Curriculum Proposal Cover Sheet

LSC Use Only Proposal No: LSC Action-Date:	*UWUCC Use Only* Proposal No: 12-119f UWUCC Action-Date: App-4/9/13 Senate Action Date: App-4/30/13

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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Check all appropriate lines and complete all information. Use a separate cover sheet for each course proposal and/or program proposal.

1. Course Proposals (check all that apply)

_X_ New Course ____ Course Prefix Change ____ Course Deletion

____ Course Revision ____ Course Number and/or Title Change ____ Catalog Description Change

Current course prefix, number and full title: _____

Proposed course prefix, number and full title, if changing: EOPT 130-Introduction to Optics

2. Liberal Studies Course Designations, as appropriate

____ This course is also proposed as a Liberal Studies Course (please mark the appropriate categories below)

____ Learning Skills ____ Knowledge Area ____ Global and Multicultural Awareness ____ Writing Intensive (include W cover sheet)

____ Liberal Studies Elective (please mark the designation(s) that applies – must meet at least one)

____ Global Citizenship ____ Information Literacy ____ Oral Communication

____ Quantitative Reasoning ____ Scientific Literacy ____ Technological Literacy

3. Other Designations, as appropriate

____ Honors College Course ____ Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

____ Catalog Description Change ____ Program Revision ____ Program Title Change ____ New Track

____ New Degree Program ____ New Minor Program ____ Liberal Studies Requirement Changes ____ Other

Current program name: _____

Proposed program name, if changing: _____

5. Approvals	Signature	Date
Department Curriculum Committee Chair(s)		2/11/13
Department Chairperson(s)		2/11/13
College Curriculum Committee Chair		4/2/13
College Dean		4/3/13
Director of Liberal Studies (as needed)		
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate		
UWUCC Co-Chairs	Gail Sechrist	4/9/13

Received
APR 4 2013
Liberal Studies

Syllabus of Record

I. Catalog Description

EOPT 130 – Introduction to Optics (3c-3l-4cr)
Prerequisites: PHYS 111/112 or PHYS 131/132

Introduces the basic principles and theory of light as a geometrical ray and an electromagnetic wave, and provides elementary treatments of light sources, image formation and important wave phenomena. Topics include properties of light, reflection, refraction, absorption, transmission, interference, diffraction, polarization. Theory is applied to common applications and devices used in the photonics field.

II. Course Outcomes

Upon successful completion of this course, the student will be able to:

1. Explain and discuss terminology related to optical devices using ray and wave description of light.
2. Apply the laws of reflection and refraction to determine paraxial image position and size for simple reflecting and transmitting optical systems using graphical construction methods and calculations.
3. Explain and discuss the effects of aberrations on optical system performance.
4. Apply basic theory of interference, diffraction, and polarization to articles in professional literature and in selecting optical components.
5. Explain diffraction effects of light beams and their dependence on wavelength and aperture size.
6. Discuss the physics concepts of geometric and wave optics and applications such as thin film coatings.
7. Design and use simple optical systems, such as beam expanders, microscopes, telescopes, prism spectrometers and interferometers.
8. Operate He-Ne (Helium-Neon) lasers, optical power meters, and a variety of other optical devices safely.
9. Use matrix optics to discuss a simple optical system
10. Demonstrate the basic operation of optical design software.
11. Demonstrate skills in performing elementary physics experiments to obtain results and form accurate scientific conclusions.

III. Detailed Course Outline

1. Introduction (8 hours)

a) Properties of light (amplitude, frequency, wavelength, speed, polarization, photon energy)
b) Spectra of light sources (atomic, molecular, solid, thermal)
c) Reflection and refraction in geometric optics and wave optics
d) Phase and phase shifts, and optical path difference

Reading Material:
Fundamentals of Light and Lasers Text Module 1-1
Light Sources and Wave Optics Text Module 5-4 *Reflection and Refraction*

2. Absorption and Transmission **(2 hours)**

a) Absorption and optical density
b) Filters (neutral density, bandpass, cutoff)

Reading Material:
Light Sources and Wave Optics Text Module 5-5 *Propagation*
Wave Optics/Components and Devices Text: Module 6-6 *Filters and Beamsplitters*

3. Reflection and Refraction at Plane and Curved Surfaces (6 hours)

a) Reflection at plane and curved surfaces
b) Refraction at plane surfaces
c) Prisms and plates
d) Thin lens and thin lens combinations
e) Thick lenses and lens aberrations

Reading Material:
Geometric Optics Text Module 2-1 *Reflection,* Module 2-2 *Refraction,* Module 2-4 *Imaging with a Single Lens, and* Module 2-5 *Imaging with Multiple Lenses*

4. Interference **(6 hours)**

a) Wave properties related to interference (phase difference, coherence)
b) Young's double slit (path differences results in phase differences)
c) Methods of producing phase differences (path differences, reflections)
d) 2-beam interference: thin film coatings, wedges
e) Some 2-beam interferometers: Newton's rings, Michelson interferometer
f) Multiple-beam interference (applied to Fabry-Perot etalon)

Reading Material:
Light Sources and Wave Optics Text Module 5-6 *Interference*
Wave Optics/Components and Devices Text: Module 6-5 *Mirrors and Etalons*

Midterm **(1 hour)**

5. Diffraction **(6 hours)**

a) Fresnel and Fraunhofer approximations (when is Fraunhofer approximation valid?)
b) Important diffraction patterns (circular and rectangular apertures and obstacles)
c) Double-slit and many slit diffraction
d) Transmission and reflection gratings
e) Resolution of imaging systems

Reading Material:
Light Sources and Wave Optics Text Module 5-7 *Diffraction*
Wave Optics/Components and Devices Text: Module 6-9 *Gratings*

6. Polarization **(6 hours)**

a) Types of polarization (linear, circular, elliptical, un-polarized)
b) Methods of producing polarized light (reflection, absorption, refraction, scattering)
c) Methods for modifying polarization ($\lambda/2$ and $\lambda/4$ plates, variable retarders)
d) Methods for measuring state of polarization
f) More applications: Brewster windows in laser cavities, optical isolators, stress- induced birefringence, Q-switches

Reading Material:
Light Sources and Wave Optics Text Module 5-8 *Polarization*
Wave Optics/Components and Devices Text: Module 6-10 *Polarizers* and Module 7-8 *Electro-Optic Modulators*

7. Simple Optical Systems **(3 hours)**
a) Human eye and cameras
b) Microscopes
c) Telescopes

Reading Material:
Geometric Optics Text Module 2-8 *Matrix Optics*

8. Matrix Optics **(3 hours)**
a) Review of matrix algebra
b) Matrix for each optical component
c) Matrix for an optical system

Reading Material:
Geometric Optics Text Module 2-7 *Optical Systems*

9. Holography **(1 hours)**
a) Introduction
b) Basic setup for making holograms
c) Exposing and processing the hologram
d) Reconstructing the image
e) Other setups for making holograms

Reading Material:
Light Sources and Wave Optics Text Module 5-9 *Holography*
Wave Optics/Components and Devices Text: Module 7-5 *Holographic Techniques and Equipment*

Final Exam (to be held during finals week)

IV. Course Outline for Labs (14 lab periods, 3 hours per lab)

Lab 1 – Thermal Radiation: Exercises include optical alignment and construction of Galilean and Keplerian beam expanders

Lab 2 - Reflection and Refraction: Exercises include measuring reflected and refracted light intensity for different polarizations and angles of incidence

Lab 3 - Absorption and Transmission: Exercises include measuring transmission of filters and other objects and determining the optical density and/or absorption coefficient

Lab 4 - Prism Spectroscopy and Refractive Index Measurement: Exercises include setting up a prism spectroscopy and using it to measure the refractive index

Lab 5 - Image Formation from Spherical Mirrors and thin Lenses: Exercises include

measuring the focal length of the spherical mirrors and thin lenses and studying their image properties

Lab 6 - Interferometer Alignment and Michelson Interferometer: Exercises include aligning and calibrating a Michelson interferometer and using it to measure some physical parameters.

Lab 7 - Fabry-Perot Interferometer: Exercises include aligning and calibrating a Fabry-Perot interferometer and using it to measure the wavelength of a laser.

Lab 8 - Common Fraunhofer Diffraction Patterns: Exercises include observing diffraction patterns of circular and rectangular objects and using the patterns to make quantitative measurements

Lab 9 - Diffraction Grating Spectrometer: Exercises include calibrating a simple transmission grating spectrometer and using it to measure wavelengths of atomic spectral lines

Lab 10 - Polarization I: Exercises include producing and analyzing linearly-polarized light

Lab 11 - Polarization II: Exercises include using retarders to modify the polarization state of light beam and measuring unknown polarization states.

Lab 12 – Optical Instruments: Exercises include setting up a telescope and a microscope and measuring their magnifications.

Lab 13 - Holography: Exercises include setting up a hologram, exposing and processing the hologram, and reconstructing the image.

Lab 14 – Optical design software: Exercises include designing a lens using optical design software and evaluating the performance of the lens and optimizing the design.

V. Evaluation Methods

The final grade will be determined as follows:

Exams (25%)
Quizzes (25%)
Lab Reports (25%)
Homework (25%)

VI. Example Grading Scale

Grading Scale: A: ≥90% B: 80-89% C: 70-79% D: 60-69% F: <60%

VII. Undergraduate Course Attendance Policy

The course attendance policy will conform to the University Attendance Policy in the Undergraduate Catalog

VIII Required Textbook(s), Supplemental Books and Readings

CORD Communications "Light Sources and Wave Optics 3rd Ed", by Center for Occupational Research and Development ISBN-10: 1578375495, 2012

CORD Communications "Wave Optics/ Components and Devices, 2nd Edition" by Center for Occupational Research and Development ISBN-10: 1578376262, 2010

CORD Communications "Fundamentals of Light and Lasers, 2nd Edition", by Center for Occupational Research and Development ISBN-10: 1578373891, 2008

CORD Communications "Geometric Optics, 2nd Edition," by Center for Occupational Research and Development ISBN-10: 1578375118,2008

IX. Special Resource Requirements

Calculator, compass, protractor, two triangles (45-45-90 & 30-60-90 degrees); and pencils of 3 different colors.

X. Bibliography

CORD Communications "Fundamentals of Light and Lasers" Center for Occupational Research and Development ISBN-10: 1578376386, 2008

CORD Communications "Light Sources and Wave Optics 3rd Ed" Center for Occupational Research and Development ISBN-10: 1578375495, 2012

Donnelly, Judith and Massa,Nicholas "Light: Introduction to Optics and Photonics; 2nd Edition", ISBN: 0981531822, New England Board of Higher Education, 2007

Hecht, E *"Optics"*, 4th Edition, ISBN 0201304252, Addison Wesley, 2001

Naess, Robert O. "Optics for Technology Students", by, ISBN: 0-13-011294-1, Prentice Hall, 2001

Page, Lewis J. Pinson "Electro-Optics", ISBN: 0894647083, Krieger Pub Co., 1993

Pedrotti, Frank L , Pedrotti, Leno M , Pedrotti Leno S , "Introduction to Optics" (3rd Edition), ISBN-10: 0131499335, Addison-Wesley 2006

Saleh, Bahaa and Teich, Malvin Carl "Fundamentals of Photonic" (Wiley Series in Pure and Applied Optics) 2nd Edition)", ISBN-10: 0471358320 Wiley-Interscience; 2007

Course Analysis Questionnaire

Section A: Details of the Course

A1 How does this course fit into the programs of the department? For what students is the course designed? (majors, students in other majors, liberal studies). Explain why this content cannot be incorporated into an existing course.

The course will be mandatory for electro-optics and laser engineering technology (EOLET) degree candidates. Students from other departments may also enroll in the course if prerequisites are met. Currently EOLET students take EOPT 110 Geometric Optics and EOPT 120 Wave Optics. Since the Physics Department is bringing the EOLET program to the main campus, the students will take the existing 8-credit Physics courses either PHYS 111/112 or

131/132 as the prerequisite. Hence the students are much better prepared with the physics and optics background. To remedy this, we need to combine the EOPT 110 and EOPT 120 into one course, to eliminate these topics already covered in the prerequisites.

A2 Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements.

The course will be added to replace the EOPT 110 and EOPT 120, and to the list of course requirements leading to A.S. EOLET degree.

A3 Has this course ever been offered at IUP on a trial basis (e.g. as a special topic) If so, explain the details of the offering (semester/year and number of students).

The course has not been offered at IUP.

A4 Is this course to be a dual-level course? If so, please note that the graduate approval occurs after the undergraduate.

The course will not be a dual-level course.

A5 If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures?

The course is a fixed credit course

A6 Do other higher education institutions currently offer this course? If so, please list examples (institution, course title).

Several other universities and community colleges offer this course. Below is an example of the catalog description from the course LFO-211 Photonic-Optic Principles & Components (4.00 cr.) *offered at Camden County College*:
"This course covers the fundamentals of geometric and physical optics, including Huygen's principle, wave motion, properties of waves, and optical instruments."

A7 Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation.

The skills emphasized in the proposed course are included in the Photonics Skills Standard for Technicians, developed by CORD (Center for Occupational Research and Development). This standard was compiled by industry to meet the needs of the 21st century photonics workplace.

Section B: Interdisciplinary Implications

B1 Will this course be taught by instructors from more than one department? If so, explain the teaching plan, its rationale, and how the team will adhere to the syllabus of record.

The course will be taught by physics faculty only.

B2 What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments that clarify their attitudes toward the proposed change(s).

No equivalent courses are taught by other departments.

B3 Will this course be cross-listed with other departments? If so, please summarize the department representatives' discussions concerning the course and indicate how consistency will be maintained across departments.

The course will not be cross-listed with other departments.

Section C: Implementation

C1 Are faculty resources adequate? If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedule(s) of current faculty. What will be taught less frequently or in fewer sections to make this possible? Please specify how preparation and equated `workload will be assigned for this course.

An additional faculty member will not be needed when the course is added. This course to be added will replace the other two courses which are not needed any more. Preparation will be needed during the first course offering, due to the laboratory nature of the course. However, the preparation should not be extensive because the EOPT 110 and EOPT 120 were already developed.

C2 What other resources will be needed to teach this course and how adequate are the current resources? If not adequate, what plans exist for achieving adequacy? Reply in terms of the following:

*Space
*Equipment
*Laboratory Supplies and other Consumable Goods
*Library Materials
*Travel Funds

The course will be offered at Indiana Campus and the laboratory facilities and space are adequate. The only other necessary resource needed for course implementation is lab suppliers and other consumable goods (electronics components), which can be covered from the operating budget. No library and travel funds will be required for course implementation.

C3 Are any of the resources for this course funded by a grant? If so, what provisions have been made to continue support for this course once the grant has expired? (Attach letters of support from Dean, Provost, etc.)

No resources are funded by a grant.

C4 How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?

This course will be offered once every two years to the EOLET students.

C5 How many sections of this course do you anticipate offering in any single semester?

One section of the course will be offered.

C6 How many students do you plan to accommodate in a section of this course? What is the justification for this planned number of students?

Class size will be determined by instrumentation and facilities.

C7 Does any professional society recommend enrollment limits or parameters for a course of this nature? If they do, please quote from the appropriate documents.

No recommended enrollment limits exist for courses of this nature. Enrollment limitations are nearly dependent on the laboratory facilities at the offering institution.

C8 If this course is a distance education course, see the Implementation of Distance Education Agreement and the Undergraduate Distance Education Review Form in Appendix D and respond to the questions listed.

The proposed course is not a distance education course.

Section D: Miscellaneous

Include any additional information valuable to those reviewing this new course proposal.

Experience obtained during past ten years of instruction in this IUP EOLET program has been used to identify curriculum changes necessary for EO graduates to succeed in the workplace. The move of the program to the Indiana Campus will largely benefit the students in the program because they can streamline the course sequence by taking the Physics, Math and other courses offered at the Indiana Campus. This will help greatly in students' study by minimizing their frustrations caused by the lack of an adequate physics and math background. As a result, we can delete the contents if they have been covered already in the prerequsites.