

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

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Proposing Department/Unit Physics	Phone 7-4590 or 7-2370

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)

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: **PHYS 105 The Physics of Light and Sound**

Proposed course prefix, number and full title, if changing:

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

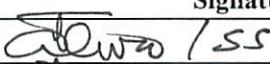


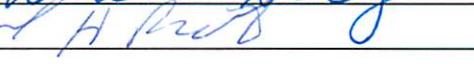
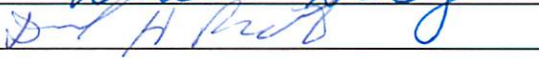

Honors College Course Other: (e.g. Women's Studies, Pan African)

4. Program Proposals

Catalog Description Change Program Revision Program Title Change New
 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)		4/23/2012
Department Chairperson(s)		4/23/2012
College Curriculum Committee Chair		4-23-12
College Dean		4/23/12
Director of Liberal Studies (as needed)		5/12/13
Director of Honors College (as needed)		
Provost (as needed)		
Additional signature (with title) as appropriate		
UWUCC Co-Chairs		5/7/13

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MAY 9 2013 MAY 3 2013 APR 16 2013 APR 24 2012
Liberal Studies Liberal Studies Liberal Studies Liberal Studies

Syllabus of Record

Overview of changes from original syllabus of record – updating to a new Liberal Studies Curriculum

I. CATALOG DESCRIPTION

PHYS 105 The Physics of Light and Sound

(3c-01-3cr)

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. A non-laboratory course for Liberal Studies requirements

II. COURSE OBJECTIVES:

Students will:

Objective 1:

Describe how light and sound waves are produced and how they propagate through and interact with the environment.

EUSLO 1 and 2:

Informed Learners and Empowered Learners

Rationale:

Demonstrations and assignments will illustrate the nature of light and sound as wave phenomena. Students will then relate the nature of the phenomena to examples they experience in their daily lives.

Objective 2:

Discuss the principles of physics in the formation of images in photographic digital imaging and human sight.

EUSLO 1 and 2:

Informed Learners and Empowered Learners

Rationale:

Demonstrations and assignments will illustrate the process of image formation. Understanding how sight and imaging works is enabling knowledge.

Objective 3:

Compare the spectral differences in natural and artificial lighting and describe how they are produced.

EUSLO 1 and 2:

Informed Learners and Empowered Learners

Rationale:

Various light sources will be used in combination with diffraction gratings to show the nature of light. Assignments will be given to augment the demonstrations. This will inform the learner on the use of light and empower him or her to use lighting correctly.

Objective 4:

Describe the principles of physics used in human hearing and the electronic recording and reproduction of sound.

EUSLO 1,2and 3:

Informed Learners, Empowered Learners and Responsible Learners

Rationale:

Demonstrations and assignments will illustrate the nature of sound recording. This will allow the students determine the fidelity of sound recording devices. Students will demonstrate knowledge and understanding of the interrelationships within and across disciplines of sound recording and physics. The discussion on human hearing will include the topic of hearing impairment. Discussion of this disability should effect students concern for social justice toward the disabled.

Objective 5:

Construct mathematical models of reflection, refraction, diffraction, interference, and scattering of sound and light.

EUSLO 1 and 2:

Informed Learners and Empowered Learners

Rationale:

Assignments will allow the students to make predictions on various aspects of wave propagation. This will enable them to determine qualities necessary for good optical or audio instruments. Students will interpret, analyze, and use numerical and graphical data. Students will demonstrate knowledge and understanding of the ways of modeling the natural, world. The skill of modeling will allow the learner to analyze other phenomena in their professional and personal life.

Objective 6:

Apply physics principles to the generation of musical tones by common musical instruments.

EUSLO 1 and 2:

Informed Learners and Empowered Learners

Rationale:

Demonstrations and assignments will illustrate the nature of musical instruments. This will allow the students to determine how various instruments produce sound. Students will demonstrate critical thinking skills, including analysis, application, and evaluation.

Objective 7:

Describe how the elements of artistic media are used to control the visual effects incorporated in objects of art.

EUSLO 1 and 2:

Informed Learners and Empowered Learners

Rationale:

Assignments will test students' knowledge of additive and subtractive color mixing, and its application in various art forms. Assignments will also require students to demonstrate knowledge and understanding of the interrelationships within and across disciplines of physics and visual art.

Objective 8:

Describe the acoustical factors incorporated in lecture and musical halls.

EUSLO 1 and 2:

Informed Learners and Empowered Learners

Rationale:

Assignments will require students to demonstrate knowledge and understanding of the interrelationships within and across disciplines. Assignments will also require students to demonstrate information literacy skills, including the ability to access, evaluate, interpret, and use information from a variety of sources.

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.

- A. The Physics of Waves (11 hours)
 - 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, and 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 hour)
- B. Acoustics and Music (14 hours)
 - 1. The characteristics, production and propagation of sound
 - 2. Musical tones, intervals, harmonics, scales, frequency, pitch
 - 3. The physics of the ear, hearing, loudness
 - 4. Equal loudness curves, phons, pitch discrimination
 - 5. Tone generation in musical instruments, percussion, plucking, and bowing
 - 6. Reeds embouchure, voice, vibrato
 - 7. Strings, violins, Chladini patterns, guitars, frets
 - 8. Pianos, soundboards
 - 9. Drum heads, standing waves in surfaces, percussion instruments
 - 10. Exam 2 (1 hour)
 - 11. Resonating tubes and cavities, woodwinds, valves, finger holes
 - 12. Brass instruments, mouthpieces, types of horns
 - 13. Flutes, organs, whistles
 - 14. Room acoustics, lecture halls, music halls, reverberation
 - 15. Digital reproduction, speakers, public address systems
- C. Light and Its Application to Art (14 hours)
 - 1. Electromagnetic waves - Nature of Light, the color spectrum, polarization
 - 2. Generation of and spectra of light sources, blackbody radiation, excited gases, lasers
 - 3. Color wheels, color systems, hue, saturation, brightness
 - 4. Additive and subtractive color mixing, absorption, transmittance, gels
 - 5. Color printing, paints, inks
 - 6. Reflectance, surface texture, diffuse & spectral reflections, mirrors, virtual & real images
 - 7. Exam 3 (1 hour)
 - 8. Refraction, lens, lens combinations
 - 9. Physics of color vision, resolving power
 - 10. Camera basics, telescopes, microscopes
 - 11. Photography, Ag colloidal suspension film, film speed, color photography, types of cameras
 - 12. Digital recorded film, exposure, contrast, lighting, light meters
 - 13. Factors that control field of view, depth of field, perspective

14. Color in art, dyes, pigments, glasses, paint, and paint mixing
15. Pointillism, color TV screens, light and color in the atmosphere
16. Rainbows, refraction by the atmosphere, blue sky, red sunsets, haze

Final Exam

(2 hours)

IV. EVALUATION METHODS.

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

- 80% Three exams (20% each) plus a final exam (20%) consisting of items of multiple choice, short answer, essay or problem items.
- 10% 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 5 pages, 8.5" x 11", using 12 point font and 1" margins. References for the paper must also be approved by the instructor.

V. GRADING SCALE

Score			Grade
100 %	to	90%	A
89%	to	80%	B
79%	to	70%	C
69%	to	60%	D
Less than		60%	F

VI. ATTENDANCE POLICY

The course attendance policy will comply with the University Undergraduate attendance policy

VII. Required textbook(s), supplemental books and readings:

Text Book:

Light and Color in Nature and Art, Williamson 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

NOTE – These are old titles. The text books on this subject are far and few between. The only recent texts that would contain appropriate content and level for the non-science majors are text books for survey physical science classes. That is the type of book we use for SCI 105 Physical Science I, and this class is much different from a Physical Science class.

Supplemental Readings:

Evolution of the Eye, Lamb, Trevor D. **Scientific American**, Jul 2011, Vol. 305 Issue 1, p 64-69
Music and the Brain, Weinberger, Norman M. **Scientific American**. Nov 2004, Vol. 291 Issue 5, p 88-95.

VIII. Special Resource Requirements.

None

IX. Bibliography

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

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

London, B. *"Photography"*, 7th Edition, Prentice Hall, 2001

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

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

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

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

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

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

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

Journals: "Scientific American", "Photography"

SUMMARY OF CHANGE

The primary objectives, topics and course activities are not being significantly changed. The purpose of this course revision is to map the course objectives to the new Liberal Studies Expected Undergraduate Student Learning Objectives. (EUSLO) This has been incorporated into the course objectives above.

Liberal Studies Course Approval Checklist Instruction Sheet

Use this checklist for all Liberal Studies categories other than writing-intensive sections; a different checklist is available for this. If you have questions, contact the Liberal Studies Office, 103 Stabley, telephone 357-5715

This checklist is intended to assist you in developing your course to meet IUP's Criteria for Liberal Studies and to arrange your proposal in a standard order for consideration by the Liberal Studies Committee (LSC) and the University-Wide Undergraduate Curriculum Committee (UWUCC). When you have finished, your proposal will have these parts:

X Standard UWUCC Course Proposal Cover Sheet, with signatures and Liberal Studies course designation checked

X Course syllabus in UWUCC format

NA UWUCC course analysis questionnaire Needed only if this is a new course not previously approved by the University Senate These are not considered by the LSC but will be forwarded to the UWUCC along with the rest of the proposal after the LSC completes its review

This is not a new course; it has been approved by the University Senate

X Assignment instructions for one of the major course assignments and a grading rubric or grading criteria for that assignment

X Answers to the four questions listed in the Liberal Studies Course Approval General Information (one page)

Submit the original of the completed proposal to the Liberal Studies Office (103 Stabley) In addition to the signed hard copy, email the proposal as a Word or RTF file attachment to Liberal-Studies@iupedu

Please Number All Pages

Liberal Studies Course Approval General Information
On a separate sheet of paper, please answer these questions

(Do not include this sheet or copies of the questions in your proposal; submit only the answers)

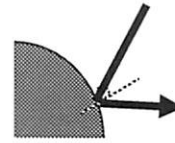
1. This course has always been taught by one instructor, and will continue to be so for the near future.
2. This class investigates mathematical descriptions of the physical world. While this topic is not an emphasis of the course, ethnic and racial minorities as well as women are discussed when appropriate.
3. As part of the course requirements, students must write a term paper. As with any research paper, the author must do a literature review. For the paper in this class, students must search databases and other library references to find the resources necessary to write the paper. The students must find a collection of non-fiction resources as part of the paper writing process. These references must be approved by the course instructor. The collection of articles collected and read by the student will fulfill the liberal studies committee outside reading requirements.
4. The breadth of PHYS 105 is much narrower than PHYS 131. In the introductory major's course, great care is taken to develop the mathematical skills necessary for Physics. PHYS 131 goes into the depth of physics problems solving and quantitative analysis. This course is much less mathematical and covers just the areas of light and sound.

Part III letters of support

Not necessary - We are only mapping the course objectives to the new Liberal Studies objectives; the course objectives themselves are not changing. It is common knowledge this is happening University wide.

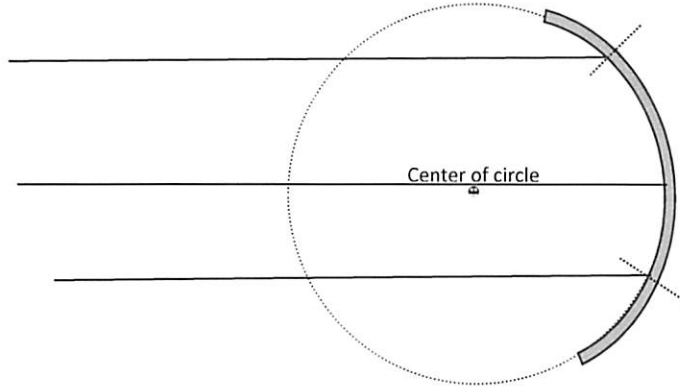
Sample assignment with rubric

The law of reflection: The angle of incidence = the angle of



reflection:

Here is a diagram of two parallel rays hitting a concave mirror. Use the law of reflection to finish the path of the rays. Identify the focal point of the mirror.



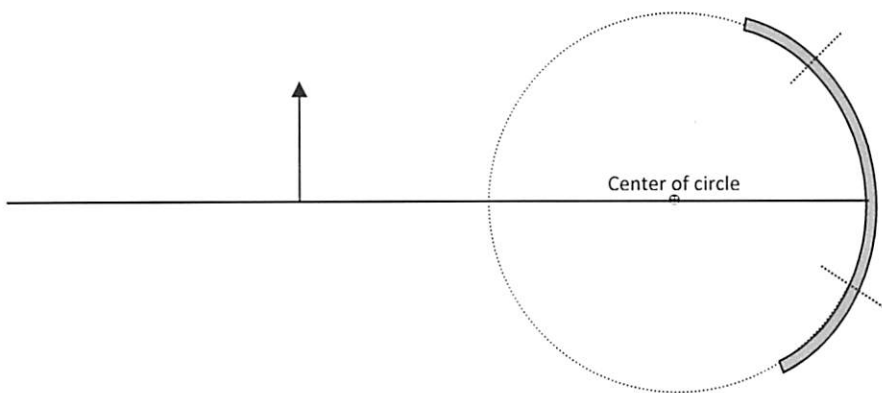
Where is the center of the mirror? _____

focal point in relationship to the radius of curvature of the

If a concave mirror has a center of curvature of 10 cm, what is the focal point for that mirror?
_____ from the mirror

For concave mirrors, rays entering the mirror parallel to the optical axis pass through the _____.
Rays passing through the focal point pass through the _____

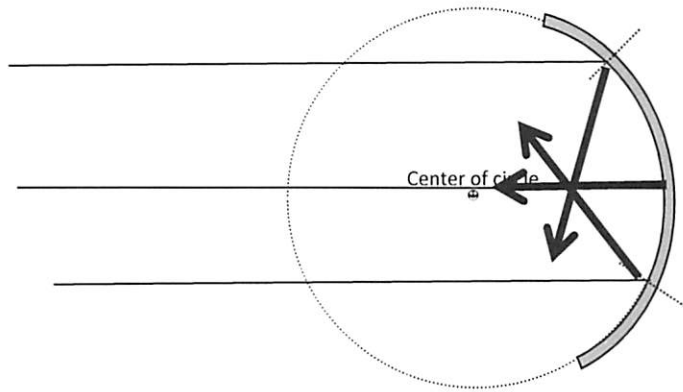
Now, use the rules you formed above and trace **two** rays to find the image of the object below:



Scoring Rubric

10 points total, points indicated in question. Score = number correct / 10

Here is a diagram of two parallel rays hitting a concave mirror. Use the law of reflection to finish the path of the rays. Identify the focal point of the mirror. (3 points, one point for each correct ray)



Where is the focal point in relationship to the center of the radius of curvature of the mirror?

Half way between the center of the curvature and the mirror. (1 point)

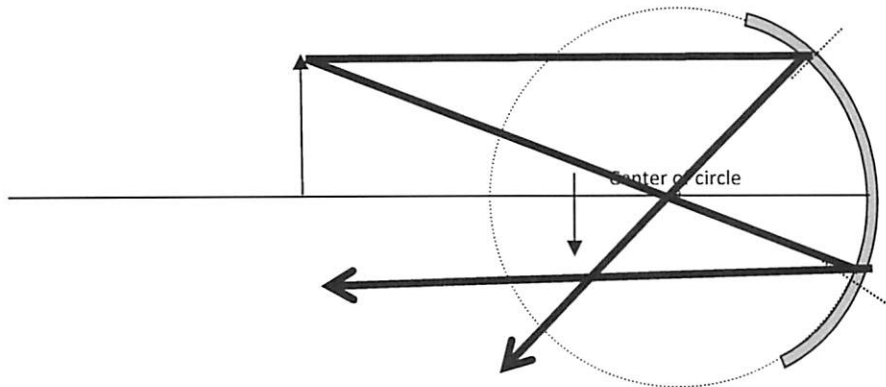
If a concave mirror has a center of curvature of 10 cm, what is the focal point for that mirror?

5 cm from the mirror (1 point)

For concave mirrors, rays entering the mirror parallel to the optical axis pass through the **focal point**. (1 point)

Rays passing through the focal point pass through the **center of curvature** (1 point)

Now, use the rules you formed above and trace **two** rays to find the image of the object below: (3 points, one point for each correct ray, one for the image))



OLD SYLLABUS OF RECORD

Catalog Description

PHYS 105 The Physics of Light and Sound

(3c-01-3cr)

Prerequisites: None

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 photographic digital technology and in human sight.
3. Compare the spectral differences in natural and artificial lighting and how they are produced.
4. Contrast the physics involved in human hearing and in the electronic recording and reproduction of sound.
5. Construct mathematical models of reflection, refraction, diffraction, interference, and scattering of sound and light.
6. Apply physics principles to 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 hours)

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, and 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 hour)

B. Acoustics and Music

(14 hours)

1. The characteristics, production and propagation of sound
2. Musical tones, intervals, harmonics, scales, frequency, pitch
3. The physics of the ear, hearing, loudness
4. Equal loudness curves, phons, pitch discrimination
5. Tone generation in musical instruments, percussion, plucking, and bowing
6. Reeds embouchure, voice, vibrato
7. Strings, violins, Chladini patterns, guitars, frets
8. Pianos, soundboards
9. Drum heads, standing waves in surfaces, percussion instruments
10. Exam 2
11. Resonating tubes and cavities, woodwinds, valves, finger holes
12. Brass instruments, mouthpieces, types of horns
13. Flutes, organs, whistles
14. Room acoustics, lecture halls, music halls, reverberation
15. Digital reproduction, speakers, public address systems

(1 hour)

C. Light and Its Application to Art

(14 hours)

1. Electromagnetic waves - Nature of Light, the color spectrum, polarization
2. Generation of and spectra of light sources, blackbody radiation, excited gases, lasers
3. Color wheels, color systems, hue, saturation, brightness
4. Additive and subtractive color mixing, absorption, transmittance, gels
5. Color printing, paints, inks
6. Reflectance, surface texture, diffuse & spectral reflections, mirrors, virtual & real images
7. Exam 3
8. Refraction, lens, lens combinations
9. Physics of color vision, resolving power
10. Camera basics, telescopes, microscopes
11. Photography, Ag colloidal suspension film, film speed, color photography, types of cameras
12. Digital recorded film, exposure, contrast, lighting, light meters
13. Factors that control field of view, depth of field, perspective
14. Color in art, dyes, pigments, glasses, paint, and paint mixing
15. Pointillism, color TV screens, light and color in the atmosphere
16. Rainbows, refraction by the atmosphere, blue sky, red sunsets, haze
17. Final Exam

(1 hours)

IV. Evaluation Methods.

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

- 80% 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. References for the paper must also be approved by the instructor.

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.