PCB Design for Advanced Design Concepts
SYLLABUS

INSTRUCTOR INFORMATION

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Leave message anytime.

PROGRAM DESCRIPTION

In the highly competitive electronics industry, the knowledge and skills of staff directly responsible for the design and layout of Printed Circuit Boards (PCB) and Printed Board Assemblies (PBA) can have a direct impact on the success or failure of the product design and time to market. The IPC PCB Design for Advanced Design Concepts Course is designed to provide the skills necessary to create IPC compliant PCB designs with:

- Advanced or complex packaging
- Reduced available board area
- Non-orthogonal placement and routing
- Non-standard board outline geometry
- Non-standard board mounting
- Advanced board materials
- Embedded components
- Cavities to reduce overall volume/skyline of the design
- Human interface/wearable technology

Taught by an IPC-certified industry expert with 25+ years of experience in the field, the eight-week program utilizes interactive webinars, on-demand recorded class sessions, job-specific exercises, and team projects to facilitate mastery of the key concepts required by circuit board designers.

This course is intended for individuals who want to master the packaging and routing challenges involved with modern high density, reduced board area, and complex geometry designs. Participants should already be familiar with the fundamental concepts and skills required to design PCBs, including:

- Schematic symbol creation in accordance with (IAW) IPC-2612-1
- Schematic Generation IAW IPC-2612
- Documentation and Dimensioning IAW IPC-2614, IPC-2615, & IPC-D-325
- Standard Rigid Printed Board Design IAW IPC-2221 & IPC-2222
- Printed Board manufacturing IAW IPC-6011 & IPC-6012
- Printed Board Assembly IAW IPC-J-STD-001
- Basics of Signal Integrity

LEARNING AND PERFORMANCE OBJECTIVES

This program is designed to provide circuit board designers with a balanced foundation of theoretical knowledge and practical skills in printed circuit board design. Upon completion, participants will be able to:

- Compress circuit topology while maintaining circuit performance.
- Understand the trade-off of advanced PCB materials.
- Define a board stackup that take implements micro-vias.
- Import and define board outline geometry for circular or other non-standard shape.
- Define and implement non-standard (non-orthogonal) parts placement and routing.
- Define non-standard PCB mechanical retention and keep-outs.
- Define and implement non-standard component packaging.
- Implement embedded passive devices formed into the board geometry.
- Design cavities for inserting physical passive/active devices into the PCB structure.
- Consider the impact of these concepts on human interface/wearable devices.

COURSE STRUCTURE

- Instructor and participants meet online twice per week from the comfort of their own home.
- Participants can view recorded online sessions to review course content and class discussions.
- Participants apply key concepts to create a real-world design from concept to completion.
- All required materials are included in the course. Participants may utilize a PCB design authoring software program of their choice. If participants do not have access to PCB design authoring software, IPC will provide complimentary access to Altium.
- Course materials are accessible 24/7 on the new IPC Edge Learning Management System.
- The course can be accessed on virtually any device with an Internet connection and major web browser, including Chrome, Firefox, Safari, Edge, and Internet Explorer.

SUPPLEMENTAL MATERIALS

- Printed Circuit Handbook – *Clyde F. Coombs* McGraw-Hill
- Right the First Time – Lee W. Ritchey Speeding Edge
- Signal Integrity Issues and Printed Circuit Boards – *Douglas Brooks* Prentice Hall

IPC STANDARDS COVERED (PROVIDED WITH COURSE)

- IPC-2152 Standard for Determining Current Carrying Capacity in Printed Board Design
- IPC-2221 GENERIC STANDARD ON PRINTED BOARD DESIGN
- IPC-2222 SECTIONAL DESIGN STANDARD FOR RIGID ORGANIC PRINTED BOARDS
- IPC-2611 GENERIC REQUIREMENTS FOR ELECTRONIC PRODUCT DOCUMENTATION
- IPC-2612 SECTIONAL REQUIREMENTS FOR ELECTRONIC DIAGRAMMING DOCUMENTATION (SCHEMATIC AND LOGIC DESCRIPTIONS)
- IPC-2612-1 SECTIONAL REQUIREMENTS FOR ELECTRONIC DIAGRAMMING SYMBOL GENERATION METHODOLOGY
- IPC-2614 SECTIONAL REQUIREMENTS FOR BOARD FABRICATION DOCUMENTATION
- IPC-2615 PRINTED BOARD DIMENSIONS AND TOLERANCES
- IPC-4101 SPECIFICATION FOR BASE MATERIALS FOR RIGID AND MULTILAYER PRINTED BOARDS
- IPC-6011 GENERIC PERFORMANCE SPECIFICATION FOR PRINTED BOARDS
- IPC-6012 QUALIFICATION AND PERFORMANCE SPECIFICATION FOR RIGID PRINTED BOARDS
- IPC-7351 GENERIC REQUIREMENTS FOR SURFACE MOUNT DESIGN AND LAND PATTERN STANDARD
- IPC J-STD-001 REQUIREMENTS FOR SOLDERED ELECTRICAL AND ELECTRONIC ASSEMBLIES
- IPC-2226 SECTIONAL DESIGN STANDARD FOR HIGH DENSITY INTERCONNECT (HDI) PRINTED BOARDS
- IPC-6016 QUALIFICATION AND PERFORMANCE SPECIFICATION FOR HIGH DENSITY INTERCONNECT (HDI) LAYERS OR BOARDS
- IPC J-STD-003 SOLDERABILITY TESTS FOR PRINTED BOARDS
- IPC J-STD-004 REQUIREMENTS FOR SOLDERING FLUXES
- IPC J-STD-005 REQUIREMENTS FOR SOLDERING PASTES
- IPC J-STD-006 REQUIREMENTS FOR ELECTRONIC GRADE SOLDER ALLOYS AND FLUXED AND NON-FLUXED SOLID SOLDERS FOR ELECTRONIC SOLDERING APPLICATIONS

COURSE SCHEDULE

WEEK 1 – HDI DESIGN

Program overview outlining class schedule and options for accessing class materials and assignments. Class session will focus on HDI design concepts.

Topics include:

- HDI
- Micro-Vias
- Sequential Lamination
- Non-std geometry
- COB/COF
- Circuit Reduction / Compression
- IPC Standards

ASSIGNMENT:

- HDI Design

WEEK 2 – EMBEDDED COMPONENT DESIGN

Class session will focus on embedded components design and usage to further improve packaging for advanced designs.

Topics include:

- Embedded components
- Formed passives
- Inserted passives
- Cavities
- IPC Standards

ASSIGNMENT:

- Embedded Component Design

WEEK 3 – WEARABLES DESIGN / SIGNAL INTEGRITY

Class session will apply the concepts covered in weeks 1 and 2 to the development of cutting-edge wearable applications.

Topics include:

- Wearables
- HID (Human Interface Design)

- Non-std geometry
- Weight
- Size
- Thermal
- Rise time / fall time
- SI
- PDN
- EM wave
- Cross talk
- Overshoot / undershoot
- Transmission lines
- IPC standards

ASSIGNMENT:

- Apply the concepts covered in weeks 1 and 2 to create a wearable design according to the principles and parameters discussed in this class session

WEEK 4 – MATERIALS

Class session will focus on the materials used in advanced designs.

Topics include:

- Standard board materials
- Embedded passive materials
- HDI materials
- Solder mask
- Legend ink
- Solder
- Solder flux
- Solder paste
- Conformal coating
- IPC standards

ASSIGNMENT:

- Continue project from previous week

WEEK 5 – MANUFACTURING

Class session will focus on the manufacturing techniques used in advanced designs.

Topics include:

- Standard multilayer fabrication

- Sequential lamination fabrication
- Embedded passive fabrication
- Cavity fabrication
- Conductive adhesives
- Standard Assembly techniques
- CSP assembly
- Cavity assembly
- Wearable assembly

ASSIGNMENT:

- Continue project from previous week

WEEK 6 – DOCUMENTATION WEEK 1

Class session will focus on schematic and fabrication documentation concepts.

Topics include:

- Schematics
- Standard fabrication drawings
- Fabrication drawings for embedded passives
- Fabrication drawings for HDI designs
- IPC standards

ASSIGNMENT:

- Work on fabrication drawing and manufacturing file package for project

WEEK 7 – DOCUMENTATION WEEK 2

Class session will focus on assembly documentation and manufacturing file concepts.

Topics include:

- Standard assembly drawings
- Assembly drawings for embedded passives
- Assembly drawings for HDI designs
- Manufacturing files
- Gerber
- Nc drill
- Netlist
- ODB++
- 2581
- Pick and place
- IPC standards

ASSIGNMENT:

- Work on assembly drawing and manufacturing file package for project

WEEK 8 – CONTENT REVIEW AND FINAL EXAM

Class session will focus on content review and final exam. Session 1 will be review. Session 2 will be final exam.

FINAL EXAM:

- Complete final exam during Session 2 or a defined exam time during the last week of the course.
- Completion of the program with a score of 70% or higher on the final exam and/or final project is required to earn a certificate of completion.
- Attempts allowed: 2. Grading method: Highest grade.