ENME 473/ENME 690

Mechanical Fundamentals of Electronic Systems (Semiconductor Packaging)

Fall 2020

MW 2:00 – 3:15 **https://umd.zoom.us/j/3014055255**

INSTRUCTOR:

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PHILOSOPHY OF THE COURSE:

There has never been a more exciting time to be involved in the integration and packaging of electronics. Electronics are embedded in every facet of our lives and their influence in our lives continues to grow. Clever packaging has created the tabletop display, wearable electronics, and implantable biological control systems. The design of these electronic systems requires engineering expertise from many different disciplines. In fact, cost, performance, size, manufacturability, quality, reliability, and even commercial success of electronic systems are often more a function of mechanical design than electrical design. The objective of the course is to introduce seniors and first year graduate students to the principles of mechanical engineering required for designing reliable electronic systems and to lay the groundwork for further study in this area. Students will master the necessary background science and mathematics to become proficient designers of electronic enclosures. Furthermore, interpersonal, teamwork, and communication skills will be developed through practical design projects. Course topics will include fundamental principles of active and passive electronic devices; MEMS and microsystems; electrical signal theory, design and manufacturing of components, circuit boards, connectors, and assemblies; and vibration, shock, fatigue, and thermal analysis of assemblies. The course will culminate in the deconstruction analysis of actual electronic systems and the design of improved packaging for these products.

REFERENCE BOOKS:

- J. Dally, P. Lall and J. Suhling, "Mechanical Design of Electronic Systems," College House Enterprises, LLC, 2008.
- Y. C. Lee and A. Suhir, *Micro-and Optoelectronic Materials and Structures: Physics, Mechanics, Design, Reliability, and Packaging*, Springer, NY, 2007.
- R. Ulrich and W. D. Brown, *Advanced Electronic Packaging, Second Edition*, IEEE Press, Piscataway, NJ, 2006. ISBN-10: 0-471-46609-3.
- M. Pecht, *Plastic Encapsulated Microelectronics*, John Wiley & Sons, New York, 1995.
- D. Seraphim, R. Lasky, and C. Li, *Principles of Electronic Packaging*, McGraw-Hill, New York, 1989.
- R. Tummala, E. Rymazsewski and A. Klopfenstein, *Microelectronics Packaging Handbook*, 2nd Edition, Chapman & Hall, New York, 1997.
- Lau, C. P. Wong, J. L. Prince, and W. Nakayama, *Electronic Packaging: Design, Materials, Process and Reliability*, McGraw-Hill, New York, 1998.
- R.R. Tummala, *Fundamentals of Microsystems Packaging*, McGraw-Hill, New York, 2001.

FORMAT OF THE COURSE

1. Lectures will be given **100% online synchronously as well as asynchronously.** The **default** lecture format is **synchronous.**

2. **Synchronous** lectures will be given at the scheduled class time (Mon and Wed 2:00 – 3:15). They will be recorded, and will be posted on CANVAS. If unexpected technical difficulties are encountered during synchronous lectures, lectures will be recorded asynchronously, and will be posted on CANVAS.

3. **Asynchronous** lectures will be prerecorded, and will be posted on CANVAS in advance. The scheduled class time will be used for additional explanations and Q/A sessions for asynchronous lectures. It is expected that students will watch the pre-recorded lectures before joining the Q/A sessions.

4. **Exams/quizzes** will be offered during the scheduled class time.

COURSE OUTLINE (SUBJECT TO CHANGE):

LECTURE TOPICS
Introduction to Electronic Packaging
Semiconductor Device
Wafer Level Processing Technology
Plastic Encapsulated Microelectronics (Materials)
Plastic Encapsulated Microelectronics (Fabrication Process)
Plastic Encapsulated Microelectronics (Assembly & Handling)
Printed Wiring Board Technology (Fabrication)
Printed Wiring Board Technology (Reliability)
Ceramic Substrates
Fundamentals of Flip Chip Technology
Ball Grid Array Technology
Board Level Assemblies and Reliability
Advanced Packaging Technologies
Accelerated Life Testing
Failure analysis
Light Emitting Diode (LED)
Introduction to Power Electronics Reliability
Inertial MEMS
Reliability of Automotive Electronics

COURSE WEBSITE:

Course lectures, notes, homework assignments, and discussion questions will be posted on CANVAS.

GRADING POLICY

Undergraduate Grading: Out of 100%

- HW: 5%
- Mid-term: 35%
- Final exam: 40%
- Group project presentation: 10%
- Final report: 10%

Graduate Grading: Out of 120%

- HW: 5%
- Mid-term: 35%
- Final exam: 40%
- Group project presentation: 10%
- Final report: 10%
- Graduate Assignment: 20%

FINAL EXAM: TBD

CLASS PROJECT AND GRADUATE ASSIGNMENT

A group project will be conducted as a part of the course. A special assignment will be given only to graduate students to fulfill to the course requirement. Details about the class project and the graduate assignments will be announced in Mid-Sep.

Academic Honesty:

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu.