Technical Examination Board, Gujarat State, Gandhinagar

Electronics Systems Packaging

Title	ESDM111: Electronics Systems Packaging
Level	Certificate Course
Course Duration	Four Month (Part time) Three Week (Full Time) 120 Hrs (Th. 48 Hrs Pr. 72 Hrs)
Entry Qualification	B.E./B.Tech/Diploma/B.E. Sem.III onward/ Diploma Sem. IV onward (EC/IC/IT/CE or Similar Branch)/ BCA/MCA/B.Sc./M.Sc./Any other graduate(with Physics/IT)

Teaching Scheme:

Sub Code	Subject Name	Teaching Scheme		Examination Scheme				Term Work Marks	Total Marks
		Theory	Practical	Theory Marks	Hrs.	Practical Marks	Hrs.		
ESDM111	Electronics Systems Packaging	4	6	50	2	100	4	25	175

Total Week = 12   Theory = 1 hour slot

Total Teaching slot/Week = 04   Practical = 2 hour slot

Theory Periods = 48   Total teaching
10 hours/week (Part-time)
06 hours/day (Full time)

Practical Periods = 72

ESDM 111: Electronics Systems Packaging

Electronic packaging is the design and production of enclosures for electronic devices ranging from individual semiconductor devices up to complete systems such as a mainframe computer. Packaging of an electronic system must consider protection from mechanical damage, cooling, radio frequency noise emission and electrostatic discharge. Product safety standards may dictate particular features of a consumer product, for example, external case temperature or grounding of exposed metal parts. Prototypes and industrial equipment made in small quantities may use standardized commercially available enclosures such as card cages or prefabricated boxes. Today products in electronics industry need to be packaged to current state-of-art if it has to be in the leading edge market. Hence systems packaging is essential.

Course Objectives:

- Give a comprehensive introduction to the various packaging types used along with the associated thermal, speed, signal and integrity power issues.
- Enable design of packages which can withstand higher temperature, vibrations and shock
- Design of PCBs which minimize the EMI and operate at higher frequency
- Analyze the concepts of Testing and testing methods
- Predict the reliability of electronic components and structures.

ESDM111 : Electronics Systems Packaging	
Unit-1	**Overview of Electronics Systems packaging**
1.1	Definition of a system and history of semiconductors
1.2	Products and levels of packaging
1.3	Packaging aspects of handheld products (IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging)
1.4	Trends, Challenges, Driving Forces on Packaging Technology
1.5	Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates
Unit -2	**Semiconductor Packages**
2.1	IC Assembly - Purpose, Requirements, Technologies
2.2	Wafer fabrication, inspection and testing
2.3	Wafer Level Packaging, reliability, wafer level burn – in and test.
2.4	Wire bonding, Tape Automated Bonding, Flip Chip
2.5	Single chip packaging: functions, types, materials processes, properties, characteristics, trends.
2.6	Multichip packaging: types, design, comparison, trends.
2.7	System–in-package (SIP) Passives: discrete, integrated, and embedded
Unit -3	**Electrical issues in Packaging**
3.1	Electrical Issues: Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock Distribution, Noise Sources, Digital and RF Issues.
3.2	Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals
3.3	Packaging roadmaps, Hybrid circuits - Resistive, Capacitive and Inductive parasitics
Unit -4	**PCB, Surface Mount Technology and Thermal considerations**
4.1	Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards
4.2	Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.
4.3	Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements
Unit -5	**Testing**
5.1	Reliability, Basic concepts, Environmental interactions
5.2	Thermal mismatch and fatigue – failures – thermo mechanically induced – electrically induced – chemically induced.
5.3	Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability

Suggested List of Practical's

Sr. No	Practical Name
1	Identify Products and levels of packaging.
2	Prepare layout and routing of technology file generation from CAD.
3	Develop CAD output files for PCB fabrication, Photo plotting and mask generation.
4	Perform PWB etching, Resist stripping, Screen-printing technology.
5	Do Solder mask for PWBs.
6	Begin a circuit design with schematic work and component layout.
7	Troubleshoot SMT failure library and Tin Whiskers.
8	Use Thermal Design considerations in systems packaging.
9	Check thermo mechanically induced, electrically induced and chemically induced in electronics systems.
10	Analyze different electrical testing for electronics systems.

Reference books:

- Tummala, Rao R., Fundamentals of Microsystems Packaging, McGraw Hill, 2001
- Blackwell (Ed), The electronic packaging handbook, CRC Press, 2000.
- Tummala, Rao R, Microelectronics packaging handbook, McGraw Hill, 2008.
- Bosshart, Printed Circuit Boards Design and Technology, TataMcGraw Hill, 1988.
- R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India, 2011
- R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005

Software/Tool list:

- Proteus, OrCAD
- Soldering station
- Tool box

Course Reference:

1. Short Term Courses- NPTEL, GoI
2. Short Term Courses- Anna University (https://www.notesforgeeks.in/2021/07/ec8005-electronic-packaging-and-testing-syllabus-2017-regulation.html)