I. **Prerequisite:** Undergraduate thermodynamics & fluids will be helpful but not necessary i.e. MA 301 and MAE 308 or MAE 356 or the equivalent. MATLAB will be used.


III. **Instructor:** Dr. Yun Jing, (Office 3288 EB III)

   Office hours by appointment (for quick questions just stop my office anytime)

   Email yjing2@ncsu.edu

   The course website is on moodle

   Material on this web site will develop as the semester progresses

IV. **Course Description** Introduction to principles of acoustic radiation from vibrating bodies and their related fields. The radiation of simple sources, propagation of sound waves in confined spaces and transmission through different media.

V. **Course Objectives** The objective of this course is to provide the student with the tools necessary to calculate the acoustic pressure field generated by vibrating surfaces, and to evaluate the pressure transmission and reflection associated with various media.

VI. **Outline:**

   **A. Introduction & Basics**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Text section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intro, Definitions and vibration review</td>
<td>(1.1--1.11,)</td>
</tr>
<tr>
<td>Monochromatic Waves. Basic solns, free waves , forced waves</td>
<td></td>
</tr>
<tr>
<td>Transverse waves Vibrating String</td>
<td>Chpt. 2 (2.1-2.10)</td>
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</tbody>
</table>

   **B. Sound Waves & Acoustic Wave Motion**

   1. Review of fluid motion. Chpt. 5 (5.1 – 5.4)
   2. Linearized wave equation ( 5.5 – 5.6)
   3. Plane waves - progressive and standing waves. (5.7)
   4. Non- linear effects (may skip this section)

   **C. Acoustic Quantities and Their Measurement**

   1. Average, peak and RMS Values
   2. Sound power and acoustic intensity (5.8, 5.9)
3 Decibels and their use (5.12)
4 Spectrum levels, combining levels (11.1 – 11.3)

D. Transmission of Sound
1 Transmission through two media (6.1, 6.2)
2 Three media & two media oblique incidence (6.3 - 6.4)
3 Reflection from a solid (6.5, 6.6)

E. Spherical Waves / Equation
1 Spherical waves (5.11)
2 Resistive and reactive fields
3 Spherical Bessel function solns (5.11)
4 Cylindrical Waves (5.13)

F. Acoustic radiation from Spheres and Plane Surfaces
1 Intro to Sources, Monopole, Pulsating sphere (7.1) (5.16)
2 Dipoles,
3 Line source (7.2, 7.3)
4 Circular Piston (7.4)
5 Piston near field
6 Review

VII Grading

Homework 20%
Hourly exams (2) 40% (lower one takes 15%)
Final project 40%

Exams: An open textbook and class notes will be permitted for use during exams, but
no other notes or books. It is recommended that you bring a calculator, table of
conversion constants & table of integrals to each exam. All other books and notes must
be closed. All material submitted for grading must be neat legible and on one side of
clean 8 1/2 x 11 in. paper. Paper & pencils must be provided by the student.

VIII Course Requirements

- Approximately eight (8) Homework assignments of associated acoustic problems will be
  made approximate every other week. The problems will be due approximately one week
  after the assignment.
- Two (2) in-class exams and a final project (presentation + written report).

IX Make-Up Work
In general, late homework will not be accepted and make-up exams will not be given. There is the possibility of an excused absence or lateness which must be cleared with the instructor in advance if possible. (i.e. required court attendance) Absence due to illness or injury may be excused only if an adequate written medical excuse is provided by the attending physician. The homework is considered late if on the homework due date, the instructor begins to review the work or answer questions about the homework in class. Please see the web address to the university Attendance Regulation (REG02.20.3) so that you may be familiar with university definitions of excused absences.

X The university Honor code will be strictly enforced. The University policy on academic integrity may be found in the Code of Student Conduct Policy (POL11.35.1) The Honor Pledge is: "I have neither given nor received unauthorized aid on this test or assignment." All assignments are expected to be signed and dated by the student. It is the understanding and expectation of faculty that the student's signature on any test or assignment means that the student neither gave nor received unauthorized aid.

XI Statement for students with disabilities. "Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with Disability Services for Students at 1900 Student Health Center, Campus Box 7509, 515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (REG02.20.1)"