

Syllabus

ECE 528: Introduction to Random Processes in ECE

Course Number: ECE 528

Recommended Prerequisite: ECE 220 and STAT 346 (all with grade of C or better), or permission of instructor.

Instructor: Bijan Jabbari, Professor

Semester: Fall 2021

Lecture Time: Monday 4:30-7:10 pm, Planetary Hall 124

Office: Eng. Bldg. Room 3232

Office phone: 703-993-1618

Email: bjabbari@gmu.edu

Web: <http://cnl.gmu.edu/>

Office hours: by appointment

Teaching Assistant: Mo Shams (email: mshams4@gmu.edu)

Recitation Time: Wednesday 7:20-8:35 pm

Office hours: Monday 11:00 am-12:30 pm (virtual) and Wednesday 3:00-4:30 pm (F2F)

Administrative Assistant: N/A

Course Description

Probability and random processes are fundamental to communications, control, signal processing, and computer networks. Provides basic theory and important applications. Topics include probability concepts and axioms; stationarity and ergodicity; random variables and their functions; vectors; expectation and variance; conditional expectation; moment-generating and characteristic functions; random processes such as white noise and Gaussian; autocorrelation and power spectral density; linear filtering of random processes, and basic ideas of estimation and detection.

Course Outline

- Probability Models in ECE
- Review of probability: set theory, basic concepts, probability spaces, conditional probability, Bayes' Rule, independence, Borel Fields, Generation of random numbers
- Discrete Random Variables: Notion of Random Variables, Probability Mass Functions (PMF), Expected Value and Moments, Important Discrete Random Variables, Generation of Discrete Random Variables
- General Random Variables (Single Variable): Cumulative Distribution Functions (CDF), Probability Density Functions (PDF), functions of random variables, expectations and characteristic function, Markov and Chebyshev inequalities
- Pairs of Random Variables: joint and marginal distributions, conditional distributions and independence, functions of two random variables, Expectations and correlations, pairs

of jointly Gaussian Random Variables, generating jointly Gaussian Random Variables

- Random vectors: Functions of several random variables expected value of vector random variables, jointly Gaussian Random vectors, convergence of random sequences
- Sums of random variables and long-term averages: the sample mean and the Laws of Large Numbers, the Central Limit Theorem
- Stochastic Processes: Basic concepts, Covariance, correlation, and stationarity, Gaussian processes and Brownian motion, Poisson and related processes, Power spectral density, Stochastic processes and linear systems
- Markov Processes and Markov Chains

Textbook and References:

- **Required Textbook:** Probability, Statistics, and Random Processes for Electrical Engineering , 3rd Edition, by Alberto Leon-Garcia, Pearson Prentice Hall, 2008.
- D. P. Bertsekas and J. N. Tsitsiklis, Introduction to Probability. Athena Scientific, Belmont, MA, 2nd Edition, 2008. See <http://www.athenasc.com/probbook.html>

Grading:

There will be weekly homework assignments along with several projects. Homework will be assigned on Mondays and will be due by 4:30 pm of the following Monday (except holidays). Projects should be typed and follow a specific given format. You should upload your solutions to Blackboard. Projects will typically be due two weeks after being assigned. Late submissions will not be accepted.

There will be one Mid-Term exam, and a Final exam (comprehensive). They will count towards the grade as follows:

- Homework and MATLAB Projects 20%
- Mid-term 35% ((Oct 18)
- Final Exam 45% (up to 2 hours and 30 minutes) – see the schedule of Final Exams (Dec 13)

Mason expects students to pursue their academic work with honesty and integrity. Students should feel free to work in groups to discuss lecture material and homework assignments; however, under no circumstances should a student represent another's work as his/her own. Copying solutions for assigned homework problems, from any source, constitutes a violation of the university honor code. Any forms of cheating may cause penalties, from getting F in this course to academic actions in accordance with university policy.

Course and University Policies

Academic Integrity and Honor Code:

Honesty and integrity are at the core of Mason academic programs, research and community. George Mason University's [honor code states the following](#):

Honor Code Statement To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of the George Mason University Community and with the desire for greater academic and personal achievement, we, the student members of the university community, have set forth this Honor Code: Student Members of the George Mason University community pledge not to cheat, plagiarize, steal, or lie in matters related to academic work.

Avoid Reposting Course Material: It is not allowed to reposting course material. The course materials (lecture notes, homework, projects, exams, solutions, and anything else posted on the course website) are copyrighted. You may not upload them to any other website or share them with any on-line or off-line test bank.

Email Communications: Students should use their Mason email account to receive important university information, including messages related to this class (see <https://mail.gmu.edu/>). Also, please write ECE542 on the subject line when you send me an email.

University Policies: The University Catalog, <https://catalog.gmu.edu/>, is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at <http://universitypolicy.gmu.edu/>. All members of the university community are responsible for knowing and following established policies. Academic integrity is of great importance to the Mason community. Mason provides accommodations through the Office of Disability Services.

Office of Disability Services: Mason provides accommodations through the Office of Disability Services (ODS) <http://ods.gmu.edu>. If you are a student with a disability and you need academic accommodations, please see me and contact ODS at 993-2474.

Student Support Resources on Campus: are available through Stearn Learning Center: See <https://stearnscenter.gmu.edu/knowledge-center/knowning-mason-students/student-support-resources-on-campus/>

Non-Discrimination Policy: See <https://www.gmu.edu>

Anti-Racism and Inclusive Excellence: See <https://www.gmu.edu>

Creating Inclusive Classrooms: See <https://www.gmu.edu>

Other useful campus resources:

Writing center: See <http://writingcenter.gmu.edu> or 703-993-1200

University libraries: See <https://library.gmu.edu>

Counseling and Psychological Services: For CAPS see <https://caps.gmu.edu/> or 703-993-2380.

Safe return to campus: Responsibility for complying with health and wellness policies:
See: <https://www2.gmu.edu/safe-return-campus/faqs-safe-return>

All students taking courses with a face-to-face component are required to follow the university's public health and safety precautions and procedures outlined on the university Safe Return to Campus webpage (<https://www2.gmu.edu/safe-return-campus>). Similarly, all students in face-to-face and hybrid courses must also complete the Mason COVID Health Check daily, seven days a week. The COVID Health Check system uses a color code system and students will receive either a Green, Yellow, or Red email response. Only students who receive a "green" notification are permitted to attend courses with a face-to-face component. If you suspect that you are sick or have been directed to self-isolate, please quarantine or get testing. Faculty are allowed to ask you to show them that you have received a Green email and are thereby permitted to be in class. As of August 11, 2021, George Mason University **will require all individuals** on our campus **to wear facemasks indoors**, including classrooms and laboratories, **regardless of vaccination status**. The facemask must cover your nose and mouth at all times in the classroom. For more information, please see [Mason's updated mask policy](#).