ENME 473/ENME 690
Mechanical Fundamentals of Electronic Systems
Fall 2017

MW 2:00 – 3:15 **JMP 2121**

Instructor:
Professor B. Han
3147 Martin Hall #88
Phone: 301-405-5255
E-mail: bthan@umd.edu

Teaching Assistant:
Mr. Byung Kim
Phone: 301-405-5471
E-mail: byklife@gmail.com

Office Hrs: Monday and Wednesday 12:00 PM– 1:00 PM (or by appointment)

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.

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)
Fundamentals of Flip Chip Technology
Advanced Flip Chip Technology
Ball Grid Array Technology
Through-Silicon-Via (TSV) Technology
Light Emitting Diode (LED)
SOC-SIP-SOP
IGBT and its reliability
Automotive Electronics
Accelerated Life Testing
Failure analysis
Cost analysis

Attendance: Sitting in or auditing the class will not be permitted without the consent of the instructor. Attendance will be taken periodically.

Website: Course notes, homework assignments, homework and exam answers, and discussion questions will be posted at the CANVAS.

Grading Policy

Undergraduate Grading: Out of 100%

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

Graduate Grading: Out of 120%

- Mid-term: 40%
- Final exam: 40%
- Group project presentation: 10%
- Final report: 10%
- Graduate Project: 20%

Final exam is Saturday, December 16 1:30-3:30pm

Class Project and Graduate Project will be announced around the end of September.

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.