

Date	Topics	P/S	Class Demos
TR 10 Sep	<b>Course Overview</b> – Description of content, expectations and requirements, grading policy, exams, etc, CI overview-D. Unger <b>Basics</b> - 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 15 Sep	Linear, circular and elliptical polarization; quarter & half-wave plates. Jones vectors and matrices	1	Polarizers, magic sheet
	<b>Lab 0</b> – Lab orientation (38-633); Laser safety training, etc		
TR 17 Sep	Reflection, refraction, Snell's law, critical angle, Brewster's angle, reflection and transmission coeffs, dipole model of interaction of light with matter.		
TU 22 Sep	<b>Geometric optics</b> – Lenses and mirrors, telescopes and microscopes; telescope types. Ray-matrix methods, single-lens and multiple-lens system, lens waveguide.	2	Newtonian and Cassegrain telescopes
	<b>Begin Lab 1</b> – Polarization states, dielectric reflection, geometric optics		
TR 24 Sep	<b>Interferometry</b> - Temporal and spatial coherence, two-beam interferometers (Michelson and Mach-Zehnder)		
TU 29 Sep	Multiple-beam interference, finesse, dielectric mirrors	3	
TR 01 Oct	Fabry-Perot and Lummer-Gehrcke interferometers. Antireflection coatings, dielectric mirrors, interference filters.		Soap films, Interference filters/mirrors
	<b>Begin Lab 2</b> – Haidinger Interference fringes (thin glass sides), two-beam and multiple-beam interferometers; Instruction on writing CI exercise on Lab 2.		
TU 06 Oct	<b>Diffraction</b> - Scalar diffraction theory, free-space propagation, spatial frequency, Fresnel diffraction formula.	4	
TR 08 Oct	Fraunhofer approximation, examples, diffraction-based light modulators.		MEMS Mirror (deformable)
	<b>Begin Lab 3</b> – Fresnel and Fraunhofer diffraction from various apertures and objects		
TU 13 Oct	<b>No Class</b> (hand in HW and pick up solutions to PS4)		
TR 15 Oct	<b>Quiz 1</b> ( open book)		
TU 20 Oct	<b>Holography</b> – Transmission holography, image separation conditions, real and virtual images, phase-conjugate waves.	5	
TR 22 Oct	Reflection holography, recording media, effects of recording medium resolution. Computer-generated holograms, real-time holography. Holograms in photorefractive media, holographic optical storage.		Transmission, white light & CGHs

	<b>Begin Lab 4</b> - Viewing, analyzing and fabricating transmission and reflection holograms; CI feedback session		
TU 27 Oct	<b>Light Modulators and Displays</b> -- Electro-optic light modulation, index ellipsoid, Pockels and Kerr effect, electro-optic tensor. Longitudinal and transverse modulators.	6	Calcite xtal, stressed plexiglass
TR 29 Oct	Raman-Nath and Bragg acousto-optic light modulation. Acousto-optic signal processors.		
TU 03 Nov	Photorefractive effect, liquid crystal light modulation, spatial light modulators and displays.		LCD cell
	<b>Begin Lab 5</b> – Electro-optic and acousto-optic light modulation cells; Photorefraction in a BaTiO <sub>3</sub> crystal.		
TR 05 Nov	<b>Lasers</b> - Laser principles, spontaneous and stimulated emission, gain, rate eqns, oscillation frequencies, longitudinal modes, Scanning F-P spectrometer.	7	
TU 10 Nov	Output power, mode locking, optical amplifiers, resonators, specific laser systems.		
	<b>Lab 6</b> – He-Ne, CO <sub>2</sub> , Yag:Nd, and diode lasers; Coherence length of diode laser; longitudinal modes with scanning F-P		
	<b>Proposal for final project due</b>		
TR 12 Nov	<b>Fourier Optics</b> – Transforming properties of lenses. Two-lens coherent processors.	8	
TU 17 Nov	Optical signal processing. Vander Lugt & matched filters, Joint transform correlator, polychromatic processors		<b>Lab 7: CTLP (in-class)</b>
	<b>Begin Projects</b>		
TR 19 Nov	<b>Optical Waveguides</b> – Step-index parallel-plate optical waveguide, modes (ray-optics method). Modes. Types of dispersion, bit rate.	9	Fiber samples
TU 24 Nov	<b>Quiz 2</b> (open book)		
TR 26 Nov	<b>No Class</b> (Thanksgiving Vacation)		
TU 01 Dec	Wave-optics approach, step and graded-index optical fibers, modes in fibers, dispersion compensation. Fiber-optic telecom systems. WDM, add-drop filters, switches.		<b>Lab 8: Fiber-optics (in-class)</b>
TR 03 Dec	<b>Photodetectors</b> - Thermal and quantum detectors and their characteristics. Responsivity, NEP, D*. Photodetector noise, Specific detectors (bolometer, PMT, photodiode, avalanche PD, etc).		Photodiode, PMT
TR 08 Dec	<b>Non-linear optics</b> – second harmonic generation, wave mixing, phase matching, conversion efficiency.		SHG with Nd-YAG laser & ADP crystal
TU 10 Dec	<b>Final Project Presentations</b>		