课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	电子封装与异质集成 Introduction to Electronics Packaging and Heterogeneous Integration
2.	**课程性质** **Compulsory/Elective**	专业核心课 Major Core Courses
3.	**开课单位** **Offering Dept.**	深港微电子学院
4.	**课程学分/学时** **Course Credit/Hours**	3/64
5.	**授课语言** **Teaching Language**	中英双语 English & Chinese
6.	**授课教师** **Instructor(s)**	曾玉强
7.	**开课学期** **Semester**	秋季 Fall
8.	**是否面向本科生开放** **Open to undergraduates or not**	否
9.	**先修要求** **Pre-requisites**	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.） 本科毕业于理工科专业 An undergraduate degree in a scientific or engineering area

10. 教学目标
Course Objectives

（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

学生在按要求学习完本课程之后，将具备以下能力：1. 理解异质集成原理及应用；2. 熟悉电气、机械和热行为的建模及表征；3. 理解材料科学和材料选择；4. 理解与电子封装相关的制造工艺；5. 运用统计和数据模型描述电子封装失效。

After completing this course, the students will have demonstrated an ability to: 1) Introduce and motivate heterogeneous integration; 2) Model and characterize electrical, mechanical, and thermal behavior; 3) Understand material science and materials selection; 4) Understand manufacturing processes relevant to electronic packaging; 5) Develop statistical and data models to describe electronic package failure.

11. 教学方法
Teaching Methods

（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

该课程利用理论和实验室教学方法，介绍现代电子封装设计和表征的基本概念，讨论微电子封装的电气、热和机械考虑因素，以及材料选择、封装制造和统计建模。该课程采用为期 16 周的授课和实验室教学模式。

本课程涵盖的主题包括：电子封装概述；电气设计和表征；热设计和表征；机械设计和表征；材料选择和表征；封装制造；统计建模和数据分析；辐射硬化。

This course leverages both theoretical and laboratory-based instruction methods to introduce concepts needed for an introductory understanding of the design and characterization of modern electronic packages. In particular, electrical, thermal, and mechanical considerations for microelectronics packing will be discussed along with material selection, package fabrication and statistical modeling. The course is based on a 16-week delivery format for both lectures and labs.

Topics Covered in this course: 1. Overview of electronics packaging; 2. Electrical design and characterization; 3. Thermal Design and characterization; 4. Mechanical design and characterization; 5. Material selection and characterization; 6. Package fabrication; 7. Statistical modeling and data analysis; 8 Radiation hardening.

12. 教学内容
Course Contents
（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

Section 1	Overview of electronics packaging, heterogeneous integration, and emerging applications
Section 2	Interconnects – Resistance, Capacitance & RC Behaviour
Section 3	Delay, Latency & Transmission Lines
Section 4	Density, Energy, Data Rate & Bandwidth
Section 5	Introduction to Heat Transfer
Section 6	Basics of Electronic Cooling I
Section 7	Basics of Electronic Cooling II
Section 8	Mechanical Design and Characterization - Motivation
Section 9	Mechanical Design and Characterization - Fundamentals
Section 10	Mechanical Testing, Failure, and Corrosion
Section 11	Material Selection
Section 12	Material Characterization
Section 13	Chip, Substrate, and Package Fabrication
Section 14	Statistical modelling and data analysis
Section 15	Consideration for Radiation Effects
Section 16	Summary

13. 课程考核
Course Assessment

（①考核形式 Form of examination；②.分数构成 grading policy；③如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

考试。
分数构成：10%课堂表现； 10%平时作业；30%课程项目；20%期末报告；30%期末考试

14. 教材及其它参考资料
Textbook and Supplementary Readings

Fundamentals of Device and Systems Packaging: Technologies and Applications

Author: Rao R. Tummala

Edition: 2nd

Publisher: McGraw-Hill Education

Publication Date: 2019

ISBN: 978-1-259-86155-0

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