COURSE: EECS 434. **TITLE:** Principles of Photonics. **PREREQUISITES:** EECS 330 or 334 or Graduate standing. **ELECTIVE.**

TEXTBOOK: B.E.A. Saleh and M.C. Teich, *Fundamentals of Photonics*, Wiley

CATALOG DESCRIPTION: Introduction to photonics, opto-electronics, lasers and fiber-optics. Topics include mirrors, interferometers, modulators and propagation in waveguides and fibers. The second half treats photons in semiconductors, including semi-conductor lasers, detectors and noise effects. System applications include fiber lightwave systems, ultra-high-peak power lasers, and display technologies.

COURSE OBJECTIVES:

1. To teach students the basics of photonics: generation, transmission, detection & manipulation of light
2. To teach students some applications of photonics, including imaging and optical communications;
3. To teach students some of the evolution of optics: ray optics to nonlinear optics & modern photonics.

COURSE OUTCOMES [Program Outcomes Addressed]

1. Ability to specify the ranges of validity of ray, wave, and electromagnetic optics; [1]
2. Ability to use Ray and Jones matrices in light propagation and reflection problems; [1,11,14]
3. Ability to design electro-optic and acousto-optic modulators to control optical beams; [1,11,14]
4. Ability to apply principles of 3 and 4 level lasers: CW, free running, Q-switching, mode-locking; [“]
5. Ability to apply basic concepts of nonlinear optics, using intensity-dependent index of refraction. [“]

TOPICS COVERED:

1. Ray, wave and EM optics: matrix optics, reflection, refraction, polarization, birefringence, wave eqn.
2. Guided wave optics: dielectric & mirror wave guides; step & graded index fiber optics, dispersion
3. Lasers: optical cavity & amplifier, Q-switching, mode-locking, CW
4. Optical beams: Electro-optics and acousto-optics, Faraday effect
5. Photons in semiconductors
6. Nonlinear optics: harmonics

ASSESSMENT (Course outcomes)

1. 10 weekly problem sets [1,2,3,4,5]
2. 3 closed-book exams [1,2,3,4,5]

PROGRAM OUTCOMES ADDRESSED: 1,11
PROFESSIONAL COMPONENT ADDRESSED: 13
PREPARED BY: Andrew E. Yagle on Nov. 25, 2004

CLASS/LABORATORY SCHEDULE:
LECTURES: 2 per week @ 90 minutes.
RECITATION: 1 per week @ 1 hour.

COURSE DESCRIPTION: University of Michigan, College of Engineering, ELECTRICAL ENGINEERING PROGRAM