NIU Course Syllabus for Physics 180

ACOUSTICS, MUSIC AND HEARING

Spring Semester, 2013, Tuesday and Thursdays, 11:00 pm-12:15 pm

Course Description:
Elementary study of acoustics designed especially for students with an interest in music, speech and hearing, the theatre, or sound recording. Topics include the waves and vibrations, perception and measurement of sound, acoustics of musical instruments, speech and singing, and the acoustics of rooms. 3 credits.

Course Objectives: Develop an understanding of:
• A basic, working knowledge of the physics of force, velocity, energy, vibration, elasticity and simple harmonic motion and how they apply to the properties of sound waves.
• The mechanics of various types of sound waves - what they look like, how they are produced by instruments, interact with other sound waves, and propagate through various materials. The physics of waves - interference, refraction, dispersion, standing waves, frequency spectrum
• How sound is detected and perceived by the human ear and brain beginning with pressure variations
• The basics of sound making and detection equipment and room acoustics.

Remarks: PHYS 181 Lab course is not required to pass this PHYS 180 course. It is independent to this course in terms of credits. However, some programs/departments may elect PHYS 181 as required. Please check with your own department. And, PHYS 181 requires this PHYS 180 to register.

The most ESSENTIAL in this class is: COMMUNICATION!

Class room: Du Sable Hall 322

Instructor: Yasuo Ito.  La Tourette 218 and/or 101 (Electron Microscopy Lab)
Tel: 815-753-6397, -8027
e-mail: vito@niu.edu

Office Hours: Tuesdays, Thursdays and Fridays 2:00 - 3:00pm; Other hours by an appointment.
Textbook/Materials: *ESSENTIALS*
- *Why You Hear What You Hear*, Eric J. Heller, Princeton

*Please read your textbook before coming to the class!!*

**Other helpful reference textbooks:**
- "Physics in the Arts”, 2nd edition P.U.P.A. Gilbert, W. Haeberli
- "Introduction to Sound, acoustics for the Hearing and Speech Sciences, 3rd edition” by C.E. Speaks.

**Blackboard web course:** The lecture viewgraphs (Power Point files), homework assignments and their solutions will be posted on the Blackboard web course. Therefore, it is essential for you to familiarize with the Blackboard web course.

**Tests and Grading (tentative):**

10% Attendance. Attendance is *MANDATORY*. Students must attend at least 85% of the course (for example, 25 out of 30 classes). *Attendance may be checked as a form of attendance sheets and/or conceptual quizzes.* If you know your absence prior to the class, please let me know at that point. Otherwise, please let me know by email within 2 days from your absent day(s). In case of medical absence, it is the best for you to present me a doctor’s note when you contact me.

40% Homework *ESSENTIAL!!* Assigned problems, essays, and other forms of assignments. I expect you to submit all of the given assignments.

25% Midterm Exams February 14th and March 28th during the class hour.

25% Final Exam (comprehensive) Tuesday May 7th, 10 – 11:50 am.

To pass this course, you must score at least 50% on the homework AND at least 50% overall.

There will be makeup tests available if you have a time conflict on the above exam schedule. Please obtain written approval (email is fine) from me *1 week prior to the exam*. If you cannot take tests due to your medical conditions/illness, please a note from Health Services or your physician (doctor).
COMMUNICATION IS ESSENTIAL.

Extra credits:
Part of points for the correct answers of the above conceptual quizzes will be added as extra credits. Other form of extra credit assignments will also be given.

YOU MAY BE ASKED TO SHOW YOUR NIU PHOTO ID WHEN YOU TAKE EACH TEST. IF YOU DO NOT HAVE YOUR ID WITH YOU YOUR TEST WILL NOT BE GRADED

COURSE NOTEBOOK: Students are strongly encouraged to keep a Course Notebook of key materials that is brought to all lecture and recitation sessions. Materials include (must be current): Syllabus, lecture notes (printed from Blackboard with room to take notes), student’s class notes, tests, class exercises.

WHAT TO BRING TO CLASS: Notebook, textbook, assignments, and calculator

COURSE POLICIES INCLUDE:

1. Be respectful of each other (this applies to Instructors, TA’s and students). Some specifics include:
   a. No cell phone/ electronic device usage in class (except clickers, calculators). Cell/ smart phones must be turned off or silenced and placed in backpacks, etc. (not in pockets or on desks). Violators may be required to turn in their devices to the Instructor for the remainder of the class period.
   b. Read your newspapers before or after class
   c. No talking during class
   d. If you need to leave class early, let your Instructor know

2. Laptops/ notebooks may be used for lecture materials and taking notes only, BUT students must sit in the first row of the lecture hall to use them.

3. Be aware of the policies and procedures regarding your rights as well as responsibilities that are published in the NIU Student Code of Conduct. It is available on line at http://www.stuaff.niu.edu/judicial/24430jo(body).pdf.
4. If you feel there was an error in the grading of a Test, submit a written request within 48 hours to the Instructor’s mailbox in Faraday West 202. Your entire test will be re-graded and returned to you.

For disabled students:
“NIU abides by Section 504 of the Rehabilitation Act of 1973 which mandates reasonable accommodations be provided for qualified students with disabilities. If you have a disability and may require some type of instructional and/or examination accommodation, please contact me early in the semester so that I can provide or facilitate in providing accommodations you may need. If you have not already done so, you will need to register with the Center for Access-Ability Resources (CAAR), the designated office on campus to provide services and administer exams with accommodations for students with disabilities. The CAAR office is located on the 4th floor of the University Health Services building (815-753-1303). I look forward to talking with you soon to learn how I may be helpful in enhancing your academic success in this course.”
(Tentative schedule)

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<td>1</td>
<td>1/15 Introduction</td>
<td>1/17 Basic ideas of Physics (mechanics) I</td>
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<td>2</td>
<td>1/22 Basic ideas of Physics (mechanics) II</td>
<td>1/24 Ch.1 How sound propagates</td>
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<td>3</td>
<td>1/29 Ch. 2 Wave Phenomenology</td>
<td>1/31 Ch.3 Sound and Sinusoids</td>
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<td>2/5 Ch.4 The Power of Autocorrelation</td>
<td>2/7 Ch.7 Sources of Sound</td>
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<td>2/12 Ch.8 Making a stretched string</td>
<td>2/14 1st Midterm test</td>
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<td>2/19 Ch. 9 Resonance rules</td>
<td>2/21 Ch.10. Damped and Driven Oscillation</td>
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<td>2/26 Ch.13 Helmholtz Resonators</td>
<td>2/28 Ch.15. Membrane and Shells</td>
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<td>8</td>
<td>3/5 Ch.16 Wind Instruments</td>
<td>3/7 Ch.17. Voice</td>
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<td>3/12 Spring break</td>
<td>3/14 Spring Break</td>
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<td>3/19 Ch.18 Violin</td>
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<td>4/2 Ch.21 Mechanisms of Hering</td>
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<td>4/9 Ch.23 Pitch Perception</td>
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<td>4/16 Ch. 25. Phantom Tones</td>
<td>4/18 Ch.26 Dissonance and Temperament</td>
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<td>4/23 Ch.27 Modern Architectural Acoustics</td>
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<td>16</td>
<td>4/30</td>
<td>5/2 Summary session</td>
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<td>5/7 Final Exam (comprehensive)</td>
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Math review?

Voice, room acoustics, Timing of Fourier analysis – should be earlier?