Department of Electrical and Computer Engineering
New Jersey Institute of Technology
FALL 2015

ECE 744: Optimization for Communication Networks
Instructor: Abdallah Khreishah, office: ECE 349, Tel: (973)-596-3528,
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Text books:

References:

Course Description:
The design of current wireless networks is increasingly faced with the challenge of guaranteeing given quality-of-service or cost constraints, while providing optimal performance in terms of resource utilization. In addition, the emerging paradigm of decentralized wireless networks, such as ad hoc and sensor networks, calls for optimization techniques to be performed in a distributed, and possibly competitive, fashion by different radio transceivers. This course covers the basic analytical and algorithmic tools that enable such centralized and decentralized optimization. Specific topics include single-objective convex optimization (duality, optimality conditions, algorithms) and fundamentals of multi-objective optimization and game theory.

Prerequisite: Basic knowledge of linear algebra and computer networks.
Course learning outcomes (CLO): The student should be able to
1. Understand the basics of optimization theory.
2. Understand the convex functions and convex sets.
3. Formulate a problem using convex optimization and game theory.
5. Understand the different numerical methods for solving optimization problems.
6. Apply convex optimization methods and game theory to analyze and design communication networks.

List of topics to be covered

Week(s) Topic(s)
1. Revision of linear algebra, the derivative matrix, basic conditions for local minimizers
2. Linear Programming
3. Convex sets
4. Convex functions
5. Convex Optimization problems
6. Lagrange Duality
7. KKT conditions
8. Numerical optimization methods
9-10 Formulation of optimization problems in communications networks
11. Pareto optimality, Best responses and Nash equilibrium
13. Variational Inequality theory
14. Application of Game theory in communication networks

Grading Criteria:  
<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Project</td>
<td>40%</td>
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<tr>
<td>Midterm</td>
<td>30%</td>
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<td>Final exam</td>
<td>30%</td>
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Office Hours: Tuesdays: 4:30-5:45 or by appointment.

Honor Code: The NJIT Honor Code will be upheld; any violations will be brought to the immediate attention of the Dean of Students.