ECE 7100: Network Optimization and Algorithms

Course Description

Convex optimization, probabilistic, and algorithmic methods for the design and analysis of efficient and practical algorithms for complex and stochastic communication networks.

Prior Course Number: 894R
Transcript Abbreviation: Network Opt & Alg
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Odd Years
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: Grad standing.
Exclusions: Not open to students with credit for 894R.
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Course Goals

Describe the challenges in optimal network controller design for wireless networks
Introduce convex optimization theory and dual methods for network algorithm design
Introduce probabilistic and control-theoretic methods for stochastic network analysis
Design distributed algorithms and analyze their performance for wireless networks

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Modeling of network control problems	2.0							
Convex optimization theory - convex sets and functions; optimality conditions; duality theory	9.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Convex optimization algorithms - unconstrained methods; dual and primal-dual methods	6.0							
Stochastic analysis techniques - probability and random processes basics: Markov chains, Martingales; stability theory, Foster-Lyapunov criteria	8.0							
Optimization-based network algorithm design - cross-layer controller description; performance analysis: proof of optimality of the cross-layer controller; extensions multi-cast traffic, asynchronous implementation	8.0							
Distributed network algorithms - greedy algorithms; pick and compare policies; randomized/random access policies	8.0							

Grades

Aspect	Percent
Midterm	30%
Project	35%
Final	35%

Representative Textbooks and Other Course Materials

Title	Author
notes	Eryilmaz
Convex Optimization, Cambridge University Press (reference)	S. Boyd and L. Vandenberghe

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
*	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Updated abbreviation, prereqs, exclusions, goals and topics to conform to university format 3/29/12

Delted text Control Techniques for Complex Networks, Cambridge University Press by meyn, added notes. 3/30/12

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