◊ Syllabus ◊

Physics 1140 **Oscillations and Waves** **Term D 2009**

Overview: This course introduces oscillations and waves, and covers the topics: free, forced, damped, superimposed and coupled oscillations of mechanical and electrical systems; simple harmonic and non-linear oscillations; traveling and standing waves; wave reflection, refraction and interference; longitudinal and transverse vibrations of waves; one dimensional waves on a string; two dimensional waves on membranes and liquid surfaces; elasticity and three dimensional sound waves in solids, liquids and gases; three dimensional electromagnetic waves in vacuum; wave packets and the wave nature of particles; and interactions of oscillators and waves.

In nature objects are coupled by mutual attractive and repulsive forces, and constantly disturb one another. Yet they yearn for quiet and will jostle around until they find nests, positions of relative equilibrium. If you nudge an object from its nest it will experience a restoring force from its neighbors, a force that seeks to return the object to its nest. But this force imparts momentum, which in turn causes the object to overshoot its nest. The cycle repeats and oscillation ensues. Now look at the object's neighbors. Through coupling the object's jiggling motion is passed along to its neighbors. The motion is carried from neighbor to neighbor and a wave is born.

Gain physical insight through hands-on labs, demos, pictures and videos of oscillations and waves. You will begin to see oscillations and waves everywhere you go, and will come to appreciate the unity of nature through the common mathematical description of a wide variety of oscillators and waves, all of which can be described by the same sinusoidal functions of space and time.

Prerequisites: You must have a working knowledge of the material covered in PH 1110/1111, PH 1120/1121, and MA 1021, MA 1022 and MA 1023.

Primary Textbook: Young and Freedman, *University Physics*, 12th Edition.

Supplementary Texts: French, *Vibrations and Waves*; Feynman, *Lectures on Physics*; and Elmore and Heald, *Physics of Waves*.

Special Needs: If you need special accommodations because of a disability, or if you have medical information to share with us, please make an appointment with the lecturer as soon as possible, and/or contact the Disability Services Office (DSO) at (508) 831-5235 to ensure that accommodations are implemented in a timely fashion. The DSO is located in Daniels Hall.

Course Schedule, General Lab Procedure and Study Guides: See these **must-read** documents at the course homepage for reading assignments, homework due dates, and other valuable guidance!

Lecturer: Frank A. Dick, (508) 831-6766, fdick@wpi.edu, office OH 025. Your may drop by anytime, but you have a better chance of catching me if you make an appointment. I will post my lecture, conference and lab schedules once these are finalized by the Registrar and Physics Department.

Course Organization: When you register for the course, you are assigned to a particular lecture, conference, and lab. In addition to the lecturer, you will also have a conference instructor and lab instructor. The Registrar provides you with the dates and times of lectures, conferences and labs. Refer to the course schedule for exam dates, and homework and lab report due dates.

Grade: Contributions to your overall course grade are apportioned as follows:

Exams	60%
Labs	20%
Written Homework	10%
Conference	10%

myWPI: Visit myWPI to track your grades and see announcements. myWPI is another good place to access all of the course's online resources.

Exams and Study Guides: Your performance on exams determines 60% of your course grade. The study guides help you prepare for the exams, but do not wait until the last minute to read them; use them to guide your studies as you work through the labs and homework. See the course schedule for exam dates and links to the study guides. If you have special needs and require additional time to complete your exam, make arrangements with the lecturer (see **Special Needs** above). If unforeseen circumstances cause you to miss a scheduled exam, you can arrange with the lecturer to take a makeup exam.

Labs: Labs are the heart of this course. Your physical "feel" for oscillations and waves comes from hands-on learning. Besides, the labs are fun and offer an easy way to boost your grade, so don't miss them! See the course schedule for links to the lab procedures.

Homework: The written homework assignments are designed to prepare you for the exams. See the course schedule for links to the homework assignments and for due dates and times. Keep pace with due dates, and seek help sooner rather than later if you get stuck. Solutions are posted after the homework due date. Written homework received after the solution is posted will not receive a grade. Submit your written homework assignments in conference. Please be neat, show your work for credit, include your section number, and staple your pages together!

Conference: Whereas lecture follows a traditional format in which the lecturer meticulously presents and the student diligently records, conference is interactive. Conference is your chance to hone your problem solving skills and get your questions answered, so don't be bashful! In conference, instructors and students "confer", engaging in question and answer, joint problem solving and discussion of concepts. Your conference instructor will tell how your conference grade is determined.