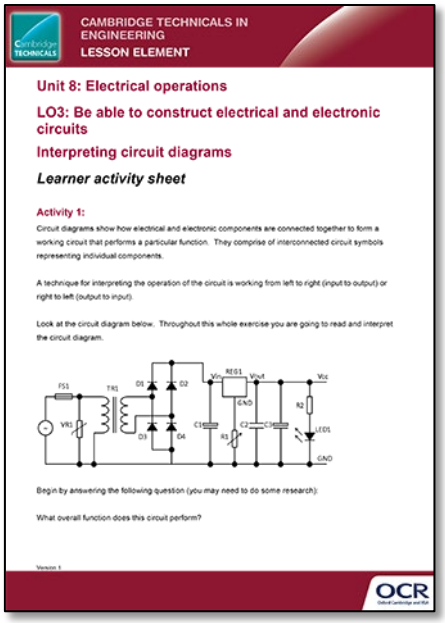
Unit 8: Electrical operations

LO3: Be able to construct electrical and electronic circuits

Interpreting circuit diagrams

Instructions and answers for teachers

These instructions should accompany the OCR resource 'Interpreting circuit diagrams' *activity which supports Cambridge Technicals in Engineering Level 3.*


CAMBRIDGE TECHNICALS IN ENGINEERING
LESSON ELEMENT

Unit 8: Electrical operations

LO3: Be able to construct electrical and electronic circuits

Interpreting circuit diagrams

Learner activity sheet

Activity 1:

Circuit diagrams show how electrical and electronic components are connected together to form a working circuit that performs a particular function. They comprise of interconnected circuit symbols representing individual components.

A technique for interpreting the operation of the circuit is working from left to right (input to output) or right to left (output to input).

Look at the circuit diagram below. Throughout this whole exercise you are going to read and interpret the circuit diagram.

Begin by answering the following question (you may need to do some research):

What overall function does this circuit perform?

Version 1

OCR

The Activity:

For this Activity learners are required to identify the overall function of a circuit.

For Activity 2, learners are required to complete a table identifying the type of component shown in the circuit diagram.

This activity offers an opportunity for English skills development.

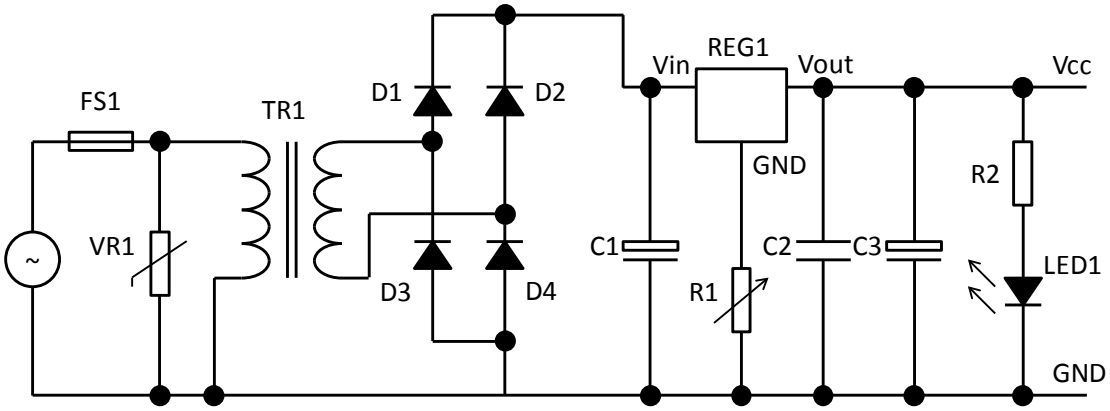
This activity offers an opportunity for maths skills development.

Suggested timings:

2 hours

Activity 1

For this Activity learners are required to identify the overall function of the circuit shown below.



Teachers might task learners to undertake some research, or could use Activity 1 as a class based discussion.

The circuit shown in the circuit diagram is of a regulated power supply, which converts an AC mains voltage to a stabilised DC voltage.

Activity 2

For Activity 2, learners are required to complete a table identifying the type of component shown in the circuit diagram. The table includes component values, or part identification number. Solutions are shown below.

Label	Part number or Value	Component Type
FS1	2A / 240 V	Fuse
VR1	275 V diameter 10 mm	Varistor
TR1	240 V/12 V 5VA	Transformer (step down)
D1 to D4	IN4001	Diode
C1	2200 μF / 25 V Electrolytic	Electrolytic capacitor
C2	0.1 μF / 25 V Ceramic	Ceramic (non-polarised) capacitor
C3	10 μF / 25 V Electrolytic	Electrolytic capacitor
R1	4.7 K	Resistor - variable
R2	1 K	Resistor - fixed
REG1	7805	Voltage regulator 5V type
LED1	L-7113LID	Light Emitting Diode

Activity 3

In Activity 3, learners are required to identify the function of each component (or group of components) in the circuit diagram. Solutions are shown below.

Label	Function in circuit
FS1	The fuse protects the circuit from overcurrent
VR1	The varistor is a variable resistor whose resistance changes with varying voltage applied across it. It protects the circuit against voltage spikes at the AC input and provides over voltage protection
TR1	TR1 is a step down transformer which converts 240 V AC input to 12 V AC
D1 to D4	D1 to D4 – forms a full-wave bridge rectifier converting AC voltage from transformer (12 V AC) into a DC voltage
C1	C1 is a smoothing capacitor which removes the ripple from the 12 V DC produced by the bridge rectifier
REG1	REG1 is a 5V regulator which converts the smoothed 12 V DC to a regulated DC supply
R1	R1 is used to adjust the output voltage from the regulator – making this power supplies output variable
C2	C2 works in conjunction with C3 to provide filtering (smoothing) of the DC output
C3	As above, C3 and C2 work in conjunction to provide further smoothing of the DC output
R2	R2 is a current limiting resistor
LED1	LED1 is a Light Emitting Diode which indicates that the power supply is working. It is supplied via current limiting resistor R2

Overall function of the circuit can be summarised as below:

AC voltage at 240 V enters the circuit at the left hand side via fuse F1. Fuse F1 provides protection against overcurrent. Varistor VR1 is connected across the AC supply providing protection against voltage spikes (over voltage protection). The 240 V AC is stepped down by transformer TR1 to 12 V AC. It is then rectified to a DC voltage by the full-wave bridge rectifier configuration of diodes D1 to D4. Capacitor C1 smoothes the DC voltage which then enters voltage regulator REG1. The output voltage of REG1 can be adjusted using resistor R1. Capacitors C2 and C3 further smooth the output DC voltage from the power supply circuit. LED1 provides an indication that the circuit is operating, and is supplied via current limiting resistor R2. Stabilised DC voltage leaves the circuit at the right hand side.

Teachers could extend the activity with learners investigating data sheets for components in the circuit, such as the 7805 voltage regulator or the IN4001 diode.

The circuit, as shown, could be constructed or simulated as a fully working circuit. It might also be used as a fault finding activity.