

<b>MODULE TITLE</b>	<b>PRINTED CIRCUIT BOARD DESIGN</b>
<b>Nominal Duration</b>	One Module
<b>Module Code or Number</b>	EA 150
<b>Module Purpose</b>	To enable students to use a PCB CAD system to produce precision artwork for board manufacture, selecting appropriate graphic layout features, and to describe PCB technology trends in Australia and overseas.
<b>Relationship to Competency Standards</b>	<p>This module will be modified in line with the requirements of the national metals and Engineering Standards when they become available.</p> <p>The module contains the knowledge and skills identified and agreed by all state/territories. It has been developed on the assumption that these will be reflected in the Standards.</p>
<b>Prerequisites</b>	Nil
<b>Summary of Content</b>	<ol style="list-style-type: none"><li><u>The Electronic Interconnection Problem</u><ul style="list-style-type: none"><li>Point to point wiring</li><li>PCBs<ul style="list-style-type: none"><li>By coloured pencils</li><li>Self adhesive shapes and tapes</li><li>Economics</li><li>Various examples</li></ul></li><li>ICs</li><li>Prototyping versus production</li><li>Levels of packing</li><li>Physical samples and information from magazines and catalogues</li></ul></li></ol>

2. PCB Materials and Production process

Copper clad laminate

Single sided

Doubled sided

Multilayer

Chemicals

Photoresist

Reversal film

Developer

Etchant

Stripper

Lacquer

Plating metals

Solder

Components

Artwork

Rivets

Links

Connectors

3. PCB Graphic Elements

Leads

Tracks

Vias

Donuts

Pads

Annular rings

Board perimeters

Registration holes

Mounting holes

Clearances

Component library

Layers

Solder-side

Component side

Silk or notation layer

Solder mask layer

Drilling "layer"

Mid layers in multilayer boards

4. Layout by copying an existing board

Familiarisation with:

Grids

Scales

Snaps

Placement

Drawing tools

Placement of components and tracks

5. Layout starting from a schematic and components list

Doubled sided board without PTHs

Design and layout rules

Minimum clearances and working clearances

Libraries

General PCB Layout guidelines

6. Electrical performance

Track resistance

Stray capacitance

Stray inductance

Voltage gradients

Current gradients

Temperature gradients

Flashover

Crosstalk between signal lines

Power supply coupling

Transmission line reflection effects

7. PCB Technology Trends

Ultra thin foil

Multilayer boards

Metal core boards

Surface mount technology (SMT)

Mechanically milled PCBs

Flexible PCBs

Automation issues and the effect on graphic layout

Automated design

Automated production

Automated assembly

Wave soldering

Automated testing

**Delivery**

**Learning outcomes**

On completion of this module the learner will be able to:

***Learning Outcome 1***

**Explain and use the special technical terms used in precision PCB layout.**

Assessment criteria

Define the electronic interconnection problem.

Identify PCB materials and the production process.

Conditions

Assessment method

Short answer and multiple choice test

***Learning Outcome 2***

**Given circuit designs in the form of a circuit schematic and component list use a PCB CAD system to produce precision artwork for board manufacture.**

Assessment criteria

Demonstrate familiarity with grids, scales, snaps and placement and drawing tools.

Place components and tracks without consideration of the electrical performance or cost consequences of layout decisions.

Conditions

Assessment method

Practical project submitted as a circuit file with documentation.

***Learning Outcome 3***

**Choose between recommended and non-recommended graphic layout features.**

Assessment criteria

Give reasons for the choice.

Relate the reasons to production yields and costs, process limitations, possible field failure and performance degradation and serviceability.

Conditions

Assessment method

Written short answer test  
Practical exercises

***Learning Outcome 4*****Demonstrate a basic knowledge of PCB technology trends in Australia and overseas.**

Assessment criteria

Demonstrate familiarity with ultra thin foil, multilayer boards, metal core boards, surface mount technology, mechanical milled PCBs, flexible PCBs, and automation issues.

Demonstrate knowledge of the effect of PCBs on graphic layout, including automated design, automated production, automated assembly, wave soldering, automated testing.

Conditions

Assessment method

Written assignment

***Learning Outcome 5*****Demonstrate a basic knowledge of how graphic layout can affect circuit performance.**

Assessment criteria

Consider digital, analogue, high frequency, fast risetime pulse circuits, power electronics and microwave PCBs.

Identify possible failure modes and performance degradations.

Conditions

Assessment method

Short answer test

**Suggested Learning Resources**

**Physical resources**

**Texts/references**

Coombs: *Printed Circuits Handbook*, McGraw-Hill, 1988

Bosshart: *Printed Circuit Boards, Design and Technology*, McGraw-Hill, 1986

Protel Technology: *Easytrax Reference Manual*, 1990

Leslie, R: "PCB Design, Do it once, Do it right" in *Australian Electronics Engineering*, August 1991

Lindsey, D: *The Design and Drafting of Printed Circuits*, Bishop Graphics Inc, 1980

Lamit/Lloyd: *Drafting for Electronics*, Merril, 1985