

Random Processes
ECE 514
Fall 2017
Monday: 4:30PM-7:00PM

Instructor: Dr. Hamid Krim
EBII #2099
e-mail:ahk@@ncsu.edu
<http://www4.ncsu.edu/people/ahk>

Objectives:

This course will acquaint the student with the basic elements of probability theory and statistics. The covered material will also provide the students the ability to comfortably read a research paper, and conduct studies where uncertainty prevails, can and/or should be modeled.

Office Hours:

Monday: 3:00PM-4:20PM in EBII 2099

Teaching Assistants: TO BE ANNOUNCED

Prerequisites:

Calculus I, II, and III and Linear Algebra, Linear Systems.

Text:

Probability, Random Variables and Stochastic Processes, by A.S. Papoulis and S.U. Pillai, Pearson Pub. (ISBN: 9780073660110) **Recommended**
May be purchased online as well (at a bargain price).

Grading:

Homework	10%
Tests (2)	40% (each)
Two homeworks/mini-projects with software problems	10%

Schedule:

-Exam I: October 24 , 2017 (approximately depending on course progress)

Homeworks:

Homework problems are assigned/due every other week (two weeks worth of work) and submitted online and right before class time (i.e. Monday-4:30PM).

Most problems will be assigned from the book, some will occasionally be made available online and similarly due every other week along with other assigned problems.

Late homeworks are accepted only in exceptional cases and if approved by the instructor.

Cooperation while preparing a homework is allowed and encouraged, but it is imperative that each be able to solve the problems independently (this is important for exam time).

You may also hand in early homeworks if you wish to be ahead.

Solutions will be made available for the problems which are due, on the course locker following the due date.

Mini-Project:

The topic of a mini-project will consist of a number of required questions to test the breadth and depth of understanding of the material on the part of the students. Additional work is encouraged and will clearly be credited (if relevant to the topic under study). Computer experiments will be carried out and will initiate the students to real world problems.

Audit Requirements:

Auditors must turn in all homeworks and receive an average grade of at least 60%. No test or project is expected.

OUTLINE
PART I: Probability and Random Variables

1 Introduction. Importance of fundamental concepts of probability :

- Axiomatic theory, Bayes' theorem
- Binominal trials, normal approximation, Trial experiments .

2 Random variables :

- Introduction
- Probability distributions, probability density functions
- Distributions of continuous, discrete and mix random variables
- Conditional and joint densities
- Conditional failure rates

3 Functions of one random variable

- The RV $g(x)$
- The distribution of $g(x)$
- Mean and variance
- Moments
- Characteristic functions

4 Two Random Variables :

- Bivariate Distributions
- One function of two RVs
- Two functions of two RVs
- Joint moments,
- Conditional distributions and conditional first moment

5 Random Sequences

- General concepts
- Conditional densities
- Characteristic function and normality
- Mean Square Estimation
- Stochastic convergence and limit theorems

Part II: STOCHASTIC PROCESSES

7 Random processes and spectral analysis

- Definition and characterization
- Mathematical properties and applications
- Main random processes
- Power spectral density
- Linear shift-invariance systems
- Mean square estimation
- Markov Chains
- Markov Processes

Captured Lectures:

This on campus course may be captured and distributed via the Internet and/or electronic media as part of the Engineering Online (EOL) program for the distance students. These video recordings may contain an image of you entering the classroom, asking a question or being a part of the studio class. Please notify Dr. Linda Krute, Director of EOL, in writing at ldkrute@ncsu.edu if you DO NOT want your image to be included in the lecture presentation. If we do not hear from you after the first week of the class, we will assume that you are in agreement with this procedure.

Supporting Fellow Students in Distress:

As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remains a safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you. When this is the case, I would encourage you to report this behavior to the NC State Students of Concern website: <http://studentsofconcern.ncsu.edu/>. Although you can report anonymously, it is preferred that you share your contact information so they can follow-up with you personally.

Schedule: Online class evaluations will be available for students to complete during the last week of class the following dates and time:

Fall Session 8 a.m. November 21 through 8 a.m. December 1

Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will never know how any one student responded to any question, and students will never know the ratings for any particular instructors.

Evaluation website: <https://classeval.ncsu.edu> Student help desk: classeval@ncsu.edu More information about ClassEval: <http://www2.acs.ncsu.edu/UPA/classeval/>