

EE 608 Optical Networks Spring 2007

Syllabus

Last updated: Jan. 6 2007

Textbook: *Optical Networks* by Rajiv Ramaswami and Kumar Sivarajan, Second edition Morgan Kaufmann Publishers.

Summary: Fiber optic communication is the technology of choice for long distances and very high bit rates (typically, 1 - 40 Gbps). The high bit rates are particularly important to support Internet traffic that is growing dramatically due to applications such as video (video on demand, IPTV), very large file transfers (youtube, grid computing,...), etc. In this course we will go over fiber-optic communication and networking. During the first half of the course, we will cover physical and link layers to understand the advantages and limitations of optical transmission technology. The second half of the course is on optical networks. The focus is on architectures, design, control and management.

Outline: [Approximate number of lectures]

- Overview of optical networks [3 lectures]
- Optical Layer: Line systems
 - Basics of transmitting bits (Chap 4) [3 lectures]
 - Fiber and Components (Chapters 2 and 3) [3 lectures]
 - Fiber, transmitters, receivers, amplifiers, simple couplers, channel impairment parameters (signal power attenuation, dispersion, noise, ...)
 - WDM line systems (Chap 4 and 5) [6 lectures]
 - Components: multiplexers, demultiplexers, amplifiers, filters,...
 - Transmission system engineering, and design
- Optical Layer: Network – Circuit switched paradigm
 - Rings and mesh topologies [3 lectures]
 - Components (Chap 3 and 7): OADMs, switches [3 lectures]
- Network Design (Chap 8) [9 lectures]
 - Client models
 - Routing and traffic grooming
 - Traffic models
 - Optimization algorithms and methods – routing algorithms, integer and mixed integer linear programming, heuristic optimization algorithms.
- Network Survivability (Chap 9) [4 lectures]
 - Standard protection and restoration, rings, mesh topologies
 - Practical: SONET/SDH, Next Generation SONET, Fast reroute, Resilient Packet Rings
 - Generalizations: Quality of protection, network coding, protecting path segments, p-cycles
- Practical Topics: [4 lectures] SONET/SDH, GFP, Ethernet, Storage Area Networks, MPLS.
- Time permitting: Bursty optical transport (e.g., burst switching, scheduled lightpaths), optical packet switching, access networks.

Grading: Homework assignments (35%), Design Projects (35%), and a Final Project (30%). The final project will include a written and oral reports on a research topic.

Prerequisites: EE 371 (undergraduate electromagnetic theory), EE 367 (undergraduate data structures), EE 342 (undergraduate probability theory), or consent.