

Information Theory and Coding (AEE 4960)
Course syllabus
Sem1 (2021/2022)

Instructor: Prof. Abdelouahab Bentrchia

OFFICE: S111

Email: abentrchia@ksu.edu.sa

Website: <http://faculty.ksu.edu.sa/abentrchia/home>

Class Timings: see time table on my website or on the office door.

Office Hours: see time table on my website or on the office door

Textbook:

- No textbook for this course.

Pre-requisite:

- AEE 3430 - Communication System Principles, STAT 150 Introduction to Statistics.

References:

- S. Haykin, *Communication Systems*, 4th Edition, John Wiley & Sons, 2001.
- B. Lathi, *Modern Digital and Analog Communication Systems*, 4th Edition, Oxford Publishing, 1998.
- Yuan Jiang, *A Practical Guide to Error-Control Coding Using MATLAB*, ARTECH HOUSE, 2010.
- Bernard Sklar, *Digital Communications, Fundamentals and Applications*, Prentice Hall P T R, Second Edition.
-

Grading Criteria:

- 10% Quizzes (worst quiz will be cancelled for each student)
- 10% Project
- 20% Midterm Exam I (?th week)
- 20% Midterm Exam II (?th week)
- 40% Final Exam

Credit hours:

- 3(3,1,0) hours

Tentative Schedule

Textbook	week	Topics to be covered	
	1,2	<ul style="list-style-type: none"> • Review of probability Set Theory Probability Theory Random Variables Distribution Functions Expectation (mean) and Variance 	2 Weeks
	3,4	<ul style="list-style-type: none"> • Information Theory Uncertainty, Information, and Entropy 	2 Weeks
	5,6	<ul style="list-style-type: none"> • Source-Coding Source-Coding Theorem Prefix Coding Huffman Coding Lempel-Ziv Coding 	2 Weeks
	7,8	<ul style="list-style-type: none"> • Mutual Information and Channel Capacity Discrete Memoryless Channels (DMC) 	2 Weeks

		Mutual Information Channel Capacity Channel Coding Theorem	
	9,10,11,12	<ul style="list-style-type: none"> Error-Control Coding: Block Codes, Linear Codes, Hamming Codes Generator Matrix Parity-Check Matrix Syndrome Cyclic codes 	4 Weeks
	13,14	<ul style="list-style-type: none"> Convolutional Codes: Convolutional Encoder Tree Representation of Convolutional Codes Finite-State Machine Code Representation Trellis Representation of Convolutional Codes Viterbi Decoding 	2 Weeks
	15	<ul style="list-style-type: none"> Cryptography: Simple Ciphers Modern Encryption secret key encryption public key encryption Stream Ciphers Block Ciphers 	1 Week

Course Learning Outcomes

1. Analyze and calculate the **information** per symbol emitted from a source (a,e).
2. Analyze and calculate source **entropy** (a,e).
3. Analyze the information-carrying **capacity** of a communication channel (a,c,e).
4. Apply and differentiate between different data **compression** schemes (a,c,e).
5. Design encoders and decoders for **block, cyclic** codes and **convolutional** codes (a,c,e).
6. Explain the basic theory of **cryptograph** and distinguish between symmetric and asymmetric encryption algorithms (a,e).
7. Use computers and MATLAB to simulate and analyze compression, channel coding and encryption algorithms. (b)

Course Policy

- **General policies**
 1. Course material such as lecture slides, homework ...etc. will be posted on my website.
 2. The student is responsible to check his email (university email) daily for any class announcements.
 3. Use of mobile phone or other electronic devices or equipment is not allowed during class. All such systems must be turned off or silenced and not used during classes without prior permission from the instructor.
 4. It is the student's responsibility to ask questions, for me if you don't ask questions then I assume that you are happy. If for one reason or another, my answer is not satisfactory for you, then you are welcome to visit my office for more discussions and details.

- **Exam policy**

1. There is no need to memorize formulas, a formula sheet will be provided in the exam.

- **Attendance**

1. Only official excuses are accepted. Personal excuses are not accepted.
2. Three late arrivals = One absence.
3. Any student who misses more than 25% of all lectures will not be allowed to enter the final exam.

- **Makeup policy**

1. No make-up will be provided for exams unless an official excuse exists.
2. Students who miss a quiz will not be offered a makeup quiz.
3. Any official excuse should be presented to the instructor within one week from the absence.

- **Assignments Policy**

1. HWs will be announced in tutorial classes and will be sent to you through LMS. Although HWs should not be submitted, they should be solved because HW problems might be brought in quizzes and exams.
2. The HW solution will be sent to you through LMS maximum 2 weeks after HW announcement.