

## National Unit Specification: general information

<b>UNIT</b>	Semiconductor Applications: An Introduction (Intermediate 2)
<b>NUMBER</b>	D133 11
<b>COURSE</b>	Electronic and Electrical Fundamentals (Intermediate 2)

### SUMMARY

This unit has been designed to introduce candidates to analogue electronics. It covers the analysis of diode parameters and circuits including power applications using thyristors and triacs. It also considers the analysis of amplifier circuits using discrete transistors (bipolar and field effect transistors (FET)) as well as operational amplifiers.

### OUTCOMES

- 1 Interpret the operation of semiconductor diode circuits.
- 2 Outline the use of power control devices.
- 3 Interpret the operating conditions of a single-stage resistance-loaded small-signal amplifier.
- 4 Investigate operational amplifier circuits.

### RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Mathematics and either Technological Studies or Physics at grade 3 Standard Grade
- equivalent National units.

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### Administrative Information

<b>Superclass:</b>	XL
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<b>Version:</b>	03

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## **National Unit Specification: general information (cont)**

**UNIT**        Semiconductor Applications: An Introduction (Intermediate 2)

### **CREDIT VALUE**

1 credit at Intermediate 2.

### **CORE SKILLS**

There is no automatic certification of core skills or core skills components in this unit.

Additional information about core skills is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

## **National Unit Specification: statement of standards**

### **UNIT        Semiconductor Applications: An Introduction (Intermediate 2)**

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to the Scottish Qualifications Authority.

#### **OUTCOME 1**

Interpret the operation of semiconductor diode circuits.

##### **Performance criteria**

- (a) The identification of operational limitations from manufacturers' data sheets is correct.
- (b) The measurement and recording of diode circuit voltage levels are correct.
- (c) The explanation of the circuit operation is correct.

##### **Evidence requirements**

The candidate could be set tasks which assess the ability to interpret the operation of two different semiconductor diode circuits. The candidate would be required to take measurements of diode circuit voltage levels and answer questions which relate these measurements to manufacturers' data sheets. The measurements would be recorded in a prespecified format. The candidate would also be required to maintain a logbook which would include a brief explanation of the operation of the circuits.

Satisfactory achievement of the outcome will be based on the candidate attaining all of the PCs and correctly answering the questions connected with PCs (b) and (c).

#### **OUTCOME 2**

Outline the use of power control devices.

##### **Performance criteria**

- (a) Power control devices are correctly identified from their symbols.
- (b) The actions of the power control devices are correctly described.
- (c) Applications for power control devices are correctly stated.

##### **Evidence requirements**

The candidate could be set a structured question to test understanding of the use of power control devices.

The candidate would be given a circuit diagram(s) containing a thyristor, diac and triac which he/she would be required to identify from their symbols. The candidate would be required to describe the action of the device and a typical application for each.

Satisfactory achievement of the outcome will be based on all parts of the question being correctly answered.

## **National Unit Specification: statement of standards (cont)**

### **UNIT        Semiconductor Applications: An Introduction (Intermediate 2)**

#### **OUTCOME 3**

Interpret the operating conditions of a single-stage resistance-loaded small-signal amplifier.

##### **Performance criteria**

- (a) The measurement and recording of circuit voltage levels are correct.
- (b) The measured voltages are correctly related to the biasing of the transistor.
- (c) The gain of the circuit is correctly determined from measurement of input and output signals.
- (d) The circuit operation is described correctly.

##### **Note on range for the outcome**

Amplifier: bipolar (common emitter) or FET (common source).

##### **Evidence requirements**

The candidate could be set a task which assesses the ability to interpret the operating conditions of a single-stage resistance-loaded small-signal amplifier. The candidate would be required to take measurements of circuit voltage levels and relate these measurements to the biasing of the transistor and gain of the amplifier and describe the overall circuit operation. The measurements would be recorded in a prespecified format.

Satisfactory achievement of the outcome will be based on all PCs being met.

## **National Unit Specification: statement of standards (cont)**

### **UNIT        Semiconductor Applications: An Introduction (Intermediate 2)**

#### **OUTCOME 4**

Investigate operational amplifier circuits.

##### **Performance criteria**

- (a) Appropriate adjustments are made to the circuit to provide a voltage null at the output.
- (b) The gain of inverting and non-inverting configurations is correctly calculated from measurements taken and recorded.
- (c) The phase relationship between input and output signals in inverting and non-inverting configurations is correctly recorded.

##### **Evidence requirements**

The candidate could complete practical exercises to demonstrate an ability to investigate operational amplifier circuits and explain the requirement for an offset null.

The candidate would be given two preconstructed units in which adjustments and measurements are to be made and recorded.

The exercises would be carried out in conjunction with a suitably constructed observation checklist.

Satisfactory achievement of the outcome will be based on all PCs being met.

## **National Unit Specification: support notes**

### **UNIT        Semiconductor Applications: An Introduction (Intermediate 2)**

This part of the unit specification is offered for guidance. The support notes are not mandatory.

It is recommended that you refer to the SQA Arrangements document for the Intermediate 2 Electronics and Electrical Fundamentals course before delivering this unit.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

This unit will establish a foundation of electrical engineering principles and laws. It is written for electrical craft and technician candidates but can also be used by craft and technician candidates from other technology related backgrounds.

#### **GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT**

Safety regulations and safe working practices should be observed at all times.

- signal diodes, rectifiers and zener diodes. Manufacturers' data for peak inverse voltage, maximum forward current and typical forward voltage drop with reference to device characteristics, testing of diode and labelling of terminals using digital-meter or multi-meter
- diode applications to include rectification, clipping, clamping, voltage stabilisation
- thyristor, diac, triac
- only common emitter and common source configuration to be investigated
- only inverting and non-inverting operational amplifier configurations to be investigated
- non-inverting configuration to include voltage follower.

#### **GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT**

This unit should be taught in a laboratory/workshop environment since it involves the operating conditions of devices in practical circuits.

In all activities preconstructed circuits should be used so that the candidate has access for adjustment and measurement.

## **National Unit Specification: support notes (cont)**

### **UNIT        Semiconductor Applications: An Introduction (Intermediate 2)**

#### **GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT**

Examples of instruments of assessment which could be used for each outcome are given below.

##### ***Outcome 1***

The candidate could be set an assignment that would assess the ability to interpret the operation of two different semiconductor diode circuits.

##### ***Outcome 2***

The candidate could be set a structured question to test understanding of the use of power control devices.

##### ***Outcome 3***

The candidate could be set a task which assesses the ability to interpret the operating conditions of a single-stage resistance-loaded small-signal amplifier.

##### ***Outcome 4***

The candidate could complete practical exercises to demonstrate an ability to investigate operational amplifier circuits and explain the requirement for an offset null.

#### **SPECIAL NEEDS**

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs/Candidates whose First Language is not English* (SQA, 1998).