

All Students:

Access lecture video recordings through Content page of D2L

Dr. Dima Lyapustin

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Office Hours: As needed

Course Description:

This course aims to provide students with a high-level understanding of design and testing principles for systems that will operate in the presence of extreme environments, with an emphasis on extraterrestrial environments. Students will gain an understanding of what constitutes extreme environments, the effects of such environments on different kinds of systems, how it is possible to design systems to be robust against extreme environments, and how those systems can be verified through test. Students will be able to use the knowledge gained from this course to make informed decisions when developing systems for operation in some of the harshest available terrestrial and extraterrestrial environments.

Course Prerequisite(s):

PHYS 241 or equivalent required

ECE 207 or equivalent desired

Instructor and Contact Information:

Dr. Dima Lyapustin

dlyapustin@email.arizona.edu

Teaching Assistant: None

Course Format and Teaching Methods:

This course is lecture based. This class will use web-based D2L (Desire to Learn) as the only means of distributing class materials including assignments. All homework assignments and a culminating project will be submitted by the student into Assignment Submission Folders on D2L before the appropriate due dates. **No late assignments will be accepted.** Your grades for this course will also be available on D2L. You will need a UANet ID to access D2L at the following site: <http://d2l.arizona.edu/>. You are expected to check D2L frequently for class information

Course Objectives and Expected Learning Outcomes:

Upon completion of this course, **Undergraduate and Graduate** students will understand the principles of and need for designing systems to work in extreme radiation, electromagnetic, mechanical, and weather-specific environments, including:

- Environments definitions and associated systems effects
- Environmental requirements
- Concept of Operation (CONOPS) development
- Extreme environment hardware, firmware, and software mitigation techniques
- Key whole-life system approach tradeoffs
- Common test and analysis methods
- Typical simulation techniques and software

In addition, **Graduate** students will learn:

- Implementation of whole-life system approaches
- Advanced environment effects mitigation techniques

Upon completion of the course all students will be able to demonstrate the following Learning Outcomes:

- Understand what constitutes an extreme environment and why it is important to mitigate associated environment effects
- Identify natural and man-made environment threats to a system
- Develop high-level comprehensive system design schemes
- Understand the uses and limitations of environment testing

Upon completion of the course graduate students will be able to demonstrate the following additional Learning Outcomes:

- Use whole-life Systems Engineering concepts to develop and support alternative comprehensive system schemes

Absences and Class Participation Policy:

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Participating in the course and attending lectures and other course events are vital to the learning process. Students are responsible for all materials covered during class. As such, attendance is strongly recommended. Occasionally, attendance may be required for special events such as Project Presentations. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

Class Guidelines:

All students:

- Check D2L regularly.
- Turn-in assignments by due date/time (allow for D2L “glitches”).

- Treat instructors, speakers, and peers with respect.
- Always behave in an ethical manner.
- Students are encouraged to use laptops for note taking and other class activities.
- View lectures in a timely manner, preferably within 48 hours of the lecture date.
- In some cases, content will be developed “For Distance Ed Students Only.” Pay careful attention to all communications.

Grad students:

- In some cases, content will be developed “For Grad Students Only.” Pay careful attention to all communications.

Course Communication:

D2L will be used for normal course communication. Both D2L and UA e-mail will be used for any critical items.

Required Text:

Students will not be required to purchase a text book. The course will, however, make extensive use of articles, handbooks, and standards, all of which will either be open access on the public domain or provided in pdf format in D2L.

Required Materials:

Laptop or PC with internet connection required.

Required Extracurricular Activities:

None

Assignments and Examinations:

The course will have weekly assignments consisting of online D2L quizzes. There will be one Midterm Exam and one Final Project. The project will have additional components for Graduate students.

Class Project:

All students will be required to complete a class project. Working in groups, students will develop a comprehensive survivability scheme for a system of their choosing. Graduate students will additionally develop an alternative comprehensive survivability scheme incorporating advanced techniques for their chosen system.

Examinations:

The course will have an online Midterm exam scheduled for TBD. There will be no Final Exam, though students will work in teams to complete a Final Project on a novel system operating in extreme environments.

Grading Scale and Policies:

The grade for this course will be determined as follows:

Draft research project proposal	5%
Final research project proposal	5%
Presentations of in-work research project	10%
Quizzes/homework	20%
Midterm exam	20%
Final report	20%
Final presentation	20%

Total

100%

The project will be evaluated on the basis of scientific merit, effective presentation, and appropriateness to the assigned project. Rubrics will be available for every assignment / deliverable.

There is no difference between graduate and undergraduate grading breakdown, though graduate students will have additional requirements for homeworks, the midterm, and the final project.

Homework is due at the time that it is specified in the homework handout and/or D2L content pages (all homework handouts will be posted on D2L).

The following scale will be used to award the final grades, for both 400 / 500 students:

Percentage	Letter Grade
90% – 100%	A
80% – 89%	B
70% – 79%	C
60% – 69%	D
<60%	E

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Honors Credit:

Honors Credit will not be available at this time.

Scheduled Topics/Activities:

The Class Schedule is available on D2L. It lists all material to be covered by date and includes references to assigned reading (also included on D2L). All assignments are listed with their respective due dates. **Note that the Assignment Submission Folder for each assignment will remain open only until 11:59 PM the day the assignment is due.**

All homework/projects/presentations and papers are to be submitted by the due date/time to the D2L Assignment Submission Folder unless otherwise specified. All D2L activities, including Discussions, Surveys and Quizzes, must be complete by the due date/time. No late work is accepted. No extra credit is available.

The following details the class topics and assignment due dates.

Week Number	Starting Day	Lessons / Week's Objective
1	15 May	<ol style="list-style-type: none"> 1. Introduction and class overview 2. Overview of types of extreme environments 3. Overview of typical systems operating in extreme environments
2	22 May	<ol style="list-style-type: none"> 1. Radiation: primer on relevant electrodynamics and nuclear physics 2. Everyday radiation environments
3	29 May	<ol style="list-style-type: none"> 1. Introduction to final projects and discussion of possible research topics 2. Extreme terrestrial and extraterrestrial natural radiation environments
4	5 June	<ol style="list-style-type: none"> 1. Man-made radiation environments
5	12 June	<ol style="list-style-type: none"> 1. Overview of final project topics 2. Radiation effects on electronics, mechanical and optical systems, and humans
6	19 June	<ol style="list-style-type: none"> 1. Radiation effects testing and analysis 2. Radiation effects mitigation
7	26 June	<ol style="list-style-type: none"> 1. Electromagnetic (EM) environments phenomenology 2. Common and extreme EM environments 3. EM environments effects 4. EM effects mitigation 5. EM effects testing
8	3 July	<ol style="list-style-type: none"> 1. Phenomenology of mechanical effects 2. Common and extreme mechanical-effects environments 3. Resonant and non-resonant effects 4. Mechanical effects mitigation 5. Mechanical effects testing
9	10 July	<ol style="list-style-type: none"> 1. Common and extreme weather environments 2. Terrestrial vs. extraterrestrial weather
10	17 July	<ol style="list-style-type: none"> 1. System weather effects 2. Weather effects mitigation 3. Weather effects testing
11	24 July	<ol style="list-style-type: none"> 1. Worked example of comprehensive system design and test scheme – Mars base
12	31 July	<ol style="list-style-type: none"> 1. Final Report outbriefs
13	7 August	<ol style="list-style-type: none"> 1. Special topics

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations:

Our goal in this classroom is that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact the Disability Resource Center (520-621-3268) to establish reasonable

accommodations. For additional information on the Disability Resource Center and reasonable accommodations, please visit <http://drc.arizona.edu>.

If you have reasonable accommodations, please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-Harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students:

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

All student records are held in strict confidence. Additional information can be found at <http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement:

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.