Electrical Engineering: Optical Devices, Materials & Systems

EEOP 6309 Fourier Optics (3 semester hours) Theory of coherent optics using a linear systems approach. Application of the concepts of impulse response and transfer function to free-space wave propagation, diffraction, and image formation. Prerequisites: EE 3302 and EE 4301 or equivalents. (3-0) T

EEOP 6310 Optical Communication Systems (3 semester hours) Operating principles of optical communications systems and fiber optic communication technology. Characteristics of optical fibers, laser diodes, and laser modulation, laser and fiber amplifiers, detection, demodulation, dispersion compensation, and network topologies. System topology, star network, bus networks, layered architectures, all-optical networks. Prerequisite: EE 3350 or equivalent. (3-0) T

EEOP 6312 Laser and Modern Optics (3 semester hours) Theory and applications of lasers, including ray and beam optics. Design issues include power maximization, noise properties, spectral purity and high-speed modulation. Particular emphasis on semiconductor lasers and their relevance to optical communications. Prerequisite: EE 4301 or equivalent. (3-0) Y

EEOP 6313 (MSEN 6313) Semiconductor Opto-Electronic Devices (3 semester hours) Physical principles of semiconductor optoelectronic devices: optical properties of semiconductors, optical gain and absorption, wave guiding, laser oscillation in semiconductors, LEDs, physics of detectors, applications. Prerequisite: EE 3310 or equivalent. (3-0) R

EEOP 6314 Principles of Fiber and Integrated Optics (3 semester hours) Theory of dielectric waveguides, modes of planar waveguides, strip waveguides, optical fibers, coupled-mode formalism, directional couplers, diffractive elements, switches, wavelength-tunable filters, polarization properties of devices and fibers, step and graded-index fibers, devices for fiber measurements, fiber splices, polarization properties, and fiber systems. Prerequisites: ENGR 3300 and EE 4301 or equivalents. (3-0) T

EEOP 6315 Engineering Optics (3 semester hours) Fundamental concepts of geometrical optics, first-order optical system design and analysis, paraxial ray tracing, aperture and field stops. Optical materials and properties; third order aberration theory. Prerequisite: PHYS 2326 or equivalent. (3-0) T

EEOP 6317 Physical Optics (3 semester hours) Study of optical propagation, interference, diffraction and polarization based primarily on the electromagnetic nature of light; interferometers; diffractive phenomena based on scalar formalisms; diffraction gratings; diffraction in optical instruments; interference of polarized waves; mathematical description of fully and partially polarized light; Jones and Mueller matrices. Prerequisite: EE 4301 or equivalent. (3-0) T

EEOP 6328 Nonlinear Optics (3 semester hours) Survey of nonlinear optical effects; origins of optical nonlinearities; laser-pulse propagation equations in bulk media and optical fibers; the nonlinear optical susceptibility tensor; second-order nonlinear optical effects (second harmonic generation, optical rectification, parametric mixing and amplification); third-order nonlinear optical effects in fiber optic communication systems (self-phase modulation, cross-phase modulation, stimulated Brillouin scattering,
stimulated Raman scattering, four-wave mixing, nonlinear polarization mode dispersion); self-focusing and
self-defocusing in bulk media; computational methods for nonlinear optics. Prerequisite: EE 4301 or
equivalent; EEOP 6310 recommended. (3-0) R

EEOP 6329 Optical Signal Conditioning (3 semester hours) Engineering principles and applications of laser
beam modulation and deflection (acousto-optics and electro-optics), harmonic generation and optical
parametric processes, optical pulse compression and shaping. Prerequisites: EE 4301 or equivalent and EE
OP 6317 recommended. (3-0) R

EEOP 6334 Advanced Geometrical and Physical Optics (3 semester hours) Geometrical optics as a limiting
case of the propagation of electromagnetic waves; geometrical theory of optical aberrations; the
diffraction theory of aberrations; image formation with partially coherent and partially polarized light;
computational methods for physical optics. Other topics may be selected from the following: diffraction
theory of vector electromagnetic fields, diffraction of light by ultrasonic waves, optics of metals, Lorenz-Mie
theory of the scattering of light by small particles, and optics of crystals. Prerequisite: EEOP 6317. (3-0) R

EEOP 6335 Engineering of Infrared Imaging Systems (3 semester hours) Thermal optics, review of Fourier
optics, review of information theory, embedded system design principles, and system modeling.
Prerequisites: EEOP 6309 or EEOP 6315 or equivalents. (3-0) T

EEOP 6338 High-Speed Optical Receivers and Transmitters (3 semester hours) Review of optical
communication systems. Definitions of attenuation and dispersion. Architecture of optical transmitters
and receivers. Principles of operation of photodetectors (PIN and APD). Application of digital
communication theory to the analysis of optical receivers. Definition of sensitivity and dynamic range in
optical receivers. Definition of sensitivity and dynamic range in optical receivers. Study of high-speed
transimpedance and limiting amplifiers. Principles of operation of lasers (DFB and Fabry-Perot). Study of
tunable lasers and high-speed external modulators. Direct and externally modulated transmitters. Study of
high-speed drivers for laser and modulators. Characteristics of optical transmitters. Prerequisite: EE 3311
or equivalent. (3-0) R

EEOP 7340 Optical Network Architectures and Protocols (3 semester hours) Introduction to optical
networks. The ITU Optical Layer. First-generation optical networks. Standards, e.g. SONET/SDH, FDDI.
Prerequisite: EESC 6340. (3-0) R

EEOP 7v3 Special Topics in Optics and Fields (1-6 semester hours) For letter grade credit only. (May be
repeated to a maximum of 9 hours.) ([1-6]-0) R