EECS 861
Random Signals and Noise

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1

Course Information

- Semester: Fall 2018
- Lecture: Room 3150 Lea; time 2:30 -03:45 PM TR
- Discussion: Room 3150 Lea; time 4:30-5:30 PM Tuesday will be used for test reviews, make up classes, and as needed homework reviews. **Will not meet every week; check web if discussion session is meeting.**
- No class Oct. 9, 2018 (date of make up - **August 28, 4:30-5:30 PM**)
- No class Nov. 20, 2018 (date of make up class – **Sept 25, 4:30-5:30 PM**)
- Text: "Random Signals: Detection, Estimation and Data Analysis " by Shanmugan and Breiphol.
- Alternate Texts:
  - "Probability, Random Variables, and Random Signal Principles" Peebles
  - Probability and Random Processes, A. Leon-Garcia
  - Probability, Random Variables and Stochastic Processes, Papoulis and Pillai

2

Course Information

- Class Web Page:
http://www.ittc.ku.edu/~frost/EECS_861/index_EECS_861_Fall_2018.htm
- Office hours and Contact Information:
  - Time: Office hours 1:00-2:15 TR
  - Place: 2001 Eaton Hall
  - Other times by appointment
  - Phone:
    - Eaton 864-4486
    - Nichols 864-4833
    - Home 841-3244
  - e-mail: frost@ku.edu
- Final: Friday, December 14: 1:30 - 4:00 pm

3

Course deliverables

- Exams: 2 in class tests (open book & notes)
- Final (open book & notes)
- Homework: problems will be assigned & graded.
- Grading:
  - 2 - In class tests; open book & notes = 200 pts
    (100 points/test)
  - Homework & Unannounced Quizzes = 40 pts
  - Class participation & attendance = 10 pts
  - Final = 150 pts
- General guidelines: Only under very extreme conditions will make up tests be given. No late homework will be accepted

4

Initial Grading Scale

- 90 - 100 % A
- 80 - 89 % B
- 70 - 79 % C
- 60 - 69 % D
- 0 - 59 % F

This course (EECS 861) will not utilize +/- grading in Fall 2017.

5

Homework

- All homework assignments will be posted on the class web page
- Solution will not be posted, problems will be worked in class or during office hours upon request.
- Electronic submission of assignments is permitted.
- Electronic submissions must be in pdf format
- Electronic submissions **must** use this file naming format.
  - Homework: HW#_LastName.pdf
  - For example, HW5_Frost.pdf

6

Homework Format

- All work containing more than one page must be stapled - no paper clips and no folded corners. In order to facilitate grading of homework problems, homework shall meet the following specifications:

  1. Hand written or typed single-sided on 8.5"x11" paper.

  2. If not typed then for text and equations, use an HB or No. 2 pencil (or darker), or blue or black ink. (Pencil is preferred.) No other colors please, except in diagrams or
  graphs.

  3. All pages should be numbered i/j in top right hand corner, with your name appearing at the top of each page. It is O.K. to use your initials after the first page.

  4. All work must be shown for full grade - be as thorough as possible.

  5. Writing should be legible and literate - if the grader cannot read your handwriting, you will receive no credit for the problem.

7

Homework Format

- 6. Answers are to be boxed and right justified, with the variables, values (if any) and units (if any), included in the box. Right justified means placed on the right side of the page.

  7. Leave half an inch between consecutive parts of a question, and draw a line across the page at the end of each complete question.

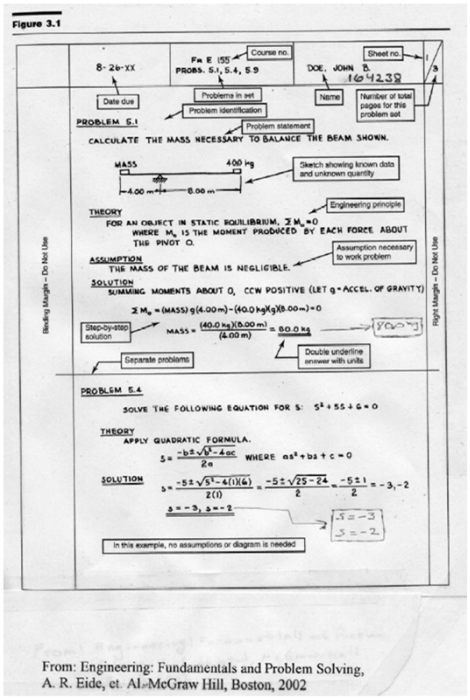
  8. No part of a question should appear in any margin of the paper.

  9. Diagrams and graphs should be of a good size (say at least 3x5 sq. inch), and may contain colors. Diagrams and graphs must be titled, labeled, and clearly drawn. Tables should also be titled.

  10. Graphs should be scaled (put number on axes), labeled (put names /units on axes), and titled at the bottom of the graph. Any graph which occupies an area of less than 3x5 sq. inch and which is not titled will not be graded.

  11. Where possible use conventional units such as bits/sec, Hz and km

8



From: Engineering: Fundamentals and Problem Solving, A. R. Eide, et. Al.-McGraw Hill, Boston, 2002

9

Tools Used for Class Assignments

- Some homework assignments will require plotting, you can use Matlab or another software tool for your choice.
- Wolfram CDF Player
  - Interactive documents
  - Installed on all EECS Windows computers
  - http://www.wolfram.com/products/player/
- Some homework assignments will require processing of .csv ("comma-separated values") files. You can use any tool for homework, e.g., matlab, excel, C, java, C++, other.

Course Outline

- Probability Review and Some New Concepts
  - Axioms
  - Random Variables
    - Discrete
    - Continuous
  - Distributions
    - Marginal
    - Joint
    - Conditional
  - Expect Value
  - Characteristic and moment generating functions
  - Random vectors and Multivariate Gaussian RVs
  - Transformations of RVs
  - Bounds and Approximations with Central Limit Theorem

~ Test 1 →

- Random Processes
  - Definition
  - Example RPs
  - Stationarity
  - Autocorrelation function
  - Power Spectral Density
  - Ergodicity
  - Decomposition of RPs
  - Major classes of RP

11

Course Outline

- Response of Systems to Random Inputs
  - Discrete time systems
  - Continuous time systems

~ Test 2 →

- Application of Random Process Theory
  - Detection
  - Optimum Filtering
  - Estimation

12

Individuals who choose to carry concealed handguns **are solely responsible to do so in a safe and secure manner in strict conformity with state and federal laws and KU weapons policy.** Safety measures outlined in the KU weapons policy specify that a concealed handgun:

- Must be under the constant control of the carrier.
- Must be out of view, concealed either on the body of the carrier, or backpack, purse, or bag that remains under the carrier's custody and control.
- Must be in a holster that covers the trigger area and secures any external hammer in an un-cocked position
- Must have the safety on, and have no round in the chamber.

Instructors are allowed by Kansas Board of Regents policy, to require backpacks, purses and other bags be placed at the back of the room during exams and quizzes, and as such those items will not be under the constant control of the individual. Students who choose to carry a concealed handgun in a purse, backpack, or bag must review and plan each day accordingly, and are responsible for making alternate arrangements as necessary. The university does not provide appropriate secured storage for concealed handguns.

Individuals who violate the KU weapons policy may be asked to leave campus with the weapon and may face disciplinary action under the appropriate university code of conduct.

13