Department of Electrical and Electronic Engineering, California State University

EEE 267 Fiber Optic Communcications, 3 units

Spring 2008, Section 2, Call No. 36247, Tue/Thu 10:30–11:45 A.M. Riverside Hall Room 1010

<u>Goal</u>: To provide graduate students interested in optical communication an opportunity to learn the fundamentals of modern lightwave communication systems.

<u>Course Content</u>: Fundamentals of modern lightwave communication systems, sources, detectors and optical fibers. Study of dispersion in Step Index, Graded Index, and Single Mode Optical Fibers. Intensity modulated direct detection systems (IMDD) and Coherent Fiber Optic Systems (COFOCS). Performance evaluation and design considerations. Wavelength division multiplexing, Local Area Networks, Optical Amplifiers and Photonic Switching.

Prerequisite: EEE 185 – Modern Communication Systems or Instructor permission.

Text: "Optical Fiber Communications", by G. Keiser, Third Edition, McGraw Hill, NY, 2000.

Instructor: Russ Tatro Office: Riverside 5010

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Office Phone: 278-4878 Optics Lab Phone: 278-4578

Office Hours: See course website for office hours or by appointment

Grading: Design Project 10%

Midterm exams (2) 60% Final 30%

<u>Homework</u>: Will be assigned and posted on the course website. Homework will not be collected nor graded. All content in the assigned homework is testable.

<u>Design Project</u>: Students will build a fiber optic communications link using course provided evaluation kits. The system will be built, measurements taken and system design criteria verified. The built system will be analyzed both by "hand calculation" and software simulation. This project will be completed outside of scheduled lecture time in groups of two or three. An individually written report will be submitted for the project grade.

<u>Exams</u>: There will be two midterm exams and a comprehensive final exam. All exams are closed book/note. An equation page will be provided.

Computer Aided Design of Fiber Optic Communication Systems

The software packages LINKSIM by RSoft and ViSSim by Visual Communications will be used in assignments. Also students will be expected to use a computational program like MATLAB, Maple, Mathematica or MATHCAD for homework assignments.

COURSE SCHEDULE - Spring 2008

| Week Date Pages Topics or Section | | | | |
|-----------------------------------|-------|-----------|---|--|
| 1 | 01/29 | 1 - 20 | Introduction, Chapter 1 | |
| 1 | 01/29 | 25 - 61 | 2-1, 2-2, 2-3, 2-4 | |
| 2 | 02/05 | 62 - 82 | | |
| | | | 2-5, 2-6, 2-7, 2-10 | |
| 2 | 02/07 | 91 - 114 | 3-1, 3-2 | |
| 3 | 02/12 | 115 - 132 | 3-3, 3-4, 3-5 | |
| 4 | 02/14 | 141 – 160 | 4-1, 4-2 | |
| 4 | 02/19 | 161 – 193 | 4-3, 4-4, 4-5, 4-6 | |
| | 02/21 | 204 – 214 | 5-1, 5-2 | |
| 5 | 02/26 | 215 – 236 | 5-3, 5-4, 5-5, 5-6 | |
| _ | 02/28 | 243 – 261 | 6-1, 6-2, 6.3 | |
| 6 | 03/04 | 262 - 268 | 6.4, 6-5, 6-6, 6-7 | |
| | 03/06 | | EXAM I: Chaps. 2, 3, 4, 5 | |
| 7 | 03/11 | 274 - 280 | Exam discussion, 7-1 | |
| | 03/13 | 281 - 304 | 7-2, 7-3 | |
| 8 | 03/18 | 305 - 314 | 7-4, 7-5 | |
| | 03/20 | 321 - 334 | 8-1 | |
| 9 | 03/25 | 335 - 351 | 8-2, 8.3, 8-4 | |
| | 03/27 | 358 - 360 | 9-1 | |
| 10 | 04/01 | | Spring Break | |
| | 04/03 | | Spring Break | |
| 11 | 04/08 | 361–366 | 9-2 | |
| | 04/10 | | EXAM II: Chaps. 6, 7, 8 | |
| 12 | 04/15 | | Exam Discussion | |
| | 04/17 | 367 - 374 | 9-3, 9-4 | |
| 13 | 04/22 | 379 - 405 | 10-1, 10-2 | |
| | 04/24 | 406 - 414 | 10-3, 10-4 | |
| 14 | 04/29 | 423 - 430 | 11-1, 11-2 | |
| | 05/01 | 431 - 449 | 11-3, 11-4, 11-5, 11-6, Project Report Due | |
| 15 | 05/06 | 457 - 477 | 12-1, 12-2 | |
| | 05/08 | | Recent developments (Chapter 12) | |
| 16 | 05/13 | | Course Wrap-up | |
| | 05/15 | | Review for Final | |
| 17 | 05/22 | | Final Exam 10:15 a.m. – 12:15 p.m. | |

Course Outline:

| Introduction to Optical Fibers | 1.25 hours |
|--------------------------------------|-------------|
| Basic Waveguide Equations | 1.25 |
| Fiber Types and Properties | 2.50 |
| Optical Sources | |
| Photodetectors and Optical Receivers | 6.25 |
| Source Coupling and Splices | 2.50 |
| IMDD Systems | |
| Analog Systems | 2.50 |
| COFOCS Systems | |
| Advanced Systems and Techniques | 3.75 |
| Current Research Perspectives | |
| Review for Midterm/Final | |
| Midterm Exams | 2.50 |
| Final Exam | <u>2.00</u> |
| | 39.50 hours |

References:

"Fiber Optic Communications", by Joseph C. Palais, Prentice Hall, Third Edition, New Jersey, 1992.

"Fiber-Optic Communication Systems", by Govind P. Agrawal, John Wiley & Sons, 1992.

"Fiber Optics & Optoelectronics", by Peter K. Cheo, Second Edition, New Jersey, 1990.

"Introduction to Optical Fiber Communication Systems", by William B. Jones, HRW Publishing, 1988.

Selected articles from IEEE Journal of Lightwave Technology and IEEE Journal of Quantum Electronics.

"An Introduction to Optical Fibers", by Allen H. Cherin, McGraw Hill, New York, 1983.

"Fundamentals of Optical Fiber Communication", by M. K. Barnoski, Academic Press, NY, 1981.

"Optical Fiber Communication Systems", by Leonid Kazovsky, Sergio Benedetto, and Alan Willner, Artech House, Norwood, MA, 1996.

"Principles and Applications of Optical Communications" by Max Liu, Richard D.Irwin Publishing Company, 1996.

"Elements of Optoelectronics and Fiber Optics", by Chin-Lin Chen, Richard D. Irwin Publishing Company, 1996.