6.161/6.637 COURSE CALENDAR **Fall 2011** **(09/08/11)**

Date	Topics	P/S	Class Demos
TR 08 Sep	**Course Overview –** Description of content, expectations and requirements, grading policy, exams, etc, CI overview-D. Unger **Basics** - Review of properties of E&M waves; amplitude, intensity, phase, polarization and coherence, E and H fields, Maxwell's Equations, dielectric and conducting media, wave equation, plane and spherical wave solutions.		
TU 13 Sep	Linear, circular and elliptical polarization; quarter & half-wave plates. Jones vectors and matrices	1	Polarizers, magic sheet
Wk of 09/11	**Lab 0 –** Lab orientation (38-633); Lab safety training, etc		
TR 15 Sep	Reflection, refraction, Snell's law, critical angle, Brewster's angle, reflection and transmission coeffs, dipole model of interaction of light with matter.		
TU 20 Sep	**Geometric optics** – Lenses and mirrors, telescopes and microscopes; telescope types. Ray-matrix methods, single-lens and multiple-lens system, lens waveguide - (WH)	2	Newtonian and Cassegrain telescopes
Wk of 09/25	**Lab 1 –** Polarization states, dielectric reflection, geometric optics		
TR 22 Sep	**Interferometry** - Temporal and spatial coherence, two-beam interferometers (Michelson and Mach-Zehnder) –(WH)		
TU 27 Sep	Multiple-beam interference, finesse, dielectric mirrors	3	
TR 29 Sep	Fabry-Perot and Lummer-Gehrcke interferometers. Antireflection coatings, dielectric mirrors, interference filters.		Soap films, Interference filters/mirrors
Wk of 10/02	**Lab 2 –** Haidinger Interference fringes (thin glass sides), two-beam and multiple-beam interferometers; Instruction on writing CI exercise on Lab 2.		
TU 04 Oct	**Diffraction** - Scalar diffraction theory, free-space propagation, spatial frequency, Fresnel diffraction formula.	4	
TR 06 Oct	Fraunhofer approximation, examples, diffraction-based light modulators.		MEMS Mirror (deformable)
Wk of 10/09	**Lab 3 –** Fresnel and Fraunhofer diffraction from various apertures and objects		
TU 11 Oct	**Columbus day Holiday** (no class)		
TR 13 Oct	**Quiz 1** (open book) – WH		
Wk of 10/16	**Lab 4 -** Viewing, analyzing and fabricating transmission and reflection holograms; CI feedback session		
TU 18 Oct	**Holography** – Transmission holography, image separation conditions, real and virtual images, phase-conjugate waves.	5	
TR 20 Oct	Reflection holography, effects of recording medium resolution.		Transmission,

	Computer-generated holograms, real-time holography. Holograms in photorefractive media, optical storage.		white light & CGHs
Wk of 10/23	**Lab 4 Continued -** Viewing, analyzing and fabricating transmission and reflection holograms; CI feedback session		
TU 25 Oct	**Light Modulators and Displays --** Electro-optic light modulation, index ellipsoid, Pockels and Kerr effect, electro-optic tensor. Longitudinal and transverse modulators - (WH)	6	Calcite xtal, stressed plexiglass
TR 27 Oct	Raman-Nath and Bragg acousto-optic light modulation. Acousto-optic signal processors.		
TU 01 Nov	Photorefractive effect, liquid crystal light modulation, spatial light modulators and displays.		LCD cell
Wk of 10/30	**Lab 5 –** Electro-optic and acousto-optic light modulation cells; Photorefraction in a $BaTiO_3$ crystal.		
TR 03 Nov	**Proposal for final project due**		
TR 03 Nov	**Lasers** - Laser principles, spontaneous and stimulated emission, gain, rate eqns, oscillation frequencies, longitudinal modes, Scanning F-P spectrometer.	7	
TU 08 Nov	Output power, mode locking, optical amplifiers, resonators, specific laser systems.		
Wk of 11/6	**Lab 6 –** He-Ne, CO_2, Yag:Nd, and diode lasers; Coherence length of diode laser; longitudinal modes with scanning F-P		
TR 10 Nov	**Begin Projects**		
TR 10 Nov	**Fourier Optics –** Transforming properties of lenses. Two-lens coherent processors	8	
TU 15 Nov	Optical signal processing. Vander Lugt & matched filters, Joint transform correlator, polychromatic processors		**Lab 7: CTLP (in-class)**
TR 17 Nov	**Optical Waveguides** – Step-index parallel-plate optical waveguide, modes (ray-optics method). Modes. Types of dispersion, bit rate.	9	Fiber samples
TU 22 Nov	**Quiz 2** (open book) - WH		
TR 24 Nov	**No Class** (Thanksgiving Vacation)		
TU 29 Nov	Wave-optics approach, step and graded-index optical fibers, modes in fibers, dispersion compensation. Fiber-optic telecom systems. WDM, add-drop filters, switches.		**Lab 8: Fiber-optics (in-class)**
TR 01 Dec	**Photodetectors** - Thermal and quantum detectors and their characteristics. Responsivity, NEP, D*. Photodetector noise		Photodiode, PMT
TU 06 Dec	Specific detectors (bolometer, PMT, photodiode, avalanche PD, etc).		
TR 08 Dec	**Non-linear optics** – second harmonic generation, wave mixing, phase matching, conversion efficiency.		SHG with Nd-YAG laser & ADP crystal
TU 09 Dec	**Final Project Presentations** (start 1:45 pm; finish 3:45 pm)		