Preview to Introduction to MEMS – MEMS1002/1092

A CNM Hybrid Course

This page is here to give you a preview of what the MEMS1002 lecture/lab course includes.

What are MEMS and Microsystems?
MEMS: *Microelectromechanical systems. A term primarily used in the United States, it refers to machines with moving parts smaller than a human hair that contain electrical, mechanical and optical components made of silicon and other materials. Also referred to as Microsystems, microstructures, microstructure technology (MST) and mechatronics.- Small Times Glossary*

Most Nanotechnologies are enabled by Microsystems and MEMS!

Why do we teach this?

You may be wondering why CNM has a program in Microsystems Technology. Historically, CNM (formally known as TVI) has had a very innovative tradition in the School of Applied Technologies to bring high tech, cutting edge education to New Mexico. This undoubtedly came about due to the strong influences of our two National Research Laboratories and high tech companies like Intel. We have received federal funding from NASA (National Aeronautic Space Administration) and NSF (National Science Foundation) totaling over $3M dollars to create our MEMS program and to teach other educational organizations how to do this. Microsystems technology is growing at a rate of about 20% CAGR (Compound Annual Growth Rate); some market segments are at over 100% (BioMEMS). New Mexico is ranked third in Microsystems Technology (SmallTimes State Rankings, 2007), part of this is due to our program. We focus on the skills and knowledge needed by technologists to be successful in this field. Employment rates are very high and starting pay is also quite good. The future of small tech is high!
Graduates have gotten jobs at small tech organizations such as Intel, Sandia National Laboratories, Emcore, TPL, and Advent Solar.

What Will You Learn?

In this course you will be exposed to a variety of topics and by the end, you will be able to answer the following questions:

- What are MEMS and Microsystems?
- Where are they used? (Applications)
- Why do we care? (Commercialization)
- How are they made? (Fabrication and Manufacturing Techniques)

- How does one design Microsystems?

You will spend some time on campus as well as online:

- Spend time in a real Cleanroom at UNM learning the basic steps in Microfabrication (micro manufacturing).
  - Handle silicon wafers
  - Operate micro fabrication equipment
  - Learn clean room protocol including safety procedures
- Perform Hands On experiments to better understand how cantilevers are used to detect nano particles.
- Design a simple MEMS device using MEMS design software
- Meet and interact with your fellow classmates and begin building your professional network.

What is the difference between the Standard Course and the Hybrid Course?

- Our traditional, what we call "on ground" Introduction to MEMS course has been offered since 2002. This class is a combination of traditional lectures, hands on activities in class, some quizzes and homework including web research, readings, short papers and worksheets.
- The Hybrid course takes the traditional lectures, readings and corresponding homework and projects out of the classroom and allows you to complete these learning activities away from campus. There are still due dates and as in industry, we expect you to complete assignments on time. We still wish to meet with you and have opportunities for face to face interaction as well as having ample opportunities to experience small tech in a "hands-on" environment. So, we will have you come to class 8 times in the semester for up to 4 hours each time to take care of the hands on elements. These classes have been scheduled to accommodate our working folks that may also have children.
- Since we do not spend as much time in the classroom discussing the activities, readings and discussions, we will spend time posting our questions, opinions and required findings online. This may seem a bit strange for some of you, as this is done asynchronously over a period of days. We also provide online chat areas so you can discuss topics with your instructor or fellow students at pre-arranged times in real time.
- Most readings and lectures will require some sort of activity to be completed, including things like posting your opinion, taking a short online quiz about what you read or reviewed or completing an assignment such as a short paper, crossword puzzle or worksheet.
- You will be able to see your grades online and track how you are doing – for some of you this may be very important.

- I will try to respond to you within a day, no more than two days to any email requests. If you wish to schedule a face to face on campus, no problem there either – I want you to succeed.

Instructor Profile – Who's Matt?

Matthias Pleil, Ph.D. is a faculty member at Central New Mexico Community College in the School of Applied Technologies and

School of Math Science and Engineering. He is also a Research Associate Professor at the University of New Mexico where he is the Principal Investigator for the Southwest Center for Microsystems Education (SCME). The SCME is a National Science Foundation funded Advanced Technological Education regional center of excellence. Dr. Pleil teaches Microsystems Fabrication and Design. He has over 12 years of experience in Semiconductor Manufacturing for both Texas Instruments and Philips Semiconductors, where he worked as a Senior Process and Equipment Engineer and Engineering Manager. Dr. Pleil received his Ph.D. in Physics in 1993 from Texas Tech University, where he completed original research on Time Resolved Fluorescence Spectroscopy.

Skills Needed to Succeed

If you are pretty good around computers and feel comfortable with them, you will be able to navigate the online course system. For example you shouldn't have issues with most of the following:

- Download
- Upload
- Posting
- Email
- Chat
- Web Searches
- Creating documents in software like Word and PowerPoint

You will be required to complete a variety of activities, so having relatively good **academic skills** will aide you in your success:

- Math – Algebra, graphing, interpreting graphs
- Writing – complete sentences, write a short summary (Introduction, body, conclusion), Compare and contrast
- Locating information
- Asking for help – this is a good thing! Don't be shy, you are here to learn!

Time Management skills are essential, you will have to complete assignments that have definite due dates. Get them done early in case you have a computer crash or the online system goes done for a few hours, for example. Waiting until the last minute is a dangerous thing to do. (Note, we want you to become self disciplined, you will become more successful).