



Course Syllabus: Information Theory - EE 341

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 341
Course Title	Information Theory
Academic Semester	Spring
Academic Year	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	09:00 AM - 10:30 AM Mon Wed

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Tareq Al-Naffouri	tareq.alnaffouri@kaust.edu.sa	+966128080298	3303, 1, Al-Khwarizmi (bldg. 1)	Monday 10:30 AM - 12:00 PM

Teaching Assistant(s)	
Name	Email
TBD	TBD

Course Information	
Comprehensive Course Description	This course introduces the fundamentals of Shannon's information theory. We will study the theoretical limits of data compression and transmitting information through communication channels. The course will cover the following topics: entropy, data compression, channel coding and channel capacity, rate distortion theory, and finally the relation between information theory, statistics and data inference. The course will cover some advanced topics in multiuser information theory including the broadcast, multiple access, and the interference channels.
Course Description from Program Guide	The concepts of source, channel, rate of transmission of information. Entropy and mutual information. The noiseless coding theorem. Noisy channels, the coding theorem for finite state zero memory channels. Channel capacity. Error bounds. Parity check codes. Source encoding.
Goals and Objectives	<ol style="list-style-type: none"> 1) To master essential information theoretic tools like entropy and mutual information 2) To learn the various methods for source coding and derive their performance 3) To master the tools needed to derive the channel capacity for memoryless channel 4) To derive the channel capacity in the discrete time case 5) To derive the channel capacity in the continuous time case 6) To understand the basic concepts of rate-distortion theory 7) To learn basic concepts in network information theory including the broadcast, multiple access, and interference channels.

Required Knowledge	The students needs to have basic knowledge in probabilty and random variables.
Reference Texts	1) Thomas M. Cover and Joy A. Thomas, Elements of Information Theory, 2nd Edition, Wiley 2006. 2) Abbas El Gamal and Young-Han Kim, Network Information Theory, Cambridge University Press
Method of evaluation	35.00% - Final exam 20.00% - Research Project 30.00% - Midterm exam 15.00% - Homework /Assignments
Nature of the assignments	1) Bi-weekly Homeworks 2) Final project where the student is expected to cover in-depth a topic not covered in class and to make a presentation to the class about it.
Course Policies	TBD
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/29/2018 Wed 01/31/2018	Entropy, Relative Entropy, and Mutual Information
2	Mon 02/05/2018 Wed 02/07/2018	Asymptotic Equipartition Property
3	Mon 02/12/2018 Wed 02/14/2018	Data Compression(1)
4	Mon 02/19/2018 Wed 02/21/2018	Data Compression(2)
5	Mon 02/26/2018 Wed 02/28/2018	Channel Capacity(1)
6	Mon 03/05/2018 Wed 03/07/2018	Channel Capacity(2)
7	Mon 03/12/2018 Wed 03/14/2018	Differential Entropy
8	Mon 03/19/2018 Wed 03/21/2018	Gaussian Channel
9	Mon 03/26/2018 Wed 03/28/2018	Rate Distortion Theory (1)
10	Mon 04/02/2018 Wed 04/04/2018	Rate Distortion Theory (2)
11	Mon 04/09/2018 Wed 04/11/2018	Broadcast Channels(1)
12	Mon 04/16/2018 Wed 04/18/2018	Broadcast Channels(2)
13	Mon 04/23/2018 Wed 04/25/2018	Multiple Access Channels (1)
14	Mon 04/30/2018 Wed 05/02/2018	Multiple Access Channels (2)
15	Mon 05/07/2018 Wed 05/09/2018	The Interference Channel
16	Mon 05/14/2018 Wed 05/16/2018	Project Presentations
17	Mon 05/21/2018 Wed 05/23/2018	Final Exam
18		

Note

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