



ENGINEERING

INTRODUCTION TO DIRECTED ENERGY
A UNM Global and National Security Policy Institute Online Course
ECE 595 Section 004/GLNS 511/ECE 495 Section 001
January 17 – March 10, 2023

Professor: Edl Schamiloglu, Distinguished Professor of Electrical and Computer Engineering; Associate Dean for Research and Innovation, School of Engineering; Special Assistant to the Provost for Laboratory Relations

Website: <http://ece-research.unm.edu/schamiloglu/>

Office: Centennial Engineering Center Suite 3071

Phone: 505-277-6095

E-mail: edls@unm.edu

Additional Syllabus Information – Please see the important information beginning on page 6 of this Syllabus.

Logistics – How to Register for the Course

If you are a University of New Mexico student, then registration is just as you would sign up for any other course. For Non-University of New Mexico prospective students, you first need to apply for admission as a non-degree student. Once you have completed this then you can register for the course. Go to <http://www.unm.edu/apply/>.

I - Course Description

Directed energy lasers and microwaves are a technology that offers the ability to deliver energy to a target at the speed-of-light with a very deep magazine. Advances in pulsed power technology, batteries, capacitors, and electronics have all contributed towards making directed energy a reality.

As directed energy technology transitions from the laboratory to the field, there will be an increasing number of personnel who will be active in the acquisitions process yet have little knowledge about directed energy or related policy issues. This course aims to fill that gap by providing an introduction to directed energy technology for the novice. The target audience includes personnel in acquisitions, those who serve in the military, policymakers, and anyone else interested in learning about the subject.

II - Course Objectives and Methodology

The primary goal of this course is to introduce the student to directed energy technology and related policy issues. This course will encourage students to develop critical thinking in the assessment of directed energy and its broad national security implications and objectives from a technology perspective.

III – Learning Objectives

1. Develop an understanding of the basics of directed energy lasers and microwaves.
2. Become knowledgeable of related policy issues.
3. Become knowledgeable of the global perspective on directed energy.



ENGINEERING

4. Forecast future global technological challenges in light of recent developments and security threats.

IV – Course Delivery

This course will be delivered on-line (distance learning) giving the students flexibility and ability to complete their academic work solely online. Course materials, such as reading assignments, power point presentations, video links, etc. will be available online. There is one required text for the course. Students are required to read the materials and to discuss with other students and the instructor the materials, including research that the students have undertaken as part of the requirements. There will be a 2-day workshop on March 09-10, 2023 **to be held jointly** with ECE 595 Section 003, *Cybersecurity and National Security*. This workshop will be held virtually using Zoom (information to be provided week of March 06, 2023).

V – Evaluation Procedures

- a) **Assignments/Discussions/Deliverables:** Students will be asked to engage in a discussion weekly (using the Discussion Tool in CANVAS) with other students and the faculty on a number of questions based on the reading assignment and the link between the materials and security. Some of the questions posed for discussion may require the students to engage on additional research beyond their course's reading assignment. These discussions are part of the overall grade of the course and will account for 50% of students' overall grade. The Discussions will be graded based on the depth of the arguments presented by the discussion.
- b) **Research Project:** Students will be required to work on a 15-20-page research project, on a topic previously approved by your instructor. In the interest of providing more benefits to every student (from their work but also from attending presentations by other students), the instructors will approve on a first-come first-serve basis a different technology area for each student. This way, a student will work on one technology area but listen to final presentations and engage in discussions in multiple areas. This research project will account for the remaining 50% of the student's final grade. The paper is due on the last week of class and will be presented by the student at the end of the course on March 09-10, 2023.
Project Description: A critical success factor continues to be the ability to write clearly, concisely, and creatively. The goal of this research project is to examine the impact of some aspect, in a broad sense, of directed energy. Each student will work on a technology area of their choice that is of importance to national security, or some other aspect, and examine it in the global context. We are competing and collaborating with many other countries/regions in the world on many fronts. Your project should also consider likely global scenario changes in the next 20-25 years.
- c) **Research Paper Guidelines:** Times New Roman style 12 – point font, double-spaced, references should follow the Chicago Style guidelines:
http://www.chicagomanualofstyle.org/tools_citationguide.html
- d) **Grading Procedure:** Grading procedure will be based on the following criteria: a) Does the weekly discussion and the research upon which it is based have a clear, and creative core argument? b) Is that core argument well-supported? c) Is it well-written? And d) Can we draw policy implications from it?
- e) **Grading Scale:** Your final grade will be a combination of the points assigned to the Discussions (50 points) and your research paper project (50 points).

The scale used is as follows: 95-100 = A+/A, 90-95= A/A-, 85-90 = A-/B+, 80-85 = B+/B, 75-80 = B/B-, 70-75 = B-/C+, 65-70 = C+/C, <65 = F



ENGINEERING

Honor Code: UNM formally recognizes the responsibility of our students and professors to behave in an ethical manner.

Netiquette

- *“In following with the UNM Student Handbook, all students will show respect to their fellow students and instructor when interacting in this course. Take Netiquette suggestions seriously. Flaming is considered a serious violation and will be dealt with promptly. Postings that do not reflect respect will be taken down immediately.” (Rebecca Adams, OLIT 535)*
- *“This course encourages different perspectives related to such factors as gender, race, nationality, ethnicity, sexual orientation, religion, and other relevant cultural identities. The course seeks to foster understanding and inclusiveness related to such diverse perspectives and ways of communicating.”*
- *Link to Netiquette document: <https://canvasinfo.unm.edu/students/intro-to-canvas/netiquette.html>*

Copyright Issues

All materials in this course fall under copyright laws and should not be downloaded, distributed, or used by students for any purpose outside this course.

Accessibility

The American with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodations of their disabilities. If you have a disability requiring accommodation, please contact the UNM Accessibility Resource Center in 2022 Mesa Vista Hall at 277-3506 or <http://as2.unm.edu/index.html>. Information about your disability is confidential.

Academic Misconduct

You should be familiar with UNM’s [Policy on Academic Dishonesty](http://pathfinder.unm.edu/campus-policies/other-campus-policies.html) and the [Student Code of Conduct](http://pathfinder.unm.edu/campus-policies/other-campus-policies.html) (<http://pathfinder.unm.edu/campus-policies/other-campus-policies.html>) which outline academic misconduct defined as plagiarism, cheating, fabrication, or facilitating any such act.

Example Drop Policy:

This section states your departmental policy for dropping students.

UNM Policies: This course falls under all UNM policies for last day to drop courses, etc. Please see <http://www.unm.edu/studentinfo.html> or the UNM Course Catalog for information on UNM services and policies. Please see the UNM academic calendar for course dates, the last day to drop courses without penalty, and for financial disenrollment dates.

VI - Technical Skills

In order to participate and succeed in this class, you will need to be able to perform the following basic technical tasks:

- Use UNM’s CANVAS platform (www.canvas.unm.edu).
- Use email – including attaching files, opening files, downloading attachments
- Copy and paste within applications including Microsoft Office



ENGINEERING

- Open a hyperlink (click on a hyperlink to get to a website or online resource)
- Use Microsoft Office applications
 - Create, download, update, save and upload MS Word documents
 - Create, download, update, save and upload MS PowerPoint presentations
 - Create, download, update, save and upload MS Excel spreadsheets
 - Download, annotate, save and upload PDF files

Technical Requirements

Computer

- A high-speed Internet connection is highly recommended.
- Supported browsers include: Internet Explorer, Firefox, Chrome, and Safari. Detailed Supported Browsers and Operating Systems: <https://canvasinfo.unm.edu/support/index.html>
- Any computer capable of running a recently updated web browser should be sufficient to access your online course. However, bear in mind that processor speed, amount of RAM and Internet connection speed can **greatly** affect performance. Many locations offer free high-speed Internet access including [UNM's Computer Pods](#).
- Microsoft Office products are available free for all UNM students (more information on the UNM IT Software Distribution and Downloads page: <http://it.unm.edu/software/index.html>).

For UNM Canvas Technical Support: <https://canvasinfo.unm.edu/support/index.html>

VII - Reading List Content: Readings for this course come from a variety of sources.

Required Textbook: P.E. Nielsen, *Effects of Directed Energy Weapons* (CreateSpace Independent Publishing Platform, an Amazon Company, Seattle, WA, 2012) available at the UNM Bookstore or from Amazon.com (https://www.amazon.com/Effects-Directed-Energy-Weapons-Nielsen/dp/1478268573/ref=sr_1_1?s=books&ie=UTF8&qid=1484425668&sr=1-1&keywords=effects+of+directed+energy+weapons). Additional readings will be provided in the on-line folders.

VIII – 2-Day Workshop

Our meetings on March 09-10, 2023 will explore all areas that we have developed in class. In these days, we will conduct the instructor feedback as well as the wrap-up for the course and presentations of the final projects for each student. This will be held jointly with the *Cybersecurity and National Security* course.

SYLLABUS¹

Week 1 – January 17, 2023

Nielsen Chapter 1 – Basic Principles – supplemented by readings in the Week 1 Folder; participate in the weekly discussion

Week 2 – January 23, 2023

Nielsen Chapter 3 – Laser Fundamentals (pp. 81-141) – supplemented by readings in the Week 2 Folder; participate in the weekly discussion

¹ Subject to updates and based on enrollment



ENGINEERING

Week 3 – January 30, 2023

Nielsen Chapter 3 – Laser Fundamentals (pp. 142-205) – supplemented by readings in the Week 3 Folder; participate in the weekly discussion

Week 4 – February 06, 2023

Nielsen Chapter 4 – Microwaves – supplemented by readings in the Week 4 Folder; participate in the weekly discussion; submit proposal for final project

Week 5 – February 13, 2023

Directed energy laser efficacy, countermeasures, applications, ethics and policy issues – readings in the Week 5 Folder; participate in the weekly discussion; review feedback on proposal for final project

Week 6 – February 20, 2023

Directed energy microwave efficacy, countermeasures, applications, ethics and policy issues – readings in the Week 6 Folder; participate in the weekly discussion; work on final project

Week 7 – February 27, 2023

Global and geopolitical perspective on directed energy – readings in the Week 7 Folder; participate in the weekly discussion; work on final project

Week 8 – March 06, 2023

What are the barriers to the deployment of directed energy? – readings in the Week 8 Folder; participate in the weekly discussion; complete final project paper and prepare presentation [additional instructions on this will be conveyed to the students in the second week of the course]; **March 09-10, 2023** – joint workshop with *Cybersecurity and National Security* via Zoom.

Final papers due by 5 PM Monday March 13, 2023



ENGINEERING

SPRING 2023 ADDITIONAL SYLLABUS INFORMATION

Dear Students:

Below each of these statements, you will find a description of related resources (in light blue). *Please note that these are resources on the Albuquerque campus only.*

Faculty Resource: Over one hundred instructors across all UNM campuses have appreciated the information on designing a welcoming and equitable syllabus offered by the Student Experience Project (see: <https://studentexperienceproject.org/firstdaytoolkit/>) and have boosted academic outcomes and positive engagement by using all of the UNM-tested research-based approaches on the [SEP Resource Hub](#).

COVID-19 Health and Awareness. UNM is a mask friendly, but not a mask required, community. To be registered or employed at UNM, Students, faculty, and staff must all meet UNM's [Administrative Mandate on Required COVID-19 vaccination](#). If you are experiencing COVID-19 symptoms, please do not come to class. If you have a positive COVID-19 test, please stay home for five days and isolate yourself from others, per the [Centers for Disease Control \(CDC\) guidelines](#). If you do need to stay home, please communicate with me at edls@unm.edu. I can work with you to provide alternatives for course participation and completion. UNM faculty and staff know that these are challenging times. Please let me, an advisor, or another UNM staff member know that you need support so that we can connect you to the right resources. Please be aware that UNM will publish information on websites and email about any changes to our public health status and community response.

Support:

[Student Health and Counseling \(SHAC\)](#) at (505) 277-3136. If you are having active respiratory symptoms (e.g., fever, cough, sore throat, etc.) AND need testing for COVID-19; OR If you recently tested positive and may need oral treatment, call SHAC.

[LoboRESPECT Advocacy Center](#) (505) 277-2911 can offer help with contacting faculty and managing challenges that impact your UNM experience.

STANDARD REQUIRED UNM SYLLABUS LANGUAGE (not COVID-19 related)

Accommodations: UNM is committed to providing equitable access to learning opportunities for students with documented disabilities. As your instructor, it is my objective to facilitate an inclusive classroom setting, in which students have full access and opportunity to participate. To engage in a confidential conversation about the process for requesting reasonable accommodations for this class and/or program, please contact Accessibility Resource Center at arcsrvs@unm.edu or by phone at 505-277-3506.

Support: Contact me at edls@unm.edu or in office/check-in hours and contact [Accessibility Resource Center](#) (<https://arc.unm.edu/>) at arcsrvs@unm.edu (505) 277-3506.

Credit-hour statement:



This is a three credit-hour course delivered in an entirely online modality over 8 weeks during the Spring 2023 semester. Please plan for a *minimum* of 18 hours per week to learn course materials and complete assignments.

Support: [Center for Academic Program Support \(CAPS\)](#). Many students have found that time management workshops can help them meet their goals (consult [\(CAPS\) website](#) under "services").

Title IX:

In an effort to meet obligations under Title IX, UNM faculty, Teaching Assistants, and Graduate Assistants are considered “responsible employees.” This designation requires that any report of gender discrimination which includes sexual harassment, sexual misconduct and sexual violence made to a faculty member, TA, or GA must be reported to the Title IX Coordinator at the Office of Equal Opportunity (oeo.unm.edu). For more information on the campus policy regarding sexual misconduct, see: <https://policy.unm.edu/university-policies/2000/2740.html>

Support: [LoboRESPECT Advocacy Center](#) and the support services listed on its website, the [Women's Resource Center](#) and the [LGBTQ Resource Center](#) all offer confidential services and reporting.

Land Acknowledgement: Founded in 1889, the University of New Mexico sits on the traditional homelands of the Pueblo of Sandia. The original peoples of New Mexico Pueblo, Navajo, and Apache since time immemorial, have deep connections to the land and have made significant contributions to the broader community statewide. We honor the land itself and those who remain stewards of this land throughout the generations and also acknowledge our committed relationship to Indigenous peoples. We gratefully recognize our history.

Resource: [Division for Equity and Inclusion](#).

Citizenship and/or Immigration Status: All students are welcome in this class regardless of citizenship, residency, or immigration status. Your professor will respect your privacy if you choose to disclose your status. As for all students in the class, family emergency-related absences are normally excused with reasonable notice to the professor, as noted in the attendance guidelines above. UNM as an institution has made a core commitment to the success of all our students, including members of our undocumented community. The Administration’s welcome is found on our website: <http://undocumented.unm.edu/>.

Respectful and Responsible Learning: We all have shared responsibility for ensuring that learning occurs safely, honestly, and equitably. Submitting material as your own work that has been generated on a website, in a publication, by an artificial intelligence algorithm, by another person, or by breaking the rules of an assignment constitutes academic dishonesty. It is a student code of conduct violation that can lead to a disciplinary procedure. *Please ask me for help in finding the resources you need to be successful in this course. I can help you use study resources responsibly and effectively.* Off-campus paper writing services, problem-checkers and services, websites, and AIs can be incorrect or misleading. You can only learn the course material if you complete and submit your own work. UNM preserves and protects the integrity of the academic community through multiple policies including policies on student grievances (Faculty Handbook D175 and D176),



ENGINEERING

academic dishonesty (FH D100), and respectful campus (FH CO9). These are in the *Student Pathfinder* (<https://pathfinder.unm.edu>) and the *Faculty Handbook* (<https://handbook.unm.edu>).

Support: [Center for Academic Program Support \(CAPS\)](#). Many students have found that time management workshops can help them meet their goals (consult [\(CAPS\)](#) website under "services").

Connecting to Campus and Finding Support: UNM has many resources and centers to help you thrive, including [opportunities to get involved](#), [mental health resources](#), [academic support including tutoring](#), [resource centers](#) for people like you, free food at [Lobo Food Pantry](#), and [jobs on campus](#). Your advisor, staff at the [resource centers](#) and [Dean of Students](#), and I can help you find the right opportunities for you.