

ESE/EEO 306: Random Signals and Systems

Summer 2024

Catalog Description:

Random experiments and events; random variables and random vectors; probability distribution functions; random processes; Binomial, Bernoulli, Poisson and Gaussian processes; system reliability; Markov chains; significance testing; detection of signals; estimation of signal parameters; properties and applications of autocorrelation and cross-correlation functions; power spectral density; response of linear systems to random inputs.

Course Prerequisites: ESE/EEO 305

Course Credits: 3

Faculty: Vibha Mane
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Office Hours: Conducted online via Zoom; details posted on Brightspace.

Course Delivery: Online, asynchronous; course material posted on Brightspace.

Exams: Online, synchronous via Zoom; details posted on Brightspace.

Textbook: Charles Boncelet, Probability, Statistics and Random Signals, Oxford University Press, 2016.

Course Dates and Duration: Summer Session 2, July 8 - August 17 (6 weeks).

Grading

Assignments	15
Discussion Board Participation*	15
Midterm Exam (Synchronous)	35
Final Exam (Synchronous)	35

*Refer to the document “DBRubric.pdf”.

Learning Modules

- There are 5 Learning Modules. Each Module consists of:
 - PowerPoint Lectures or Notes
 - Video Lectures
 - Reading list
 - Assignment
 - Discussion Board Participation

Regarding Assignments

- The assignments have points for submission which show effort and sufficient progress. No detailed grading or feedback will be provided.

Course Schedule

- The schedule for Learning Modules and exam dates is posted in a file shared with the class.

Additional Notes

- There will be synchronous Midterm and Final Exams. All students are expected to attend.
- In the event you miss an exam due to significant illness or any other personal emergency, alternative accommodation will be made. However, it is your responsibility to provide documentation to support such a request.
- There are no makeup exams to boost scores.
- There are no extra credits.
- No resubmission of assignments is allowed.
- Any grade dispute should be brought to the attention of the instructor within one week of posting the grades.
- Stony Brook University makes religious accommodations. Please check the university religious holiday calendar for a list of major holidays and policies.

Course Learning Outcomes: Upon completion of the course, students will

- Have knowledge of random variables, such as discrete and continuous distributions, joint and conditional distributions, and Bayes theorem.
- Have knowledge of random processes and their applications.
- Apply the above concepts to solve engineering problems.

Topics:

Module 1	Probability Basics: Random experiments, sample space, probability measure and axioms of probability. Conditional Probability: Conditional probability, total probability theorem, Bayes theorem and independence.
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Module 2	<p>Combinatorics: Permutations, combinations, and binomial theorem.</p> <p>Discrete Random Variables: Properties of discrete random variables; examples of discrete random variables: Bernoulli, Binomial and Geometric; Poisson random variable and its applications.</p>
Module 3	<p>Continuous Random Variables: Properties of continuous random variables; examples of continuous random variables: Uniform, Exponential and Normal.</p>
Module 4	<p>Joint Random Variables & Expectations: Jointly distributed random variables and their properties; marginals and independence; expectations of one random variable and joint random variables.</p>
Module 5	<p>Random Processes: Properties of random processes; Bernoulli, Binomial and Poisson random processes.</p>

University Policies

Academic Integrity Statement

Each student must pursue their academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, Dental Medicine) and School of Medicine are required to follow their school-specific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty please refer to the academic judiciary website at http://www.stonybrook.edu/commcms/academic_integrity/index.html

Student Accessibility Support Statement

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, Stony Brook Union Suite 107, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodation is necessary and appropriate. All information and documentation are confidential. Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: <https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities> and search Fire Safety and Evacuation and Disabilities.

Critical Incident Management Statement

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Student Conduct and Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook.

Electronic Communication

Email and especially email sent via Brightspace is one of the ways the faculty officially communicates with you for this course. It is your responsibility to make sure that you read your email in your official University email account. For most students that is Google Apps for education (<http://www.stonybrook.edu/mycloud>).

If you choose to forward your official University email to your other off-campus account, faculty are not responsible for any undeliverable messages to your alternative personal accounts. You can setup Google mail forwarding using these DoIT-provided Instructions found at <http://it.stonybrook.edu/help/kb/setting-up-mail-forwarding-in-google-mail>.

If you need technical assistance, please contact Client Support at 631-632-9800 or supportteam@stonybrook.edu.

Course Materials and Copyright Statement

Course material accessed from Brightspace, Zoom, Echo 360, VoiceThread, etc. is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity.

Additional Resources

- To access mental health services, call Counseling and Psychological Services (CAPS) at 631-632-6720; Counselors are available to speak with 24/7.
- For updated information on the Academic Success and Tutoring Center (ASTC), please check www.stonybrook.edu/tutoring for the most up-to-date information.
- For IT Support: Students can visit the Keep Learning website at <https://sites.google.com/stonybrook.edu/keeplearning> for information on the tools you need for alternative and online learning.
- Need help? Report technical issues at <https://it.stonybrook.edu/services/itsm> or call 631-632-2358.
- For information on Library services and resources, please visit <https://library.stonybrook.edu>