Module 3: CAD & Custom Hardware Manufacturing

Target Audience: University Students / Advanced Tech Enthusiasts
Duration: 12 Classes (1 Hour Each)

Curriculum Breakdown

- **Classes 1–5:** Fusion 360 3D Mechanical Modeling
- **Class 6:** 3D Printing & Optimization (DFM)
- **Classes 7–11:** Schematic Capture & PCB Design (KiCad / EasyEDA)
- **Class 12:** Hands-on DIY PCB Manufacturing & Assembly

Detailed 12-Class Syllabus

Class #	Topic & Tools	What You Will Build & Learn
Class 1	**Fusion 360 Basics & 2D Sketching** • Fusion 360 Workspace • 2D Sketching & Dimensions • Geometric Constraints	Learn navigation, sketch 2D mechanical profiles, constrain sketches properly, and set exact parametric dimensions.
Class 2	**3D Modeling Techniques** • Extrude, Revolve, Sweep, Loft • Fillet & Chamfer Tools	Convert 2D sketches into 3D mechanical objects, model structural chassis parts, and create mounting standoffs.
Class 3	**Enclosure & Assembly Design** • Multi-Component Assemblies • Joint Constraints & Shell Tool	Model custom two-part electronic enclosures, design snap-fit lids, and fit imported hardware STEP models.

Class #	Topic & Tools	What You Will Build & Learn
Class 4	**Parametric Design & Hardware Integration** • Parameters (fx) • Clearance Tolerances & Wall Thickness	Use parametric equations to modify design sizes instantly, design mounting holes for sensors/microcontrollers, and add cable pass-through slots.
Class 5	**Mechanical Project: Custom Robot Chassis / Casing** • Top-Down Mechanical Design • 3D Rendering & Interference Checks	Complete a 3D robot body or sensor casing design, perform physical interference checks, and render realistic 3D visuals.
Class 6	**3D Printing & Manufacturing Optimization** • 3D Printers & Slicers • STL/3MF File Formats	Master Design for Additive Manufacturing (DFM): configure wall thickness, layer height, infill patterns, overhang supports, and export print-ready G-code.
Class 7	**PCB Design 1: Schematic Capture Basics** •EasyEDA Workflows •Component Symbols & Netlabels • Power Rails & ERC	Learn EDA software workflows, place schematic symbols for microcontrollers/sensors, connect nets, and run Electrical Rules Checks (ERC).
Class 8	**PCB Design 2: Footprints & Custom Symbol Creation** • Library Footprints & Datasheet Pinouts • SMD vs Through-Hole Components	Match schematic symbols to physical component footprints, read datasheets, and create custom footprints for non-standard parts.

Class #	Topic & Tools	What You Will Build & Learn
Class 9	**PCB Design 3: Board Layout & Component Placement** • Mechanical Board Outlines • Placement Rules & Decoupling	Transfer schematics to PCB layout, define mechanical board outlines, place headers and connectors logically, and keep power traces short.
Class 10	**PCB Design 4: Trace Routing & Ground Planes** • 2-Layer Board Routing & Vias • Trace Width Calculations & DRC	Route signal traces without 90-degree bends, calculate trace widths based on current, add ground copper fills, and run Design Rule Checks (DRC).
Class 11	**PCB Design 5: Manufacturing File Generation** • Gerber Files (RS-274X) & NC Drill Files • Pick-and-Place (CPL) & BOM Output	Prepare industrial manufacturing files, generate Gerber & Drill zip packages, output Bill of Materials, and review files using Gerber Viewers.
Class 12	**Hands-On PCB Fabrication & Surface Soldering Workshop** • Chemical Etching / Milling / Toner Transfer • SMD & Through-Hole Soldering	Fabricate a prototype PCB using hands-on etching or milling, solder surface-mount (SMD) and through-hole parts, test continuity, and earn your Module 3 Certificate!