

## Syllabus for EE-761

### Random Processes

Course Website: <http://www.cs.wright.edu/~ashaw/ee761>

Fall Quarter, 2009

4.0 Credit Hours

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OFFICE HRS.: 1:30 - 2:30PM (MONDAY); 2:30 - 3:30 PM (WEDNESDAY) and *by appointment*

**Prerequisite** : Background in Fourier Transform

**Text** : *Random Signals : Detection, Estimation and Data Analysis*, by K. Sam Shanmugan and Arthur M. Breipohl.

#### Suggested References

1. *Probability, Random Variables and Stochastic Processes* by Athanasios Papoulis and S. Unnikrishna Pillai
2. *Probability, Random Variables and Stochastic and Random Signal Principles*, 4th Edition, by P. Z. Peebles, Jr.
3. *Introduction to Matlab*: Available On-line - <http://www.cs.wright.edu/ee/pdf-files/introtomatlab.pdf>

#### Recommended Software

1. *MATLAB & Simulink Student Version R2008b*; The Mathworks, Boston, MA, 2008. **Note**: The Student edition is a low-cost stand-alone version of the full-feature Matlab package. It is packed with seven most commonly used Toolboxes and Blocksets (Signal Processing, Image Processing, Statistics, etc.) useful for all engineers. The student version can be purchased at: <http://www.academicsuperstore.com/products/MathWorks/270909/940167>

**Math Requirement** : EE-761 satisfies the 1 course Math-requirement for completing MS in EE.

#### Course Objectives :

Most signals that electrical/computer engineers deal with are also random in nature, as for example, in Wireless Communication, radar, sonar, control systems, signals in electrical circuits and VLSI chips, computer and telephone networks, TV and radio channels and others. Noise and other interfering signals are the primary causes of such randomness. Hence, the primary job of many electrical engineers is to **detect** and/or **estimate** the useful parts of signals from noisy observations.

In this course, the fundamentals of Probability Theory, Random Variables and Random Processes will be covered. The fundamentals learnt in this course, will be useful in a large number of follow-up courses in Communication and Signal Processing offered by the Electrical Engineering Department.

#### Follow-up Courses :

- EE-735 : Wireless Communication
- EE-736 : Advanced Wireless Communication
- EE-762 : Detection and Estimation theory
- EE-763 : Modern Spectral Estimation

- EE-718 : Multi-Target Tracking
- EE-716 : Kalman Filters
- EE-740 : Information Theory and Coding

### Course Outline

Axioms of Probability, Set Theory and Probability Spaces	Chapter-2
Introduction to Random Variables	Chapter-2
Probability Distribution and Density Functions	Chapter-2
Moments and Conditional statistics	Chapter-2
Introduction to Random Processes	Chapter-3
Stationary Processes	Chapter-3
Correlation function and Power Spectral Density	Chapter-3
Time Averaging and Ergodicity	Chapter-3
Examples of random processes arising in Engineering	Chapters 3 and 4
Input/Output relationships for linear systems with stochastic inputs	Chapter-4
Discrete Linear Models ( <i>if time permits</i> )	Chapter-5

### Grading Procedure :

<b>Homework:</b> ~ 1 per week (due in one week) - the lowest HWK grade is dropped	10%
<b>Computer Projects (Using Matlab)</b>	10%
<ul style="list-style-type: none"> <li>• Generation of Random Variables having various Probability Density Functions (PDF)</li> <li>• Calculation of sample mean, variance and autocorrelation</li> <li>• Estimation of PDFs and Cumulative Distribution, Histogram</li> <li>• Generation and Whitening of colored Random Processes</li> <li>• Estimation of Power Spectral Density using FFT</li> </ul>	
<b>Mid-term</b> , Chapters 2 and 3 (part). (Oct. 21, 2009)	40%
<b>Final</b> , <i>Comprehensive</i> , (5:45-7:45 PM, Monday, Nov 16th, 2009)	40%

### NOTES

- The lowest marks obtained in the Homework sets will be dropped for each student.
- **CAUTION** : Each student is expected to complete all homeworks and Computer Projects **entirely on their own**. Copying or sharing of homeworks or Project Reports or Computer codes, or any form of cheating during examinations will not be tolerated and will result in prompt reporting to the appropriate authorities. If you need help on any matter related to the course, please feel free to contact the Instructor for personal attention.
- **In accordance with the standard college policy, scholastic dishonesty of any kind would also result in a prompt F grade for the course.**
- There will be **NO** makeup examinations (Mid-term or Final) barring extreme circumstances (injury or illness certifiable by a qualified physician). The students are advised to inform and seek permission from the instructor regarding inability to attend a test due to valid causes *prior* to the examination.