# Syllabus

## PHYS, ECE, BENG-5700: Introduction to Microfabrication

**Instructor**: T.-C. Shen (tc.shen@usu.edu)

Bedri Cetiner (Bedri.cetiner@usu.edu)

David Britt (david.britt@usu.edu)

**Textbook**: *Fabrication Engineering at the Micro- and Nanoscale* by Stephen A. Campbell, 4rd ed. (2012), Oxford University Press.

**Class website:** www.usu.edu/nanolab/5700

**Class meets**: Friday: 3:30-6:00 at SER 244 and NDL (SER-010)

The goal of this course is to provide a basic understanding and hands-on experience on microfabrication which is the basis for every micro- to nano-scale device encountered everyday including electronics, photonics, biological and chemical sensors, photovoltaic cells, prosthetics, etc. In addition to the applied science, microfabrication can create low-dimensional material systems, such as nanowires and graphene sheets, to study basic charge and phonon transport physics.

Limited by space and process modules in the newly established Nanoscale Device Lab, we plan to accept only 15 students. The priority will be given to students of imminent research and career needs. Please submit the application form from the class website before the first class. Applications will be considered until the class is full. This laboratory has a $100 fee used for consumables and repairs.

The class will begin with 7 weeks of lectures to cover the science of semiconductor processing and instruments. In lieu of a single mid-term exam, there will be a quiz at the beginning of each class from week 2 on the material discussed in the previous week. In lieu of homework, each student will do one 10-min PowerPoint presentation about a particular subject complementary to the lectures in the semester. The presentation topics will be given during lectures. Reference should be included in the slides in the format of Journal volume, page (year). The presentation slides will be posted in the course website for everyone to learn.

Students will form groups of 3 in the lab section of the course from week 8. Students will gain the experience of dicing, wet-chemical cleaning, photolithography, etching, and deposition. Each student will write his/her own lab report describing the experiment and discussing the results. The grade will be composed of 50% lab report, 30% of quizzes and 20% presentation.

The planned lecture topics are as follows.

9/4 Crystals, silicon bulk and surface structures
9/11 Band theory, conductivity, doping
9/18 Oxidation, diffusion, photolithography
9/25 Photolithography, deposition
10/2 Etch, vacuum technology
10/9 MEMS, soft lithography
12/4 Student presentation