

Colonnade Program Course Proposal: Explorations Category

1. What course does the department plan to offer in Explorations? Which subcategory are you proposing for this course? (Arts and Humanities; Social and Behavioral Sciences; Natural and Physical Sciences)

Physics 130- Acoustics of Music and Speech
Subcategory: Natural and Physical Sciences

2. How will this course meet the specific learning objectives of the appropriate subcategory. Please address **all** of the learning outcomes listed for the appropriate subcategory.

PHYS 130 Acoustics of Music and Speech Objectives	Explorations: Natural Sciences
Principles of sound are introduced through guided discovery experiments, where students work through structured hypothesis testing activities to discover for themselves the principle ideas, so they are to a significant extent experiencing and engaging in scientific inquiry themselves.	<i>1. Demonstrate an understanding of the methods of science inquiry.</i>
The basic concepts of sound generation, frequency, loudness, pitch, harmonics and detection are combined with the scientific ideas of force and motion to provide a quantitative analysis of sound.	<i>2. Explain basic concepts and principles in one or more of the sciences.</i>
The production of sound in vocal, musical and electronic forms is explored in a lab setting requiring hypothesis testing, prediction and feedback to correct and understand sound interactions.	<i>3. Apply scientific principles to interpret and make predictions in one or more of the sciences.</i>
Connections between science and technology are made with special sessions devoted to musical instruments with a focus on student centered practice and production of sound. Sound production and hearing are explored within the context of speech production and common disorders in vocal and hearing impairments. The use of sound and music in stage and church settings is investigated with field trips to organ and chamber rooms where high quality sound production is required.	<i>4. Explain how scientific principles relate to issues of personal and/or public importance</i>

3. Syllabus statement of learning outcomes for course. NOTE: In multi-section courses, the same statement of learning outcomes must appear on every section's syllabus.

As a result of working through this course, you will be able to:

- Explain how sound is produced in vocal and musical settings including the relationship between geometry and harmonics.
- Read and interpret various sound intensity and frequency plots containing information on sound quality, timbre and faithfulness.
- Identify various harmonic and overtone combinations that have the same fundamental leading to different sounds of the same note.
- Explain the nature of science and scientific knowledge, including the role of evidence and theory, how it is developed and modified, and interaction of science with technology and society linking music and speech to local communities.

4. Brief description of how the department will assess the course for these learning objectives.

Essential learning Outcome	Assessment
<i>1. Demonstrate an understanding of the methods of science inquiry.</i>	Students explore scientific analysis of sound production using mathematical calculations, and narrative explanations in a lab based upon sound production. These lab grades will be used as the assessment of the application of the methods of scientific inquiry.
<i>2. Explain basic concepts and principles in one or more of the sciences.</i>	The results of an exam covering key scientific principles: wave addition, subtraction, and related phenomena using harmonic diagrams will be compiled and used to assess basic scientific concepts.
<i>3. Apply scientific principles to interpret and make predictions in one or more of the sciences.</i>	Each student will have a specific assignment on sound production and acoustics that will involve making and testing predictions in a lab setting. The results will be used to assess making and interpreting predictions.
<i>4. Explain how scientific principles relate to issues of personal and/or public importance</i>	Each student give a classroom presentation connecting course concepts to their own academic field via a musical instrument, a speech communication application, an acoustic stage design and usage issue or a chamber geometry acoustics problem. The results will be used to assess student understanding of how scientific principles relate to issues of personal and/or public importance

5. How many sections of this course will your department offer each semester?

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6. Please attach sample syllabus for the course.

Attached is a syllabus from the current semester. This is a course that has evolved over many semesters, and will continue to evolve as the instructors identify better ways to address the learning objective

Acoustics of Speech and Music PHYS 130

1. **Instructor:** Physics
2. **Class Meetings:** MWF 12:40-1:35 PM, TCCW 201
3. **Office Hours:** MWF: 1:40PM -2:40 PM
4. **Textbook:** *Physics of Sound, 3ed*, Richard E. berg, David G. Stork, Addison Wesley, 2004, **ISBN-10:** 0131457896
5. **Readings From:** *Communication Sciences and Disorders: A Contemporary Perspective 2ed*, Laura M. Justice, Pearson, 2009 **ISBN-10:** 0135022800
6. **Course Description:** This course is a basic study of the production and detection of sound.
7. **Colonnade Goals:**

Students in this course will be able to:

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| <i>1. Demonstrate an understanding of the methods of science inquiry as used in the acoustics lab.</i> |
| <i>2. Explain basic concepts and principles in the sound and acoustics areas.</i> |
| <i>3. Apply scientific principles to interpret and make predictions used in the labs setting applied to sound and acoustics.</i> |
| <i>4. Explain how scientific principles relate to issues of personal and/or public importance from an application of acoustics to sound production and usage.</i> |

8. **Attendance:** Consistent with the WKU policy you are responsible for the content and conduct of each and every class. Chronic tardiness or missing of more than three classes will significantly reduce your grade independent of your current average; any unexcused absences beyond this will be grounds for failing the class. Please be courteous with respect to others speaking, the use of computers and cell phones.
9. **Homework:** Each chapter and topical unit requires a significant homework and reading assignment to be completed on time and in a formal style. Group discussion is encouraged to help understand material but you must hand in your own work at the beginning of the due date class period. Mastery of homework material is expected and students will be asked to discuss and develop these skills during the class period, this will include summaries of readings. Late homework is not accepted.
10. **Presentations and Directed Readings:** each group student will formally write up one sound related problem selected in consultation with the instructor as a report and present as a PowerPoint presentation to the class. The report grade is 50 points and must include a quiz problem. Reading summaries will be presented by students directly from the textbook on relevant sections for discussion.
11. **Quizzes:** Unannounced in-class quizzes will be given that will be similar to the homework assignments. They will be averaged with the homework and normalized to one exam grade.

12. **Exams:** There will be three one hour exams, of 100 points, and a comprehensive final exam, of 150 points.
13. **Grades:** Instantaneous grade values are calculated on a weighted percentage basis. You may check your grade at any time. The final term grade is based upon the percentage of total points with cutoff grades determined by weighting functions by:

$$G(t) = \sum_{i=1}^N w_j \frac{(HW_i + Q_i)}{N} + \left(\frac{Re}{50} \right) 100 + \sum_{k=1}^3 \frac{E_k}{3} + \left(\frac{FE}{150} \right) 100$$

where at any time t if $G(t) > 90\%$ the resulting grade is in the A range and if $G(t) < 50\%$ the resulting grade is in the F range. Homework is weighted with a sharp discontinuity that gives an F grade to any student who does not hand in the homework independent of the exam average, **late homework is not accepted.**

14. **Students with disabilities: Student Disability Services**

In compliance with university policy, students with disabilities who require academic and/or auxiliary accommodations for this course must contact the Office for Student Disability Services in Downing University Center, A-200. The phone number is 270 - 745- 5004. Please DO NOT request accommodations directly from the professor or instructor without a letter of accommodation from the Office for Student Disability Services.

15. **Safety:** review emergency exits and procedures during the first class period.

16. **Academic Honesty:** Students are expected to adhere to the WKU standards of integrity and honesty with regards to cheating and plagiarism. All work you turn in must be your own, WKU uses *TERM PAPER*© to check against web resources for plagiarism, any violations will be handled by the Judicial Board.

17. **Final Exam:** Thursday, from 1:00 PM-3:00 PM.

18. **Assignments:** Homework each week following the table below.

Homework

Week	Chapter		Page	Problem	Points
1	Ch. 1	Units Scale	p. 8	6,7, 9	30
2	Ch.2	Pressure and Sound Waves	p.47	3,8,10,13	40
3	Ch. 3	Forces, Frequency, Pitch	p.65	1,9,12	30
4	Ch. 4	Decibels, force, resonance	p.88	6,9,10,12	40
5	EXAM I	Sound Pressure			100
6	Ch. 5	Solids and deformation, superposition	p.122	2,12,15,21	40
7	EOS	Harmonics and higher order sounds, resonance	Presentation	Group	

8	Ch. 6	Voice and air flow	p. 157	2,8,9,10	40
	EXAM II	Waves			100
9	Ch. 7	Music, instruments and recording	p.180	1,4,6	30
10	Ch. 8	Hearing, reflections and rooms	p.218	4,10,16	30
11	Exam III	Harmonics			100
12	Ch. 9	Dysfunctional sound production Halls and design for sound authenticity	p.268	1,4,8	30
13	Ch. 10	Artificial voice reconstruction, applications	p.307	1,5,8	30
Finals: Thursday	Final Exam	Comprehensive	1:00-3:00 PM		150
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