INEL 6078 ESTIMATION, DETECTION, AND STOCHASTIC PROCESSES

Fall 2004

Course Description: Fundamentals of detection, estimation, and random process theory for signal processing, communications, and control. Random processes and sequences. Linear systems driven by random processes. Bayesian and nonrandom parameter estimation. Signal detection and estimation from waveform observations.

Pre-requisites: (ININ 4011or equivalent) and (INEL4301 or INEL 4505)

Textbook: L.C. Ludeman, **Random Processes: Filtering, Estimation, and Detection**, John Wiley & Sons, 2003.

References:

1. H. Stark and J.W. Woods, **Probability, Random Processes, and Estimation Theory for Engineers**, 3rd Edition, Prentice Hall, 2002.
2. A. Papoulis and S.U. Pillai, **Probability, Random Variables, and Stochastic Processes**, Fourth Edition, McGraw-Hill, 2002.
3. P.Z. Peebles, **Probability, Random Variables, and Random Signal Principles**, Fourth Edition, McGraw-Hill, 2001.
4. R. N. McDonough and A.D. Whalen, **Detection of Signals in Noise**, Second Edition, Academic Press, 1999.
5. E.R. Dougherty, **Random Processes for Image and Signal Processing**, IEEE Press, 1998.
6. Y. Viniotis, **Probabilities and Random Processes for Electrical Engineers**, McGraw-Hill, 1998.
7. R.E. Ziemer, **Elements of Engineering Probability and Statistics**, Prentice Hall, 1997.
8. R.G. Brown and P.Y.C. Hwang, **Introduction to Random Signals and Applied Kalman Filtering with MATLAB Exercises and Solutions**, Third Edition, John Wiley, 1997.
9. M.D. Srinath, P.K. Rajasekaran, and R. Viswanathan, **Introduction to Statistical Signal Processing with Applications**, Prentice Hall, 1996.
10. D.F. Mix, **Random Signal Processing**, Prentice Hall, 1995.
11. A. Leon-García, **Probability and Random Processes for Electrical Engineering**, Second Edition, Addison Wesley, 1994.
12. B. Picinbono, **Random Signals and Systems**, Prentice Hall, 1993.
13. D. Kazakos, and P. Papatoni-Kazakos, **Detection and Estimation**, Computer Science Press, 1990.
14. R.N. Bhattacharya. **Stochastic processes with applications**. New York: Wiley. 1990
15. K.S. Shanmugan and A.M. Breipohl, **Random Signals: Detection, Estimation, and Data Analysis**, John Wiley, 1988.
16. P.S. Maybeck. **Stochastic models, estimation and control**. New York, Academic Press. 1979.
17. E. Wong. **Stochastic processes in information and dynamical systems**. New York, McGraw-Hill. 1971.
18. A.H. Jazwinski. **Stochastic processes and filtering theory**. New York, Academic Press. 1970.
19. H. Van Trees, **Detection, Estimation, and Modulation Theory, Part I**, John Wiley 1968.

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Office Hours: M-W-F 9:00 to 10:00 am and by appointment. **I can also answer your questions via e-mail. YOU HAVE TO READ YOUR E-MAIL FOR CLASS ANOUNCEMENTS!!**

Class e-mail list: inel6078@ece.uprm.edu

You have to subscribe!!!!!!!!!!!!!!

Grading policy: Your final grade will be based on two to three partial exams (60 %), a final exam (30%) and homework (10 %). Grades:

At least 90	A
At least 80	B
At least 70	C
At least 60	D
59 or less	F

There will be a "gray area" between two-letter grades in the final distribution, so that two people getting the same weighted average grade could get different letter grades. If you are in one of these gray areas, whether your get a higher or lower grade depends primarily on two factors: (a) class participation and (b) whether your performance has been improving or declining.

An **incomplete** grade is given **only** for a valid reason when arrangements have been made with me and, in that case, only if the student was passing the course.

Prerequisites by Topic:

1. Probability Theory
2. Basic Linear Algebra
3. Fourier and Laplace Transforms
4. Linear Systems Theory

Topics:

Description	Lectures	Reference
1. Probability review	6 hrs	Ch. 1 &2
2. Vector random variables	3 hrs	Ch. 2
3. Estimation of random and non-random variables	9 hrs	Ch. 3
4. Random processes	12 hrs	Ch. 5 & 6
5. Hypothesis testing and detection theory	12 hrs	Ch. 9 & 10
6. Exams	3 hrs	

Computer Usage: Use of MATLAB in homeworks to complement class discussions.

Revised by Dr. Miguel Vélez-Reyes in August 2004.