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## Special Topics: Radar in Industry

### EE495 Summer 19

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<http://www.ee.unlv.edu/~b1morris/ee495>

Professor:	Brendan Morris	Class:	MoWe 13:00-14:55, WHI 105
E-mail:	<a href="mailto:brendan.morris@unlv.edu">brendan.morris@unlv.edu</a>	Discussion:	NA
Office:	SEB 3216	Office Hours:	MoWe 14:55-15:55
Phone:	702-774-1480	Final:	We Aug 14, 13:00-14:55

#### Instructors

Robyn Meinhard	<a href="mailto:Robyn.Meinhard@jt4llc.com">Robyn.Meinhard@jt4llc.com</a>
Justin Glaesemann	<a href="mailto:Justin.Glaesemann@jt4llc.com">Justin.Glaesemann@jt4llc.com</a>
Ricky Ryan	<a href="mailto:Richard.Ryan@jt4llc.com">Richard.Ryan@jt4llc.com</a>

#### Textbook

Stimson's Introduction to Airborne Radar, G.W. Stimson, 3rd Edition      ISBN: 9781613530221

#### Grading

Final:	30%	08/14 13:00
Homework:	40%	Weekly
Project:	30%	Weekly

#### Catalog Description

Covers experimental and other topics which maybe of current interest. Fundamentals of radar including industry applications such as airborne radar.

**Prerequisites:** Junior standing.

#### Topics

The most up-to-date information regarding the class will be available on the course website – this will include the course schedule and assignments.

<http://www.ee.unlv.edu/~b1morris/ee495>

- Coordinate systems and transforms
- Radar components
  - Transmitter, receivers, duplexer
  - Display types
- Review of decibels
- Fundamental parameters of antennas
  - Radiation pattern, radiation power density
  - Beamwidth, bandwidth, frequency, wavelength, pulse repetition frequency
  - Directivity, gain, beam efficiency, polarization
- Detection range
  - Radar cross section (RCS)
  - Radar range equation
- Swerling cases
- Ambiguities

- Range
- Doppler
- Pulse Doppler radar
- Fourier transform
- Ground clutter
- Air-to-air operation
- Tracking loops
- Synthetic aperture radar
- Electronic applications
  - Electronic countermeasure (ECM) techniques
  - Electronic counter-countermeasure (ECCM) techniques
- Phased array radar
- MATLAB applications

Additional course material not present in the textbook will be distributed to the class when needed. Extra problems can be found in the recommended texts.

### **Course Outcomes** (Program Outcomes) [UULO]

Upon completion of this course, students will be able to:

- Understand the terminology by radar engineers. (a, c, e, g) [1, 2]
- Analytically and conceptually understand the various radar component parameters. (a, c, e), [1, 2]
- Utilize computational tools to perform analysis. (a, b, e, k) [1, 2]
- Perform basic radar design and analysis with computational tools. (a, b, c, e, k) [1, 2]

### **Course Policies**

- There will be no make-up exams or late homework without prior arrangements.
- Extensions will only be granted for medical emergencies or due to the observance of a religious holiday. The instructor must be notified of the absence prior to the last day of late registration.
- As a university student it is your responsibility to conduct yourself ethically and with integrity as described in the Academic Misconduct Policy. Cheating and plagiarism will not be tolerated. Any student caught cheating will be given an F grade.  
(<http://studentconduct.unlv.edu/misconduct/policy.html>)

**Electrical Engineering Program Objectives**

The Program Educational Objective of the Electrical Engineering program is to create, apply, and disseminate knowledge immediately or within a few years after graduation such that the graduate:

1. can successfully practice and mature intellectually in the field of Electrical Engineering or a related field.
2. can be admitted to and successfully progress through a post graduate program in Electrical Engineering or related program

**Electrical Engineering Program Goals**

To achieve these objectives and goals, each graduate of the Electrical Engineering Major will attain the following outcomes before graduation:

1. Appropriate technical knowledge and skills
2. Appropriate interpersonal skills
3. The knowledge and skills to be a responsible citizen

**Electrical Engineering Student Outcomes**

To achieve the above objectives and goals, each graduate of the Electrical Engineering Major will attain the following outcomes before graduation:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.



**Academic Misconduct**—Academic integrity is a legitimate concern for every member of the campus community; all share in upholding the fundamental values of honesty, trust, respect, fairness, responsibility, and professionalism. By choosing to join the UNLV community, students accept the expectations of the Student Academic Misconduct Policy and are encouraged when faced with choices to always take the ethical path. Students enrolling at UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's function as an educational institution. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another, from the Internet or any source, without proper citation of the sources. See the *Student Academic Misconduct Policy* (approved December 9, 2005) located at: <https://www.unlv.edu/studentconduct/student-conduct>.

**Classroom Conduct**—Students have a responsibility to conduct themselves in class and in the libraries in ways that do not interfere with the rights of other students to learn or of instructors to teach. Use of electronic devices such as pagers, cellular phones, or recording devices, or potentially disruptive devices or activities, are permitted only with the prior explicit consent of the instructor. The instructor may rescind permission at any time during the class. If a student does not comply with established requirements or obstructs the functioning of the class, the instructor may initiate an administrative drop.

**Copyright**—The University requires all members of the University Community to familiarize themselves with and to follow copyright and fair use requirements. You are individually and solely responsible for violations of copyright and fair use laws. The university will neither protect nor defend you, nor assume any responsibility for employee or student violations of fair use laws. Violations of copyright laws could subject you to federal and state civil penalties and criminal liability, as well as disciplinary action under University policies. Additional information can be found at: <http://www.unlv.edu/provost/copyright>.

**Disability Resource Center (DRC)**—The UNLV Disability Resource Center (SSC-A 143, <http://drc.unlv.edu/>, 702-895-0866) provides resources for students with disabilities. If you feel that you have a disability, please make an appointment with a Disabilities Specialist at the DRC to discuss what options may be available to you. If you are registered with the UNLV Disability Resource Center, bring your Academic Accommodation Plan from the DRC to the instructor during office hours so that you may work together to develop strategies for implementing the accommodations to meet both your needs and the requirements of the course. Any information you provide is private and will be treated as such. To maintain the confidentiality of your request, please do not approach the instructor in front of others to discuss your accommodation needs.

**Final Examinations**—The University requires that final exams given at the end of a course occur at the time and on the day specified in the final exam schedule. The general schedule is typically available at the start of the semester, and the classroom locations are available about a month before the end of the semester. See the schedule at: <http://www.unlv.edu/registrar/calendars>.

**Incomplete Grades**—The grade of "I"—Incomplete—can be granted when a student has satisfactorily completed three-fourths of course work for that semester/session but for reason(s) beyond the student's control, and acceptable to the instructor, cannot complete the last part of the course, and the instructor believes that the student can finish the course without repeating it. The incomplete work must be made up before the end of the following regular semester for undergraduate courses. Graduate students receiving "I" grades in 500-, 600-, or 700-level courses have up to one calendar year to complete the work, at the discretion of the instructor. If course requirements are not completed within the time indicated, a grade of "F" will be recorded and the GPA will be adjusted accordingly. Students who are fulfilling an Incomplete do not register for the course but make individual arrangements with the instructor who assigned the "I" grade.

**Library Resources**—Librarians are available to consult with students on research needs, including developing research topics, finding information, and evaluating sources. To make an appointment with a subject expert for this class, please visit the Libraries' Research Consultation website: <http://guides.library.unlv.edu/appointments/librarian>. You can also ask questions via chat and text message at <http://ask.library.unlv.edu/>.

**Rebelmail**—By policy, faculty and staff should email students' Rebelmail accounts only. Rebelmail is UNLV's official email system for students. As such, it is a primary way students receive official university communications such as information about deadlines, major campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the university. **Emailing within WebCampus is acceptable.**

**Missed Classwork**—Any student missing class quizzes, examinations, or any other class or lab work because of observance of religious holidays shall be given an opportunity during that semester to make up missed work. The make-up will apply to the religious holiday absence only. It shall be the responsibility of the student to notify the instructor within the first 14 calendar days of the course for fall and spring courses (excepting modular courses), or within the first 7 calendar days of the course for summer and modular courses, of his or her intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit:

<http://catalog.unlv.edu/content.php?catoid=6&navoid=531>.

In accordance with the UNLV Faculty Senate-approved policy regarding class time and assignments missed, students who represent UNLV in any official extracurricular activity shall also have the opportunity to make up assignments, provided that the student provides official written notification to the instructor no less than one week prior to the missed class(es).

The spirit and intent of the policy is to offer fair and equitable opportunities to all students, including those representing the university in extracurricular activities. Instructors should consider, for example, that in courses which offer a “drop one” option for the lowest assignment, quiz, or exam, assigning the student a grade of zero for an excused absence for extracurricular activity is both contrary to the intent of the Faculty Senate's policy, and an infringement on the student's right to complete all work and fairly earn her or his grade in the course.

This policy shall not apply in the event that completing the assignment or administering the examination at an alternate time would impose an undue hardship on the instructor or the university that could reasonably have been avoided. There should be a good faith effort by both faculty and student to come to a reasonable resolution. When disagreements regarding this policy do arise, they can be appealed to the department chair/unit director, college/school dean, and/or the Faculty Senate Academic Standards Committee.

For purposes of definition, extracurricular activities may include, but are not limited to: fine arts activities, competitive intercollegiate athletics, science and engineering competitions, liberal arts competitions, academic recruitment activities, and any other event or activity sanctioned by a college/school dean, and/or the Executive Vice President and Provost.

**Transparency in Learning and Teaching**—The University encourages students to use a transparency template to discuss with their instructors how assignments and course activities benefit student success:

[https://www.unlv.edu/sites/default/files/page\\_files/27/TILT-Framework-Students.pdf](https://www.unlv.edu/sites/default/files/page_files/27/TILT-Framework-Students.pdf).

**Tutoring and Coaching**—The Academic Success Center (ASC) provides tutoring, academic success coaching and other academic assistance for all UNLV undergraduate students. For information regarding tutoring subjects, tutoring times, and other ASC programs and services, visit <http://www.unlv.edu/asc> or call 702-895-3177. The ASC building is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of SSC A (ASC Coaching Spot). Drop-in tutoring is located on the second floor of the Lied Library and College of Engineering TBE second floor.

**UNLV Writing Center**—One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, located in CDC-3-301. Although walk-in consultations are sometimes available, students with appointments will receive priority assistance. Appointments may be made in person or by calling 702-895-3908. The student's Rebel ID Card, a copy of the assignment (if possible), and two copies of any writing to be reviewed are requested for the consultation. More information can be found at: <http://writingcenter.unlv.edu/>.