

ECE 302 Probabilistic Methods in ECE

Syllabus (Fall 2020) Version 8/20/2020

Course Information

ECE 302 Probabilistic Methods in Electrical and Computer Engineering
Sessions: 30200-001 (lecture), 30200-003 (lecture), 30200-004 (distant learning)
CRN: 17728, 17104, 25619
Meeting time: This is a hybrid course. See meeting time information below.
Course credit hours: 3
Course web page: <https://engineering.purdue.edu/ChanGroup/ECE302/>
Piazza: <http://piazza.com/purdue/fall2020/ece302>
Brightspace: All students should go to 30200-001 to read announcements
Gradescope: All homework should be submitted to Gradescope

The information in this syllabus is subject to change as needed in response to unexpected developments, although the instructors will attempt to avoid disruptions as much as possible. Please see the Emergency Preparation section of this document for more information.

Information about the Instructor(s)

Prof Stanley Chan
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Prof Saul Gelfand
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Prof Mary Comer
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Teaching Assistant: Chengzhang Zhong
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Teaching Assistant: Pratik Kashyap
Email: pkashya@purdue.edu

Homework questions should be posted on Piazza: <http://piazza.com/purdue/fall2020/ece302>

Lectures

Lectures will be delivered asynchronously. That is, we will pre-record the lecture videos and make them available on the course website. Lecture videos are recorded according to *modules*. For example, you will see some short modules of 15 minutes, and some long modules of 35 minutes. We will post the lecture schedule on the course website. Please follow the recommended schedule so that you can keep up with the course.

Recitations

Apart from the lectures, we have scheduled recitations. Recitations are used to discuss examples, problems, and show demonstrations. We will, however, **not** discuss homework problems in recitations. (Homework problems should be asked in Piazza and office hours.) Recitations will be run in both in-person mode and online mode. While they are not mandatory, you are highly recommended to participate in at least one of the recitations per week, either in person or online.

Face-to-face meetings are limited to residential students. Due to room capacity and social distance requirement, we will partition the class into 4 groups. Please check your mypurdue registration to determine which group you belong to. (If there is any inconsistency, use the in-person planning tool in mypurdue as the final version.)

Session 003-LEC	Last Name A – K	W 3:30-4:20pm	PHYS 223
Session 003-LEC	Last Name L – Z	F 3:30-4:20pm	PHYS 223
Session 001-LEC	Last Name A – L	Tu 3-4:15pm	MSEE B012
Session 001-LEC	Last Name M – Z	Th 3-4:15pm	MSEE B012

The schedule and frequency of in-person recitations are subject to change, depending on the attendance and demand.

In-person meetings will be recorded and made available to all students.

In addition to in-person recitations we also have online recitations. Online recitations are open to all students, including residential and online students. We will NOT record these meetings. The time for online recitations include:

M 9-10am

Tu 10-11am

Tu 3-4:15pm

W 3:30-4:20pm

Th 3-4:15pm

F 3:30-4:20pm

The schedule of the recitations can be found at the bottom of this syllabus.

Meeting URLs will be posted in Brightspace.

Office Hours

All office hours will be online. We will not record the office hours.

Prof Stanley Chan Friday 9:30-10:30am

Prof Saul Gelfand Wednesday 2-3pm

Prof Mary Comer Thursday 1-2pm

Chengzhang Zhong (TA) Monday 10-12am, Tuesday 5-6pm

Pratik Kashyap (TA) Thursday 10:30-12:30am, Friday 1:30-2:30pm

Meeting URLs will be posted in Brightspace.

Piazza

Please sign up and use the following Piazza forum

<http://piazza.com/purdue/fall2020/ece302>

All homework related questions should be posted on Piazza. We will answer questions as quickly as we can.

The TAs will be responsible for answering questions on Piazza.

Course Description

An introductory treatment including probability of events, discrete and continuous random variables, multiple random variables, sums of random variables and long-term averages, and elementary random processes. Applications involving uniform, Gaussian, exponential, geometric and related random variables. Introduction to parameter estimation and hypothesis testing. Discussion of wide-sense stationary random processes, including correlation functions, spectral densities and the response of linear time invariant systems. Course examples are drawn from signal processing, wireless communications, system reliability, and data science.

Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated:

- An ability to solve elementary probability problems involving random events and random variables.
- An ability to model uncertainty by random variables and analyze the implications in a range of engineering applications.
- An understanding of the idea of a random process, along with some basic examples and applications.

Texts

- Required Textbook:
 - A. Leon-Garcia, Probability, Statistics, and Random Processes for Electrical Engineering, Prentice Hall, 3rd Edition, 2008.
- Additional Readings:
 - Stanley H. Chan, Introduction to Probability for Data Science, 1st Edition, 2020. e-book. Available on course webpage.
- Software/web resources
 - Python
 - MATLAB

Assignments and Points

Homework: 10%

All homework will be grade **coarsely**. We will have three grades for each homework:

3: Correct / Almost correct

2: Partially correct

1: You hand in something, but bare minimum

0: Do not hand in / Close to nothing

Please submit your homework through Gradescope.

Midterm 1: 25%

Date: 9/30 (Wednesday)

Format: Please see the ECE302 exam guideline.

Midterm 2: 25%

Date: 11/11 (Wednesday)

Format: Please see the ECE302 exam guideline.

Final Exam: 40%

Date: TBD

Format: Please see the ECE302 exam guideline.

Missed or Late Work

All homework should be submitted by 11:59pm Eastern Time on the due day. No late homework will be accepted. All homework must be submitted through Gradescope.

Grading Scale

This class is graded according to a set curve. Final grades will be distributed through a ranking of scores on the assignments outlined above, weighted according to their respective percentages.

Incompletes

A grade of incomplete (I) will be given only in unusual circumstances. To receive an "I" grade, a written request must be submitted prior to December 1, and approved by the instructor. The request must describe the circumstances, along with a proposed timeline for completing the course work. Submitting a request does not ensure that an incomplete grade will be granted. If granted, you will be required to fill out and sign an "Incomplete Contract" form that will be turned in with the course grades. Any requests made after the course is completed will not be considered for an incomplete grade.

Attendance Policy

Because we are teaching the course in a hybrid mode, we require you submit homework regularly so that we can track your progress. If you do not submit homework regularly and we do not hear anything from you, we will reach out to you and find out how we can help. If the situation does not improve, we will discuss follow up plans. This includes, but not limited to, failing the course.

Academic Integrity

You are in college, not high school. We respect you as adults, and we expect you behave as adults. Therefore, we ask you to be honest and ethical in the course. In that respect, any action that might give a student unfair advantage on homework or exams will be considered dishonest. Examples include, but are not limited to:

- Sharing information during exam, including through online communication channels;
- Using forbidden material or device during exam;
- Viewing and/or working on an exam before or after the official time allowed;
- Requesting a re-grade of work that has been altered;
- Submitting work that is not your own.

If you work with another student on a homework, you must acknowledge the person(s) by writing their names on your submission. Regardless if you have worked with another classmate, you must write your own solution. "Write your own solution" means you write in your own words, write your own program, make your own plots. If we see two identical homework, both parties will receive zero.

Cheating in homework and exams will receive penalties including, but not limited to, partial or no credit for the respective work, and / or failing the course.

All cases of academic dishonesty will be reported to the Office of Student Rights and Responsibilities, and will result in punishment. Possible punishments include, but are not limited to, a score of zero on work related to the cheating incident, a failing grade for the course, and, in severe cases, expulsion from the university.

Nondiscrimination Statement

Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. [Link to Purdue's nondiscrimination policy statement.](#)

Students with Disabilities

If you have a letter of accommodation from the disability resources center (DRC), please send it to Prof. Stanley Chan.

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

Guidelines regarding ensuring access to emergency information:

- *Keep your cell phone on to receive a Purdue ALERT text message.*
- *Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts.*
- *If you have a "no cell phone" in class policy allow one or two students who have signed up for Purdue ALERT to keep their phones on to receive any alerts*

Mental Health Statement

- **If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#).** Sign in and find information and tools at your fingertips, available to you at any time.
- **If you need support and information about options and resources,** please see the [Office of the Dean of Students](#) for drop-in hours (M-F, 8 am- 5 pm).
- **If you're struggling and need mental health services:** Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Netiquette

Your instructor and fellow students wish to foster a safe online learning environment. All opinions and experiences, no matter how different or controversial they may be perceived, must be respected in the tolerant spirit of academic

discourse. You are encouraged to comment, question, or critique an idea, but you are not to attack an individual. Our differences, some of which are outlined in the University's nondiscrimination statement below, will add richness to this learning experience. Please consider that sarcasm and humor can be misconstrued in online interactions and generate unintended disruptions. Working as a community of learners, we can build a polite and respectful course ambience.

Please read the Netiquette rules for this course:

- Do not dominate any discussion. Give other students the opportunity to join in the discussion.
- Do not use offensive language. Present ideas appropriately.
- Be cautious in using Internet language. For example, do not capitalize all letters since this suggests shouting.
- Avoid using vernacular and/or slang language. This could possibly lead to misinterpretation.
- Keep an “open-mind” and be willing to express even your minority opinion.
- Think and edit before you push the “Send” button.
- Do not hesitate to ask for feedback.

Violent Behavior Policy

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

See the [University's full violent behavior policy](#) for more detail.

Diversity and Inclusion Statement

In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:

- We are all in the process of learning about others and their experiences. Please speak with one of the instructors, anonymously if needed, if something has made you uncomfortable.
- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.

Course Evaluation

During the last two weeks of the course, you will be provided with an opportunity to evaluate this course and your instructor. Purdue uses an online course evaluation system. You will receive an official email from evaluation administrators with a link to the online evaluation site. You will have up to two weeks to complete this evaluation. Your participation is an integral part of this course, and your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

Disclaimer

This syllabus is subject to change. Describe how you will announce and share changes made to the syllabus.

Course Schedule

Week	Date	Topic	Book	Note	Homework (Fri)
1	8/24	Introduction, background review	1	1.1 - 1.4	
2	8/31	Combinatorics, Set theory, sample space	2.1 – 2.3	1.5 - 2.3	HW1 due
3	9/7	Axioms, conditional, Bayes	2.4-2.5	2.4 - 2.6	
4	9/14	Random variables, PMF, CDF	3.1-3.2	3.1 – 3.3	HW2 due
5	9/21	Expectation, moment, variance	3.3	3.4	
6	9/28	Common discrete random variables	3.5	3.5	HW3 due
7	10/5	PDF, CDF, Expectation	4.1 – 4.3	4.1 – 4.3	
8	10/12	Common continuous random variables	4.4	4.5	HW4 due
9	10/19	Function of R.V., Joint PDF, CDF	4.5 – 5.4	4.6 – 5.1	
10	10/26	$E[XY]$, covariance, $E[X Y]$	5.6 – 5.7	5.2 – 5.4	HW5 due
11	11/2	Sum of R.V., characteristic function	5.8, 4.7	5.5, 6.1	
12	11/9	Law of large number, Central limit	7.1 – 7.3	6.2 – 6.4	HW6 due
13	11/16	Intro to random process, mean function	9.1 – 9.2	8.1 – 8.2	
14	11/23	Thanks giving week			
15	11/30	WSS and power spectral density	10.1 – 10.2	8.3 – 8.5	HW7 due
16	12/7	Final Exam			