Signals and Systems I
EE360 Spring 23

http://www.ee.unlv.edu/~b1morris/ee360

Professor:	Brendan Morris	Class:	TTh 14:30-15:45, BHS 201
E-mail:	brendan.morris@unlv.edu	Discussion:	Fr 17:30-18:30, TBD
Office:	SEB 3216	Office Hours:	TuTh 15:45-16:45
Phone:	702-774-1480	Final:	Th. 5/11, 15:10-17:10

Textbook

Signals and Systems, A.V. Oppenheim, A.S. Willsky, and S.H. Nawab, 2e   ISBN: 9780138147570

Recommended Text

Schaum's Outlines: Signals and Systems, H. Hsu, 4th Edition,   ISBN: 9781260454246
Linear Systems and Signals, B.P. Lathi, 3rd Edition   ISBN: 9780190200176

Grading

Final:	20%	Th. 5/11
Midterms:	40%	Th. 3/02, Th. 4/13
Homework:	20%	Weekly
Computer:	10%	Bi-Weekly
Participation:	10%	Weekly

You will be able to track your grades through UNLV Webcampus [link]. Note that the calculated % is not necessarily reflective of your final grade. The gradebook should be used mainly to ensure that I have correctly recorded your scores.

- This course will utilize a "flipped" classroom. Lectures (video and slides) will be provided online for asynchronous viewing while the "lecture" time will be used as extended office hours and as a problem solving session.
- Students are expected to come to lecture prepared. We will not do a traditional lecture but instead answer questions and work on problems. You should come with your problems ready to ask. Additionally, lecture reading assignments should be completed before lecture in order to be successful.
- **Class attendance during the "lecture" time is required**. Make sure you are reading the book and watching recorded lectures.
- Homework will be assigned weekly and will include Matlab programming problems (Computer problems).
- Students may study together in (virtual) groups but all assignments must be completed individually. Copying homework is unacceptable and will result in a fail in the class with an F grade.
- Homework will be due via Webcampus (Canvas) on the designated date. No late homework will be accepted unless prior notification and arrangements are made.
- Class participation will be recorded through online "quizzes". Each participation quiz will be worth 5 points only toward the final grade (despite usually having more posted points). This means you can make a few mistakes and still get full points. Use these to identify areas where you need help.
- Exams are cumulative but will emphasize new material.

- NOTE: Homework and exams will be submitted online via Webcampus. You must obtain tools to scan or make pdf images of your work.
- Instruction of computational programming language (Matlab) and its application to signals and systems takes place in EE360D.

Catalog Description

Deterministic signals and linear systems. Time domain description and analysis of analog and discrete linear systems. Analysis of linear systems using the Laplace transform and the z-transform. Block diagram and flow graph representation of signals and linear systems. Introduction to state space representation and analysis.

Prerequisites: EE 221 or EE 292 and MATH 431
Corequisites: EE360D and either MATH 459 or MATH 432

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.

<div align="center">http://www.ee.unlv.edu/~b1morris/ee360</div>

- Introduction to signal and system description and classification
- Time-domain analysis of linear analog and discrete systems

  - Solutions to difference and differential equations
  - Zero-input response (ZIR)
  - Zero-state response (ZSR)
  - Impulse response (analog and discrete systems)
  - Convolution integral and convolution sum of signals
  - Stability of systems (analog and discrete systems)

- Laplace transform and z-transform analysis for analog and discrete systems

  - Unilateral and bilateral Laplace and inverse Laplace transforms
  - Unilateral and bilateral z-transform and inverse z-transform
  - Properties of Laplace and z-transform
  - Solutions of differential and difference equations
  - Transfer functions
  - Poles and zeros

- Block diagrams

  - System realization (discrete and continuous)

- State space representation and analysis

  - Developing state space descriptions of linear systems
  - Solutions of state space models of linear systems

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. The Schaum series book has a number of worked problem solutions making it a good investment.

Course Outcomes (Program Outcomes) [UULO]

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

- Classify signals and systems according to the mathematical properties that model them. (1, 6) [1, 2]
- Graphically model linear difference and differential equations using block diagrams. (1, 6), [1, 2]
- Determine the ZIR, ZSR, and impulse response of linear discrete systems modeled by difference equations using time domain methods. (1,6) [1, 2]
- Determine the ZIR, ZSR, and impulse response of linear analog systems modeled by differential equations using time domain methods. (1, 6) [1, 2]
- Use the Laplace transform to analyze signals and linear systems. (1, 6) [1, 2]
- Use the z-transform to analyze signals and linear systems. (1, 6) [1, 2]
- Determine a state space representation of a linear system. (1, 6) [1, 2]
- Determine the ZIR, ZSR, and impulse response of a linear system using a state space representation. (1, 6) [1, 2]
- Write computer (Matlab) programs that generate discrete signals and implement discrete systems. (1, 6) [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.
  (`https://www.unlv.edu/studentconduct/student-conduct`)

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

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
(3) An ability to communicate effectively with a range of audiences
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

University Undergraduate Learning Outcomes [UULO]
The five University Undergraduate Learning Outcomes (UULOs) define what all UNLV students should know and be able to do when they graduate. Because students engage with the UULOs in both their general education and academic majors, the UULOs help make the undergraduate experience intentional and coherent.

Full context online (https://www.unlv.edu/provost/gen-ed/uulo)

[1] Intellectual Breadth and Lifelong Learning
[2] Inquiry and Critical Thinking
[3] Communication
[4] Global/Multicultural Knowledge and Awareness
[5] Citizenship and Ethics

University Policies

All instructors are required to include the academic policies listed below in the syllabi for their courses, perhaps under a section entitled University Policies. This document is posted on the University Policies webpage, https://www.unlv.edu/policies/additional, in the Executive Vice President and Provost section, under Academic Semester Memos.

Please address questions to Kate Korgan, Senior Vice Provost for Academic Affairs, via email at SVPAA@unlv.edu or (702) 895-5950.

Public Health Directives
Face coverings are currently optional for all faculty and students in the classroom. Students must follow all active UNLV public health directives while enrolled in this class. UNLV public health directives are found at Health Requirements for Returning to Campus, https://www.unlv.edu/coronavirus/health-requirements. Students who do not comply with these directives may be asked to leave the classroom. Refusal to follow the guidelines may result in further disciplinary action according to the UNLV Student Conduct Code, https://www.unlv.edu/sites/default/files/page_files/27/StudentConduct-Code.pdf, including being administratively withdrawn from the course.

Academic Misconduct
Academic integrity is a legitimate concern for every member of the University community. We 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 to always take the ethical path whenever faced with choices. Students enrolling at UNLV assume the obligation to conduct themselves in a manner compatible with UNLV's educational mission. An example of academic misconduct is plagiarism. Plagiarism is using the words or ideas of another person, from the Internet or any other source without proper citation of the source(s). See the Student Conduct Code, https://www.unlv.edu/studentconduct/student-conduct.

Auditing a Course
Auditing a course allows a student to continue attending the lectures and/or laboratories and discussion sessions associated with the course, but the student will not earn a grade for any component of the course. Students who audit a course receive the same educational experience as students taking the course for a grade, but will be excused from exams, assessments, and other evaluative measures that serve the primary purpose of assigning a grade.

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 devices such as cellular phones and pagers, or other potentially disruptive activities are only permitted with the prior explicit consent of the instructor.

Students are specifically prohibited to record classes without instructor authorization, including online/remote classes (either audio only, or video and audio). 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 withdrawal of the student from the course.

Since the COVID-19 pandemic forced some instruction to be delivered remotely starting in Spring 2020, numerous students have asked instructors to record their synchronous classes, so that they can access them at their

convenience. Instructors who agree to record their classes (audio only, or video and audio) should inform students in advance. Recorded lectures may not be broadly released to anyone, but made available exclusively to those students enrolled in the class during the particular academic term. Recorded lectures must be stored securely, and are subject to the Nevada System of Higher Education's Records Retention Policy, meaning that the recordings can only be deleted 120 days after the end of class (i.e., after grades are posted). Once this requirement is met, the recordings should be deleted. Class recordings are protected from disclosure, as they are deemed part of an educational record under the Family Educational Rights and Privacy Act (FERPA).

Copyright
The University requires all members of the University Community to familiarize themselves with and 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 student or employee 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 copyright policy information is available at https://www.unlv.edu/provost/copyright.

Disability Resource Center (DRC)
The UNLV Disability Resource Center (Campus Resource Center (CRC), across Harmon from the Lied Library, https://www.unlv.edu/drc, telephone 702-895-0866) provides resources for students with disabilities. Students who believe that they may need academic accommodations due to a permanent disability, temporary or permanent medical need, or academic support due to pregnancy are encouraged to contact the DRC as early as possible in the academic term. A Disabilities Specialist will discuss what options may be available to you. Students who are already registered with the DRC should request their accommodations online each semester, and make an appointment to discuss their accommodations with their instructors.

Final Examinations and Study Week
The University requires that final exams given at the end of a course occur on the date and at the time specified in the Final Exam schedule. The general schedule is typically available at the start of the semester, and the classroom locations are available approximately one month before the end of the semester. See the Final Exam Schedule, https://www.unlv.edu/registrar/calendars.

Identity Verification and Online Course Requirements
All UNLV students must use their Campus-issued ACE ID and password to log in to WebCampus-Canvas. UNLV students enrolled in online or hybrid courses are expected to read and adhere to the Student Academic Misconduct Policy, https://www.unlv.edu/studentconduct/misconduct/policy, which states that "acting or attempting to act as a substitute for another, or using or attempting to use a substitute, in any academic evaluation or assignment" is a form of academic misconduct. Intentionally sharing ACE login credentials with another person may be considered an attempt to use a substitute, and could result in investigation and sanctions, as outlined in the Student Academic Misconduct Policy. UNLV students enrolled in online courses are also expected to read and adhere to the Acceptable Use of Computing and Information Technology Resources Policy, https://www.it.unlv.edu/policies/acceptable-use-computing-and- information-technology-resources-policy, which prohibits sharing university accounts with other persons without authorization. To the greatest extent possible, all graded assignments and assessments in UNLV online courses should be hosted in WebCampus-Canvas or another UNLV-managed platform that requires ACE login credentials for access.

Incomplete Grades
The grade of "I" (Incomplete) may be granted when a student has satisfactorily completed three-fourths of course work for that semester/session, but cannot complete the last part of the course for reason(s) beyond the student's control and acceptable to the instructor, and the instructor believes that the student can finish the course without repeating it. For undergraduate courses, the incomplete work must be made up before the end of the following regular semester. 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 period indicated, a grade of "F" will be recorded, and the student's GPA will be adjusted accordingly. Students who are fulfilling an Incomplete grade 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, https://guides.library.unlv.edu/appointments/librarian. You can also ask the library staff questions via chat and text message at https://ask.library.unlv.edu/.

Missed Classwork

Any student missing class, quizzes, examinations, or any other class or laboratory work because of observance of religious holidays will be given an opportunity during that semester to make up the missed work. The make-up opportunity will apply to the religious holiday absence only. It is the responsibility of the student to notify the instructor within the first 14 calendar days of the course for Fall and Spring courses (except for modular courses), or within the first 7 calendar days of the course for Summer and modular courses, of their intention to participate in religious holidays which do not fall on state holidays or periods of class recess. For additional information, please visit the Missed Classwork policy, under Registration Policies, on the Academic Policies webpage, https://catalog.unlv.edu/content.php?catoid=39&navoid=10666.

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

The spirit and intent of the policy for missed classwork is to offer fair and equitable assessment 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 for the course.

This policy will 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 be reasonably avoided. There should be a good faith effort by both the instructor and the student to agree to a reasonable resolution. When disagreements regarding this policy arise, decisions can be appealed to the Department Chair/School 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 academic recruitment activities, competitive intercollegiate athletics, fine arts activities, liberal arts competitions, science and engineering competitions, and any other event or activity sanctioned by a College/School Dean, and/or by the Executive Vice President and Provost.

Rebelmail

Rebelmail is UNLV's official email system for students and by University policy, instructors and staff should only send emails to students' Rebelmail accounts. Rebelmail is one of the primary ways in which students receive official University communications, information about deadlines, major Campus events, and announcements. All UNLV students receive a Rebelmail account after they have been admitted to the University. Sending emails within WebCampus-Canvas is also acceptable.

Title IX

UNLV is committed to providing an environment free of all forms of unlawful discrimination including sexual and

gender-based discrimination, harassment, and violence like sexual assault, intimate partner violence, and stalking. If you, or someone you know, has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available. To learn more or to report an incident, please visit the Office of Equal Employment and Title IX website at https://www.unlv.edu/compliance. Please be aware that as an instructor, I am not a confidential resource, and I will need to report incidents of sexual misconduct to UNLV's Title IX Coordinator. You can also report concerns directly using the online reporting form, at https://cm.maxient.com/reportingform.php?UnivofNevadaLasVegas&layout_id=18, or via email at titleixcoordinator@unlv.edu or 702-895-4055. For confidential support in matters of sexual violence, relationship/family violence, or stalking, contact the Care Center at https://www.unlv.edu/carecenter or 702-895-0602.

Tutoring and Coaching
The Academic Success Center (ASC), at the Claude I. Howard Building, 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, please visit the ASC website, https://www.unlv.edu/asc, or call 702-895-3177. The ASC is located across from the Student Services Complex (SSC). Academic success coaching is located on the second floor of SSC A, Room 254. Drop-in tutoring is located on the second floor of the Lied Library, and on the second floor of the College of Engineering building (TBE A 207).

UNLV Writing Center
One-on-one or small group assistance with writing is available free of charge to UNLV students at the Writing Center, https://writingcenter.unlv.edu/, located in the Central Desert Complex, Building 3, Room 301 (CDC 3–301). Walk-in consultations are sometimes available, but students with appointments receive priority assistance. Students may make appointments in person or by calling the Center, telephone 702-895-3908. Students are requested to bring to their appointments their Rebel ID Card, a copy of the instructions for their assignment, and two copies of any writing they have completed on their assignment.

988 FREE 24/7 SUICIDE & CRISIS LIFELINE
In addition to campus resources such as the Counseling and Psychological Services (CAPS) website at https://www.unlv.edu/caps, visiting the YOU@UNLV website at https://you.unlv.edu/, and Early Alert (for graduate students, at https://www.unlv.edu/graduatecollege/academy/early-alert), you may now call or text 988 or chat at 988lifeline.org if you or someone you know is in crisis and in need of support.

OPTIONAL BUT RECOMMENDED STATEMENTS FOR INCLUSION:

Diversity Statement
As an institution of higher learning, UNLV represents a rich diversity of human beings among its faculty, staff, and students, and is committed to cultivating a campus environment that values diversity, practices inclusion, and actively promotes equitable experiences and outcomes. Accordingly, the University supports understanding and appreciation of all members of its community, regardless of race, sex, age, color, national origin, ethnicity, creed, religion, disability, sexual orientation, gender, gender identity, marital status, pregnancy, genetic information, veteran status, or political affiliation. Please see University Statements and Compliance, https://www.unlv.edu/about/statements-compliance.

A successful learning experience requires mutual respect and trust between the students and the instructor. Accordingly, the instructor asks that students be willing to listen to one another's points of view, acknowledging that there may be disagreements, keep discussion and comments on topic, and use first person, positive language when expressing their perspectives.

UNLV Land Acknowledgement
UNLV is situated on the traditional homelands of Indigenous groups, including the Nuwu or Nuwuvi, Southern

Paiute People, descendants of the Tudinu, or Desert People. We honor and offer gratitude for those who have stewarded the land; for the land itself; and for the opportunity to cultivate a thriving, diverse, inclusive, and just scholarly community here today that works for a better tomorrow for all.