

ECE4754 Course Syllabus (Offered Spring Semester)
Nanotechnology, Coordinating TIA

ECE4754 -- Electronics Packaging Assembly, Reliability, Thermal Management, and Test (2-3-3)

Required Elective Selected Elective

Course Coordinator / Instructor: Smet (ECE), Wong (MSE)

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, physics-of-failure, finite element modeling, thermal management, and test of next-generation microsystems. Crosslisted with ME and MSE 4754.

Textbook(s): No textbook required. Instructor notes used.

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

1. Package and assemble semiconductor devices
2. Develop an interdisciplinary packaging strategy involving electrical, mechanical, thermal, materials and processes
3. Select interconnection and assembly materials to meet electrical, mechanical and thermal requirements
4. Apply various heat transfer mechanisms to develop a thermal management strategy
5. Assess package reliability through a combined modeling and experimental approach
6. Identify the electrical failure mechanisms due to the fatigue behavior of metals or other material and interface degradation (polymer delamination, voiding, etc)
7. Apply characterization methods to packaging to extract the physical properties of materials or monitor the package integrity
8. Assess 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.

1. (P) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. () 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. () an ability to communicate effectively with a range of audiences
4. () 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 interdisciplinarity
 - a. Electrical
 - b. Mechanical
 - c. Thermal
 - d. Materials
 - e. Chemical processes
3. Thermo-mechanical modeling and design for reliability of interconnections
4. Flip-chip assembly materials and processes
5. Heat transfer and thermal management
6. Non-destructive inspection
7. Failure analysis
8. Laboratory safety