

Rivier College
Syllabus
CS455 Topics in Computer Science: Fiber-Optic Technologies

1. **Course number and title:** CS455 Topics in Computer Science: Fiber-Optic Technologies
2. **Instructor's name:** Dr. Vladimir V. Riabov, Associate Professor; Office: STH-312; Tel: (603) 897-8613; E-mail: vriabov@rivier.edu; Web site: <http://www.rivier.edu/faculty/vriabov/>
3. **Course description:** This course (offered on a timely basis) provides an in-depth understanding of the fiber-optic technologies and architecture of storage area networks. The fiber-optic-based network design approaches are reviewed to meet specific communications requirements and the implementation issues of storage area networks technologies to the various application environments, as well as the emerging technologies and standards. Topics include: fiber-optic-based network architecture, interconnection between fiber-optic-based networks and the Internet; fiber-optic-based network topologies; layered network architectures, transmission media (fiber-optic cabling), communication security, communications architecture and protocols for various fiber-optic-based networks including storage area networks.
Prerequisite: CS455 Local Area Networks.

4. **Course objectives:**

The sophistication of data communications and computer networks is growing rapidly. New technologies, standards, and systems are emerging each day to meet the requirements of new applications. It is essential for computer engineers and technical professionals to develop a solid foundation as well as state-of-the-art expertise in data communications, and storage area networks in order to face these challenges.

This course attempts to provide an overview of the fiber-optic-based network technologies and architecture of storage area networks, and encourage students to develop a solid foundation and on-hand experience in this area. Topics to be covered include data communication fiber-optic-based networking models, standards, data transmission, transmission media, communication security, communications architecture and protocols for various fiber-optic-based networks including storage area networks.

Upon completion of this course, the student should learn:

- Why do we need fiber-optic-based networks;
- Basic fiber-optic-based network architecture and the interconnection between fiber-optic-based networks and the Internet;
- Fundamentals of Wave-Division Multiplexing;
- The difference between star, ring, bus and tree network topologies and how to determine which topology to choose in fiber-optic-based network design and implementation;
- Review of different transmission media (fiber-optic cabling) and how to determine which media to choose in fiber-optic-based network design and implementation;
- Review of the layered network architecture concept, the difference between the OSI Reference Model, TCP/IP protocol suite, and the fiber-optic-based network protocol layers;
- What is Synchronous Optical Network (SONET);
- What is Synchronous Digital Hierarchy (SDH);
- What is Storage Area Networks;
- The latest networking technologies including Tools for Trouble Shooting Fiber-Optic Systems.

5. **Class Dates and Time:** September 14, 2004 – December 14, 2004
Tuesdays: 7:45 PM - 9:45 PM
6. **Required textbook:** Roger L. Freeman, Fiber Optic Systems for Telecommunications, 1st edition, Wiley-Interscience; (July 15, 2002), ISBN: 0471414778.

7. Recommended books:

- William Stallings, Data and Computer Communications, 6th edition, Prentice Hall, 2000, ISBN: 0130843709.
- Stefano Bottacchi, Optical Fibre Transmission Theory, Technology, and Design, Volume 1, Optic Propagation Theory, John Wiley & Sons; (January 18, 2002), ISBN: 0471891754.
- David R. Goff, Kimberly S. Hansen, and James G. Stewart, Fiber Optic Reference Guide: A Practical Guide to the Technology, 3rd edition, Butterworth-Heinemann; (April 1, 1996), ISBN: 0240802632.
- Serge Ungar and John C.C. Nelson, Fibre Optics: Theory and Applications, 1st edition, John Wiley & Sons Inc; (November 27, 1990), ASIN: 0471927589.
- Robert M. Gagliardi and Sherman Karp, Optical Communications (Wiley Series in Telecommunications and Signal Processing), 2nd edition, Wiley-Interscience; (February 6, 1995); ISBN: 0471542873.
- R. Barker and P. Massiglia, Storage Networking Essentials: A Complete Guide to Understanding & Implementing SANs. New York: John Wiley & Sons, (2001).
- T. Clark, Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel SANs. Boston, MA: Addison-Wesley, (1999).
- T. Clark, IP SANS: An Introduction to iSCSI, iFCP, and FCIP Protocols for Storage Area Networks. Boston, MA: Addison-Wesley, (2002).
- M. Farley, Building Storage Networks, 2nd edition. New York: Osborne/McGraw-Hill, (2001).
- P. Sachdev and R. S. Arunkundram, Special Edition Using Storage Area Networks. Indianapolis, IN: Que, (2002).
- R. H. Thornburgh and B. J. Schoenborn, Storage Area Networks: Designing and Implementing a Mass Storage System. Upper Saddle River, NJ: Prentice Hall PTR, (2001).
- J. W. Toigo, The Holy Grail of Data Storage Management. Upper Saddle River, NJ: Prentice Hall PTR, (2001).
- J. Vacca, The essential guide to storage area networks. Upper Saddle River, NJ: Prentice Hall, (2002).
- Behrouz Forouzan, Local Area Networks, 1st edition (2003), McGraw-Hill, ISBN: 0072336056.
- Tom Sheldon, McGraw-Hill's Encyclopedia of Networking & Telecommunications, 2nd edition, McGraw-Hill, June 2001, ISBN: 0072120053.
- Andrew S. Tanenbaum, Computer Networks, 3-d edition, Prentice-Hall, Inc., 1996, ISBN: 0133942481 [or 2-nd edition, ISBN: 0133499456].
- Leon-Garcia and Widjaja, Communication Networks: Fundamental Concepts and Key Architectures, McGraw-Hill Professional Publishing, 1999.
- *Articles* published in IEEE and other Technical Journals.
- *Technical information* and *white papers* published on the Internet.

Partial List of Excellent Reference Sources for Classes and Project Assignments:

- IEEE Communications Magazine (technical journal);
- IEEE Journal on Selected Areas in Communications (technical journal);
- IEEE Network (technical journal);
- IEEE Spectrum (technical journal);
- IEEE Transactions on Communications (technical journal);
- Computer Communications (technical journal);
- Computer Networks and ISDN Systems (technical journal);
- Bell System Technical Journal;
- Lightware, The Journal of Fiber Optics (technical journal);
- Data Communications (trade magazine – O.K. for technical reference);
- Network Magazine (trade magazine -- OK for technical reference)
- Telecommunications (trade magazine – O.K. for technical reference);
- Embedded Systems (trade magazine – O.K. for technical reference);
- Communications Week (weekly newspaper – NOT for technical reference);
- Network World (weekly newspaper – NOT for technical reference).

8. Classroom Policies:

- a) **Attendance:** As college students, it is your responsibility to be present for lectures. Missed notes, etc. are also your responsibility. Not attending class more than two times may result in a reduction of your grade, unless prior permission is received from the instructor. Please notify me of extenuating circumstances.
- b) **Project Assignment** (individual project): Your assignment is to write a study report *or* a research paper. The purpose of writing the report/paper is for you to gain an in-depth understanding of a particular topic that you are interested, or the technical knowledge that you learned will benefit you for your work or for your career development. It also gives you an opportunity to learn how to do independent research work as well as how to write a technical report/paper.

The potential topics for your report/paper are listed as follows:

- Fiber Optic Technologies and High-speed LAN/MAN;
- Fiber Optic Technologies and Multimedia Data Communications;
- Fiber Optic Technologies and Storage Area Networks;
- Fiber Optic Technologies and Local Area Networks;
- Light Sources and Detectors;
- Synchronous Optical Network (SONET);
- Synchronous Digital Hierarchy (SDH);
- A topic of your own selection (may be related to your work).

The paper should consist of about 15 typed pages plus illustrations, bibliography, and appendices (if necessary). A minimum of six technical articles and/or books must be used as sources for your paper. At least thirty percent of your reference materials should be technical articles published within two years.

You **must** submit your outline and discuss it with me before you start writing the paper or start your project. If you need advice regarding the topic to select, the format of the paper, the contents of the paper, or reference material, you should discuss it with me. Discussing the same with your classmates is also encouraged. The outline discussion process is very important, because, only through this process, I may help you to organize your paper, advise you on the contents of the paper, advise you on where to find references, and guide you to the right direction.

The Project/Paper is due on December 7, 2004.

- c) **NO additional homework assignments** are scheduled.

9. Evaluation Mechanism:

Students are required to pass all exams and complete all assignments. Exams will be based on textbooks, lecture material, and handouts. All exams will be comprehensive and home-taken. See "**Project Assignments**" for detailed project assignment requirements. Grades for all exams and assignments will not be determined by curves. Letter grades submitted to the Registrar's Office would be based on the Rivier College Grading system (see the Catalog).

The grade is made up of your performance on your project, midterm and final exams. Approximate weightings are as follows:

Midterm Exam	25%
Final Exam	35%
Project	40%

10. Due Dates:

Project Proposal:	October 5, 2004
Midterm Exam:	October 19, 2004
Project due:	December 7, 2004
Final Exam:	December 14, 2004

11. **Topic Outline:**

SESSION	TOPIC	READING
1 (09/14)	Introduction to Fiber-Optic Transmission Fiber-Optic Cable	Ch. 1 Ch. 2
2 (09/21)	Connectors, Splices, and Other Passive Devices	Ch. 3
3 (09/28)	Light Sources Light Detectors	Ch. 4 Ch. 5
4 (10/05)	Impairments to Light Transmission Regenerators and Fiber-Optic Amplifiers	Ch. 6 Ch. 7
5 (10/12)	Wave-Division Multiplexing [PROJECT PROPOSAL DUE]	Ch. 8
6 (10/19)	[MID-TERM EXAM]	[MID-TERM EXAM]
7 (10/26)	Synchronous Optical Network (SONET) Synchronous Digital Hierarchy (SDH) Link Engineering of Lightwave Systems	Ch. 9 Ch. 9 Ch. 10
8 (11/02)	Outside Plant Considerations System Availability and Survivability	Ch. 11 Ch. 12
9 (11/09)	Powering Options to Improve Availability Hybrid Fiber-Coax (HFC) Systems	Ch. 13 Ch. 14
10 (11/16)	On-Premises Wiring of Buildings—Fiber Optics	Ch. 15
11 (11/23)	Tools for Trouble Shooting Fiber-Optic Systems	Ch. 16
12 (11/30)	Optical Networking <i>Final Exam Preparation</i>	Ch. 17
13 (12/07)	[PROJECT DUE]	[PROJECT DUE]
14 (12/14)	[FINAL EXAM]	[FINAL EXAM]