جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Digital Communication and Coding - EE 242

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 242
Course Title	Digital Communication and Coding
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	09:00 AM - 10:30 AM | Mon Thu

Instructor(s)				
Name	**Email**	**Phone**	**Office Location**	**Office Hours**
Tareq Al-Naffouri	tareq.alnaffouri@kaust.edu.sa	+966128080298	3303, 1, Al-Khawarizmi (bldg. 1)	Sunday 1:00 PM to 2:30 PM or by appointment

Teaching Assistant(s)	
Name	**Email**
TBD	

Course Information	
Comprehensive Course Description	This course is designed to introduce to the student the fundamentals of the theory of digital communications and coding. The course will provide in-depth knowledge of communication fundamentals, which include Digital transmission of information across discrete and analog channels. Sampling; quantization; noiseless source codes for data compression: Huffman’s algorithm and entropy; block and convolutional channel codes for error correction; channel capacity; digital modulation methods: PSK, MSK, FSK, QAM; matched filter receivers. Signal Design for bandlimited channels. Performance analysis: power, bandwidth, data rate and error probability.
Course Description from Program Guide	Digital transmission of information across discrete and analog channels. Sampling; quantization; noiseless source codes for data compression: Huffmans algorithm and entropy; block and convolutional channel codes for error correction; channel capacity; digital modulation methods: PSK, MSK, FSK, QAM; matched filter receivers. Performance analysis:power, bandwidth, data rate and error probability.

Goals and Objectives	1. Learning communication theory fundamentals 2. Learning basic concepts in source coding, 3. Learning basic concepts in block and convolutional codes, 4. Developing skills in the design and analysis of digital modulation methods.
Required Knowledge	Probability and Random variables/Basic knowledge of linear Albebra
Reference Texts	J. Proakis and M. Salehi Digital Communications, 5th edition, McGraw-Hill Science/Engineering/Math
Method of evaluation	**22.00**% - Midterm exam **13.00**% - Homework /Assignments **36.00**% - Final exam **25.00**% - Course Project(s) **4.00**% - Attendance and Participation
Nature of the assignments	The HW will consist of a set of problems assigned biweekly. HW is to be submitted in class. Late HW's are not accepted. There will be two simulation based projects. Projhect 1 (10%) and Project 2 (15%).
Course Policies	- Late HW's are not accepted - HW has to be solved indvidually - Class participation and attendance constitues 4% of the final grade.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 08/26/2019 Thu 08/29/2019	Introduction •Basic Elements of Digital Communication Systems •Communication Channels
2	Mon 09/02/2019 Thu 09/05/2019	Source Coding •Entropy and mutual information •Coding for discrete memoryless sources
3	Mon 09/09/2019 Thu 09/12/2019	Source Coding •Coding for discrete memoryless sources
4	Mon 09/16/2019 Thu 09/19/2019	Optimum Receivers for the Vector Channel
5	Mon 09/23/2019 Thu 09/26/2019	Characterization of Communication Signals and Systems •Representation of Band-Pass Signals and Systems •Signal Space Representations •Representation of Digitally Modulated Signals
6	Mon 09/30/2019 Thu 10/03/2019	Characterization of Communication Signals and Systems •Representation of Band-Pass Signals and Systems •Signal Space Representations •Representation of Digitally Modulated Signals
7	Mon 10/07/2019 Thu 10/10/2019	Optimum Receivers for the Additive White Gaussian Noise Channel •Optimum Receiver for Signals Corrupted by Additive White Gaussian Noise •Performance of the Optimum Receiver for Memoryless Modulation •Trade off of power, bandwidth, data rate, and error probability
8	Mon 10/14/2019 Thu 10/17/2019	Optimum Receivers for the Additive White Gaussian Noise Channel •Optimum Receiver for Signals Corrupted by Additive White Gaussian Noise •Performance of the Optimum Receiver for Memoryless Modulation •Trade off of power, bandwidth, data rate, and error probability
9	Mon 10/21/2019 Thu 10/24/2019	Optimum Receivers for the Additive White Gaussian Noise Channel •Optimum Receiver for Signals Corrupted by Additive White Gaussian Noise •Performance of the Optimum Receiver for Memoryless Modulation •Trade off of power, bandwidth, data rate, and error probability
10	Mon 10/28/2019 Thu 10/31/2019	Nyquist Pulse Shaping & Equalization
11	Mon 11/04/2019 Thu 11/07/2019	Nyquist Pulse Shaping & Equalization
12	Mon 11/11/2019 Thu 11/14/2019	Error Correcting Coding and Channel Capacity •Block coding
13	Mon 11/18/2019 Thu 11/21/2019	Error Correcting Coding and Channel Capacity •Convolutional coding
14	Mon 11/25/2019 Thu 11/28/2019	Error Correcting Coding and Channel Capacity •Convolutional coding
15	Mon 12/02/2019 Thu 12/05/2019	Error Correcting Coding and Channel Capacity •Channel capacity
16	Mon 12/09/2019	Multi-Access Modulation Techniques

Note

The instructor reserves the right to make changes to this syllabus as necessary.