Carleton UNIVERSITY | Department of Systems and Computer Engineering

SYSC 2510
Probability, Statistics and Random Processes for Engineers

Calendar description

Discrete and continuous random variables. Joint and conditional probabilities, independence, sums of random variables. Expectation, moments, laws of large numbers. Introduction to statistics. Stochastic processes, stationarity, additive white Gaussian noise, Poisson processes. Markov processes, transition probabilities and rates, birth death processes, introduction to queueing theory.

Includes: Experiential Learning Activity.

Lectures three hours a week, laboratory three hours alternate weeks.

http://calendar.carleton.ca/undergrad/courses/SYSC/

Prerequisites

MATH 1004 and MATH 1104, and second-year status in Engineering.

Prior knowledge

Students should have knowledge of:

- Integrals
- Techniques of integration and their applications to areas and volumes
- Systems of linear equations
- Linear transformations

Course objectives

This course will cover topics in probability theory and random processes with applications in Communications Engineering. In particular, the course covers probability model, counting methods, discrete and continuous random variables (R.V.), computer generation of R.V.'s, conditional distribution, multiple R.V.'s, functions of several R.V.'s, expected value of functions of R.V.'s (moments, correlation, and covariance), laws of large numbers, central limit theorem, and introduction to random processes.

List of topics

- Random experiment, statistical regularity, relative frequency, sample space.
- Set theory, axioms of probability, computing probabilities using counting methods.
- Conditional probability, independence of events, sequential experiments.

- Discrete and continuous random variables, probability mass function.
- Cumulative distribution function (cdf), probability density function (pdf), conditional cdf's and pdf's, expected value.
- Some important continuous random variables, functions of a random variable, Markov and Chebyshev inequalities.
- Transform methods, computer generation of random variables, pairs of random variables.
- Independence of two random variables, conditional probability and conditional expectation, vector random variables.
- Functions of several random variables, expected values of vector random variables, Jointly Gaussian random vectors.
- Sums of random variables, the laws of large numbers, central limit theorem. Introduction to statistics.
- Random processes; mean, autocorrelation, and auto-covariance functions, stationary random processes.
- Power spectral density, Markov processes, introduction to queueing theory.

Learning outcomes

By the end of this course, students should be able to:

- Distinguish between deterministic and probabilistic models.
- Analyze continuous and discrete-time random processes.
- Understand the fundamentals of probability, conditional probability and independence of events.
- Deal with cumulative distribution function, probability density function, conditional distribution and expected values for one or multiple random variables.
- Apply the fundamentals of probability theory and random processes for solving practical engineering problems in communication and information systems.
- Understand Markov processes and queueing theory.

Graduate Attributes (GAs)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. Activities related to the learning outcomes listed above are measured throughout the course and are part of the department's continual improvement process. Graduate attribute measurements will not be taken into consideration in determining a student's grade in the course. For more information, please visit: https://engineerscanada.ca/.

Graduate Attribute	Learning outcome(s)
1.1: Knowledge Base: Developed: Mathematical skills	1, 3, 6
2.1: Problem Analysis: Developed: Problem definition	2, 4, 5
2.2: Problem Analysis: Developed: Approach to the problem	2, 4, 5
2.4: Problem Analysis: Developed: Interpreting the solution – validity of results	2, 4, 5
3.5: Investigation: Developed: Interpretation of data (synthesis) and discussion	5

Accreditation Units (AUs)

For more information about Accreditation Units, please visit: https://engineerscanada.ca/.

The course has a total of 46 AUs, divided into:

- Engineering Math: 75%
- Engineering Science: 25%

Instructor and TA contact

Specific to course offering (tbd)

Textbook (or other resources)

Specific to course offering (tbd)

Evaluation and grading scheme

Specific to course offering (tbd)

Breakdown of course requirements

Specific to course offering (tbd)

Tentative week-by-week breakdown

Specific to course offering (tbd)

General regulations

Specific to course offering (tbd)