Transforming Your PCB Engineering Methods

SYLLABUS

INSTRUCTOR INFORMATION

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Availability: Usually available between 6 p.m. and 9 p.m., Pacific Standard Time. You may leave a message anytime.

PROGRAM DESCRIPTION

Designing and engineering printed circuit boards (PCBs) is like mastering an art form. It's not just a skill; it's a booming career path in the electronics world. Engineering communities and electronic companies worldwide are hungry for solutions to unique PCB design challenges. That's why merely knowing the basics won't cut it anymore. You need a robust skill set to lead in today's advanced packaging realm.

Taught by a seasoned PCB design engineer with more than 30 years of experience in electronics and aerospace, this four-week program will elevate your designs to be more precise and yield-worthy. The principles and methods you'll learn here are essential for adapting to the specific requirements of all boards, including complex RF and mixed-type designs.

Throughout this course, we'll work with a real-time sample design to implement various design methodologies and create a schematic diagram that establishes an electrical model. We'll develop methods to integrate electrical and mechanical models and explore component placement concepts based on producibility to enhance your initial design. Additionally, we'll cover basic constraint management, design grounding, and solder masking techniques.

You'll also discover how to establish a design review process with your vendors and incorporate producibility, Design for Excellence (DFE), and Design for Manufacturing/Assembly (DFM/A) concepts into your winning design strategies. Finally, we'll categorize and simplify board design types into three main groups and establish strict routing guidelines to aid in model board design.

LEARNING AND PERFORMANCE OBJECTIVES

Upon completion of this course, you will:

- Understand how to better transform engineering baselines for all board types.
- Understand the unique unification of electrical/mechanical models for all board types.
- Generate board design notebooks that enable stable process flow of your designs.
- Develop producibility standards for stack-ups and DFM/A as a strict design baseline.
- Place components the "engineering way."
- Develop and understand via structures and space minimization methods.
- Drive and develop a 2-D/3-D electronic mechanical check process.
- Understand the importance of proper ground techniques for all board design.
- Develop a process to update and fix broken designs.

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: A Practice Handbook on High-Speed PCB and System Design* (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-2612-01: Sectional Requirements for Electronic Diagramming Symbol Generation Methodology*

COURSE SCHEDULE

WEEK 1

Lecture #1: Schematic Diagram and Mechanical Model Design Baseline

- Introduction and sample design
- Transform your designs using engineering methodologies.
- Explore schematic design concepts.
- Take proactive steps with your library of schematic symbols and pad patterns.
- Engineer the schematic diagram to synchronize with the mechanical model.
- Grasp and refine the mechanical model.
- Unite the models.
- Develop producible concepts by unifying models for all board types.
- Initiate producible concepts for component placement.
- Quickly examine different board types.

ASSIGNMENT:

- Review today's lecture and list any questions for the next lecture.

Lecture #2: Stack-Up, Component Placement and Routing Prep

- 15-min round table discussion on Lecture #1
- Import outline and mounting tactics.
- Comprehend specific board types and process flow instructions.
- Introduce producibility methodologies.
- Review the importance of a stable and producible stack-up.
- Apply component placement methodologies incorporating DFM/A concepts.
- Develop via creation and best-practice processes.
- Unify models to achieve a total mechanical model.

ASSIGNMENT:

- Review today's lecture and list any questions for the next lecture.

WEEK 2

Lecture #3: Routing Process Control, DFM Process, Producibility and Vendors

- 15-min round table discussion on Lecture #2
- Explore routing methodologies and engineering set-up concepts.
- Review DFM/A and reinforce your engineered routing methodologies.
- Apply producibility concepts: Route to meet design engineering baselines.
- Manage basic constraints effectively in engineering.

- Master the engineering of start-, mid-, and 90-routing checks and balances.
- Organize vendor review meetings to gather and empower your engineering work.
- Define and collaborate on our sample model-database.

ASSIGNMENT:

- Submit Lecture #3 questionnaire before Lecture #4.

Lecture #4: Our Model in Action: Let's Work – Part One

- 15-min round table discussion on Lecture #3
- Review Lecture #3 questionnaire answers
- Review and engineer our model.
- Conduct routing review, checks, and balances.
- Examine all flight footprints and via structures.
- Develop and complete the Fix Before Flight (FIXB4FLT) Checklist.
- Perform interactive artwork checks and balances.
- Conduct pre-final producibility and vendor check.
- Identify and address problems revealed by a mechanical check.

ASSIGNMENT:

- Submit Lecture #4 questionnaire before Lecture #5.

WEEK 3

Lecture #5: Our Model in Action: Let's Work – Part Two

- 15-min round table discussion on Lecture #4
- Review Lecture #4 questionnaire answers.
- Focus on addressing design issues or problems.
- Meet, Discuss, Plan, Update, Engineer It
- Engineer the model design to resolve the mechanical problem.
- Apply lessons learned across all board types.
- Develop and finalize design updates or fixes.
- Conduct interactive artwork checks and balances.
- Pre-final producibility and vendor check.
- Sample closed.

ASSIGNMENT:

- Upcoming thoughts to consider: How do we transform our PCB design engineering methodologies to all board types?
- Submit Lecture #5 questionnaire before Lecture #6.

Lecture #6: Organize Board Types & Engineering Methodologies – Part One

- Identify various board design types and their common features.

- Implement strategies to manage the reality of each board type and establish design methodologies.
- Simplify and categorize designs based on features and constraints.
- Utilize the model-based structure to engineer the grouping of board types.
- Organize and comprehend all board types, detailing specific engineering methods.
- Classify board design types into three main groups for better organization.
- Manage mounting holes and via sizing within designated DFE groups.
- Organize the non-metal features for each design type group.
- Recognize that all board design types have specific features critical for their success.

ASSIGNMENT:

- Submit Lecture #6 questionnaire before Lecture #7.

WEEK 4

Lecture #7: Organize Board Types and Engineering Methodologies – Part Two

- Review power supply board designs.
- Review one- and two-layer board designs.
- Review multi-layer "CCA" board designs.
- Review digital board designs.
- Review RF and complex RF board designs.
- Review chip-on-board and wire-bond board designs.
- Review mixed-signal board designs.
- Examine design issues for Group #3 design types.

ASSIGNMENT:

- Submit Lecture #7 questionnaire before Lecture #8.

Lecture #8: Organize Board Types and Engineering Methodologies – Part Three

- Identify specific design features crucial for the success of all board design types.
- Discuss the non-metal features for Group #1 and #2 board type groups.
- Recognize guidelines for these board design types and their intersections.
- Schedule meetings to review designs with your fab house.
- Discuss non-metal features for these board design types.
- Implement and engineer the common-based routing and constraint methodologies.
- Conclude with final thoughts.
- Acknowledge that boards are ubiquitous, and the design process relies on engineered models.
- Recognize that design features evolve, but a model-based design will consistently accommodate change.
- Foster the development and optimization of your vision, ideals, and passion to engineer your board designs.
- Build your PCB design teams to understand engineering and model-based designs.

ASSIGNMENT:

- Submit Lecture #7 questionnaire within 3 days.