PH 332 "Light, Vision and Colors"
Syllabus, Fall 2016

Principal Objectives

The PH332 "Light, Vision and Colors" is one of the Oregon State University's Baccalaureate Core (Bacc Core) Courses. Their principal objective is to instill in students the abilities to:

1. **Analyze relationships among science, technology, and society using critical perspectives or examples from historical, political, or economic disciplines.**
2. **Analyze the role of science and technology in shaping diverse fields of study over time.**
3. **Articulate in writing a critical perspective on issues involving science, technology, and society using evidence as support.**

Specific aims in the Ph332 Course are given below in the Section "Specific aims".

SPECIFIC AIMS AND GENERAL INFORMATION FOR PH 332

Instructor: Tom Giebultowicz ("Dr. Tom");
Office: Weniger 424 **Phone:** 737-1707 **email:** giebultt@onid.orst.edu
Office Hours: TR 11:15-13:00 WNGR 424.
Class meetings: Wngr 149, TR 10:00 – 10:50 am
Labs meet in Wngr 204. There are four lab sections: R 12:00-13:50; R 14:00-15:50; R 16:00-17:50; R 18:00-19:50
Website: http://www.science.oregonstate.edu/~giebultt/COURSES/ph332/

Baccalaureate Core: This course is part of the baccalaureate core and fulfills the requirement for study related to science, technology and society. This course will require students to think critically and creatively, to synthesize ideas and information when evaluating major societal issues, and promote understanding of interrelationships among disciplines.

SPECIFIC AIMS

Student learning outcomes:
After completing the course, the students will be able to define light, color, vision, speed or velocity, wavelength, frequency, period, amplitude, intensity, wavefronts, polarization, the electromagnetic spectrum (radio waves, microwaves, infrared light, visible light, ultraviolet light, x-rays, gamma rays, cosmic rays), blackbody, geometrical optics, light rays, reflection, mirrors, The Law of Reflection, refraction, lenses, index of refraction, Snell's Law of Refraction, critical angle, total internal reflection, dispersion, images, real vs. virtual, upright vs. inverted, convex vs. concave, converging vs. diverging, focal length, image distance, object distance, magnification, optical power, diopters, chromatic aberration, spherical aberration, cornea, iris, pupil, retina, rods and cones, optic nerve, objective, eyepiece, refracting telescope magnification, Weber's Law, monochromatic light, intensity distribution, complementary colors, chromaticity diagrams, interference, constructive, destructive, path difference, interference pattern, diffraction grating, Snell's Law of Diffraction, spectrometer, Huygens' Principle, diffraction, resolving power, scattering, Rayleigh scattering, polarization, unpolarized light, polarizer, analyzer, photoelectric effect, photons, atomic energy levels, emission and absorption spectral lines, lasers, Einstein's Theory of Special Relativity, Einstein's Theory of General Relativity and The Doppler Effect.

After completing the course, the students will be able to solve numerical and symbolic problems which involve frequency and period; speed, frequency and wavelength; The Law of Reflection; index of refraction, true speed and apparent speed; Snell's Law of Refraction; critical angle and indices of refraction; The Lens or Mirror Equation; magnification, image and object distances, image and object heights; optical power and focal length; path difference for two sources of light and an observer; Snell's Law of Diffraction; resolving power and angle of separation; resolving power and wavelength difference; and Malus's Law.

Critical Thinking Skills:
After completing the course, the students will be able to remember and recite information related to light, vision and color, and apply this information according to the rules and principles listed above.

ESSENTIAL INFORMATION

Prerequisites: None. However, a basic understanding of algebra, logarithms, exponents and trigonometry is necessary.

Required Text: *Physics 332 Laboratory Manual* (will be posted in the course Web site); **May be helpful, but not required: :** *Seeing The Light* by Falk, Brill and Stork (Wiley, 1986). It may be helpful, but definitely it is not necessary. I do not advice buying it, unless you can get a copy for a really low price. .

Laboratory: Original work and attendance are required. **Read the lab instructions before coming to lab.** Lab reports are due by the end of the lab period. The lab instructor will grade the lab reports and return them to you at the beginning of the next lab. If you miss a lab, then try to make it up that week. If you can't, then there will be a make-up week at the end of the term. You can make up at most two labs during the last week.

Help Room: Physics TAs will hold their office hours in the Help Room, Weniger 145. A schedule is posted on the door of the room. **If you are not able to get the help that you need in this room, then please come to the instructor's office hours.**

Exams: There will be one midterm and a final. The final will be comprehensive, i.e. it will cover the entire course. The midterm will be given on Thursday, November 3rd during the usual lecture time. The final will be given on Monday, December 05th from 18:00 to 19:50 (6:00 PM.to 7:50 PM). Exams are closed book and closed notes. A formula sheet will be provided by the instructor for each exam, so you do not need to memorize any formulas from the course. **Please arrive to the exam room five to ten minutes early and bring a calculator that has trigonometric (sine, cosine and tangent), logarithm and exponential function keys. Using any other electronic devices at the exams, such as laptops, tablets, and cell phones, is strictly forbidden. It will be treated as "academic dishonesty" and reported to higher OSU authorities.**

Term Paper: You will write a three-to-five page paper (typed, double-spaced) on one of the following topics (or a different one approved by the instructor): **Solar Energy, The Greenhouse Effect, The Ozone Layer, Radar, Laser Technology, Optical Data Storage Devices, Infrared Vision, The Hubble Space Telescope, Adaptive Optics in Astronomy, Atomic and Molecular Spectroscopy, Holography, Eclipses, Mirages, Rainbows, The Photoelectric Effect, Fiber Optics.**

Optional Outline: You may submit an outline of your paper, rough draft or other writing sample for the instructor to read, comment on and return to you at the beginning of the following lecture. It is recommended that you submit an outline, rough draft or other writing sample for feedback before writing the final version of your paper.

Quizzes and **In-class Group Work.** There will be quizzes and in-class group work tasks at almost all class meetings, starting from October 4th. People who miss the class will not get points for the quizzes and tasks administrated on that day. Therefore, it is important not to skip the classes, even though the attendance is not mandatory – too many classes skipped may ruin one's chance for getting an . A.

Academic Integrity: All students are expected to uphold the highest standards of honesty and integrity in their academic work. **All graded work is to be done on an individual basis.** Any incidence of academic dishonesty will be dealt with in accordance with OSU policies.

Students with Disabilities: Students with **documented** disabilities who need special accommodations should make an appointment with the instructor as soon as possible to discuss the accommodations. Students' privacy is our top concern – therefore, the instructor should be contacted by e-mail in order to schedule an individual appointment at a time most convenient to the student (possibly, not during the regular office hours).

Final Grades: Your final grade will be computed as follows: Midterm 15%, Final 30%, Term Paper 15%, Lab Reports 25%, and quizzes and in-class group work 15%.

The grade scale is as follows:

93 - 100% = A	73 - 76% = C
90 - 92% = A-	70 - 72% = C-
87 - 89% = B+	67 - 69% = D+
83 - 86% = B	63 - 66% = D
80 - 82% = B-	60 - 62% = D-
77 - 79% = C+	0 - 59% = F

Schedule of classes -- Planned

(small changes still possible)

WEEK	DATE	TOPIC	READING	LAB EXPERIMENTS
0	Sept 22	Introduction	None	No Labs
01	Sept 27	Fundamental Properties	1.1 - 1.4	2: The Law of Reflection 3: Image Formation in a Plane Mirror
	Sept 29	Reflection, Mirrors	2.1 - 2.4	
02	Oct 04	Refraction	2.5 - 2.6	4: The Law of Refraction 5: Reversibility
	Oct 06	Lenses	3.1 - 3.3	
03	Oct 11	The Human Eye and Vision, Part 1	3.4 - 3.5	6: Dispersion and Total Internal Reflection 8: Light and Color
	Oct 13	Optical Instruments	5.1 - 5.3	
04	Oct 18	The Human Eye and Vision, Part II	6.1 - 6.4	7: Converging Lens
	Oct 22	The Human Eye and Vision: Part II	7.1 - 7.3	
05	Oct 25	Color; Interference & Diffraction	9.1 - 9.6	9: Two-Slit Interference 15: The Diffraction Grating
	Oct 27	Interference and diffraction **Optional Outline due at 11:00 AM in Wngr 149**	12.1 - 12.5	
06	Nov 01	**Review for Midterm**	None	18: Introduction (to be done as pre-lab) 21: The Telescope
	Nov 03	**Midterm Exam from 10:00 AM to 10:50 AM (venue TBA)**		
07	Nov 08	Colors Part II; Polarization	9.1 – 9.3	10: Polarization
	Nov 10	Polarization:	13.1, 13.4, 13.6, 13.8-10	
08	Nov 15	3D vision, Part I	9.4 ; 8.1-8.4	
	Nov 17	3D vision, Part II; 3D movies (“Avatar”)	Notes on the Web Page	No Labs (Thanksgiving Week)
09	Nov 22	Modern Physics: selected topics	15.1 - 15.3	Make-Up Week
	Nov 24	**Thanksgiving Holiday**		
10	Nov 20	Modern Physics, cont.; Laser.		None
	Dec 01	**Review for Final** **Term Paper due at 11:00 AM in Wngr 149**		None