

ECE4754 Course Syllabus

ECE4754

Electronics Packaging Assembly, Reliability, Thermal Management, and Test (2-0-3-3)

CMPE Degree

This course is Elective for the CMPE degree.

EE Degree

This course is Elective for the EE degree.

Lab Hours

3 supervised lab hours and 0 unsupervised lab hours

Prerequisites

ECE 3030 [min C] or ECE 3040 [min C] or ECE 3710

Corequisites

None

Catalog Description

The course provides hands-on instruction in electronics packaging, including assembly, reliability, thermal management, and test of next-generation microsystems. Crosslisted with ME and MSE 4754.

Textbook(s)

No Textbook Specified.

Course Outcomes

Upon successful completion of this course, students should be able to:

1. Explain why and how any semiconductor device is packaged and assembled.
2. Explain interdisciplinarity of packaging involving electrical, mechanical, thermal, materials and processes.
3. Explain the role of interconnection and assembly materials to meet electrical, mechanical and thermal requirements.
4. Explain the need for thermal management and various heat transfer mechanisms.
5. Explain the need for modeling and experimental assessment of package reliability.
6. Explain the electrical failure mechanisms due to the fatigue behavior of metals or other material and interface degradation (polymer delamination, voiding, etc).
7. Explain characterization methods used in packaging to extract the physical properties of materials or monitor the package integrity.
8. Explain chemical safety in handling a variety of chemicals.

Student Outcomes

In the parentheses for each Student Outcome:

"P" for primary indicates the outcome is a major focus of the entire course.

"M" for moderate indicates the outcome is the focus of at least one component of the course, but not majority of course material.

"LN" for "little to none" indicates that the course does not contribute significantly to this

outcome.

1. (P) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. (LN) An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. (LN) An ability to communicate effectively with a range of audiences
4. (LN) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. (M) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. (P) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. (P) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Topical Outline

1. Introduction to System-On-Package
2. Introduction to Packaging and Assembly and its interdisciplinary nature
 - a. Electrical
 - b. Mechanical
 - c. Thermal
 - d. Materials
 - e. Chemical processes
3. Thermo-mechanical modeling and design for reliability of interconnects
4. Flip-chip assembly materials and processes
5. Heat transfer and thermal management
6. Non-destructive inspection
7. Failure analysis
8. Laboratory safety