Course Information

Fall 2018
(Last Update: November 2, 2018)

Lecture Hours: TuTh 3pm-4:15pm, Room: MSEE B012

Instructor: Professor Stanley Chan
Room: MSEE 338
Email: stanchan@purdue.edu
Office Hours: Monday 4:30-5:30pm, or by email appointment.

Teaching Assistant: Madhuri Nagare
Email: mnagare@purdue.edu
Office Hours: Thursday 12-1pm and Friday 11am-12pm, EE 208

Grader: Wenrui Li
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Project Assistants (For Projects Only):
Room: MSEE 370
Office Hours: Wed 4:30-5:30, Thu 4:30-5:30
-Xiangyu Qu (qu27@purdue.edu)
-Zhiyuan Mao (mao114@purdue.edu)
-Omar Elgendy (oelgendy@purdue.edu)

Course Website: https://engineering.purdue.edu/ChanGroup/ECE302
Piazza: piazza.com/purdue/fall2018/ece302

Course Objectives:
ECE 302 is an introductory probability and random process course for Electrical and Computer Engineering students. Our syllabus has a strong emphasis on the theoretical foundations. ECE 302 is different from the statistics courses you took in high school. For example, you probably know about how to calculate the “mean” and “standard deviation” of some data, but have you thought about how to use the mean and standard deviation to classify objects in an image? You will learn some basic tools in statistics which will eventually allow you to work on big problems in the future.

The objective of this course is that by the end of the semester, you will have

- a solid background in probability and random processes that can help you take advanced courses;
- an ability to formulate engineering problems using a probabilistic approach;
- an ability to analyze large-scale systems using statistical methods;
- experience in using computers to solve probability problems.
Textbook (Recommended):

While you are not required to purchase the textbook, you are encouraged get a copy. There are two reasons. First, lectures are intended to highlight the key concepts of the topics. We will not have time to go over all the details (e.g., derivation, proofs) in lectures. This is where the textbook will help you. Second, the textbook contains many interesting examples that can demonstrate the concepts. Reading them carefully.

Reference (Recommended):

The book by Bertsekas and Tsitsiklis is an excellent text on probability. It contains many good examples, and problems with solutions. One thing Prof Chan likes about this book is that it provides many pictorial illustrations. Sometimes these pictures can help you understand the material better.

How textbooks are used:
We will not follow the sequence of the textbook or the reference book. Rather, we will take a “topic” based and “problem-based” approach. The course is divided into four topics, with each topic covering one or more chapters of the textbook. Therefore, you are advised to follow the reading assignment posted on the course website closely, for otherwise you will get lost. Many lecture examples and homework problems are taken from the textbook though.

Pre-requisites:
(MA 26200 or MA 26600 or MA 36600) and ECE 30100 [may be taken concurrently]

ECE 302 is a mathematically challenging course in the ECE curriculum. We require all students to be fluent in calculus and linear algebra. If you are uncertain whether you are ready to take ECE 302, please talk to Prof Chan.

We will try to minimize the dependency of ECE 301 in the first half of the semester. However, we expect you to be prepared for the Fourier Transforms when we start to discuss about moment generating functions (MGF).

The programming exercises require Python. However, students are not required to have prior knowledge of Python, although knowing Python is certainly a plus. We will teach the basics of Python, and you will be asked to write programs in Python. We do not use MATLAB (any more), although you can use MATLAB with an approval from Prof Chan.

Grades:
- Homework: 10%. There are 12 homework assignments and we will drop the worst 2. Homework will be assigned every week. Homework are due 4:30pm on the due date at the dropbox in MSEE 330. No homework will be accepted in class, and no late homework will be accepted. **Please staple the homework or otherwise you will get 0.** Homework will be coarsely graded. Historically, the amount of efforts students spent on homework is directly proportional to their overall grades.
- Projects: 15%. There will be three projects in this course. All projects should be done individually.
- Midterms: 30%. There are two mid-term exams in this course. The mid terms are scheduled on
  - Mid-term 1: See Schedule
– Mid-term 2: See Schedule

Mid-terms are closed-book, closed-note. No electronics, including calculators, cell phones, and smart watches are allowed.

• Final: 45%. The date of the final exam will be announced later. Final is closed-book, closed-note. No electronics, including calculators, cell phones, and smart watches are allowed.

Make-up Exam Policy:
We do NOT offer make-up exams except for very special occasions, e.g., serious illness (with doctor certificate) and civil service (Jury duty or military training, with proofs). No make-up exam will be made due to travel schedule. You should not travel before the end of the final exam week (including the last Saturday). Prof Chan reserves the right to decline any makeup exam request.

All make-up exams will be done orally, and should be taken before the actual exam. Historically, students attempting oral exams found it more difficult than the written exam.

Re-Grade Policy:
If you like us to re-grade your homework and exams, you must send your request to the TA within three days after we return you the graded homework or exams. No late re-grade requests will be entertained. When submitting your request, please write your question clearly on a sheet of blank paper. We will only read what you write on the request. We do not accept oral request.

Our re-grade policy is that we will give you points which you deserve if the mistake is proven on our side. However, if we find new mistakes that are not spotted in the first grading, we will take your points off, regardless of where these mistakes are. That is to say, please think carefully before you request for re-grade.

Office Hour Policy:
Depending on the types of questions you have, you should seek help from appropriate sources.

Teaching Assistant: The TA should be your first point of contact. The TA is responsible for

• Homework questions. If you need any help on the homework, please talk to the TA. The TA will host a weekly discussion session. Please bring your questions to the discussion session. If you need additional help, you can visit the TA during his office hour.

• Re-grade requests. All homework + exam regrades should be forwarded to the TA. The TA has the full authority to change your homework grade. The TA will collect exam regrade requests and discuss with Prof Chan before getting back to you.

• Lecture material. You may ask any question about the lecture material to the TA.

Instructor: You should go to Prof Chan’s office hour if you want to:

• Ask about lecture: If you are unclear about anything in the lecture, please come and ask. We welcome all kinds of questions, except homework.

• Seek help on problems that you have thoughtful ideas: We welcome thoughtful questions. If you have one and you want to chat, just come.

• Report academic dishonesty: Please let us know immediately if you suspect cheating in class.

• Course advice: If you are lagging behind, or if you want to learn additional stuff, please come and talk.
• Feedback: Both positive and negative feedbacks are welcome. The more that you suggest, the more that we can improve.

Please do NOT bring your homework to Prof Chan’s office and work on homework in the office. Homework are supposed to be done at HOME!

Examples:

1. “I am confused about topic XYZ you taught in class. Can you help me with that?” Sure, of course. Please come to Prof Chan’s or the TA’s office hour. We are very happy to help you.

2. “I have no idea of how to work on Problem X.” In this case, you should first read the lecture note and the textbook. Most homework problems are taken from the textbook and are carefully chosen to fit your level. Make some attempts. You can also talk to your friends. If you still got stuck, you can ask the TA for help. Prof Chan will NOT answer homework questions before you made adequate attempts.

3. “I have an alternative approach for Problem X, but my answer is different from my friends. Here is my idea ... blah blah blah. What could be wrong?” This is great! Come to the office hour and we will help you.

4. “Will topic X be covered in the exam?” The coverage of the mid terms are roughly outlined in the syllabus. Prof Chan will announce the exact coverage one week before the exam. If you come to the office hour just for this question, Prof Chan will tell you to study everything.

5. “I missed a class last week. Tell me what you have taught.” If you miss a class, it is YOUR responsibility to catch up. We will only provide you appropriate guidelines of what to study. Unless you have specific questions, both the TA and Prof Chan will not go through the lecture with you.

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Academic Dishonesty:

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;
• 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. (You can discuss problems with your classmates. But you must write your own solution.)

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.
Copyright of Course Material:

All ECE 302 course material, including lecture, homework, project, solutions and exams are protected by copyright law. Without Prof Chan’s permission, you are not allowed to distribute through any media including online sources. Below is an excerpt from http://www.purdue.edu/studentregulations/student_conduct/misc.html

... Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally. Notes taken in class are, however, generally considered to be "derivative works" of the instructor’s presentations and materials, and they are thus subject to the instructor’s copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor...

Emergency Procedure:

Purdue University is a very safe campus and there is a low probability that a serious incident will occur here at Purdue. However, just as we receive a “safety briefing” each time we get on an aircraft, we want to emphasize our emergency procedures for evacuation and shelter in place incidents. Our preparedness will be critical if an unexpected event occurs.

Purdue prepares for natural disasters or human caused incidents with the ultimate goal of maintaining a safe and secure campus, but in the end, emergency preparedness is your personal responsibility. Let’s quickly review the following procedures:

- To report an emergency, call 911. To obtain updates regarding an ongoing emergency, sign up for Purdue Alert text messages, view www.purdue.edu/ea.
- There are nearly 300 Emergency Telephones outdoors across campus and in parking garages that connect directly to the PUPD. If you feel threatened or need help, push the button and you will be connected immediately.
- If we hear a fire alarm during class we will immediately suspend class, evacuate the building, and proceed outdoors. Do not use the elevator.
- If we are notified during class of a Shelter in Place requirement for a tornado warning, we will suspend class and shelter in [the basement].
- If we are notified during class of a Shelter in Place requirement for a hazardous materials release, or a civil disturbance, including a shooting or other use of weapons, we will suspend class and shelter in the classroom, shutting the door and turning off the lights.

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. In such an event, information will be provided through the course website and through emails.
Syllabus:

The following outline is a tentative schedule of the topics that we will cover in this course. Please refer to the course website for the finalized version.

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics</th>
<th>Note</th>
<th>HW, Due Date</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Aug-21 (Tu)</td>
<td>Intro, Series, Approximation, Linear Alg</td>
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<td>HW#1, due 8/24</td>
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<tr>
<td>1</td>
<td>Aug-23 (Th)</td>
<td>Set Theory, Combinatorics, Prob Space</td>
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<tr>
<td>2</td>
<td>Aug-28 (Tu)</td>
<td>Axioms and Properties, Conditional Prob</td>
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<td>HW#2, due 8/31</td>
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<td>2</td>
<td>Aug-30 (Th)</td>
<td>Conditional Prob, Independence, Bayes</td>
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<td>3</td>
<td>Sep-04 (Tu)</td>
<td>Discrete Random Variable, PMF</td>
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<td>HW#3, due 9/5</td>
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<tr>
<td>3</td>
<td>Sep-06 (Th)</td>
<td>CDF, Expectation, Moment</td>
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<td>4</td>
<td>Sep-11 (Tu)</td>
<td>Bernoulli, Binomial, Poisson</td>
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<td>HW#4, due 9/14</td>
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<td>4</td>
<td>Sep-13 (Th)</td>
<td>Continuous Random Variable, PDF, CDF</td>
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<td>5</td>
<td>Sep-18 (Tu)</td>
<td>Uniform, Exponential, Gaussian</td>
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<td>HW#5, due 9/21</td>
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<td>5</td>
<td>Sep-20 (Th)</td>
<td>Function of random variables</td>
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<td>6</td>
<td>Sep-25 (Tu)</td>
<td>Joint CDF, Conditional PMF and PDF</td>
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<td>Proj#1, due 9/28</td>
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<td>6</td>
<td>Sep-27 (Th)</td>
<td>Joint Expectation and Moment</td>
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<td>7</td>
<td>Oct-02 (Tu)</td>
<td>Conditional Expectation</td>
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<td>7</td>
<td>Oct-04 (Th)</td>
<td>Mid Term 1</td>
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<td>8</td>
<td>Oct-09 (Tu)</td>
<td>October Break</td>
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<td>HW#6, due 10/12</td>
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<td>8</td>
<td>Oct-11 (Th)</td>
<td>Two-dimensional Gaussian</td>
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<td>9</td>
<td>Oct-16 (Tu)</td>
<td>Function of two random variables</td>
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<td>HW#7, due 10/19</td>
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<td>9</td>
<td>Oct-18 (Th)</td>
<td>Sum of Random Variables</td>
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<td>10</td>
<td>Oct-23 (Tu)</td>
<td>Moment generating function</td>
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<td>HW#8, due 10/26</td>
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<td>10</td>
<td>Oct-25 (Th)</td>
<td>Law of Large Number</td>
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<td>11</td>
<td>Oct-30 (Tu)</td>
<td>Central Limit Theorem</td>
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<td>Proj#2, due 11/2</td>
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<td>11</td>
<td>Nov-01 (Th)</td>
<td>Regression</td>
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<td>12</td>
<td>Nov-06 (Tu)</td>
<td>MLE and MAP</td>
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<td>12</td>
<td>Nov-08 (Th)</td>
<td>Mid Term 2</td>
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<td>13</td>
<td>Nov-13 (Tu)</td>
<td>Intro to Random Process</td>
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<td>13</td>
<td>Nov-15 (Th)</td>
<td>Stationary, WSS</td>
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<td>HW#9, due 11/16</td>
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<td>14</td>
<td>Nov-20 (Tu)</td>
<td>Power spectral density</td>
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<td>14</td>
<td>Nov-22 (Th)</td>
<td>Thanksgiving</td>
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<td>15</td>
<td>Nov-27 (Tu)</td>
<td>Cross power spectral density</td>
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<td>No class</td>
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<td>15</td>
<td>Nov-29 (Th)</td>
<td>Optimal linear filter</td>
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<td>HW#10, due 11/30</td>
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<tr>
<td>16</td>
<td>Dec-04 (Tu)</td>
<td>Linear Predictive Code</td>
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<td>Proj#3, due 12/7</td>
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<td>16</td>
<td>Dec-06 (Th)</td>
<td>Conclusion</td>
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