University of Tehran
School of Electrical and Computer Engineering

<table>
<tr><td>Course:</td><td>8101163 – Information Theory</td></tr>
<tr><td>Course type:</td><td>
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<tr><td></td><td colspan="6">EE*</td><td colspan="3">CE*</td><td rowspan="3">Credit: 3</td></tr>
<tr><td></td><td>Com</td><td>E</td><td>P</td><td>B</td><td>Con</td><td>D</td><td>SW</td><td>HW</td><td>IT</td></tr>
<tr><td>Required</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr>
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<tr><td>Level:</td><td>Undergraduate ☐
Graduate ■</td></tr>
<tr><td>Co-requisite(s):</td><td>Stochastic Processes (8101272)</td></tr>
<tr><td>Prerequisite(s):</td><td>None</td></tr>
<tr><td>Prerequisite by topic:</td><td>Probability</td></tr>
<tr><td>Textbook(s):</td><td>[1] T. Cover and J. A. Thomas, Elements of Information Theory, Wiley, 2nd edition, 2005.</td></tr>
<tr><td>Coordinator:</td><td>A. Olfat, Associate Professor, School of ECE</td></tr>
<tr><td>Goals:</td><td>The course presents the theoretical limits for data compression and transmission in digital communication systems. In this course the concept of information is quantified in an axiomatic way and then concepts of entropy and capacity are derived as theoretical limits of data compression and reliable transmission respectively. The mathematical models for information sources are introduced and their properties will be established. The mathematical techniques for construction of optimal and suboptimal source coding schemes for some distributions introduced and the capacity of some practical channel models will be derived.</td></tr>
<tr><td>Outcome:</td><td>Upon successful completion of the course, students will be able
1. To understand the concept of information, entropy and mutual information,
2. To develop mathematical models for information sources,
3. To obtain optimal codes for certain sequences,
4. To understand the concept of channel capacity,
5. To compute channel capacity or some bounds for it for some practical models,
6. To learn extensions of the concepts to networks.</td></tr>
<tr><td>Topics:</td><td>1) Measure of information , entropy and mutual information</td></tr>
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	2) AEP Theorem and entropy rates of stochastic processes 3) Markov chains and mathematical models for information sources 4) Data compression and optimal source coding 5) Channel capacity 6) Differential entropy and Gaussian channel 7) Rate distortion theory 8) Network information theory
Computer usage:	None
Assignments:	9 to 11 assignments
Projects:	Term project on a related topic.
Grading:	Assignments: 15% Project: 15% Midterm exams: 30% Final exam: 40%
Further readings:	[1] R. W. Yeung, *Information Theory and Network Coding,* Springer, 2008. [2] R. G. Gallger, *Information Theory and Reliable Communication,* Wiley,1968. [3] R. B. Ash, *Information Theory,* Dover publications, 1965.
Prepared by:	Ali Olfat
Date:	December 9, 2017.

*EE: Electrical Engineering		CE: Computer Engineering	
Com	Communications	SW	Software
E	Electronics	HW	Hardware
P	Power	IT	Information Technology
B	Bioelectronics		
Con	Control		
D	Digital System		