

18-819M Special topics in Applied Physics: Ultrasonic Devices and Applications

12 units

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(meeting time and place to be determined; to be scheduled once a week for three hours)

This course will provide a graduate-level introduction to ultrasonic devices and applications. The first portion of the course will consist of introductory lectures and the second portion will consist of presentations by the students on papers assigned by the instructor. Topics will include: waves in solids; waves in plates and at surfaces; piezoelectricity and the emission and detection of ultrasonic waves; resonators; capacitive MEMS ultrasonic transducers; surface acoustic wave devices; and possibly other related topics.

Admission is by permission of the instructor. Students are expected to have graduate standing in a relevant discipline and an appropriate background. Students should contact Prof. Greve before the start of the semester if they are interested in this course. The number of registered students is limited to no more than 7 (see schedule below). Because of the nature of the course, the requirements for auditors are the same as those for regular registered students.

The meeting time will be determined at the start of the semester.

Detailed description/ syllabus/ course details

This course will be taught as a combined lecture/ readings course. The first six or seven classes will be lectures on various wave phenomena. The lectures will approximately cover the following topics:

1. Waves: the wave equation and its solutions; bulk waves in solids.
2. Transverse and longitudinal waves interacting with boundaries; interactions with discontinuities.
3. Plate and surface waves.
4. Piezoelectricity and the generation and detection of waves; the Mason equivalent circuit.
5. Applications: resonators; the capacitive MEMS ultrasonic transducer.
6. Applications: surface acoustic wave devices; ultrasonic imaging.

In contrast to typical lecture courses, student involvement with derivations, examples, etc. presented during lectures will be required (see below).

The second half of the semester (up to 7 classes) will consist of student presentations on assigned journal articles. Students are expected to present a tutorial on the subject of the assigned paper at approximately the depth and level of detail of the instructor's lectures.

Grading will consider both involvement in exercises during the lectures and the paper presentation. An A grade will indicate substantial and continuing participation in exercises in the lecture portion of the course *and* presentation of a thorough and clear tutorial on the assigned paper.

Textbook

There will be no assigned textbook. Lectures will be drawn from various sources. From time to time the instructor will indicate available resources (books, journal articles, etc.).