



# ELECTRONIC PACKAGING AND MANUFACTURING

**PROF. ANANDAROOP BHATTACHARYA**

Department Of Mechanical Engineering  
IIT Kharagpur

**TYPE OF COURSE** : Rerun | Elective | UG/PG

**COURSE DURATION** : 8 Weeks (24 Jan' 22 - 18 Mar' 22)

**EXAM DATE** : 27 Mar 2022

**INTENDED AUDIENCE** : Mechanical Engineering, Electrical Engineering, Electronics Engineering, Chemical Engineering

**INDUSTRIES APPLICABLE TO** : Intel, IBM, Dell, Cisco, GE, Bosch, HP, Qualcomm, HAL

## **COURSE OUTLINE :**

Advanced packaging has permitted the integration of electronics into all manner of products and applications, embedding electronics into every facet of our lives and making them ubiquitous in every engineering system. We are facing an ever-increasing demand in the speed and amount of information we need to transmit, communicate and process. To meet this demand and compete in the international marketplace, we have to constantly seek methods to achieve early adoption of new and emerging technologies, improve quality and reliability, and reduce cost. It is now generally recognized that the performance and price of an electronic system are ultimately limited, not so much by advancements in new device and chip technology, but by our ability to package and manufacture these individual chips into modules, substrates, boards, sub-systems and systems. This course is designed to provide a basic knowledge of the technologies and processes required for the packaging and manufacturing of electronic products. The focus of the course will be on the mechanical, materials and manufacturing aspects which are often neglected in the design phase with potentially catastrophic consequences. Students will be exposed to the underlying scientific and technological knowledge-base needed to become proficient builders and users of electronic systems. Course topics will include fundamental principles for packaging active and passive electronic devices; design of components, circuit boards, connectors, and assemblies; additive and subtractive manufacturing techniques; thermal and mechanical design; and reliability assessment methods.

## **ABOUT INSTRUCTOR :**

Prof. Anandaroop Bhattacharya is an Associate Professor of Mechanical Engineering at IIT Kharagpur. His research interests lie in the areas of electronics cooling, transport in porous media and gas turbine heat transfer. Prior to joining IIT, Anandaroop spent 12 years in the industry in USA and India working at Intel, General Motors and General Electric Research Centers. He has 19 US patent filings and close to 45 publications to his credit. He is an Associate Editor of the IEEE Transactions on Components and Packaging Technologies.

## **COURSE PLAN :**

**Week 1:** Introduction - Electronic Packaging, Levels of Packaging, Wafer fabrication, Recap of Basic Electronics

**Week 2:** First level packaging – Package Taxonomy, Chip and chip carrier, lead frame, Interconnection types and methods, Flip-Chip bonding, area arrays

**Week 3:** Second level packaging - Design and manufacture of Printed Wiring Boards, Types of circuit boards, Component placement, Routing, Lamination, Solder Masks

**Week 4:** Third level packaging and System level integration – cables, connectors, chassis, display

**Week 5:** Advanced Packaging - Chip Scale Packaging, Multi-chip Module, Stacked Package, System in package (SIP), system on chip (SOC) Specialized packages (RF, MEMS, Sensors, Harsh Environments, Wearable/Flexible)

**Week 6:** Mechanical Design - Vibration analysis, Theorem of Castigliano; Fatigue and creep analysis

**Week 7:** Thermal Design - Basics of heat transfer, Thermal Resistance, Thermal Interface Materials, Heat spreaders and Heat sinks, System level thermal challenges, modeling and analysis

**Week 8:** Reliability - Design for reliability, Life cycle, Failure Modes and Mechanisms, Reliability Metrology and Analysis, Accelerated Degradation Modeling, Environmental Stress Screening.