University of Tehran
School of Electrical and Computer Engineering

Course:	**8101000 – Network Information Theory**		
Course type:	Elective	EE*	Credit: 3
Level:	Graduate		
Co-requisite(s):	None		
Prerequisite(s):	Information Theory		
Prerequisite by topic:	Concepts of entropy and mutual information, Shannon theorems for source and channel coding		
Textbook(s):	1- Abbas El Gamal, Young-Han Kim, *Network Information Theory*, Cambridge University Press, 2012. 2- Raymond W. Yeung, *Information Theory & Network Coding*, Springer, 2008 3- Selected research articles		
Coordinator:	Farshad Lahouti, Associate Professor		
Goals:	This is a graduate level course on multiuser/network information theory and wireless communications. Besides covering the fundamentals of network information theory, we will emphasize on the application of information theory in wireless communications. The students will acquire knowledge on derivation and analysis of performance bounds for reliable communications or efficient compression in multiuser wireless networks. Most fundamental network communications scenarios are studied. The students are introduced to network coding and the due performance gains in multicast networks. Taking the research oriented course projects, the students are enabled to conduct further research in network information theory and its applications in (wireless) communication networks.		
Outcome:	Upon successful completion of the course, students will be able to 1. Understand the role of network coding in communication networks and the corresponding design methodologies 2. Acquire fundamental knowledge on performance limits of multiple-access and broadcast channels, effective transmission strategies and resource allocation 3. Acquire basic knowledge on the performance limits and transmission strategies for reliable communications over relay networks 4. Acquire fundamental knowledge on distributed source coding in lossy and lossless settings, related performance bounds, effective		

	compression strategies and efficient corresponding coding schemes 5. Acquire basic knowledge on interference channel, its performance bounds and transmission strategies 6. Acquire basic knowledge on the role of side information for reliable communications over multiuser networks 7. Gain the scientific essentials and experience to conduct research in network information theory and its applications in many areas including wireless communications
Topics:	1. Network information flow 2. Network coding 3. Capacity of multiple-access channel 4. Capacity of broadcast channel 5. Capacity of relay channel 6. Source coding with side-information- Slepian-Wolf coding 7. Source coding with side-information- Wyner-Ziv coding 8. Multiuser channels with feedback and side information 9. Interference channel 10. Selected Topics (Capacity of Ad Hoc networks, Interference alignment, …)
Computer usage:	Matlab
Assignments:	The course includes homework, paper review assignments
Projects:	A research term project
Grading:	Assignments: 30% Project: 30% Final exam: 40%
Further readings:	1- Selected Research Articles. 2- Thomas Cover, *Elements of Information Theory*, John Wiley & Sons, 2nd ed., 2006. 3- David J. C. MacKay, *Information Theory, Inference and Learning Algorithms*, Cambridge University Press, 2003. 4- Robert G. Gallager, *Information Theory and Reliable Communication*, John Wiley & Sons, 1968. 5- N.J.A. Sloane, Aaron D. Wyner (Eds.), *Claude Elwood Shannon: collected papers.* IEEE Press, 1993.
Prepared by:	Farshad Lahouti
Date:	October 2012

*EE: Electrical Engineering CE: Computer Engineering IT: Information Technology