



University of Tehran
School of Electrical and Computer Engineering

Course:	– Advanced Data Networks		
Course type:	Required	EE*	Credit: 3
Level:	Graduate		
Prerequisite(s):			
Co-requisite:	Stochastic Networks		
Prerequisite by topic:	General knowledge of computer/communication networks,		
Textbook(s):	<ul style="list-style-type: none"> – Boyd and Vandenberghe, <i>Convex Optimization</i>, Cambridge University Press, 2004. – Mung Chiang, Steven Low, Robert Calderbank, John Doyle, <i>Layering as Optimization Decomposition: A Mathematical Theory of Network Architectures</i>, Proceedings of the IEEE, Vol. 95, issue 1, Jan. 2007. – C. Papadimitriou, K Steiglitz, <i>Combinatorial Optimization Algorithms and Complexity</i>, Dover Publication Inc, 1998. – Shakkottai and Srikant, <i>Network Optimization and Control</i>, NoW Publishers 2007. 		
Coordinator:	Vahid Shah-Mansouri, Assistant Prof., ECE		
Goals:	<p>This course is designed for the students who are interested or carrying out research in the area of data communications. It is aiming to provide a vision on how to mathematically model the wireless networks. Although the focus is on optimization theory and graph modeling, we look at these tools from the network side. We spend most of our times on dealing with network related problems and how to derive mathematical models for them. The assignments would include paper readings and the main part of the course grade belongs to the project.</p>		
Outcome:	<p>Upon successful completion of the course, students will be able to</p> <ol style="list-style-type: none"> 1. Become familiar with 2. understand how to use graph theory to represents wireless/wired networks 3. Become familiar with the mathematical modeling of the wired/wireless networks 4. Understand different aspects of applications of optimization theory in communication networks. 		

Topics:	<p>Modeling of Wireless Networks</p> <p>Introduction</p> <p>Graph theory as a tool for describing wireless networks</p> <p>Application of graph theory in wireless networks</p> <p>Interference, clique, independent set, and graph coloring</p> <p>Overview of Convex Analysis and Optimization</p> <p>Convex sets and functions, quasiconvex and log-convex functions</p> <p>Lagrangian function and dual problem, KKT optimality, Gradient and sub-gradient methods</p> <p>Fairness and Utility Functions</p> <p>Alpha-fair function, max-min fairness, proportional fairness, Pareto optimal</p> <p>Application of Convex Optimization in Wireless Networks</p> <p>Flow control and TCP forward engineering</p> <p>Network utility maximizations (Cross-layer design)</p> <p>Combinatorial optimization</p> <p>Fundamentals, complexity considerations, heuristics methods</p> <p>Applications in resource allocation</p>
Computer usage:	computer assignment
Assignments:	Written and computer assignment
Projects:	Final project
Grading:	<p>Assignment: 15%</p> <p>Project: 15%</p> <p>Midterm Exam: 40%</p> <p>Final Exam: 30%</p>
Prepared by:	Vahid Shah-Mansouri
Date:	Dec., 2017

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