Instructor:  Sam Mukdadi, Ph.D.
Class: M, W, F - 11:00–11:50 AM, Room ESB G-84
Office: Room G58 ESB, Phone: (304) 293-3110
E-mail: Sam.Mukdadi@mail.wvu.edu
Office Hours: M, W, F, 1:00-2:00 PM, or by appointment.


Suggested References:

Goals:
The objective of this course is to provide in-depth overviews on fundamental of vibrations, vibrations in string, bars, membranes and plates. We will study the equation of motion acoustic waves and demonstrate for analytical solutions. Physical phenomena of acoustic waves will be studied including transmission and reflection, absorption and attenuation, and radiation and reception. Particular forms of acoustic wave propagation in media including bulk, surface and guided waves will be studied. Applications of acoustic waves in nondestructive testing and medical ultrasound imaging will be demonstrated by the end of the semester. Laboratory demos and experiments will be conducted in the Ultrasonics Laboratory located at ESB B03.

Attendance:
Students are urged to attend all classes, but there is no direct penalty for failing to attend. Students are individually responsible for knowing all material presented and announcements made during a class that they did not attend. If a group of over ten students must be absent for some common reason, then that group should approach me, so that I can adjust the material presented on the day of absence. Since there is no requirement for students to attend every class, class will proceed despite bad weather, unless the University itself is closed.

ABET:
This course is directed to satisfy accreditation goals, namely

**Goal 1.** Graduates will be able to translate a set of objectives and constraints into solution approaches.

**Goal 2.** Graduates will be able to draw and label system diagrams.

**Goal 3.** Graduates will be able to formulate governing equations.

**Goal 4.** Graduates will be able to choose and execute a method of solution for given equations.

This will be satisfied by a computer project that will be part of this class. The computer project, covered in a separate handout, will address a real-world engineering problem.
Course Grading:

- Homework Assignments 30%
- Mid-term Exam(s) 30%
- Final Project Report 40%
- TOTAL 100%

You are assured of at least the following grades: 90-A, 80-B, 70-C, 60-D, but I may elect to award higher letter grades than a number grade suggests if the class performance suggests that this is equitable.

Homework Assignments:

Written and reading homework assignments will be given to students in a weekly basis. The objective of these assignments is to improve understanding the material taught in the classroom. Discussion and review of journal papers and patents on ultrasound technologies will be assigned to discuss recent development of ultrasound imaging and applications. Programming assignments will be given to simulate acoustic waves and vibrations in structures. Students will be using Matlab© software for this task. Homework assignments will not be returned to students; however key solutions will be discussed in the class.

Mid-term Exam(s):  
Mid-term exam(s) will be conducted during the semester. The exam(s) will be closed book and closed notes. All types of calculators will be allowed. If a student misses an exam, a legit excuse must be submitted to instructor within 48 hours. Then, make-up exam will be scheduled at a convenient time.

Final Project Report:  
At the completion of this course, students are expected to design and analyze different types of ultrasound transducers. Computer software named PiezoCAD™ will be used for this purpose. Graduate students will work individually where undergraduate students will form a team of two students. Students will have access to this software in the ultrasound Lab Room ESB B03.

Academic Honesty:

I expect that homework, projects and examinations will be completed by the individual alone. Cheating and Plagiarism (see http://www.as.wvu.edu/psyc/Undergraduate/Handbook/StudentSuccess/plagiarism.htm) will not be tolerated. The instructor will pursue detected cases according to WVU policy. Under this policy, if the instructor and student cannot reach consensus on the sanction for the act of dishonesty, the case is referred to the Office of Student Judicial Affairs. (See http://www.studentlife.wvu.edu/judicial.html) See http://www.arc.wvu.edu/rightsa.html#Anchor-1.-12494 for detailed information on the Judicial Affairs process.

Statement on Social Justice:  
WVU is committed to social justice. The instructor of this course concurs with WVU’s commitment and expects to maintain a positive learning environment, based upon open communication, mutual respect and nondiscrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color, or national origin. Any suggestions are encouraged as to how to further such a positive and open environment and to anticipate needing any type of
accommodation in order to participate in this class. Please advise us and make appropriate arrangements with Disability Services (293-6700).

**Tentative Course Schedule**

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<th>Topic</th>
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<tr>
<td>1. Fundamental of Vibrations</td>
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<td>2. Transverse Motion</td>
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<td>3. Vibration in Bars</td>
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<td>4. Vibration in Membranes and Plates</td>
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<td>5. The Acoustic Wave Equation</td>
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<td>6. Transmission Phenomena</td>
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<td>7. Absorption and Attenuation</td>
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<td>8. Radiation and Reception of Acoustic Waves</td>
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<td>9. Transducers, Beam Patterns and Resolution</td>
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<td>10. Diagnostic Ultrasound Imaging</td>
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<td>11. Nondestructive Evaluation (NDE) of Materials</td>
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<td>12. Structural Health Monitoring</td>
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