



Special Topics/ Elective Course

EEMF7V82 / MECH 6V96 / BME 6V87

Offered for

ECE/ME/BME

Advanced microsystems, modules and integration

Instructor : Dr Mahadevan (Devan) Iyer

FALL 2020

EE MF7V82/Mech 6V96/BME6V87

Class Location: ECSW

MW 530-645pm

COURSE TITLE: “ **Advanced microsystems, modules and integration** - Multi-disciplinary Course

TEACHING MODALITY for Fall 2020 : This is an **On line Course for Fall 2020**.

“**Blackboard Collaborate**” will be used as the media for teaching. Class Notes / Presentation slides will be uploaded through e Learning. Thursdays and Fridays 1-2 PM will be the office time for students to consult/ discuss on the class /projects. These discussions will be done through Blackboard collaborate.

PRIMARY FACULTY

Dr Mahadevan (Devan) IYER (Electrical and Computer Engineering)

REFERENCE TEXT:

Fundamentals of Microsystems Packaging, Rao R Tummala, McGraw Hill, Tummala, 2001

Additional Reference Text : Introduction to System on Package -miniaturization of the entire system, Rao R Tummala, Madhavan Swaminathan, Mc Graw Hill, 2008

FORMAT OF THE COURSE:

Lectures, Invited presentations/ Guest lectures from Industry Experts, Student Group Presentations/Seminars, Term paper, Mid term & Final exam.

ABOUT THE COURSE:

This is an electronics system level overview and a cross-disciplinary microsystems packaging course that reviews and discusses the systems packaging and integration technologies for consumer, computer, telecom, industrial, automotive and bio electronic systems. It integrates various disciplines including electrical, mechanical and materials and is an advanced introductory overview course for graduate students in ECE, ME and MSE. It provides both fundamental and applied aspects of electronic packaging technologies as applied to emerging products trends and applications, system miniaturization and multifunctional (computing, communication and sensing) integration needs.

COURSE SYLLABUS

Introduction to microsystems designs, materials, assembly/ packaging

- Fundamentals of microminiaturized systems, products , multifunctional integration challenges
- Role of packaging technologies at device and system level – Electrical, Mechanical, Materials
- Role of electronic packaging in next generation smart and connected systems – sensing, bio medical, automotive and industrial,

Fundamentals of Package Electrical Designs

- Package Electrical Design needs
- Signal and Power Distribution methods
- Electromagnetic Interference and implication on package design
- RF/ mmwave Packaging

Fundamentals & Principles of Thermal management

- Device, Package and system level thermal management fundamentals
- Cooling requirements and methods for electronic devices and systems
- Thermal Characterization – Numerical & Experimental methods – fundamentals

COURSE SYLLABUS (Contd.)

Basics of Electronic Package Mechanical design and analysis

- Thermo mechanical stress and stress induced failures/ failure modes and analysis
- Stress mitigation, design optimization
- Fundamentals of design for reliability, reliability/ qualifications.

Electronic Packaging Technology – Materials, Assembly processes and Manufacturing

- Role of materials in device and systems packaging
- Electronic Packaging materials, properties and characterization (electrical and mechanical)
- Assembly Processes – Wire bond, Flip Chip and wafer scale packaging processes
- Manufacturing fundamentals – Quality, Cost, Reliability, Design for Manufacturing

Basics of Single chip and Multichip packaging technologies

- Basics of Single chip and Multi chip packaging, assembly and interconnection technologies
- Single chip and multichip - Co design fundamentals with materials assembly & reliability requirements.

Basics of Package reliability

- Reliability fundamentals
- Design for Reliability
- Failure modes and mechanisms

COURSE OBJECTIVES:

At the end of the course, the students should be able to :

- ❑ explain what is meant by microsystems packaging in the context of devices, electronic modules/subsystems and systems.
- ❑ articulate packaging technologies pertinent to devices and systems and as applied to System on Chip, System in Package and other advanced system miniaturization technologies.
- ❑ understand and explain the fundamentals of package co designs from electrical, thermal and mechanical performance point of view in the context of computing, communication, sensing product needs..
- ❑ explain the electronic device and system packaging materials needs, characterization techniques and design optimization methodologies with a clear understanding of material properties.
- ❑ understand and describe the electronic packaging assembly processes and manufacturing fundamentals
- ❑ understand and explain the fundamentals of design for performance, design for reliability and design for manufacturing needs, thermal management, thermo mechanical stress mitigation and reliability.
- ❑ understand the industry trends in micro miniaturized products and smart system integration technologies as applied to computing, communication and sensing for mobile connectivity, industrial automation, automotive, medical and aero space sectors.

GRADING

Exam. 1	: 30%
Exam. 2	: 30%
Project/Presentations	: 40%

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please go through these policies and procedures particularly the dos and don'ts in the context of COVID-19.

Please go to <https://coursebook.utdallas.edu/syllabus-policies> for these policies.

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Instructor