Physics of Audio and Video

Topics Include:

- Waves
- Acoustics
- Speakers
- Magnetism
- Musical Instruments
- Radio Broadcasting
- Fiber Optic Communications
- Antennas
- Lasers
- Communications Satellites
- Video and HDTV
- CD, DVD

Pulnix a Gen. Ed. Requirement
SYLLABUS

PHYSICS OF AUDIO AND VIDEO
ANALOG TO DIGITAL

Lectures: M, W, F 10:45 A.M. - 11:35 A.M., JFB 101

INSTRUCTOR:

Orest G. Symko
316 J.C. Fletcher Building (JFB), Telephone: 581-6132, Fax: 581-4801, E-mail: orest@physics.utah.edu
Office Hours: 8:30 to 9:30 a.m., Monday, Wednesday, or by appointment.
Secretary: Chase Adams, 201 JFB, Telephone 585-1754

AIM:

This is an introduction to the principles of physics as applied to audio and video systems and their performance. The goal is to bring out the relevance of physics, which is used in sound and video recording and reproduction in analog and digital forms, including the latest technologies. The course also has lab experiments to provide hands-on experience in this popular and important field. The topics covered address the question of “how does it work” in acoustic and video reproduction and recording.

TEXT:

Physics of Hi-Fi: Analog to Digital, O.G. Symko, Kendall/Hunt Publishing co., and notes

TESTS:

1. February 6, 2015
2. March 6, 2015
3. April 17, 2015
4. FINAL: Tuesday, May 5, 2015, 10:30am-12:30pm.

Absolutely NO make-up tests!

GRADING:

3 tests at 16% each 48%
1 final 24%
5 homeworks at 2.4% each 12%
4 labs 4% each 16%
100%

INFORMATION:

Last day to drop (delete) classes: January 21
Martin Luther King Jr. Holiday January 19
Last day to register: January 19
Last day to withdraw from class: March 6
President’s Day Holiday: February 16
Spring Break: March 15-22
Classes end: April 28
Final Exam Period: April 30 – May 6

As part of this course, there are labs which were developed to help you understand some of the material presented in the course, and to give you a chance to test your skills at taking measurements and writing reports. There are 4 labs:

LABS: I. Analyzing Complex Waves
II. Speaker Characteristics and Frequency Response of Amplifier
III. Radio Broadcasting
IV. Magnetic Recording and Digital Recording.
**SCHEDULE OF LABS:**

Choose one convenient time slot for each lab in the indicated periods below. It will take you approximately 1 hour for each experiment.  
**Location:** 211 J.C. Fletcher Building.

<table>
<thead>
<tr>
<th>Lab</th>
<th>Date</th>
<th>Time</th>
<th>Duration</th>
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</thead>
<tbody>
<tr>
<td>Lab I</td>
<td>January 26</td>
<td>10:45 – 11:30 am</td>
<td>1-2 p.m., 2-3 p.m.</td>
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<td>January 27</td>
<td>9:00 – 10:00 a.m.</td>
<td>1-2 p.m., 2-3 p.m.</td>
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<td>Lab II</td>
<td>February 16</td>
<td>10:45 – 11:30 am</td>
<td>1-2 p.m., 2-3 p.m.</td>
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<td>February 17</td>
<td>9:00 – 10:00 a.m.</td>
<td>1-2 p.m., 2-3 p.m.</td>
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<td>Lab III</td>
<td>March 16</td>
<td>10:45 – 11:30 am</td>
<td>1-2 p.m., 2-3 p.m.</td>
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<td>March 17</td>
<td>9:00 – 10:00 a.m.</td>
<td>1-2 p.m., 2-3 p.m.</td>
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<td>Lab IV</td>
<td>April 13</td>
<td>10:45 – 11:30 am</td>
<td>1-2 p.m., 2-3 p.m.</td>
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<td>April 14</td>
<td>9:00 – 10:00 a.m.</td>
<td>1-2 p.m., 2-3 p.m.</td>
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Choose only 1 time interval for each lab. If scheduled times are impossible for you, please make arrangements with the instructor.

- The above lab schedule must be followed - **NO LATE LABS!!**
- Lab reports are your own individual work (i.e. NO COPYING).
- **PLEASE NOTE: LATE HOMEWORKS WILL NOT BE ACCEPTED!**
- PLEASE NOTE: If you have no time to attend the lectures and do your labs and tests, you should not be in this course.

The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations.

All written information in this course can be made available in alternative format with prior notification to the Center for Disability Services.
1. **Introduction to Audio and Video**
   Stereo components, surround sound, home theater, 7.1 system and speaker arrangement, cell phones, computers, MP3.

2. **Waves & Sound**
   Properties of waves (speed, frequency, wavelength), examples: sound, radio waves, microwaves, light waves. Reverberation, room acoustics, resonance, interference, complex waves and musical sounds, Fourier analysis, number systems, decibels (dB).

3. **Loudspeakers**
   Speaker action, infinite baffle, bass reflex, acoustic suspension, horns, speaker specs, efficiency, speaker sound dispersion, speaker enclosures, designing speakers, equalizers, home theater speakers, computer sound systems, mini speakers.

4. **Electricity & Electromagnetism**
   At rest: electrostatics, semi-conductors, voltage and electric field. In motion: electric current, resistance, Ohm's law, circuit, electric power, fuses, speakers in parallel and in series, impedance, capacitor, inductor, cross-over networks, amplifiers, feedback, power ratings, distortion, magnetic field, magnetic force on current in a magnetic field, applications to speakers, Faraday's law of induction, applications to audio and video, tape playback, transformers, microphone.

5. **Electromagnetic Waves**
   Electromagnetic radiation, tuners, AM & FM broadcasting, superheterodyne receiver, TVs and broadcasting audio and video, microwaves, satellite communications, cable TV. Antennas: electric and magnetic detection, polarization (vertical, horizontal, circular), geostationary satellites, transponders, C-band, K-band, Remote controls; IR.

6. **Magnetic Recording & Playback**
   Fundamentals of magnetism for recording, saturation, recording and playback heads, dynamic range, limitations, computers.

7. **Digital Recording & Playback**
   Digital recording, sampling, Sampling Theorem, optical playback, laser, CD, dynamic range, DVD, error correction, recordable discs, CD-R, CD-RW, compression, resolution, density of information, HDTV, bar codes, Blu-ray DVD, HDTV.

8. **Audio & Video with Computers**
   Computers, hard disks, recording and playback heads, magneto-resistive playback head, MP3, density of information, MPEG, iPods, wireless.

9. **Internet Audio & Video, Cell Phones**
   How do we communicate? Fiber optics, bandwidth, achievements.