Instructor Information and Office hours:
Professor Ioannis Lambadaris, Room 4448 ME, Tel: ext.. 1974, Email: ioannis@sce.carleton.ca, http://www.sce.carleton.ca/faculty/lambadaris.html

Office Hours: Tuesdays and Thursdays from 12:00 noon till 1:30pm (i.e. after the lectures)

Lectures: Tuesdays and Thursdays from 10:00am -11:30am in Canal Building CB2202

Course Web Page:
http://www.sce.carleton.ca/courses/sysc-5503/
login:syc5503, password:iel2018

Course Number and Calendar Description
Basic concepts of randomness, as applied to communications, signal processing, and queuing systems; probability theory, random variables, stochastic processes; random signals in linear systems; introduction to decision and estimation; Markov chains and elements of queuing theory. Precludes additional credit for EACJ 5109 (ELG 5119).

Course Objectives:
The course objective is to provide a basic knowledge of probability, stochastic processes and queueing theory to engineering students. The course will not depend on the abstract development of axiomatic probability theory and stochastic processes, however some mathematical maturity from the students is expected.

Prerequisites:
Undergraduate preparation in calculus and analysis

Learning Outcomes:
At the end of the class students will be able to
1. State the defining properties of various stochastic process models.
2. Identify and formulate fundamental probability distribution and density functions, as well as functions of random variables
3. Understand and analyze continuous and discrete-time random processes
4. Explain the concepts of expectation and conditional expectation, and describe their properties
5. Explain the concepts of stationarity and wide-sense stationarity, and appreciate their significance
6. Identify appropriate stochastic process model(s) for a given research or applied problem. Provide logical and coherent proofs of important theoretic results.
7. Employ the theory of stochastic processes to analyze linear systems
8. Apply the above knowledge to solve basic problems in filtering, prediction and smoothing

Textbooks:
2. Class notes mostly via the course web site.
Additional References:
2. An Introduction to Probability and Statistics for Engineers and Scientists, Sheldon M. Ross, John Wiley and Sons, 1987
5. Probability Theory: A concise course, Y. A. Rozanov, Dover publications, 1977

Exams:
We will have three exams for this course:
The first exam (quiz) will determine if your background fulfils the prerequisites for the course. It will be closed book and one page of handwritten notes will be allowed along with calculators. It will take place on Thursday January 31.
The second in-class exam (midterm) will be held on: Closed book. Calculators and one page of handwritten notes are allowed. It will take place on Tuesday February 26 (immediately after the spring break!) during normal class hours. Please make sure that you will be able to attend the midterm. The third in-class exam will take place on Saturday March 26 and it will cover material after the second exam. The fourth exam (quiz) will take place on Tuesday April 9 (last day of classes).

Marking:
First Exam (Quiz) 10%
Second Exam 40%
Third Exam 40%
Fourth Exam (Quiz) 10%

The third examination is for evaluation purposes only and will not be returned to students. You will be able to make arrangements with the instructor or with the department office to see your marked final examination after the final grades have been made available.

- Due dates for each assignment will be shown on the web and will be also announced in class. Solutions will be posted. The assignments will not carry a grade. However I will give you some challenge problems from time to time that will carry an additive bonus towards your final grade. Details will be discussed in due time.
- Handouts, assignments etc. will usually be distributed in class on one occasion only. Most of the material will be on the web though.
- PLEASE check the web regularly!!!!!!
- It is your responsibility to check whether anything has been issued if you miss a class.
The purpose of assignments is to help you learn the material and prepare for examinations. It is essential that you fully understand all the assignments. If you perform badly on some questions, ensure that you find out afterwards what you should have done.

**Week by week outline:**

Week

1. Probability Models and Basic concepts of Probability
2. Conditional Probability and Sequential Experiments
3. The notion of Random Variable and its Characterization
4. Multiple Random Variables, Jointly Gaussian Random Variables
5. Functions of Random Variables
6. Sums of Random Variables and Limit Theorems
7. Introduction to random Processes
8. Random Processes (Cont.)
9. Analysis and Processing of Random Signals
10. Markov Chains
11. Markov Chains and Introduction to Queueing Theory
12. Queueing Theory (cont)
13. Special Topics on Estimation, Stochastic Control and Queueing theory (if time permits)

**General Regulations**

**Student Responsibility:** It is the student's responsibility to remain informed of all rules, regulations and procedures required by their program and by the Faculty of Graduate and Postdoctoral Affairs. Ignorance of regulations will not be accepted as a justification for waiving such regulations and procedures.

**Academic Integrity:** Students should be aware of their obligations with regards to academic integrity. Please review the information about academic integrity at: [https://carleton.ca/registrar/academic-integrity/](https://carleton.ca/registrar/academic-integrity/). This site also contains a link to the complete Academic Integrity Policy that was approved by the University's Senate.

**Plagiarism:** Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated.

**Deferred Term Work:** Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work are held responsible for immediately informing the instructor concerned and for making alternate arrangements with the instructor and in all cases this must occur no later than three (3.0) working days after the term work was due. The alternate arrangement must be made before the last day of classes in the term as published in the academic schedule. For more information, see the current *Graduate Calendar, Academic Regulations of the University, Section 9.3.*
Academic Accommodation: You may need special arrangements to meet your academic obligations during the term. You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://www.carleton.ca/equity/ For an accommodation request, the processes are as follows:

- **Pregnancy obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

- **Religious obligation:** write to me with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details see https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

- **Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your Letter of Accommodation at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult https://carleton.ca/pmc/students/dates-and-deadlines/ for the deadline to request accommodations for the formally-scheduled exam (if applicable).

- **Survivors of Sexual Violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton’s Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: https://carleton.ca/sexual-violence-support/.

- **Accommodation for Student Activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more
details, see https://carleton.ca senate/wp-content/uploads/Accommodation-for-
Student-Activities-1.pdf

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course outline and any slides, posted notes, labs, project, assignments, quizzes, exams
and solutions) are intended for personal use and may not be reproduced or redistributed
or posted on any web site without prior written permission from the author(s).

Health and Safety: Every student should have a copy of our Health and Safety Manual.
A PDF copy of this manual is available online: http://sce.carleton.ca/courses/health-and-
safety.pdf

Students from the University of Ottawa: You can request to have access to cuLearn:
please see http://gradstudents.carleton.ca/forms-policies/