Instructor: Professor Yariv Ephraim

Office: Nguyen Engineering Building Room 3229

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Phone: (703) 993-1562

Office Hours: Monday 1:45-2:45 pm; Wednesday 4:30-5:30 pm.

Course Credit: 3 credit hours

Time: Wednesday, 7:20-10:00 pm

Place: Robinson Hall Room A208

Date Range: 1/22 - 5/2.

Spring Break: 3/12 - 3/16

Final Exam: Comprehensive Exam, Wednesday, 5/9, 7:30 - 10:15 pm.

Mid-term exam: 3/21, 4/11, 7:20-8:50 pm.

Exams Policy: You may only use the lecture notes during all exams. No other material is allowed. Electronic devices of any kind are not allowed.

Grading: 1st test 30%; 2nd test 30%; 3rd test 30%; homework 10%.

Prerequisites: Grade C or better in ECE 460.

Required Text Book:

Y. Ephraim, ECE 463 Lecture Notes: Digital Communication Systems, January 15, 2018. Notes are sold (Mason Money only) by the department (at the Tech Shop - ENGR 3916) for a nominal fee of $8.50 to cover printing costs only.

Recommended Text Book:


Course Description:

This course builds upon ECE 460. It focuses exclusively on digital communications. We shall first address source coding whereas the information source is reduced to a sequence of bits at the minimum possible rate. Then we discuss channel coding whereas the received noisy signal is decoded with minimum probability of error. We quantify that error and show how it can be minimized for channels with finite bandwidth. Several modulation schemes such as PSK, FSK, PAM, QAM, CDMA, etc., will be studied. We provide an introduction to coding theory and discuss in detail convolutional codes and the Viterbi algorithm for their decoding. After establishing all the necessary theory as outlined above, we shall review the established (and somewhat outdated) IS95 standard.

Course Outline:

- Introduction (Lecture 1)
- Basics of source coding:
  1. Entropy (Lecture 1)
  2. Lempel-Ziv entropy coding (Lecture 2)
  3. Quantization (Lecture 3)
- Basics of channel coding:
  1. Channel characterization and intersymbol interference (Lecture 4)
  2. MAP decision rule (Lecture 5)
  3. Minimum energy signals (Lecture 5)
  4. probability of error and union bound (Lecture 6)
  5. Fading and Non-coherent detection (Lecture 7)
  6. PAM, PSK, QAM, BFK, and MSK modulation schemes (Lecture 8)
  7. Block orthogonal signaling (Lecture 9)
  8. Introduction to linear block codes (Lecture 10)
  9. Convolutional codes (Lecture 11)
  10. The Viterbi algorithm (Lecture 12)
- Wireless communication and Spread spectrum (Lecture 13)
- The IS95 standard (Lecture 14)

Attendance and homework:

1. Students are encouraged to attend all lectures and to submit all homework assignments.
2. **Please refrain from using cellphones and other electronic devices during lectures.**

3. Practicing the material taught in class, by working out the homework problems, is crucially important to your success in this class. Homework will be assigned weekly, and will be due in class the week following their assignment. Graded homework will be returned in class the week following their due date. **Late homework submission will not be graded. No exceptions except for medical emergencies.**

4. You are encouraged to discuss the material and homework problems with other classmates, but you must submit your OWN solutions.

5. **Weekly homework will be assigned on Wednesday and will be due the following Wednesday by 7:20pm on my desk. Late homework will not be accepted.**

6. Copying solutions for homework assigned problems, from any source, constitutes a violation of the university honor code. See the paragraph on **Academic Integrity** below.

7. Electronic devices of any kind are not allowed (and will not be needed) during exams.

8. **Audio taping, video taping, or picture snapping, during lectures, are not allowed.**

9. Students must use their MasonLive email account to receive important University information, including messages related to this class. See [http://masonlive.gmu.edu](http://masonlive.gmu.edu) for more information. Homework assignments and other course material will be emailed to your MasonLive email account. Please make sure that your mailbox is not full at any time during the semester. Also, when you send me an email, please write ece460 on the subject line.

10. Students who cannot attend an exam due to religious holidays and observations should contact me as soon as possible to arrange for an alternative date.

**Support Resources:** A list of support resources on campus may be found in: [http://ctfe.gmu.edu/teaching/student-support-resources-on-campus/](http://ctfe.gmu.edu/teaching/student-support-resources-on-campus/)

**University Policies:** The University Catalog, [http://catalog.gmu.edu](http://catalog.gmu.edu), is the central resource for university policies affecting student, faculty, and staff conduct in university academic affairs. Other policies are available at [http://universitypolicy.gmu.edu](http://universitypolicy.gmu.edu/). All members of the university community are responsible for knowing and following established policies.
Academic Integrity: GMU is an Honor Code university; please see the University Catalog for a full description of the code and the honor committee process. The principle of academic integrity is taken very seriously and violations are treated gravely. What does academic integrity mean in this course? Essentially this: when you are responsible for a task, you will perform that task. When you rely on someone else's work in an aspect of the performance of that task, you will give full credit in the proper, accepted form. Another aspect of academic integrity is the free play of ideas. Vigorous discussion and debate are encouraged in this course, with the firm expectation that all aspects of the class will be conducted with civility and respect for differing ideas, perspectives, and traditions. When in doubt (of any kind) please ask for guidance and clarification.

Office of disability services: If you are a student with a disability and you need academic accommodations, please see me and contact the Office of Disability Services (ODS) at 993-2474. All academic accommodations must be arranged through the ODS. http://ods.gmu.edu

Other useful campus resources:

- Writing center: A114 Robinson Hall; (703) 993-1200; http://writingcenter.gmu.edu
- University libraries: “Ask a Librarian” http://library.gmu.edu/mudge/IM/IMRef.html
- Counseling and psychological services (CAPS): (703) 993-2380; http://caps.gmu.edu