THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

Convex and Stochastic Network Optimization

ECE 6500

Credit Hours:
3.00 - 3.00

Course Levels:
Graduate (5000-8000 level)

Course Components:
Lecture

Course Description:
Convex and stochastic optimization theory and algorithms applied to selected electrical engineering application areas.

Prerequisites and Co-requisites:
Prereq: Grad standing.

Course Goals / Objectives:
- Discuss convex formulation of problems with stochastic components from diverse ECE domains such as circuit design, communications, signal processing, control, estimation, learning, and/or electromagnetics.
- Introduce primal and dual methods for the solutions of convex optimization problems.
- Introduce probabilistic and control-theoretic methods for stochastic network analysis
- Design decentralized and low-complexity algorithms and analyze their performance for decentralized operation.

Course Topics:

- Modeling of convex optimization problems with applications in electrical and computer engineering, such as communications, networking, signal processing, learning, estimation, and/or electromagnetics.
- Convex optimization theory - convex sets and functions, optimality conditions for unconstrained/constrained and non-smooth convex optimization;
- Duality Theory and Methods – Geometric Duality, Lagrangian Duality, Strong/Weak Duality, KKT conditions.
- ?Convex optimization algorithms - unconstrained methods; dual and primal-dual methods; gradient, sub gradient, Nesterov/Heavy-Ball, Proximal, Mirror-Descent Methods.
- Stochastic design and analysis techniques - probability and random processes basics: Markov chains; stability theory, Foster-Lyapunov criteria; Lyapunov Drift Minimization; Heavy-traffic analysis; Stochastic GD, Random Gradient Descent, Variance Reduction Methods.
- 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; decentralized and low-complexity algorithms

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Designation:
Elective