PCB Design for Signal Integrity

SYLLABUS

INSTRUCTOR INFORMATION

Instructor: Kristopher Moyer

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Best time to call: Usually available between 6pm – 9pm Pacific Time USA.
Leave message anytime.

PROGRAM DESCRIPTION

In the highly competitive electronics industry, the knowledge and skills of designers directly responsible for the design and layout of the Printed Circuit Board (PCB) and Printed Board Assembly (PBA) can have a direct impact on the success or failure of the product design and impact time to market. The IPC PCB Design for Signal Integrity course is designed to provide the skills necessary to create PCB/PBA designs that require advanced signal integrity design and comply with all necessary IPC standards. Taught by an IPC-certified industry expert with 25+ years of experience in the field, the six-week program utilizes interactive webinars, on-demand recorded class sessions, job-specific demonstrations to facilitate mastery of the key concepts required by circuit board designers.

This course is intended for those individuals that have completed or possess the equivalent skills experience of Introduction to PCB Design 1 & 2 and who need further experience with design, manufacturing, packaging and routing challenges involved with designs for high-speed digital 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:

- Understand basic Electrical Engineering (EE) concepts.
- Understand the trade-offs in materials used in these applications.
- Define a board stackup that implements structures that will meet needs of signal integrity.
- Understand and mitigate signal integrity issues.
- Understand and implement routing techniques to mitigate signal integrity issues.
- Understand and implement stackup design to mitigate signal integrity issues.
- Understand and implement Power Distribution Network (PDN) design to mitigate signal integrity issues.

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 a select choice of programs.
- 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-2221 GENERIC STANDARD ON PRINTED BOARD DESIGN
- IPC-2222 SECTIONAL DESIGN STANDARD FOR RIGID ORGANIC PRINTED BOARDS
- IPC-6011 GENERIC PERFORMANCE SPECIFICATION FOR PRINTED BOARDS
- IPC-6012 QUALIFICATION AND PERFORMANCE SPECIFICATION FOR RIGID PRINTED BOARDS
- IPC-2141 DESIGN STANDARD FOR HIGH DENSITY INTERCONNECT (HDI) PRINTED BOARDS

COURSE SCHEDULE

WEEK 1 – BASIC EE CONCEPTS

Program overview outlining class schedule and options for accessing class material and assignments. Lecture will focus on basics of EE design.

Key concepts include:

- EE concepts
- Components
- Voltage, current, power
- Waveforms

DEMONSTRATION:

- Simulation and measurement of components and waveforms

WEEK 2 – ADVANCED EE CONCEPTS

Advanced EE design.

Key concepts include:

- Electromagnetic interference
- Reflections
- Cross-Talk
- Time domain vs. Frequency domain
- Differential pairs
- Routing
- IPC standards

DEMPONSTRATION:

- Demonstration of routing techniques

WEEK 3 – POWER DISTRIBUTION NETWORK (PDN)

Materials and PDN used in SI designs. Physical properties. Types of structures, trade-offs.

Key concepts include:

- Bypass caps
- Planar Caps
- Frequency response
- Stackup
  - Overlap
  - Separations
  - Materials
  - Wrong plane reference
- IPC standards

DEMONSTRATION:

- Demonstrate stackup and PDN design

WEEK 4 – TRANSMISSION LINES

Transmission line design and analysis.

Key Concepts include:

- Transmission line design
- Lossy lines
- Eye diagrams
- Skin effect
- equalization
- IPC Standards

DEMONSTRATION:

- Demonstrate key transmission line concepts

WEEK 5 – DOCUMENTATION

Produce proper documentation in compliance with IPC standards for these designs.

Key concepts include:

- IPC-2610 series.
- IPC-D-325.
- Documentation methodology
- Special feature call outs

INDIVIDUAL ASSIGNMENT:

- Demonstrate key signal integrity documentation requirements

WEEK 6 – 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.