Department of Aeronautics and Astronautics

Massachusetts Institute of Technology

Communications and Networks

September 26, 2013

1. Introduction and Purpose

The purpose of the track documents is to provide incoming masters and doctoral level students guidance in planning the courses they will take during their graduate program. This particular track focuses on the Communications and Networks area. The suggestions outlined here are to be understood as guidance and not as a mandatory, rigid framework. The final decision as to which courses are taken and in what sequence is to be decided between each student and their academic advisor and/or doctoral committee. In addition to these recommendations, the official S.M. and doctoral degree completion requirements must be taken into account during the design of a graduate program[1].

2. Aerospace Communications and Networks

The increasing reliance on information technology in aerospace makes communications a critical element of most modern air and space operations. In many instances communication resources and networks are essential for delivering mission critical information. Moreover, in many locations lacking in a terrestrial communication infrastructure, satellite-based networks are the only viable mechanism for providing needed communication services. Department faculty are engaged in a wide range of research activities in the communications and networks area, including wireless and sensor networks, space networks, satellite and hybrid communication networks, and ultrawideband communications. Please consult faculty web pages for more detailed information about current research activities.

3. Faculty and staff with interest in Aerospace Communications and Networks

Professor Eytan Modiano (Modiano@mit.edu)

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[1] Refer to the S.M., Ph.D. and Sc.D. degree requirements in Aeronautics and Astronautics section of the MIT Bulletin, or to http://web.mit.edu/aeroastro/academics/grad/index.html

Please consult the Communications and Networks Research Group's Web page (http://cnrg.mit.edu/) for more information about Professor Modiano's research activities in the area of communication networks.

Professor Moe Win (moewin@mit.edu)

Please consult the Wireless Communications Research Group's Web page (http://wgroup.lids.mit.edu/) for more information about Professor's Win research activities in wireless communications.

4. Suggested classes and typical tracks in Communications and Networks

Students interested in communications and networking typically will take 3 or 4 of the following courses; depending on their research interests. Communications Systems and networks is a good introductory course to both communications and networking. Students whose interest is in the networking area will typically follow with Data Networks (16.37), while those interested in Communications at the physical layer will typically follow with Principles of Digital Communications (6.450).

16.363	Communication Systems and Networks
16.37/6.263	Data Networks
6.441	Transmission of Information
6.450	Principles of Digital Communications
16.391/6.434	Statistics for Engineers and Scientists
16.395	Principles of Wide Bandwidth Communication

In addition to the above core communications and networking classes, students who are doing research in this area are likely to take classes from the following areas:

Algorithms:

6.046J/18.410J	Introduction to Algorithms
6.852J/18.437J	Distributed Algorithm
6.854J/18.415J	Advanced Algorithms
6.856J/18.416J	Randomized Algorithms

Optimization:

6.255/2.098/15.093	Optimization Methods
6.231	Dynamic Programming and Stochastic Control
6.252/15.084	Nonlinear Programming
6.253	Convex Analysis and Optimization
6.254	Game Theory with Engineering Applications

16.321/6.251	Mathematical Programming
6.855/15.082/ESD.78	Network Optimization
6.859/15.083	Integer Programming and Combinatorial Optimization

Mathematics:

6.262	Discrete Stochastic Processes
6.264/15.072	Queues: Theory and Applications
6.435	System Identification
6.431	Probabilistic System Analysis
6.436/15.085	Fundamentals of Probability
16.391/6.434	Statistics for Engineers & Scientists
18.100 B	Analysis

A. Typical track for an S.M. degree

A typical masters student would take two of the header classes (either 16.363 and 16.37 or 16.37 and 6.450). In addition, they may take two math courses and two courses on optimization and algorithms.

Header courses in communications and networks:

16.363 – Communications Systems and Networks
16.37 – Data Networks
6.450 – Digital Communications

Math courses:

6.262 – Discrete Stochastic Processes
6.431– Probabilistic System Analysis

Two introductory courses in optimization and algorithms: e.g.,

6.231 – Dynamic Programming
16.321 – Mathematical Programming
6.046 – Algorithms

B. Typical track for a Ph.D. degree

A Doctoral student would typically take about four additional courses depending on the focus area. Outlined below are example courses for people with a communications focus and networking focus.

Communications focus:

16.395 – Principles of Wide Bandwidth Communication
16.391 – Statistics for Engineers & Scientists
6.436 – Fundamentals of Probability
6.437 – Inference and Information
18.100 – Analysis

Networking Focus:

6.255/15.093 – optimization methods
6.855/15.082 – network optimization
6.854J/18.415J – Advanced algorithms
6.437 – Inference and Information
6.438 – Algorithms for Inference