SPACE 478: Engineering for the Space Environment

Fall 2023 Syllabus and Course Conduct Statement

[Updated 28 Aug 2023] SYLLABUS SUBJECT TO CHANGE

Scheduled Time: 11:30 am - 1:20 pm Tuesdays, Thursdays;

Lectures are recorded and posted in Modules.

Location: 2246 CSRB (Auditorium)

Instructor: Professor Susan Lepri

2429 Climate and Space Research Building

slepri@umich.edu

Office Hours: 10:30 - 11:20 am Thursdays in 2429 CSRB

Graduate Student Instructor: Rohan Chandratre

rvpc@umich.edu

Office Hours: In-person 4:00 - 4:50 pm Thursdays in 2218 CSRB

Zoom Office Hours TBD

If the designated office hour times do not suit your schedule, you are strongly encouraged to contact Rohan directly to arrange a mutually convenient time for discussion.

Slack: SPACE478F23
Link to sign in: um-fa23-space478f2.slack.com

Statement on Office Hours: Office hours for the Graduate Student Instructor will be communicated at the start of the course. Opportunities will be made available to schedule separate times for discussion, not only when assistance is needed but also for career advice, guidance, and related interests. Furthermore, a dedicated Slack workspace for the course will be established for asynchronous communication and queries.

Required Text: The primary course material will be "The Space Environment and Its Effects on Space Systems" (2nd Ed) by Vincent L. Pisacane; ISBN: 978-1-62410-353-7.

The first edition is available online but missing substantial content, hence the second edition is highly recommended. Links to additional resources, references, and helpful guides to writing summaries and citing papers will be provided as required.

https://www.amazon.com/Environment-Effects-Systems-Second-Education/dp/1624103537

Attendance and Participation:

Active involvement in the course goes beyond just physical attendance. Participation includes engaging in in-class exercises, discussions on Canvas, and the dedicated Slack workspace for the course. This participation will be noted, also participation in online graded discussions will be recorded.

Statement on Face Masks:

In line with the university's guidelines, face masks within the classroom and common areas of the building are optional. However, any student who feels more comfortable or safe with the instructor wearing a face mask can make such a request, and the instructor will comply. Students who choose to wear face masks for their own reasons are supported in their decision. We aim to foster an environment of understanding and respect, where individual choices related to health and well-being are honored. Note that this policy may be updated as conditions and guidelines change. Students will be notified promptly of any modifications.

Accommodations for Students with Disabilities: If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Services for Students with Disabilities (SSD) office to help us determine appropriate academic accommodations. SSD (734-763-3000; http://ssd.umich.edu) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

Syllabus Inclusion Statement: It is my intention that students from all backgrounds and perspectives will be well served by this course, and that the diversity that students bring to this class will be viewed as an asset. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, socioeconomic background, family education level, ability – and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Your suggestions are encouraged and appreciated.

Lived Name/Pronoun Syllabus Statement: I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.

Student Well-Being: As a student, you may experience a range of issues that can negatively impact your learning, such as anxiety, depression, interpersonal or sexual violence, difficulty eating or sleeping, loss/grief, and/or alcohol/drug problems. These mental health concerns or stressful events may lead to diminished academic performance and affect your ability to participate in day-to-day activities. In order to support you during such challenging times, the University of Michigan provides a number of confidential resources to all enrolled students, including Counseling and Psychological Services (CAPS) (734-764-8312; caps.umich.edu/contact), Sexual Assault Prevention and Awareness Center (SAPAC) (24-Hour Crisis Line: 734-936-3333; sapac.umich.edu), Psychiatric Emergency Services (734-996-4747), and Services for Students with Disabilities (734-763-3000; 734-615-4461 [TDD]; 734-619-6661 [VP]; ssdoffice@umich.edu).

Make-up Classes: The professor may attend several in/out of town meetings during the semester; therefore some lectures may need to be rescheduled from time to time, and/or guest lecturers may appear on occasion.

Learning Objectives

1. **Risk Management in Space Environment:** Gain a deeper understanding of the risks associated with the space environment and quantify these risks using appropriate calculations.
2. **Variability of the Space Environment:** Comprehend the inherent variability of the space environment and quantify this variability accurately.
3. **Impact on Technology and Spacecraft:** Analyze and calculate how the space environment affects technology and spacecraft, including studying various elements such as non-ideal magnetic fields, gravitational fields, and electric fields.
4. **Interplay Between Currents and Magnetic Fields:** Understand the interaction between currents and changing magnetic fields for effective navigation of space-based technology.

5. **Engineering in Space Environment:** Learn about the industrial applications of concepts learned during the course, which will include guest lectures from professionals working on space missions.
6. **Use of Simulation Software:** Gain insights into simulation softwares providing a practical understanding of systems in the space environment.

Skill Development

1. **Problem Solving:** Cultivate problem-solving skills for different space phenomena and impacts on space systems.
2. **Failure Modes Analysis:** Analyze failure modes and effects to predict and mitigate potential system failures.
3. **Model Interpretation:** Use and interpret models of the space radiation environment effectively.
4. **Analyzing Physical Parameters:** Analyze and interpret physical parameters related to the space environment, e.g., magnetic activity indices, solar wind properties, ionospheric conductivity, etc.
5. **Technical Summary Writing:** Develop the ability to write a technical summary of a journal article.
6. **Interactive Learning:** Enhance understanding of complex concepts and work with advanced AI tools like ChatGPT for an interactive learning experience.
7. **Simulation Software Proficiency:** Gain hands-on experience and hone the ability to use and apply simulation software in practical scenarios.

Tentative Schedule and Topics

Week 1	W1_Tues	Intro to Class, Chapter 1: Introduction
	W1_Thurs	Start Chapter 2: Risk Management
Week 2	W2_Tues	Chapter 2, continued
	W2_Thurs	Intro to Plasmas, E&M

Week 3	W3_Tues	Start Chapter 4: The Solar System
	W3_Thurs	Chapter 4, continued
Week 4	W4_Tues	Start Chapter 5: The Sun
	W4_Thurs	Chapter 5, continued
Week 5	W5_Tues	Guest Lecture: Dr. Jonathan Van Noord
	W5_Thurs	Guest Lecture: Fernando Saca
Week 6	W6_Tues	Start Chapter 7: Gravitational Fields
	W6_Thurs	Chapter 7, continued
Week 7	W7_Tues	Chapter 8: Magnetic and Electric Fields
	W7_Thurs	Chapter 8, continued
Week 8	W8_Tues	No Class - Fall break
	W8_Thurs	Chapter 9: Magnetosphere
Week 9	W9_Tues	Chapter 10: Space Radiation Environment

	W9_Thurs	Chapter 10, continued (Midterm released)
Week 10	W10_Tues	No Class (Midterm)
	W10_Thurs	No Class (Midterm)
Week 11	W11_Tues	Start Chapter 11: Radiation Interactions
	W11_Thurs	Chapter 11, continued
Week 12	W12_Tues	Guest Lectures
	W12_Thurs	Simulation Software Session
Week 13	W13_Tues	Guest Lecture
	W13_Thurs	No Class (Thanksgiving)
Week 14	W14_Tues	Presentations
	W14_Thurs	Presentations
Week 15	W15_Tues	Presentations
	W15_Thurs	Presentations

Grading Apportionment (Some of these percentages may be adjusted at the end of the term)

Homework: 35%

1 Take Home Midterm: 30%

Final Project: 25%

Attendance/Participation/Quizzes: 10%

Milestone Dates

October TBD, Final Project Selection Due

November TBD, Final Report Slide Deck Due

December TBD, Final Report Due

Final Project: There will be a Final Project that will require both a written and oral component, each counting for 50% of the Final Project grade. The topic of the project will be discussed in class. It will be due after Thanksgiving and oral presentations will be given during the last two weeks of class. This project will be a group project, but everyone must hand in an individual written report. The report will be on the order of 10-20 pages, and the presentations will be on the order of 20-30 minutes. Details will be discussed in more depth at the end of September.

Writing assignments

For those of you who are unfamiliar with writing a summary, here are some helpful links:

https://www.aresearchguide.com/summarize-an-article.html (Links to an external site.)

https://www.aresearchguide.com/how-to-paraphrase.html (Links to an external site.)

https://www.aresearchguide.com/6plagiar.html (Links to an external site.)

How to cite papers:
https://www.aresearchguide.com/apa-citation-guide.html (Links to an external site.)

Course Conduct Statement

The College of Engineering has an honor code, which is taken seriously. For more details, please visit:
http://honorcode.engin.umich.edu/wp-content/uploads/sites/147/2014/07/Honor-code-pamphlet-Adobe-Prof.pdf

Policy on Homework

You are encouraged to form study groups to work on homework problems and to study in other ways. You are allowed to consult with other students during the conceptualization of a problem. However, all written work, whether in scrap or final form, is to be generated by you alone. Show all work for homework problems, a correct answer can be marked down if work is not shown on how you arrive at the answer. You are not allowed to possess, look at, use, or in any way derive advantage from the existence of solutions prepared in prior years, whether these solutions were former students' work product or copies of solutions that had been made available by others. You may be required to use a computational math program (Mathematica, MATLAB, etc.) for homework. Be sure such work is clearly annotated. In modern software, the number of comment lines describing the calculation is expected to exceed the number of lines of actual code. You should meet this standard. Unless arrangements are made beforehand, late homework will be given half credit if submitted before the on-time homework is graded and returned. After the homework has been graded and returned, late homework will no longer be accepted.

Policy on Exams

You are to complete all examinations on your own, with only the benefit of the allowed aids that you yourself have prepared, and without looking or talking about the examination work of others. Violation of this policy is grounds for me to initiate an action that would be filed with the Dean's office and would come before the Honor Council of the College of Engineering. If you have any questions about this policy, PLEASE do not hesitate to contact me.

Policy on using AI Tools

Given the increasing prominence and utility of Artificial Intelligence (AI) tools in academic and research settings, the following policy delineates their use:

- **Permissible Use:** Students may consult AI tools, such as ChatGPT, to help understand concepts, access supplementary information, or aid in broader research initiatives. If not explicitly instructed otherwise, students can use and incorporate outputs from these tools in their submissions.
- **Disclosure:** For assignments or tasks where AI tools have been consulted, students are suggested to cite and indicate the specific sections where they received assistance from such tools. If prompted, students are expected to disclose their use of AI tools.
- **Honor Code Adherence:** Failing to adhere to any explicit instruction against the use of AI tools for a particular task or assignment will be viewed as a violation of the College of Engineering's honor code. We expect all students to maintain the highest levels of academic integrity and honesty.
- **Responsibility:** While AI tools offer significant assistance, students are reminded that the core objective is a genuine understanding and mastery of the course materials. Solely relying on AI without personal effort and comprehension may be counterproductive to the learning process.
- **Updates & Clarifications:** As the landscape of AI technologies shifts, this policy might undergo updates to address new situations and challenges. If unsure about the appropriate use of AI tools for any specific task, students are always encouraged to seek clarification from the instructor.

By observing this policy, students can integrate AI tools into their learning experience ethically and effectively while ensuring that the course's core objectives are achieved.

Grading policy

Grading of each homework or exam problem will be numerical on a 10-point nominal scale. The meanings of the points are:

(10) A complete and correct yet succinct treatment of the problem, methods used for generating the answer are explained clearly, and logically move through the steps.

(8) A nearly complete and nearly correct yet succinct treatment of the problem, methods used for generating the answer are explained clearly, and logically move through the steps. Minor calculation problems or a missed step may be present.

(6) Correct approach and concepts, however lacking the necessary mathematics or conceptual reasoning to obtain the correct result.

(4) Shows the ability to identify relevant known formulae or simple concepts but not to successfully apply them, or work that does not adequately set up and define the problem.

(2) Some work, but incorrect approach and incomplete work.

Students presenting alternative but valid methods of problem-solving should discuss their approach with the instructor to ensure fair grading. Out-of-the-box thinking is encouraged and will be recognized.

Grading Breakdown

A+	97.0%	B	83.0%	C-	70.0%
A	93.0%	B-	80.0%	D+	67.0%
A-	90.0%	C+	77.0%	D	63.0%
B+	87.0%	C	73.0%	D-	60.0%