ECE 578

Course Title: **Photonics**
Credit Units: **3.0**
Design Units: **0.25**
Course Type: **Elective**
Prerequisite: **ECE 370**

Course Description:
Ray Optics, Wave Optics, Fourier Optics, Electromagnetic Optics, Quantum Optics, Holography, Lasers, Solar Cells, Photonic Semiconductor Materials and Devices, Photonic Integrated Circuits (PICs), Infrared Devices and Circuits, optical waveguides, as well as practical applications of microwaves in combination with lightwaves are included in this course. Theory, analysis and practical design issues of Photonic devices, circuits and systems are addressed.

Textbook and/or Other Required Material:
Saleh BEA, and Teich MC: Fundamentals of Photonics, 2nd edition, Wiley-Interscience, 2007, ISBN: 0471358320
Additional References
Pollock CR: Fundamentals of Optoelectronics, Richard D Irwin, 1994, ISBN: 0256101043
Verdeyen JT: Laser Electronics, Prentice Hall, 3rd edition, 1994, ISBN: 013706666X
Sze SM: Semiconductor Devices: Physics and Technology, Wiley, 2nd edition, 2002, ISBN: 0471333727

Course Objectives:
After completing this course the students should be able to:
1. Solve optical Circuit problems with optical or electrical sources.
2. Design optical amplifiers, optical oscillators, optical detectors/mixers and optical control circuits.
3. Apply the advanced concepts in photonics to analyze opto-electronic integrated circuits (OEICs), with sinusoidal inputs.
4. Apply optical processing techniques to complex optical circuits and systems

Topics Covered:
- Overview of Optics
- Ray and Wave Optics
- Fourier Optics
- Electromagnetic Optics
- Quantum Optics
- Luminescence: Photoluminescence and Electroluminescence
- Electro-Optics
- Lasers
- Photonic Devices and Circuits
- Infrared Devices and Circuits
- Microwaves and Photonics

Class/Laboratory Schedule:
1 session per week, 165 minutes each

Contribution to Professional Component:
Engineering Sciences: 2.25
Engineering Design: 0.25
Optical Science: 0.5

Relationship to Program Outcomes:
This course supports the achievement of the following outcomes:

a. An ability to apply knowledge of mathematics, science, and engineering to the analysis of electrical engineering problems.
b. An ability to design and conduct scientific and engineering experiments, as well as to analyze and interpret data.
c. An ability to design systems which include hardware and/or software components within realistic constraints such as cost, manufacturability, safety and environmental concerns.
e. An ability to identify, formulate, and solve electrical engineering problems.
i. A recognition of the need for and an ability to engage in life-long learning.
k. An ability to use modern engineering techniques for analysis and design.
m. An ability to analyze and design complex devices and/or systems containing hardware and/or software components.
n. Knowledge of mathematics including differential equations, linear algebra, complex variables and discrete math.
o. The ability to be competitive in the engineering job market and/or to continue their studies at the graduate level.

Prepared by:
Matthew Radmanesh, October 2006
J. Michael Kabo, May 2007