

EECS 861

Random Signals and Noise

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Course Information

- Semester: Fall 2022
- Lecture: Room 1136 Lea; time 9:30 -11:45 PM TR
- Discussion: Room 1136 Lea; time 5:00-6:50 PM Monday 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.**
- 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

Course Information

- Class Web Page:

http://www.ittc.ku.edu/~frost/EECS_861/index_EECS_861_Fall_2022.htm

- Office hours and Contact Information:

- 2054 Eaton Hall-- 8:00 - 9:00 & 1:00 - 2:00 T & R
- Other times by appointment
- Phone: 785 864 1028
- e-mail: vsfrost@ku.edu
- Final: Friday, December 16: 7:30 - 10:00 am

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 = 75 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

Initial Grading Scale

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

Lower limit on these ranges maybe reduced as a function of the distribution of the final scores.

This course (EECS 861) will not utilize +/- grading in Fall 2022.

Homework

- All homework assignments will be posted on the class web page
- Solution will not be posted, any problem will be worked in class or during office hours upon request.
- Homework is to be submitted on paper at the beginning of the class period.
- Electronic submission of assignments is **not** permitted.

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.

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

Figure 3.1

	8-26-XX Date due	F R E (55) PROBS. 5.1, 5.4, 5.9 Problems in set Problem Identification	Course no. DOE, JOHN B. Name	Sheet no. 104238 Number of total pages for this problem set
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PROBLEM 5.1

CALCULATE THE MASS NECESSARY TO BALANCE THE BEAM SHOWN.

Sketch showing known data and unknown quantity

THEORY
 FOR AN OBJECT IN STATIC EQUILIBRIUM, $\sum M_o = 0$
 WHERE M_o IS THE MOMENT PRODUCED BY EACH FORCE ABOUT THE PINOT O.

ASSUMPTION
 THE MASS OF THE BEAM IS NEGLIGIBLE.

SOLUTION
 SUMMING MOMENTS ABOUT O, CCW POSITIVE (LET g = ACCEL. OF GRAVITY)

$$\sum M_o = (\text{MASS})g(4.00\text{ m}) - (40.0\text{ kg})(g)(8.00\text{ m}) = 0$$

Step-by-step solution

$$\text{MASS} = \frac{(40.0\text{ kg})(8.00\text{ m})}{(4.00\text{ m})} = \underline{\underline{80.0\text{ kg}}}$$

80.0 kg

Double underline answer with units

Separate problems

PROBLEM 5.4

SOLVE THE FOLLOWING EQUATION FOR S: $s^2 + 5s + 6 = 0$

THEORY
 APPLY QUADRATIC FORMULA.

$$s = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad \text{WHERE } as^2 + bs + c = 0$$

SOLUTION

$$s = \frac{-5 \pm \sqrt{5^2 - 4(1)(6)}}{2(1)} = \frac{-5 \pm \sqrt{25 - 24}}{2} = \frac{-5 \pm 1}{2} = -3, -2$$

s = -3, s = -2

In this example, no assumptions or diagram is needed

$s = -3$
 $s = -2$


Binding Margin - Do Not Use

Right Margin - Do Not Use

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
 - 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*
 - Random Processes
 - Definition
 - Example RPs
 - Stationarity
 - Autocorrelation function
 - Power Spectral Density
 - Ergodicity
 - Decomposition of RPs
 - Major classes of RP
- ~ Test 1 

* Possible new topics

Course Outline

- Response of Systems to Random Inputs
 - Discrete time systems
 - Continuous time systems
- Application of Random Process Theory
 - Detection
 - Estimation

~ Test 2 

Use of EdTech Services

- Professors and instructors at the KU School of Engineering are aware that some students are actively posting homework, laboratory, and exam questions and responses to EdTech services (e.g., Chegg) even during exam time frames.
- Keep in mind that when a person signs up to participate by either uploading, and/or downloading, and/or using posted material from these sites, the “terms of service” that are agreed to do not protect the person when KU and/or the School of Engineering decide to conduct investigations related to academic misconduct (e.g., plagiarism and/or cheating).
- In fact, EdTech services, like Chegg, retain contact information of students who use their services and will release that information, which is traceable, upon request. Using these services constitutes academic misconduct, which is not tolerated in the School of Engineering. It violates Article 3r, Section 6 of its Rules & Regulations, and may lead to grades of F in compromised course(s), transcript citations of academic misconduct, and expulsion from the University of Kansas.
- If unsure about assignments, it is important that students use the allowable available resources, such as instructor office hours, graduate teaching assistants, and/or tutoring. The School of Engineering wants students to be successful; cheating is not the way to attain that success.

Use of smartphones, tablets, and laptops in class.

- Smartphones, tablets, and laptops may only be used in direct support of class activities.
- Texting, general web browsing, checking of e-mail is NOT permitted during class.
- Video and audio recording of the EECS 861 class lectures is prohibited.

Changes announced in class and the class web site supersede these written instructions.