EECS 628 - Fiber Optic Communications Systems (Spring 2018)
Monday, Wednesday 3:00 – 3:50 pm, Room 2133 Learned
KU Course # 59869
Website: http://www.ittc.ku.edu/~hui/eecs628/
Instructor: Professor Ron Hui
Offices: 3026 Eaton Hall 864-8814
222 Nichols Hall 864-7740
Office Hours: 4:00 - 5:00 pm Monday, Wednesday, Friday (3026 Eaton)
1:30 - 5:00pm on Tuesday, Thursday and Friday (222 Nichols), or by appointment
Catalog Listing: EECS 628 (3) Description and analysis of the key components in optical communication systems. Topics covered include quantum sources, fiber cable propagation and dispersion characteristics, receiver characteristics, and system gain considerations.
Prerequisite: EECS 220 and PHSX 313, or equivalent.
Course Objective: To identify the current state-of-the-art in fiber optic communications and to gain an understanding of basic system design considerations.
Grading: The following factors will be used to arrive at the final course grade
Outside Reading & Project 10%
Homework 20%
Midterm 1 20%
Midterm 2 20%
Final 30%
Grading Scale: Grades will be assigned to the following scale:
A 90 - 100 %
B 80 - 89 %
C 70 - 79 %
D 60 - 69 %
F < 60 %
These are guaranteed maximum scales and may be revised downward at the instructor's discretion.
Homework: Homework will be collected at the beginning of class on a roughly weekly basis. Collaboration with classmates is permitted. Copying is not permitted.
Exams: Make-ups for missed exams will not be given. The first missed exam will be scored by taking 90% of the average of your other exams. Subsequent missed exams will be scored as zero.
Ethics Policy: Academic misconduct will not be tolerated. It will result in a failing grade and may result in further disciplinary action by the University. For details see the Academic Misconduct section of the Timetable.
Course Outline: Propagation in Optical Fibers, Filters, Optical Sources, Modulation, Noise, Detection, Systems
One of the most important aspects of any engineering discipline is to keep abreast of new developments in the field. This is particularly true of a relatively new discipline such as fiber optic communications. It is also important to gain a familiarity with the kinds of equipment presently being manufactured.

To this end, a requirement for EECS 628 is that a notebook of abstracts be kept surveying various aspects of fiber optic system and components. Each abstract of a research paper, written by the student, should consist of two paragraphs and cover the major engineering significance of each article selected. Also included should be the title of the article, the journal name, volume number, and the page numbers, the date, and the author’s names and their affiliations. The product summary should include manufacturer's name and basic performance specification. A table of contents for the notebook (with page numbers) should also be included, with the abstracts grouped according to the subject category.

<table>
<thead>
<tr>
<th>Subject</th>
<th># of Articles</th>
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<tr>
<td>Optical fiber</td>
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<td>Semiconductor Lasers or LED</td>
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<td>Photo-detectors</td>
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<td>Optical amplifiers</td>
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<td>Optical transceivers</td>
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<td>Integrated optical circuits</td>
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<td>Optical WDM systems</td>
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<td>Fiber-optic Sensors</td>
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The following Journals (available in the Engineering Library) may be useful in the preparation of these abstracts (this is not an exhaustive list):

- *Optics Express*
- *IEEE Photonics Technology Letters*
- *IEEE Photonics Journal*
- *Optics Letters*
- *Journal of Lightwave Technology*
- *IEEE Journal of Quantum Electronics*
- *IEE Electronics Letters*
- *Laser Focus World*

This notebook will be graded according to the appropriateness of the articles selected, the quality of the abstracts and manufacturer summaries, and your general understanding of each specific topic. This assignment is due on the last day of class.
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<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
<th>Reading Assignment</th>
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<td>1</td>
<td>Jan. 15</td>
<td>Course outline and overview. General properties of optical wave</td>
<td>Sec. 2.1</td>
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<td>2</td>
<td>Jan. 22</td>
<td>Reflection and refraction. Propagation modes in optical fibers</td>
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<td>Group velocity and dispersion</td>
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<td>3</td>
<td>Jan. 29</td>
<td>Fiber attenuation. Group velocity and dispersion</td>
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<td>4</td>
<td>Feb. 5</td>
<td>Nonlinear effects in an optical fiber. Different types of optical fibers</td>
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<td>Sec 2.7</td>
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<td>5</td>
<td>Feb. 12</td>
<td>Properties of semiconductor materials for light sources. Light-Emitting Diodes (LEDs)</td>
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<td>Sec 3.2</td>
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<td>6</td>
<td>Feb. 19</td>
<td>Laser Diodes (LDs)</td>
<td>Sec 3.3</td>
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<td>7</td>
<td>Feb. 26</td>
<td>Single-frequency semiconductor lasers. VCSEL</td>
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<td><strong>EXAM 1</strong> (Chapters 2 – 3)</td>
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<td>Mar. 5</td>
<td>PN-junction photodiodes. Responsivity and bandwidth</td>
<td>Sec. 4.1</td>
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<td>Sec. 4.2</td>
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<td>Photodetector noise and SNR. APD and other types of photodetectors</td>
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<td>Sec. 4.4, 4.5</td>
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<td>10</td>
<td>Mar. 19</td>
<td>Spring Break. Spring Break. Spring Break</td>
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<td>11</td>
<td>Mar. 26</td>
<td>Optical amplifier gain, gain bandwidth and saturation. Noise figure, SOA and EDFA</td>
<td>Sec. 5.1, 5.2</td>
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<td>External electro-optic modulator operating principle. Fiber directional coupler</td>
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<td>BER versus Q-value for binary modulated systems. Receiver sensitivity and required OSNR</td>
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<td><strong>EXAM 2</strong> (Chapters 4 – 8)</td>
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<td>Coherent optical communication systems</td>
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<td>Apr. 30</td>
<td>Optical communication system and modulation formats. Optical system link budgeting</td>
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<td>May 2</td>
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<td>May 3</td>
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<td>May 7</td>
<td><strong>Final Exam</strong>, 1:30 - 4:00pm (Monday)</td>
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