An Introduction to Electronics Systems Packaging - Video course

COURSE OUTLINE

The objective of this course is to sensitize the undergraduate students and graduate students to the all-important multidisciplinary area of electronics systems packaging.

The course will discuss all the important facets of packaging at three major levels, namely, chip level, board level and system level.

The entire spectrum of microelectronic systems packaging from design to fabrication; assembly and test will be covered. Current trends in packaging of electronic systems will be covered.

COURSE DETAIL

S.No	Topics and contents
1.	**I) Overview of electronic systems packaging** 1. Introduction and Objectives of the course 2. Definition of a system and history of semiconductors 3. Products and levels of packaging 4. Packaging aspects of handheld products; Case studies in applications 5. Case Study (continued); Definition of PWB, summary and Questions for review
2.	**II) Semiconductor Packaging Overview** 6. Basics of Semiconductor and Process flowchart; Video on “Sand-to-Silicon”

NPTEL

http://nptel.iitm.ac.in

Electrical Engineering

Pre-requisites:

Electrical and Electronics; Mechanical, Chemical, Instrumentation, Chemistry, Physics, Materials Engineering, Industrial Engineering.

Coordinators:

Prof. G.V. Mahesh
Centre for Electronics Design and TechnologyIISc Bangalore

	7. Wafer fabrication, inspection and testing 8. Wafer packaging; Packaging evolution; Chip connection choices 9. Wire bonding, TAB and flipchip-1 10. Wire bonding, TAB and flipchip-2; Tutorials
3.	**III) Semiconductor Packages** 11. Why packaging? & Single chip packages or modules (SCM) 12. Commonly used packages and advanced packages; Materials in packages 13. Advances packages (continued); Thermal mismatch in packages; Current trends in packaging 14. Multichip modules (MCM)-types; System-in-package (SIP); Packaging roadmaps; Hybrid circuits; Quiz on packages
4.	**IV) Electrical Design considerations in systems packaging (L. Umanand)** 15. Electrical Issues – I; Resistive Parasitic 16. Electrical Issues – II; Capacitive and Inductive Parasitic 17. Electrical Issues – III; Layout guidelines and the Reflection problem 18. Electrical Issues – IV; Interconnection
5.	**V) CAD for Printed Wiring Boards** 19. Quick Tutorial on packages; Benefits from CAD; Introduction to DFM, DFR & DFT 20. Components of a CAD package and its highlights 21. Design Flow considerations; Beginning a circuit design with schematic work and component layout 22. Demo and examples of layout and routing; Technology file generation from CAD; DFM check list and design rules; Design for Reliability

6.	**VI) Printed Wiring Board Technologies: Board-level packaging aspects** 23. Review of CAD output files for PCB fabrication; Photo plotting and mask generation 24. Process flow-chart; Vias; PWB substrates 25. Substrates continued; Video highlights; Surface preparation 26. Photoresist and application methods; UV exposure and developing; Printing technologies for PWBs 27. PWB etching; Resist stripping; Screen-printing technology 28. Through-hole manufacture process steps; Panel and pattern plating methods 29. Video highlights on manufacturing; Solder mask for PWBs; Multilayer PWBs; Introduction to microvias 30. Microvia technology and Sequential build-up technology process flow for high-density interconnects 31. Conventional Vs HDI technologies; Flexible circuits; Tutorial session	
7.	**VII) Surface Mount Technology** 32. SMD benefits; Design issues; Introduction to soldering 33. Reflow and Wave Soldering methods to attach SMDs 34. Solders; Wetting of solders; Flux and its properties; Defects in wave soldering 35. Vapour phase soldering, BGA soldering and Desoldering/Repair; SMT failures 36. SMT failure library and Tin Whiskers 37. Tin-lead and lead-free solders; Phase diagrams; Thermal profiles for reflow soldering; Lead-free alloys 38. Lead-free solder considerations; Green electronics; RoHS compliance and e-waste	

	recycling issues
8.	**VIII) Thermal Design considerations in systems packaging (L. Umanand)** 39. Thermal Design considerations in systems packaging
9.	**IX) Embedded Passives Technology** 40. Introduction to embedded passives; Need for embedded passives; Design Library; Embedded resistor processes 41. Embedded capacitors; Processes for embedding capacitors; Case study examples; Summary of materials in packaging
10.	**X) Conclusion and Summary** 42. Exclusive chapter wise summary

References:

1. Rao R. Tummala, Fundamentals of Microsystems Packaging, McGraw Hill, NY, 2001.
2. William D. Brown, Advanced Electronic Packaging, IEEE Press, 1999.
3. Web-based Current literature.