

ENGINEERING

Unit 6: Introduction to electronics



Engineering

Level 1 Unit 6: Introduction to electronics

Sample scheme of work

This is an example of a possible scheme of work. You can use it as it is, adjust it or extract content to create a scheme of work to suit your delivery needs. It can also be adjusted by adding theory workshops to support learners who have/need additional learning time.

This unit is assessed through a centre set and marked assignment, which will be externally moderated. A sample assignment brief is available at www.diplomainfo.org.uk

Total GLH	30
Aim	<p>To provide learners with the opportunity to gain skills and knowledge in electronics. Learners will be able to:</p> <ul style="list-style-type: none"> • understand circuit diagrams • select components • create and test models and prototypes of circuits using computer-aided design (CAD) and prototyping systems • safely and effectively build and test electronic circuits.
Notes	<p>The scheme of work presented here uses a project-based approach to teach the learning objectives for this unit. This means that several different assessment criteria may be integrated within a single project.</p> <p>Under FS (functional skills):</p> <p>* indicates opportunities for assessment in English of speaking and listening and/or written communication + indicates opportunities for use of functional mathematics # indicates opportunities for the use of information and communication technology (ICT).</p>

Session number	Topic and learning outcomes	Activities, assignments, assessments, resources	LO and AC	PLTS	FS	GLH	Other comments
1	Introduction to the unit	<p>Provide an overview of the learning objectives and the tasks to be carried out for this unit.</p> <p>As a group, learners carry out a product analysis of an electronic product (eg a radio) to identify that it contains a printed circuit board (PCB), many different types of components and is produced using soldering.</p>	LO1 AC1b		*	1	Learners may have prior knowledge of electronics and circuit diagrams from either technology or science at Key Stage 3.
2–4	<p>Focussed practical task: making an LED badge</p> <p>Aims/learning outcomes:</p> <ul style="list-style-type: none"> • Be able to use tools and equipment to construct an electrical circuit on a PCB. 	<p>This is a short introductory exercise to develop learners' soldering skills.</p> <ul style="list-style-type: none"> • Demonstrate manual soldering and explain the potential risks and hazards. Follow with a guided group discussion to identify safe working practices. • Working in pairs, learners should carry out a practical exercise to develop soldering skills (eg making soldered joints on stamp-size samples of scrap PCBs or stripboards). • Working in pairs, learners then produce their circuits (on a simple PCB that needs to be provided) and assemble their badges. 	LO1 LO3 AC1c AC3b	SM	* +	3	<p>The badge consists of a graphic stuck onto card with a hole for the LED. Learners could be given a choice of available graphics or allowed to identify their own. A safety pin can be attached to the back of the badge with a hot glue gun, so that it can be attached to clothing.</p> <p>The circuit is an LED, a battery snap (for a PP3) and a 330 ohm resistor. The circuit is stuck to the back of the badge using a hot glue gun.</p>

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5-7	<p>Virtual modelling: mini-project (1)</p> <p>Aims/learning outcomes:</p> <ul style="list-style-type: none"> • Be able to interpret and use circuit diagrams. • Be able to explain the functions of common components. • Be able to model a circuit using CAD software. 	<p>For the next few sessions, learners will work on modelling and making a bicycle light.</p> <p>Provide a circuit diagram. Explain how to read and interpret circuit diagrams and the functions of the components shown.</p> <p>Learners should be guided through creating and testing a CAD model of the provided circuit diagram.</p> <p>The CAD software should be used to simulate the circuit and then convert it into a real-world view and a PCB layout.</p>	<p>LO1</p> <p>LO2</p> <p>AC1a-b</p> <p>AC2a</p>	<p>IE</p> <p>SM</p>	<p>+</p> <p>#</p> <p>*</p>	3	<p>Circuit diagrams and the CAD modelling of electronic circuits may have been introduced in Unit 3: Using computer-aided engineering.</p> <p>The bicycle light is a simple astable 555 IC circuit with the output to a series of LEDs. The enclosure for the light should be provided; this could be bought in, or produced separately in Unit 2: Practical engineering and communication skills, or Unit 5: Introduction to engineering materials.</p>

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8–10	<p>Physical modelling: mini-project (2)</p> <p>Aims/learning outcomes:</p> <ul style="list-style-type: none"> • Be able to explain the functions of common components. • Be able to make a physical model of a circuit using a breadboard. 	<p>Continue with the mini-project.</p> <p>Provide an exposition on the use of prototyping systems. This should include:</p> <ul style="list-style-type: none"> • a demonstration of physical modelling using bread boarding • identification of the components and a brief review of their functions. <p>Working in pairs, learners should then produce a series of breadboard models of increasing complexity (eg a simple LED and switch, then a 555IC with a single LED and so on), finishing with a model of the circuit for the bicycle light.</p> <p>These circuits should allow for a range of different component values to be used to reinforce knowledge of the function of the components.</p>	<p>LO1</p> <p>LO2</p> <p>AC1b, c</p> <p>AC2a</p>	<p>IE</p> <p>CT</p> <p>TW</p> <p>SM</p> <p>EP</p>	<p>+</p> <p>*</p>	3	

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11–14	<p>PCB manufacture: mini-project (3)</p> <p>Aims/learning outcomes:</p> <ul style="list-style-type: none"> • Be able to produce circuit boards. • Be able to produce a production plan for PCB manufacture. • Be able to use multimeters to check continuity. 	<p>Continue with the mini-project.</p> <p>Demonstrate how to manufacture a PCB using either etching or milling, followed by drilling the holes for the components. As a group, discuss the health and safety requirements.</p> <p>Working in pairs, learners should manufacture the PCB for their bicycle light. They should then complete a ‘fill in the blanks’ type activity to develop a production plan for manufacturing a PCB.</p> <p>Demonstrate the use of a multimeter to check continuity. Learners should work in pairs to check their individual PCBs.</p>	<p>LO3</p> <p>AC3a–d</p>	<p>CT</p> <p>RL</p> <p>TW</p> <p>SM</p> <p>EP</p>	<p>*</p> <p>+</p>	4	Quality checking, safe working and production planning could be linked to Unit 2: Practical engineering and communication skills.
15–16	<p>Circuit manufacture: mini-project (4)</p> <p>Aims/learning outcomes:</p> <ul style="list-style-type: none"> • Be able to use tools and equipment to construct electronic and electrical systems on PCBs. 	<p>Continue with the mini-project. This should involve the following.</p> <ul style="list-style-type: none"> • Give a ‘refresher’ demonstration of soldering and a brief review of safe working practices. Add in a practical question-and-answer based review on component identification and the functions of the components used. • Working in pairs, learners to then produce their circuits. 	<p>LO1</p> <p>LO3</p> <p>AC1a–c</p> <p>AC3a, b</p>	<p>IE</p> <p>TW</p> <p>SM</p> <p>EP</p>	<p>*</p> <p>+</p>	2	

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17–18	Testing: mini-project (5) Aims/learning outcomes: <ul style="list-style-type: none"> • Be able to use a multimeter to test a circuit. 	Continue with the mini-project. Demonstrate testing of resistance, voltage and current to check the components and the circuit, using a multimeter. Working in pairs, learners to test some provided reference circuits and then their own circuits.	LO3 AC3c, d	IE CT TW EP	* +	2	Testing could be linked to Unit 2: Practical engineering and communication skills.
19–27	Product development Aims/learning outcomes: <ul style="list-style-type: none"> • Be able to model or prototype circuits. • Be able to build and test circuits. 	Learners to work on another mini-project to make an alarm. This should include the following. <ul style="list-style-type: none"> • Learners use CAD software to model a simple design for an alarm with a tilt switch, a pulse generator, a transistor driver and a buzzer, and produce an annotated circuit diagram. • Learners model their alarm circuits using breadboards (prototype boards). • Working in pairs, learners use the CAD software to create their PCB designs and then manufacture their PCBs. • Learners create a production plan for the assembly of their circuit. • Learners work in pairs to produce their own circuits. • Learners test their circuits using a multimeter. 	LO1 LO2 LO3 AC1a, c AC2a AC3a–d	IE CT RL TW SM EP	* # *	9	The alarm could be designed to protect bicycles, bags or private possessions to maximise engagement. This mini-project could use either an astable 555 IC or a (pre-programmed) microcontroller. Suitable alternatives could be substituted instead. As above, the enclosure should be provided; this could be bought in, or produced separately in Unit 2: Practical engineering and communication skills, or Unit 5: Introduction to engineering materials.

Session number	Topic and learning outcomes	Activities, assignments, assessments, resources	LO and AC	PLTS	FS	GLH	Other comments
28–30	Assessed assignment	<p>Learners to carry out the example assignment: to manufacture and test an electronic circuit. Learners will:</p> <ul style="list-style-type: none"> • create a CAD model of a circuit • annotate the circuit diagram • develop a production plan • manufacture the circuit. 	All	IE CT RL SM	* + #	3	This example assignment is available at www.diplomainfo.org.uk