

Eastern Illinois University
Revised Course Proposal
PHY 1071, Physics of Sound and Music

Please check one: ☐ New course ☒ Revised course

PART I: CATALOG DESCRIPTION

1. **Course prefix and number, such as ART 1000:** PHY 1071
2. **Title (may not exceed 30 characters, including spaces):** Physics of Sound and Music
3. **Long title, if any (may not exceed 100 characters, including spaces):** Physics of Sound and Music
4. **Class hours per week, lab hours per week, and credit [e.g., (3-0-3)]:** (3-0-3)
5. **Term(s) to be offered:** ☒ Fall ☒ Spring ☐ Summer ☐ On demand
6. **Initial term of offering:** ☒ Fall ☐ Spring ☐ Summer **Year:** 2011
7. **Course description (not to exceed four lines):** Development of basic ideas in physics of motion and applications to vibrations and sound waves. Introductory concepts in perception of loudness, pitch, and timbre. Fundamental ideas in acoustics of rooms and acoustics of musical instruments. Does not count toward a physics major or minor. P1 901
8. **Registration restrictions:**
 - a. **Identify any equivalent courses** (e.g., cross-listed course, non-honors version of an honors course). none
 - b. **Prerequisite(s)**, including required test scores, courses, grades in courses, and technical skills. Indicate whether any prerequisite course(s) MAY be taken concurrently with the proposed/revised course. none
 - c. **Who can waive the prerequisite(s)?**
☐ No one ☒ Chair ☐ Instructor ☐ Advisor ☐ Other (Please specify)
 - d. **Co-requisites** (course(s) which MUST be taken concurrently with this one): PHY 1072: Physics of Sound and Music Laboratory
 - e. **Repeat status:** ☒ Course may not be repeated.
☐ Course may be repeated to a maximum of hours or times.
 - f. **Degree, college, major(s), level, or class** to which registration in the course is restricted, if any: none
 - g. **Degree, college, major(s), level, or class** to be excluded from the course, if any: none
9. **Special course attributes** [cultural diversity, general education (indicate component), honors, remedial, writing centered or writing intensive] none
10. **Grading methods** (check all that apply): ☒ Standard letter ☐ C/NC ☐ Audit ☐ ABC/NC
("Standard letter"—i.e., ABCDF—is assumed to be the default grading method unless the course description indicates otherwise.)

- 11. Instructional delivery method:** ☒ lecture ☐ lab ☐ lecture/lab combined ☐ independent study/research
☐ internship ☐ performance ☐ practicum or clinical ☐ study abroad
☐ other

PART II: ASSURANCE OF STUDENT LEARNING

1. List the student learning objectives of this course:

Students will be able to:

- A.** Analyze physical systems and apply the fundamental laws of physics to qualitatively explain the behavior of those systems.
- B.** Describe the meaning of physical measurements of sound.
- C.** Communicate scientific ideas.
- D.** Solve quantitative physics problems that involve simple algebra.
- E.** Communicate basic principles of wave propagation and phenomena.

- a. If this is a general education course, indicate which objectives are designed to help students achieve one or more of the following goals of general education and university-wide assessment:**

- **EIU graduates will write and speak effectively.**
- **EIU graduates will think critically.**
- **EIU graduates will function as responsible citizens.**

- b. If this is a graduate-level course, indicate which objectives are designed to help students achieve established goals for learning at the graduate level:**

- **Depth of content knowledge**
- **Effective critical thinking and problem solving**
- **Effective oral and written communication**
- **Advanced scholarship through research or creative activity**

2. Identify the assignments/activities the instructor will use to determine how well students attained the learning objectives:

Objective Activity	A. Analyze and apply physical laws	B. Describe the meaning of physical measurements of sound.	C. Communicate scientific ideas	D. Solve quantitative problems	E. Communicate principles of wave phenomena
Homework	X	X	X	X	X
Quizzes	X	X	X	X	X
Hour exams	X	X	X	X	X
Final exam	X	X	X	X	X

3. Explain how the instructor will determine students' grades for the course:

A student's score will be determined from a weighted average of performance on homework, quizzes, hour exams, and the final exam. The weighting for the components is:

Homework and quizzes	30%
Hour exams	40%
Final exam	30%

Based on the total possible score, grades will be assigned based on the percentage of points earned by the student:

A semester grade of A will be assigned if students score is greater than or equal to 90%

A semester grade of B will be assigned if students score is greater than or equal to 80% but less than 90%

A semester grade of C will be assigned if students score is greater than or equal to 70% but less than 80%

A semester grade of D will be assigned if students score is greater than or equal to 60% but less than 70%

A semester grade of F will be assigned if students score is less than 60%

4. For technology-delivered and other nontraditional-delivered courses/sections, address the following:

- a. Describe how the format/technology will be used to support and assess students' achievement of the specified learning objectives: n/a
- b. Describe how the integrity of student work will be assured: n/a
- c. Describe provisions for and requirements of instructor-student and student-student interaction, including the kinds of technologies that will be used to support the interaction (e.g., e-mail, web-based discussions, computer conferences, etc.): n/a

5. For courses numbered 4750-4999, specify additional or more stringent requirements for students enrolling for graduate credit. These include:

- a. course objectives; n/a
- b. projects that require application and analysis of the course content; and n/a
- c. separate methods of evaluation for undergraduate and graduate students. n/a

6. If applicable, indicate whether this course is writing-active, writing-intensive, or writing-centered, and describe how the course satisfies the criteria for the type of writing course identified. (See Appendix *.) n/a

PART III: OUTLINE OF THE COURSE

Provide a week-by-week outline of the course's content. Specify units of time (e.g., for a 3-0-3 course, 45 fifty-minute class periods over 15 weeks) for each major topic in the outline. Provide clear and sufficient details about content and procedures so that possible questions of overlap with other courses can be addressed. For technology-delivered or other nontraditional-delivered courses/sections, explain how the course content "units" are sufficiently equivalent to the traditional on-campus semester hour units of time described above.

Week	Topic
1	<p>Newton's First Law (2 hours); Linear Motion (1 hour)</p> <ul style="list-style-type: none"> • Newton's First Law of Motion-Inertia • Net Force and Support Force • The Equilibrium Rule • Speed and Velocity
2	<p>Linear Motion (cont. 1 hour); Newton's Second Law of Motion (2 hour)</p> <ul style="list-style-type: none"> • Acceleration • Free Fall • Force Causes Acceleration • Friction • Mass and Weight
3	<p>Newton's Second Law of Motion (cont. 1 hour); Newton's Third Law of Motion (1 hour); Exam Review and Discussion (1 hour)</p> <ul style="list-style-type: none"> • Mass Resists Acceleration • Newton's Second Law of Motion • Free Fall and Non-Free Fall • Forces and Interaction • Newton's Third Law of Motion
4	<p>Hour Exam #1 (1 hour); Momentum (2 hours)</p> <ul style="list-style-type: none"> • Momentum • Impulse • Impulse Changes Momentum • Conservation of Momentum
5	<p>Energy (3 hours)</p> <ul style="list-style-type: none"> • Work and Power • Mechanical Energy, Potential Energy, and Kinetic Energy • Work-Energy Theorem • Conservation of Energy
6	<p>Introduction in Vibrations and Waves (1 hour), Sound (1 hour), and Musical Sound (1 hour)</p> <ul style="list-style-type: none"> • Vibration of a Pendulum • Wave Motion and Wave Description • Transverse Waves and Longitudinal Waves • Origin of Sound and Nature of Sound in Air • Speed of Sound in Air • Natural Frequency and Resonance • Pitch, Sound Intensity, and Sound Loudness • Classification of Musical Instruments
7	<p>Exam Review and Discussion (1 hour); Hour Exam #2 (1 hour); The Nature of Sound (1 hour)</p> <ul style="list-style-type: none"> • Acoustics and Music • Organizing Our Study of Sound

	<ul style="list-style-type: none"> • The Physical Nature of Sound • The Speed of Sound • Pressure and Sound Amplitude
8	<p>Waves and Vibrations (2 hours); Sources of Sound (1 hour)</p> <ul style="list-style-type: none"> • The Time Element in Sound • Waveforms • Simple Harmonic Oscillation • Classifying Sound Sources • Percussion Instruments • String Instruments
9	<p>Sound Propagation (3 hours)</p> <ul style="list-style-type: none"> • Reflection: Examples of reflection of light and sound waves • Diffraction: Examples of diffraction of light and sound waves • Outdoor music • Three generalizations of outdoor music • Designs for outdoor musical theaters • Interference • Derivation of conditions for constructive and destructive interference
10	<p>Sound Propagation (cont. 1 hour); Homework Discussion (1 hour); Sound Intensity and Its Measurement (1 hour)</p> <ul style="list-style-type: none"> • Numerical examples involving constructive and destructive interference • Amplitude, Energy, and Intensity • Sound Level and the Decibel Scale
11	<p>Sound Intensity and Its Measurement (cont. 2 hours); Exam Review and Discussion (1 hour)</p> <ul style="list-style-type: none"> • Sound Level and the Decibel Scale (cont.) • Numerical examples involving sound intensity, sound level and the decibel scale • Inverse-Square Law
12	<p>Hour Exam #3 (1 hour); Sound Spectra (1 hour); Discussion of a take-home assignment on Sound Intensity Level (1 hour)</p> <ul style="list-style-type: none"> • The Harmonic Series • Prototype Steady Tones • Periodic Waves and Fourier Spectra • Fourier Spectrum of a Periodic Square Wave
13	<p>Sound Spectra (cont. 1 hour); Homework Discussion (1 hour); Piano and Guitar Strings (1 hour)</p> <ul style="list-style-type: none"> • Fourier Spectrum • Fourier Components • Fourier Synthesis • Fourier Analysis

	<ul style="list-style-type: none"> • Natural Modes of a Thin String
14	Piano and Guitar Strings (cont. 1 hour); Homework Discussion (1 hour); Exam Review and Discussion (1 hour) <ul style="list-style-type: none"> • Numerical examples involving natural modes of a thin string • Vibration Recipes for Plucked Strings
15	Hour Exam #4 (1 hour); Brief Introduction of Formants (0.5 hour); Final Exam Review and General Review (1.5 hours)

PART IV: PURPOSE AND NEED

1. Explain the department's rationale for developing and proposing the course.

This course has been taught for over 20 years (renumbered more recently).

- If this is a general education course, you also must indicate the segment of the general education program into which it will be placed, and describe how the course meets the requirements of that segment. n/a
- If the course or some sections of the course may be technology delivered, explain why. n/a

2. Justify the level of the course and any course prerequisites, co-requisites, or registration restrictions.

This is a 1000-level course taught at a level consistent with other 1000-level physics courses and does not require any prerequisites. PHY 1072 (Physics of Sound and Music Laboratory) is the laboratory component of this course.

3. If the course is similar to an existing course or courses, justify its development and offering.

- If the contents substantially duplicate those of an existing course, the new proposal should be discussed with the appropriate chairpersons, deans, or curriculum committees and their responses noted in the proposal. n/a
- Cite course(s) to be deleted if the new course is approved. If no deletions are planned, note the exceptional need to be met or the curricular gap to be filled. This course already exists.

4. Impact on Program(s):

- For undergraduate programs, specify whether this course will be required for a major or minor or used as an approved elective. This course is required for Communication Disorders Science majors.
- For graduate programs, specify whether this course will be a core requirement for all candidates in a degree or certificate program or an approved elective. n/a

If the proposed course changes a major, minor, or certificate program in or outside of the department, you must submit a separate proposal requesting that change along with the course proposal. Provide a copy of the existing program in the current catalog with the requested changes noted. n/a

PART V: IMPLEMENTATION

1. **Faculty member(s) to whom the course may be assigned:** Physics Department faculty

If this is a graduate course and the department does not currently offer a graduate program, it must document that it employs faculty qualified to teach graduate courses. n/a

2. **Additional costs to students:** none

Include those for supplemental packets, hardware/software, or any other additional instructional, technical, or technological requirements. (Course fees must be approved by the President's Council.)

3. **Text and supplementary materials to be used (Include publication dates):**

Conceptual Physics, 10th edition, by Paul G. Hewitt, 2009

Musical Acoustics, 2nd edition, by Donald E. Hall, 1991

PART VI: COMMUNITY COLLEGE TRANSFER

If the proposed course is a 1000- or 2000-level course, state either, "A community college course may be judged equivalent to this course" OR "A community college course will not be judged equivalent to this course." A community college course will not be judged equivalent to a 3000- or 4000-level course but may be accepted as a substitute; however, upper-division credit will not be awarded. A community college course may be judged equivalent to this course.

PART VII: APPROVALS

Date approved by the department or school: August 12, 2011

Date approved by the college curriculum committee: August 17, 2011

Date approved by the Honors Council (*if this is an honors course*):

Date approved by CAA: September 1, 2011

***In writing-active courses**, frequent, brief writing activities and assignments are required. Such activities -- some of which are to be graded -- might include five-minute in-class writing assignments, journal keeping, lab reports, essay examinations, short papers, longer papers, or a variety of other writing-to-learn activities of the instructor's invention. Writing assignments and activities in writing-active courses are designed primarily to assist students in mastering course content, secondarily to strengthen students' writing skills. In **writing-intensive courses**, several writing assignments and writing activities are required. These assignments and activities, which are to be spread over the course of the semester, serve the dual purpose of strengthening writing skills and deepening understanding of course content. At least one writing assignment is to be revised by the student after it has been read and commented on by the instructor. In writing-intensive courses, students' writing should constitute no less than 35% of the final course grade. In **writing-centered courses** (English 1001G, English 1002G, and their honors equivalents), students learn the principles and the process of writing in all of its stages, from inception to completion. The quality of students' writing is the principal determinant of the course grade. The minimum writing requirement is 20 pages (5,000 words).

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