

**ECE6776**                      **Integrated and Low-Cost Microelectronics Systems Packaging (3-0-0-3)**  
**Fall Offering**

**Lab Hours**                      0

**Course Coordinator**        Bakir

**Prerequisites**

**Corequisites**

**Catalog Description**        Introduction to cross-disciplinary microelectronic packaging technologies, including electrical design, thermal considerations and technologies, reliability, optoelectronic packaging, and RF-/mm-packaging. Crosslisted with ME and MSE 6776.

**Textbook(s)**                      Title: System on Package (SOP): Miniaturization of the Entire System, Author: Tummala & Swaminathan, Year Published: 2008, Used\_In\_Prereq: N, Req/Opt: Y; Title: Fundamentals of Microsystems Packaging, Author: Tummala, Year Published: 2001, Used\_In\_Prere

Outcome 1: Students will demonstrate expertise in a subfield of study chosen from the fields of electrical engineering or computer engineering.
Upon successful completion of the course, the student should be able to:  1. Explain the different kind of electronic packages and their applications 2. Explain the benefits of emerging dense integration technologies
Outcome 2: Students will demonstrate the ability to identify and formulate advanced problems and apply knowledge of mathematics and science to solve those problems
Upon successful completion of the course, the student should be able to:  1. Electrical modeling and assessment of interconnects networks commonly encountered at the package, including insertion loss and frequency dependent parasitics 2. Thermal modeling of electronic package assemblies, including calculating junction temperature.
Outcome 3: Students will demonstrate the ability to utilize current knowledge, technology, or techniques within their chosen subfield
Upon successful completion of the course, the student should be able to:

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| 1. Apply course knowledge to design modern electronic packages for digital and mm-wave applications |
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## **Topical Outline**

- I. IC Evolution
- II. Electronic Packaging and Design Considerations
  - Wirebond, TAB, flip-chip, and multi-chip modules
  - Signal distribution, power distribution, delta-I noise, mixed-signal design
  - Chip I/O structures, electrical performance, density, reliability considerations
- III. Overview of Off-Chip Interconnects and their Evolution
  - Emergence of 2.5D and 3D IC technologies: attributes, performance, fabrication, and design considerations
- IV. Package Thermomechanical Design
  - Stress and warpage, material considerations, modeling
- V. Electrical Test
  - Testing and test methods at IC packaging level, board level, and system level
- VI. Discrete and Integrated Components
  - Technologies and impact on electrical package design
- VII. Optoelectronic Integration
  - Motivation, packaging approaches and attributes, and challenges
- VIII. RF/mm-wave Packaging:
  - Design consideration, packaging materials, processes, and integration
- IX. Thermal Management
  - Thermal IC power needs, cooling technologies, design consideration