EE 693F Optical Networks Spring 2003

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Class days, times, location: MW 8-915 Holmes 389

This is an Computer Elective, and EP and Systems students are more than welcome.

Textbook: *Optical Networks* by Rajiv Ramaswami and Kumar Sivarajan, Morgan Kaufmann Publishers. We may also require an additional book (and software) on mathematical programming. I have to check if Matlab will do the job. Please check this course's web site (see below) or contact the instructor for more information.

Summary: Fiber optic communication technology has advanced dramatically over the past few years. There are least two reasons. It was particularly active during the telecomm boom when there was an urgency to build-out new networks. This was in response to the growth of Internet traffic, which seemed to double every 9 months. Fiber optics is best medium to transport high bit rates over very long distances. Since Internet traffic is not geographically localized, it often goes long distance. Both old and new long distance carriers responded to this by deploying new fiber-optic transport and networking equipment. Though the telecomm industry has slowed down, fiber-optics is still important because (1) it is the most cost effective medium to transmit high bit rates over long distances and (2) though the Internet traffic is not doubling every 9 months, it is still is doubling every year. In addition, fiber-optics is one of the three important media for communication, the others being electrical and wireless.

In this course we will go over fiber-optic technology from the physical layer on up. During the first half of the course, we will cover physical and link layers. This includes fiber-optic signal propagation and optical devices. Since we will cover some of the equations for signal propagation, an undergraduate course on electro-magnetics is a pre-requisite. The second half of the course is on optical networks. Here is where data structures is useful, though we will not require fancy data structures. A knowledge of link lists, arrays, queues, stacks, and data structures from EE 160 is sufficient. You must be able to program in C.

Outline: (Note that this outline is subject to change.)

1) *Introduction to optical networks*
2) *Propagation of signals in fiber:* light propagation in optical fiber, loss and bandwidth, chromatic dispersion, nonlinear effects.
3) *Components:* Couplers, isolators and circulators, multiplexers and filters, optical amplifiers, transmitters, detectors, switches, wavelength converters.
4) *Modulation and demodulation*
5) *Transmission system engineering*: system model, power penalty, transmitter, receiver, optical amplifiers, crosstalk, dispersion, fiber nonlinearities, wavelength stabilization.
6) *First-generation optical networks*: SONET/SDH, Fiber Channel, Gigabit Ethernet, traffic engineering and grooming, network design (elements of mathematical programming), Storage Area Networks. Note we'll cover a little bit on IP and ESCON but not much. Note IP is covered in other courses.
7) *Local area and access networks*: Local access architectures and local area network protocols.
8) *Second-generation optical networks*: routing optical connections, protection schemes, physical impairment constraints, nonblocking network theory, network models and design.
9) *Control and management*: network management functions, configuration management, performance management, fault management, optical safety, service interface.
10) *Optical networks and the Internet:* Topics will include GMPLS, CR LDP. We may also discuss Resilient Packet Rings if time permits.
11) *Photonic packet switching:* Component limitations, burst switching.

Grading: There will be weekly or bi-weekly homework assignments (40%), a final exam (30%), and a final project (30%). The final project will be a written report on a research topic. The report will require a survey of the topic and directions for new research. The report will be approximately 12-15 pages (per person). The project will include an oral presentation (around 30 min) if the attendance is not too large.

Prerequisites: EE 371 (undergraduate electromagnetic theory) or equivalent, and EE 367 (undergraduate data structures) or equivalent.

For More Information: http://www-ee.eng.hawaii.edu/~sasaki/EE693F/Spring03/