COURSE OUTLINE
ECE581 SEMICONDUCTOR OPTOELECTRONICS LABORATORY
(SPRING 2009)

Course number and title: ECE580 Semiconductor Optoelectronics Laboratory

Credits: 3

Term(s) to be offered: Spring 2009

Prerequisite(s): ECE 471 (required), ECE 404 (recommended)

Course Description: Experimental characterization techniques for semiconductor optoelectronic devices and design and testing of related electronic circuits.

Instructors: Kevin Lear

Text(s): None

Additional Class Material: instructor’s notes, review and/or tutorial articles on semiconductor devices, optoelectronics, noise, amplifiers, and printed circuit boards

Course Objective(s): This course will be suitable for first year graduate students and undergraduate seniors majoring in electrical engineering needing greater theoretical and practical knowledge of semiconductor based optoelectronic devices and electronic analog circuits used to interface them. The learning objectives for students passing this course are:

- They will be able to describe the light-current-voltage relationships of LEDs, laser diodes, and photodiodes and demonstrate how to measure associated parameters.
- They will be able to draw circuit schematic diagrams, layout simple printed circuit boards, construct, and test analog circuits interfacing optoelectronic devices.
- They will be able to discuss ideal and practical sources of noise in amplifier circuits.
- They will be able to analyze LabVIEW block diagrams used for controlling measurement equipment and to make minor modifications to the related code.
- They will be able to model optoelectronic components using PSpice.
- They will be able to write laboratory reports that effectively communicate experimental purpose, design, execution, data collection, analysis, and conclusions and to summarize project information in presentations.

Course Topics/Weekly Schedule:
Week 1   Lab report format / LabVIEW
Week 2   Semiconductor Parameter Analyzer / LED current-voltage characteristics
Week 3   Optical power and spectrum measurements / LED characterization
Week 4   Electrical probe station / Photodiode responsivity characterization
Week 5  Laser diode DC characteristics
Week 6  PSpice modeling of circuits with optoelectronic devices
Week 7  Pulsed (AC) measurements using LEDs, laser diodes, and photodiodes
Week 8  Circuits for amplifying photodiode signals
Week 9  Noise and shielding / Circuit construction techniques
Week 10  Printed circuit board design
Week 11  Fiber optic transceiver modules
Week 12  Printed circuit board assembly and testing
Week 13  Fiber optic system test (Part 1)
Week 14  Fiber optic system test (Part 2)
Week 15  Final student presentations
Week 16  Final student presentations

**Instructional Methodology:** The class will meet for 1 hour of lecture each week to cover general concepts required for the laboratory activities. Students will work in teams of two during 4 hours of lab sessions on equipment in a functioning research laboratory. Due to the limited availability of the laboratory equipment, each pair of students will arrange for non-overlapping 4 hour periods to access the equipment. Related readings from review articles, equipment manuals, and software tutorials will be assigned in conjunction with the course topics. Students will use industry standard software tools throughout the semester including LabVIEW for data acquisition and PSpice for circuit simulations. A printed circuit board layout tool, e.g. Eagle CAD, will be selected that is compatible with college software support and vendor circuit board manufacturing support.

**Mode of Delivery:** Material will be presented during lecture with traditional classroom instruction including the use of PowerPoint slides during lecture. Laboratory experiments will be guided by written instructions and supervision by the instructor or graduate teaching assistant.

**Methods of Evaluation:** The course will be graded using traditional grading during the initial offering in Spring 2009. Students will be evaluated primarily on written laboratory reports prepared by each student each week counting for 75% of the overall class score. 20% of the class score will be based on the final presentation including the performance of the fiber optic system circuits, and the remaining 5% of the score will be based on factual peer evaluations of laboratory partners.