

LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action Date:
		02-124	App - 4/22/03	App - 4/29/03

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person Kenneth E. Hershman	Email Address hershman@iup.edu
Proposing Department/Unit Physics	Phone 724 357 2371

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

1. Course Proposals (check all that apply)

New Course Course Prefix Change Course Deletion

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

<i>Current Course prefix, number and full title</i>	<i>Proposed course prefix, number and full title, if changing</i> PHYS 105 The Physics of Light and Sound
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2. Additional Course Designations: check if appropriate

This course is also proposed as a Liberal Studies Course. Other: (e.g., Women's Studies, Pan-African)

This course is also proposed as an Honors College Course.

3. Program Proposals

New Degree Program Program Title Change Other

New Minor Program New Track

<i>Current program name</i>	<i>Proposed program name, if changing</i>
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4. Approvals		Date
Department Curriculum Committee Chair(s)	Kenneth E Hershman	4/18/03
Department Chair(s)	Kenneth E Hershman	4/18/03
College Curriculum Committee Chair	[Signature]	09/18/03
College Dean	John D. [Signature]	04/18/03
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail Schiust	4/22/03

* where applicable

APR 19 2003

Syllabus of Record

I Catalog Description

PHYS 105	The Physics of Light and Sound	3 class hours 0 lab hours
Prerequisites:	None	(3c, 0l, 3cr)

The study of light and sound as applied in the production of objects of art and the production of music. Includes the study of vision, light in nature, photography and artistic media; the study of hearing, musical sound, musical instruments, and room acoustics.

II. Course Objectives.

Students will be able to

1. Explain how light and sound waves are produced and how they propagate through and interact with the environment.
2. Describe the physics involved in photography and in human sight.
3. Describe the spectral differences in natural and artificial lighting and how they are produced.
4. Describe the physics involved in human hearing and in the electronic recording and reproduction of sound.
5. Describe the phenomena of reflection, refraction, diffraction, interference, and scattering of sound and light.
6. Describe the generation of musical tones by common musical instruments.
7. Describe how the elements of artistic media are used to control the visual effects incorporated in objects of art.
8. Describe the acoustical factors incorporated in lecture and musical halls

III. Detailed Course Outline

The course is divided into three units of approximately equal length. The course content is listed topically below in the order in which it will be taught by lecture (based on three one-hour lecture periods per week).

A. The Physics of Waves (11 hr)

1. Overview of the course and introduction to waves
2. Characteristics and propagation of mechanical waves
3. Reflection and refraction and dispersion of waves
4. Diffraction, phase shift, and interference
5. Scattering and polarization
6. Doppler shift, superposition, and resonance
7. Traveling waves
8. Standing waves in 1 dimensional vibrating systems, modes of vibration
9. Standing waves in limited fixed and free media of 2 or 3 dimensions
10. Energy, intensity, complex waves, spectra
11. Exam 1 (1 hr)

B. Acoustics and Music (14 hr)

12. The characteristics, production and propagation of sound
13. Musical tones, intervals, harmonics, scales, frequency, pitch
14. The physics of the ear, hearing, loudness

15. Equal loudness curves, phons, pitch discrimination
 16. Tone generation in musical instruments, percussion, plucking, bowing
 17. Reeds embouchure, voice, vibrato
 18. Strings, violins, Chladini patterns, guitars, frets
 19. Pianos, soundboards
 20. Drum heads, standing waves in surfaces, percussion instruments
 21. Exam 2 (1 hr)
 22. Resonating tubes and cavities, woodwinds, valves, fingerholes
 23. Brass instruments, mouthpieces, types of horns
 24. Flutes, organs, whistles
 25. Room acoustics, lecture halls, music halls, reverberation
 26. Digital reproduction, speakers, public address systems
- C. Light and Its Application to Art (14 hr)
27. Electromagnetic waves - Nature of Light, the color spectrum, polarization
 28. Generation of and spectra of light sources, blackbody radiation, excited gases, lasers
 29. Color wheels, color systems, hue, saturation, brightness
 30. Additive and subtractive color mixing, absorption, transmittance, gels
 31. Color printing, paints, inks
 32. Reflectance, surface texture, diffuse & spectral reflections, mirrors, virtual & real images
 33. Exam 3 (1 hr)
 34. Refraction, lens, lens combinations
 35. Physics of color vision, resolving power
 36. Camera basics, telescopes, microscopes
 37. Photography, Ag colloidal suspension film, film speed, color photography, types of cameras
 38. Digital recorded film, exposure, contrast, lighting, light meters
 39. Factors that control field of view, depth of field, perspective
 40. Color in art, dyes, pigments, glasses, paint, paint mixing
 41. Pointillism, color TV screens, light and color in the atmosphere
 42. Rainbows, refraction by the atmosphere, blue sky, red sunsets, haze
 43. Final Exam (2 hr)

IV. Evaluation Methods.

The final grade for this course will be determined as follows:

- 80% Exams. Four exams (20% each) consisting of items of multiple choice, short answer, essay or problem items.
- 10% A minimum of 10 short lecture quizzes
- 10 % Paper. The student will make a study of the development of an art technique, photography, instrument development, recording development, etc. in an area chosen by them with instructor approval. The paper will be word processed and will be no shorter than pages, 8.5" x 11", using 12 point font and 1" margins

Grading Scale: A: 90 – 100 %, B: 80 < 90 %, C: 70 < 80 %, D: 60 < 70 %, F: < 60 %

V. Attendance Policy.

Students are expected to conform to the attendance policy as stated in the Undergraduate Course Attendance Policy as described in the IUP Undergraduate Catalog. Students are expected to attend and participate in class and to take lecture quizzes and exams.

VI. Required textbook(s), supplemental books and readings.

**Light and Color in Nature and Art*, Herman and Cummings, Wiley, 1983

**Acoustical Foundations of Music*, John Backus, W. W. Norton, 1990

* These textbooks are the standard textbooks in these fields. The basic science of light and sound has not changed in the last two decades and these texts can be inexpensively obtained by the student. If more recent publications are desired, the student may refer to those listed in the bibliography.

VII. Special Resource Requirements.

None

IX. Bibliography.

"A – Z of Creative Photography", Lee Frost, Watso-Guptill Publications, 1998.

"*Light Science: Physics of the Visual Arts*", T Rossing, C Chiaverina, Springer Verlag, 1999

"*Fundamentals of Musical Acoustics*" Arthur Benade, Dover Publications, 1990

"*The Science of Music*", Robin Naconie, Oxford University Press, 1997

"*Physics and the Sound of Music*" John Rigden, Wiley, 1985

"*Colour and Optical Properties of Materials*" Richard Tilley, Wiley, 2000

"*Color and Light in Nature*" D Lynch, W Livingston, Cambridge University Press, 2001

"*Photography*", 7th Edition Barbara London, Prentice Hall, 2001

"*Photography and the Art of Seeing*", Freeman Patterson, Key Porter Books, 2001

"*Art & Physics: Parallel Visions of Space Time and Light*", Leonard Shlain, Quill, 1993

Journals

"Scientific American"

"Photography"

2. Course Analysis Questionnaire

Section A: Details of the Course

A1 *How does this course fit into the programs of the department?*

This course is designed to be a liberal studies natural science non-laboratory elective required by the College of Fine Arts. It utilizes those aspects of physics and their basic application to music and the visual arts and is not taught as such in any existing physics course.

A2 *Does this course require changes in the content of existing courses or program requirements?*

This course does not require a content change in any existing courses and no program must be changed as a result of the adoption of this course.

A3 *Has this course ever been offered at IUP on a trial basis?*

This particular course has not been offered on a trial basis.

A4 *Is this course to be a dual-level course?* This course is not a dual level course.

A5 *If this course may be taken for variable credit?*

This course cannot be taken for variable credit.

A6 *Do other higher education institutions currently offer this course?*

Yes, similar courses include:

East Stroudsburg University of Pennsylvania: PHYS 110 "Sound, Waves and Light"

Edinboro University of Pennsylvania: PHYS 111 "Nature of Sound", (Gen Ed.) and PHYS 111, "Nature of Light and Color" (Gen. Ed.)

Millersville University of Pennsylvania, PHYS 205 "Musical Acoustics"

Bloomsburg University of Pennsylvania, PHYS 106 "The Science of Sound"

Duke University, Physics36/Music/36, "Acoustics and Music"

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.*

No.

Section B: Interdisciplinary Implications

B1 *Will this course be taught by instructors from more than one department?*

No, it is intended that this course be taught by one instructor in the Physics Department.

B2 *What is the relationship between the content of this course and the content of courses offered by other departments?*

This course addresses the basic phenomena that are the foundation of art and music and as such is addressed incidentally in art and music major courses to the extent needed for a specific application of sound or light. The involved sciences are not taught as a concerted whole in any other course.

B3 *Will this course be cross-listed with other departments?*

No

Section C: Implementation

C1 Are faculty resources adequate?

Faculty resources are adequate.

C2 *What other resources will be needed to teach this course and how adequate are the current resources?*

This course will be taught in Room 107 of Weyandt Hall which is adequate to meet the projected enrollment. The equipment to teach this course is presently available in the Physics Department. There are no Laboratory Supplies or other Consumable Goods or Library Materials or Travel Funds needed to implement this course

C3 *Are any of the resources for this course funded by a grant?*

No

C4 *How frequently do you expect this course to be offered?*

Each semester.

C5 *How many sections do you anticipate offering?*

One section will be offered each semester.

C6 *How many students do you plan to accommodate in a section of this course?*

According to the College of Fine Arts the projected enrollment is approximately 80 students per semester.

C7 *Does any professional society recommend enrollment limits or parameters for a course of this nature?*

There are no enrollment limits set by a professional society for a course of this nature

C8 *This course will not be offered as a distance education course.*

No

D. Miscellaneous

No additional information is necessary.

Liberal Studies Office
110 Gordon Hall ext. 7-5715

Mary Sadler
email: msadler

Date: April 21, 2003

To: Dr. Kenneth Hershman
Physics Department

From: Mary Sadler, Director Liberal Studies



Subject: PHYS 105 The Physics of Light and Sound

At the April 17, 2003 meeting, the Liberal Studies Committee approved PHYS 105 The Physics of Light and Sound for the non-laboratory science category in the Liberal Studies Program. Thank you for submitting a strong proposal and for attending to our minor recommendations so promptly.

Our approval will be forwarded to the UWUCC where the proposal is in the process of review as a new course.

CC: Dr. John Eck, Dean
UWUCC