# ECE302H1S 2014 - Probability and Applications

**Description:** Engineers and scientists deal with systems, devices, and environments that contain unavoidable elements of randomness. Probability theory is a mathematical tool that allows logical ways to reason about knowledge and uncertainty. This course introduces 3rd- and 4th-year electrical and computer engineering students to basic concepts in probability theory.

**Textbook:** A. Leon-Garcia, *Probability and Random Processes for Electrical Engineering*, Third Edition, Addison Wesley, ISBN-13: 978-0-13-147122-1.

**Instructor and Course Coordinator:**
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**Lectures:**
Tuesdays 11:00 - 12:00; GB119
Wednesdays 11:00 - 12:00; GB248
Thursdays 12:00 - 13:00; GB119

**Tutorials:**
TUT01: Mondays 9:00 - 11:00; WB119
TUT02: Thursdays 17:00 - 19:00; WB342

**Teaching Assistants:**
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**Course Website:**
The course website is at UofT Portal. Homework, handouts, grades, and announcements will be posted here. Students are required to check it regularly for new information.

**Homework:**
While ECE302 is one of the most interesting and useful courses in electrical and computer engineering, it is also one of the most challenging upper-year courses, so it is critical that you take this course seriously immediately. It is a course almost completely in mathematics, where new concepts are built on previous ones. To do well in this course you must ***keep up to date with the class schedule***. The best way to accomplish this is to ***practise***, through homework and other exercise problems. Homework problems will be announced weekly. They will not be collected, but you are required to work out the homework problems before new materials are covered.

**Tutorials:**
In tutorials, teaching assistants will cover homework exercise problems, take questions from students, and present extended examples or applications of probability theory. Further, there will be one 15-minute quiz in each tutorial. These quizzes will be closed-book. The purpose of these quizzes is to help keep you up to date with the class material, so they will be designed to be quite

easy – you should ace these quizzes if you attend lectures and pay attention. Tutorials begin on Monday, January 13. The lowest two quiz marks will be automatically dropped from your course grade calculation, which will account for illnesses, scheduling conflicts, etc. Other than that, ***no exemption for missing quizzes will be given***. You are required to attend the tutorial and quiz section registered on ROSI.

**Grading Policy:**
Quizzes (weekly, closed book, no aid sheet): 15%
Midterm Exam (**evening of Feb 25**, closed book, single hand-written aid sheet): 35%
Final Exam (closed book, single hand-written aid sheet): 50%

**Lecture Schedule:**

| Week | Tuesday | Wednesday | Thursday |
|---|---|---|---|
| Jan 6 | Course Introduction, Random Experiments, Relative Frequency (ch 2.1, 1.3) | Events, Axiomatic Definition of Probability, Properties of Probability (ch 2.2) | Properties of Probability, Specifying Probability: Discrete and Continuous (ch 2.2) |
| Jan 13 | Computing Probability by Counting (ch 2.3) | Conditional Probability (ch 2.4) | Total Probability, Bayes' Rule (ch 2.4) |
| Jan 20 | Independence of Events (ch 2.5) | Sequential Experiments, Independent Bernoulli Trials, Binomial Prob Law (ch 2.6) | Geometric Prob Law, Dependent Sequential Experiments (ch 2.6) |
| Jan 27 | Random Variables, Discrete RVs, PMF (ch 3.1, 3.2) | Expected Value: Discrete, Expected Value of g(X) (ch 3.3) | Variance, Conditional PMF and Expectation (ch 3.3, 3.4) |
| Feb 3 | Important Discrete RVs: Uniform, Bernoulli, Binomial (ch 3.5) | Important Discrete RVs: Geometric, Poisson (ch 3.5) | CDF (ch 4.1) |
| Feb 10 | Types of RVs, PDF (ch 4.1, 4.2) | Conditional CDF and PDF (ch 4.2) | Expected Values (ch 4.3) |
| Feb 17 | *Reading Week* | | |
| Feb 24 | Midterm Review | Important Continuous RVs: Uniform, Exponential, Gaussian (ch 4.4) | Gaussian, Gamma, Cauchy (ch 4.4) |
| Mar 3 | Function of RV (ch 4.5) | Function of RV, Markov and Chebyshev Inequalities (ch 4.5, 4.6) | Characteristic Function (ch 4.7) |
| Mar 10 | Two RVs, Joint PMF (ch 5.1, 5.2) | Marginal PMF, Joint CDF, Marginal CDF (ch 5.3) | Joint PDF, Marginal PDF (ch 5.4) |
| Mar 17 | Joint CDF/PDF, Two Mixed RVs, Midterm Discussion (ch 5.3, 5.4) | Independence of Two RVs (ch 5.5) | Expected Value of a Function of Two RVs, Correlation, Covariance (ch 5.6) |
| Mar 24 | Conditional Probability and Density with Two RVs (ch 5.7) | Total Probability, Conditional Expectation (ch 5.7) | One Function of Two RVs (ch 5.8) |
| Mar 31 | Transformation of Two RVs (ch 5.8) | Two Jointly Gaussian RVs (ch 5.9) | Sum of RVs, Sample Mean (ch 7.1, 7.2) |
| Apr 7 | Sample Mean, Law of Large Numbers (ch 7.2) | Central Limit Theorem (ch 7.3) | Course Review |