ECE 5220
Electro-Optical Engineering
Syllabus/Schedule

Semester: Fall 2016	**Section:** 001	**CRN:** 43586	**Credits:** 3

Catalog Description: Explores optical principles; image formation; electroptical materials and components; electroptical detectors, radiometry, and photometry; electroptical devices and instruments; and electroptical systems instrumentation analysis, design, and test..
Intended for senior-level undergraduate and first-year graduate students.

Prerequisites: Sophomore Physics

Course Objectives and Outcomes:
1. Application of STEM knowledge to emission, transmission, and detection in optoelectronics.
2. Systems design, conduct experiments, analyze and interpret measurements data from optoelectronic emitters and sensors.
3. Function on interdisciplinary teams to identify, formulate and solve engineering problems.
4. Commitment to professional ethical responsibility and lifelong learning.
5. Experience and effectiveness in communicating in both oral and written venues.
6. Capability and experience in using techniques, skills and modern engineering tools for engineering practice.

Text:
1. Boreman, G.D., *Basic Electro-Optics for Electrical Engineers*, SPIE; 1998.

2. Uiga, *Optoelectronics*, Prentice Hall**:** 1995 (Loan or purchase)
3. Baker, *Electro-optical Engineering*, Utah State University: 2016 (online)

ISBN: 9780819428066

References:
Hecht, W., *Optics*, Addison Wesley; 2002

Yacoubian, *Optics Essentials: An Interdisciplinary Guide* (Optics and Photonics), CRC Press: 2015
Willers, *Electro-Optical System Analysis & Design*, SPIE; 2013.
Palmer, J., & B. Grant, *The Art of Radiometry*, SPIE, 2010.
Blaker, J.W., and W.M. Rosenblum, *Optics: Introduction for Students of Engineering*, Macmillan; 1995.
Pedrotti, F.L., & L.S. Pedrotti, *Introduction to Optics,* Prentice-Hall; 1993.
Ware, M., et al., *Physics of Light and Optics*, BYU; 2013.
Burle, Inc., *Electro-Optics Handbook*, Davidson Physics; 1975.

Classroom: EL-120	**Time:** MWF 1:30-2:20 p.m.	Homework Google
Lab: EL-104 or 102A Hardbound lab book and protoboard required Guidelines/Standards for Lab Notebooks, Rose-Hulman Institute of Technology, Terre Haute, Ind; 2005.	**Time:** During class time on a Friday	
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Date		**Topic**	**Study**	**Homework Due Date**
WEEK #1		Chapter 1		
			Campus Weather Station Campbell Scientific Solar Array	
August 29	M	Introduction	Photon Calculator Standard Model of Particle Phyx Frequency to Wavelength to Energy Calculator	
31	W	Overview of light Read text	Electromagnetic Waves, D.J. Baker Book Section Electromagnetic Theory & Maxwell's Equation The Electromagnetic Spectrum Zeiss Light Coherence	ONE: 1.2 & 1.3
September 2	F	Coherence of Right Waves	Electromagnetic Wave Animation List of Light Sources	TWO: 1.4 & 1.7
WEEK # 2			OPTICAL EMISSIONS	
5	M	Labor Day	Holiday	---

7	W		Calculator APE	THREE: 2.5 & 2.3
9	F	Radiometry & Photometry	Michigan State Wavelength - Energy Converter BYU Wavelength - Energy Converter	FOUR: 3.2 & 3.3
WEEK # 3				
12	M		Diode Sources	FIVE: 3.4 & 3.5
14	W		Incandescent Sources	SIX: 3.6 & 4.3
16	F	Lab #1: LEDs See Lab instructions in Files section of canvas.	LED Parameters Measurement Items	SEVEN: 5.1 & 5.2
WEEK # 4			Blackbody Calculator Wien's Calculator	
19	M		Radiation Sources	EIGHT
21	W		Diode Lasers	NINE
23	F	Lab #2: Laser Diode Lab	Example Problem	TEN
WEEK # 5			OPTICAL TRANSMISSIONS	
26	M	Quiz #1	Sources	---
28	W		Hyper Physics light and Vision Triangle Calculator	ELEVEN
30	F		Spectral Emissions Wavenumber/Wavelength How to Build a Laser Diode Circuit	TWELVE
WEEK # 6				
October	M	Lenses		THIRTEEN

3				
5	W	Mirrors and Lenses	BYU Optics Text, Ch 9 ABCD Matrix Calculator BYU ABCD Matrices Tutorial	FOURTEEN
7	F	Fiber Optics Demo (Coburn) EL-102	Arcelect Fiber Optic Tutorial Read Chapter 8	FIFTEEN
WEEK #7				
10	M	Optical Systems	Ray Tracing Easy Matrix Calculator Lens Calculator	SIXTEEN
12	W	Lens systems		SEVENTEEN
14	F			
WEEK # 8				
17	M	Microprocessor		---
19	W	Visible detector	Op amp modulators & squared wave spectrum	EIGHTEEN
20	T	Lab #4: Lab on microprocessor-fiber-detector	Set up & test fiber system EL-104	---
21	F	FALL BREAK	NO CLASS	
WEEK # 9				
24	M	Quantum Laser	Presentation by Jordan Jacobson	NINETEEN
26	W	Diffraction	dft decimation Deffraction - Hyper Physics	TWENTY
28	F	Lab #5: Lab on Gratings	Meet in EL-102B Lab Instructions	TWENTY ONE

			Laser Grating Experiment Wavenumber/Wavelength Calculator	
WEEK # 10				
31	M	Interferometers		TWENTY TWO
November 2	W	Spectrometers	Simple FFT and Filtering Tutorial with MATLAB	TWENTY THREE
4	F		Sources⟶Transmission⟶Detectors Fast Fourier Transform	TWENTY FOUR
WEEK # 11			OPTICAL DETECTION	
7	M	Quiz #2	TAOS TSL254R data sheet	---
9	W		Study Chapter 6 BYU Photonics Frequency to Wavelength Calculator	TWENTY FIVE
11	F	Dr. Crowther Presentation	1PC 650NM 6MM 5V 5MW Laser Dot Diode Module Head Red Model # IM131029001	TWENTY SIX
WEEK # 12			Radiometry & Detectors Class, Spring 2016	
14	M			TWENTY SEVEN
16	W		Measurement Techniques for Spectral Characterization for Remote Sensing A Multispectral Approach to Remote Detection of Deer	TWENTY EIGHT
18	F			TWENTY NINE
WEEK # 13				

21	M	Light Detection	Optical Instruments Infrared Spectrometer: Liquid-helium-cooled Rocketborne Circular-variable Filter	THIRTY
23	W	Thanksgiving		---
25	F	Thanksgiving		---
WEEK # 14				
28	M	Measurements	Optical Detectors Noise Calculation Detectors SABER Instrument Design -- Roy Esplin	THIRTY ONE
30	W	Imagers	ELECTRO-OPTICS HANDBOOK Section - American Institute of Physics	THIRTY TWO
December 2	F	TV Camera Tubes	Photoelectron emission MTF or OTF notes CCD's TV Camera Tubes	THIRTY THREE
WEEK # 15				
5	M	SDL's WISE Presentation by Pedro Sevilla		THIRTY FOUR
7	W			THIRTY FIVE
9	F	Last Day of Classes	Review bring Lab Books Return Borrowed Text Books Kingbright T-1 3/4 (5mm) Full Color LED Lamp	No homework
WEEK # 16		Finals Week		

12	M	Final Exam	EL-120 1:30-3:20	Comprehensive
			Tentative Component Grade Weighting: Participation and Attendance = 10% Experiments = 15% Quizzes = 20% Final Exam = 25% Homework = 30%	