU, students can not request re-grading of any assignment (e.g., lab or exam) past the date when final course grades are due in May.**

Respectful Communication

The classroom will be a place where everyone is treated with due respect. That includes accommodation of recipients' choice of pronouns or titles. The appropriate form of address for the instructor of this course is **Dr. Rozier** or **Prof. Rozier**. TAs and/or supplemental instructors also work to create a successful learning environment in this course; they need to be addressed respectfully and appropriately. Your comments to others should be constructive and free from harassing statements. Strive to include everyone and select ideas and solutions on their merits, not based on prejudices and personalities. Mutual respect is expected inside and outside the classroom. Please contact the instructor if you have suggestions for improving the classroom environment.

Academic Dishonesty

Academic misconduct includes all acts of dishonesty in any academically-related matter and any knowing attempt to help another student commit an act of academic dishonesty that includes, but is not limited to (a) Obtaining unauthorized information, (b) Tendering of information, (c) Misrepresentation, and (d) Plagiarism. See the Conduct Code at `www.policy.iastate.edu/policy/SDR` for more details (See 4.2.1). Anyone suspected of

academic dishonesty will be reported to the Dean of Students Office and could receive an F grade on the test/assignment, or an F grade for the course at the discretion of the instructor.

Disruptive Behavior

The ISU faculty handbook section 10.5 defines a graduated approach to address disruptive behavior in classrooms. CELT also has quick links on this topic at `https://www.celt.iastate.edu/teaching/effective-teaching-practices/classroom-behavior/` Examples of disruptive conduct may include, but are not limited to, the following:

- Speaking without being recognized, interrupting, or talking over others;
- Arrival to class late or leaving early without instructor permission;
- The use of technology, such as cell phones, computers, or other devices, without instructor permission, particularly in uses unrelated to course content;
- Creation of loud or distracting noises either carelessly or with intent to disrupt;
- Eating, sleeping, or carrying out other personal activities in class that are unrelated to course content without instructor permission;
- Non-protected malicious or harassing or bullying speech or actions directed at instructors or students, such as personal insults, ad hominem attacks, name-calling, other abusive or ridiculing comments, or threats;
- Gratuitous use of cursing/expletives or other speech that is not relevant to class discussion;
- Inappropriate physical contact or threats of inappropriate physical contact directed at instructors or students;
- Refusal to comply with instructor's request for appropriate conduct.

Accessibility Statement

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff via email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

Religious Accommodations

If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request. You or your instructor may also seek assistance from the Dean of Students Office or the Office of Equal Opportunity.

Other Special Concerns

If you require special accommodations, you should notify the professor as soon as possible. In particular, you should contact the professor if an illness, religious practice, or disability might interfere with the successful completion of a course requirement. ISU has a website focused on directing students and campus community members to resources for support on campus: `https://www.studentaffairs.iastate.edu/support`.

Statement on Prerequisites

It is the policy of the Department of Aerospace Engineering and the College of Engineering to require all students enrolled in this course to have satisfied all of the course's prerequisite requirements. If it is discovered that a student has not met any applicable prerequisite requirements, he/she will be required to immediately drop the course. The failure to drop the course will result in a final course grade of 'F', regardless of course performance. Students who discover they have improperly enrolled in a course without meeting the applicable prerequisite requirements are strongly encouraged to meet with advising staff to promptly drop the course and make alternative scheduling arrangements or discuss if an official waiver of the pre-requisite requirements may be applicable.

Statement on Prep Week

This class follows the Iowa State University Prep Week policy as noted in section 10.6.4 of the Faculty Handbook.

Harassment and Discrimination

Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, Student Assistance at 515-294-1020 or email dso-sas@iastate.edu, or the Office of Equal Opportunity at 515-294-7612.

Free Expression

Iowa State University supports and upholds the First Amendment protection of freedom of speech and the principle of academic freedom in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

The contents of this document may be changed by the instructor during the semester.