

WM3C8-15 Electronics Design and Development Principles

27/28

Department

WMG

Level

Undergraduate Level 3

Module leader

Farah Villa Lopez

Credit value

15

Module duration

14 weeks

Assessment

100% coursework

Study locations

University of Warwick main campus, Coventry Primary

Distance or Online Delivery

Description

Introductory description

This module focuses on various aspects of the design and development of printed circuit boards for electronic products. Both theoretical and practical aspects involved in the design, manufacture, assembly and testing of electronics are covered.

In this module, principles of CAD tools are applied for the design of electronic boards. Practical sessions will be carried out for the manufacture of printed circuit boards.

This module is linked with C1, C2, C3, C12, C13 and C17 of the AHEP 4.

LO1 - C1, C2, C13

LO2 - C13, C17

LO3 - C3

LO4 - C12, C13

[Module web page](#)

Module aims

This module aims to introduce learners to the principles and processes used in the design, manufacture and assembly of electronic systems for finished products. The module enable learners to consider practical aspects in the design and development of electronic boards including design constraints, product requirements, manufacturing capabilities and testing considerations.

Learners will be introduced to the use of Computer Aided Design (CAD) software for the design of printed circuit boards (PCBs). They will apply layout design considerations for signal integrity, manufacturability and testability and use the CAD software for the design of complex circuit boards.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

- Electronic Components: Packaging technologies (surface mount and through-hole mount).
- Integrated circuits (hybrid, monolithic and chip-on-board integration) .
- Passive components (composition and general characteristics, and selection).
- Printed Circuit Boards (PCBs): layer stack , configurations and materials.
- Layout design features: tracks, pads, solder lands, footprints, vias, mounting holes.
- General Design of PBCs: component placement, thermal relief, necking, teardrops.
- Design for Manufacture: minimum spacing, widths, hole sizes, manufacturer tolerances and capabilities.
- Design for Signal Integrity: track current carrying capacity, crosstalk, grounding, EMC.
- Thermal considerations and electronics cooling: heatsinks and thermal vias.
- Design for Testability: testing methods and test points.
- Design for other applications such as high-frequency boards or flexible substrates.
- Manufacturing and assembly processes for prototyping and mass production.
- Schematic capture, routing and fabrication outputs.

Learning outcomes

By the end of the module, students should be able to:

- Apply practical design considerations related to signal integrity, manufacturability, testability and assembly of printed circuit boards according to product specifications. [AHEP:4-C1,C2,C13]
- Discuss practical issues associated with the design, manufacture and assembly of electronic circuits for mass production. [AHEP:4-C13,C17]
- Design printed circuit boards using computer aided design software. [AHEP:4-C3]
- Produce a prototype printed circuit board to meet design and product assembly specifications. [AHEP:4-C12,C13]

Indicative reading list

[Reading lists can be found in Talis](#)

Subject specific skills

Translate conceptual ideas or technical requirements into operational designs or specifications for systems or components to solve electrical/electronic challenges (S1 in ST0024).

Select, use and apply approved problem-solving methods to solve complex problems and determine appropriate solutions (S2 in ST0024).

Collate and use a range of data sources and supporting documentation to support projects (S3 in ST0024).

Interpret and produce technical documentation such as schematic and circuit diagrams, engineering drawings or CAE models, simulation models, project plans, engineering reports, test reports, fault reports or data analytics (S4 in ST0024).

Identify and rectify faults, inaccuracies, discrepancies or unexpected results during the electrical/electronic assembly, testing and commissioning processes, which may impact the quality and reliability of the component or system (S12 in ST0024).

Ensure that all systems or testing/prototyping equipment has been correctly configured and checked for safe operation before use (S13 in ST0024).

Identify areas for improvement and lead continuous improvement activities in the operation and performance of the system or component (S14 in ST0024).

Use of Computer Aided Design software relevant to electrical/electronic engineering.

Transferable skills

- Critical thinking: Recognise patterns, themes and key messages from sometimes confused and incomplete data. Make information decisions on the value of a range of sources allowing an evidence based conclusion based on this analysis.
- Problem solving: Use rational and logical reasoning to deduce appropriate and well-reasoned conclusions. Retain an open mind, optimistic of finding solutions, thinking laterally and creatively to look beyond the obvious.
- Communication: Present arguments, knowledge and ideas, in a range of formats.
- Information literacy: The systematic collection, analysis and evaluation of information in the investigation of a topic.
- Digital literacy: Comfortable with using digital media to communicate, solve problems, manage information, collaborate, create and share content.
- Professionalism: Prepared to operate autonomously. Aware of how to be efficient and resilient. Manages priorities and time. Self-motivated, setting and achieving goals, prioritising tasks.

Study time

Type	Required
Lectures	9 sessions of 1 hour (6%)
Seminars	12 sessions of 1 hour (8%)
Supervised practical classes	3 sessions of 1 hour (2%)
Online learning (scheduled sessions)	6 sessions of 1 hour (4%)
Online learning (independent)	5 sessions of 1 hour (3%)
Other activity	5 hours (3%)
Private study	50 hours (33%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

- Revision of module contents.
- Study and use of PCB design software through supplementary tutorials.
- Online forum and discussion (asynchronous).

Other activity description

On-line support and consultancy for the design work and before assessment.
Software Installation.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group A2

	Weighting	Study time	Eligible for self-certification
Assessment component			
Video Essay	40%	24 hours	Yes (extension)

Weighting**Study time****Eligible for self-
certification**

An individual video (up to 5 minutes) on:

- (1) The overall design assembly for a printed circuit board to meet product specifications.
- (2) The manufacturing process and functional testing of the prototype printed circuit board.
- (3) A discussion on practical issues associated with the design, manufacture and assembly of printed circuit boards for mass production.

Reassessment component is the same

Assessment component

Report on PCB design 60%

36 hours

Yes (extension)

An individual written report (up to 2400 words) on the layout design of a printed circuit board (PCB) for a particular application. In this assessment, students will complete the layout design of a PCB using computer aided software, and will submit the report on the design considerations made.

Reassessment component is the same

Feedback on assessment

Formative Feedback:

- Verbal formative feedback during software tutorials and practical sessions.
- Verbal formative feedback on preliminary design of product assembly.

Summative Feedback:

- Written Individual feedback on Assessment 1 (Individual video essay)
- Written Individual feedback on Assessment 2 (Individual written Report)

Availability**Courses**

This module is Core for:

- Year 4 of UWMS-H7C2 Undergraduate Applied Professional Engineering (Electrical/Electronic Support Engineer)
- Year 4 of DWMS-H7C6 Undergraduate Applied Professional Engineering

(Electrical/Electronic Support Engineer) (Degree Apprenticeship)