



## National Unit Specification: general information

**UNIT** Power Supplies (SCQF level 6)

**CODE** F5J5 12

### SUMMARY

This Unit introduces candidates to the principles of direct current (dc) power supplies. This Unit is suitable for candidates wishing to progress a career in electronic engineering. It is also relevant to candidates studying other branches of engineering, science or technology, requiring knowledge of the operation of dc power supplies and means of stabilising and protecting its output. Candidates will study the principles of alternating current (ac) to dc transformation, which forms the basis of a power supply, and to describe the functions incorporated into a power supply such as smoothing, stabilisation and protection of the dc output. The candidate will also gain skills in the use of test equipment to observe the operation of rectifier circuits.

This Unit may form part of a National Qualification Group Award or may be offered on a freestanding basis.

### OUTCOMES

- 1 Verify the operation of half and full-wave rectifier circuits (resistive load).
- 2 Describe and verify the operation of smoothing circuits for half and full-wave rectifier circuits.
- 3 Describe and verify the operation of stabilisation circuits and output protection techniques.

### RECOMMENDED ENTRY

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

- ◆ NQ Unit *Fundamental Electronics* (level 6)
- ◆ NQ Unit *Transformation and Rectification* (level 5)
- ◆ NQ Unit *Electrical Principles* (level 6)
- ◆ NQ Unit *Electronic Test Equipment and Measurement* (level 6)

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#### Administrative Information

**Superclass:** XK

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

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### **CREDIT VALUE**

1 credit at SCQF level 6 (6 SCQF credit points at SCQF level 6\*).

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

### **CORE SKILLS**

There is no automatic certification of Core Skills in this Unit.

The Unit provides opportunities for candidates to develop aspects of the following Core Skills:

- ◆ Communication (SCQF level 5)
- ◆ Numeracy (SCQF level 5)
- ◆ Problem Solving (SCQF level 5)

These opportunities are highlighted in the Support Notes of this Unit Specification.

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

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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 SQA.

#### **OUTCOME 1**

Verify the operation of half and full-wave rectifier circuits (resistive load).

##### **Performance Criteria**

- (a) Verify correctly the operation of half-wave rectifier circuits, using appropriate test equipment.
- (b) Verify correctly the operation of full-wave bridge rectifier circuits using appropriate test equipment.
- (c) Verify correctly the operation of full-wave bi-phase rectifier circuits using appropriate test equipment.

#### **OUTCOME 2**

Describe and verify the operation of smoothing circuits for half and full-wave rectifier circuits.

##### **Performance Criteria**

- (a) Correctly describe capacitive smoothing.
- (b) Accurately perform calculations related to smoothed rectifier waveforms using given formulae (ripple voltage, CR time-constant and C and R values).
- (c) Verify correctly the operation of smoothed half and full-wave rectifier circuits using appropriate test equipment.

#### **OUTCOME 3**

Describe and verify the operation of stabilisation circuits and output protection techniques.

##### **Performance Criteria**

- (a) Correctly describe series pass transistor stabilisation circuits.
- (b) Correctly describe power supply overvoltage and overcurrent output protection techniques.
- (c) Verify correctly the operation of regulated power supplies using appropriate test equipment.

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

### **UNIT        Power Supplies (SCQF level 6)**

#### **EVIDENCE REQUIREMENTS FOR THIS UNIT**

Evidence is required to demonstrate that candidates have achieved all Outcomes and Performance Criteria.

Written and/or recorded oral evidence is required which demonstrates that the candidate has achieved all Outcomes to the standards specified in the Outcome and Performance Criteria.

This evidence must be produced under supervised, controlled conditions at appropriate points throughout the Unit either on an Outcome by Outcome basis or as integrated assessments. All calculations and measurements should be given using the relevant SI units of measurement.

The required evidence, for all Outcomes, is as follows:

#### **Outcome 1**

The evidence required for this Outcome is a written and/or recorded oral report based on an investigation of three rectifier circuits, namely a half-wave rectifier and a full-wave bridge rectifier and full wave bi-phase rectifier. The report is to include sketches of input and output waveforms, and an explanation of these.

#### **Outcome 2**

The evidence required for this Outcome is a written and/or recorded oral report in which the candidate records the input and output waveforms for three different values of smoothing capacitor for each of the two rectifier circuits.

The candidate will compare these measured responses with those calculated using given formulae and describe the waveforms obtained.

#### **Outcome 3**

The evidence required for this Outcome is two written and/or recorded oral reports:

In one report the candidate records the operation of a circuit employing a series pass regulating transistor for both input and output regulation,

In the other report the candidate records the operation of a circuit employing crowbar overvoltage protection and also overcurrent protection.

## National Unit Specification: support notes

### UNIT Power Supplies (SCQF level 6)

This part of the Unit Specification is offered as guidance. The support notes are not mandatory.

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

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

This is a restricted core Unit within the National Certificate Electronic Engineering, at SCQF level 6. It may also form part of other National Certificates in engineering and can also be taken as a free-standing Unit.

This Unit is intended to provide the candidate with an overview of linear regulated power supplies.

Although the candidate is not designing the supplies, he/she is gaining an understanding of features of their design that affect their performance and usefulness.

The Unit is mainly practical in nature, since it introduces the candidate to measurements on practical power supplies and to an evaluation of their performance.

The Unit builds on the content of earlier Units covering transformation, rectification, electronic devices and the use of test equipment.

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

Learning and teaching approaches for this Unit should progressively lead the candidate through the steps resulting in a functional regulated power supply, namely transformation to rectification to smoothing to regulation to output protection.

The reasons for, and means of implementing, each stage should be clearly explained, and then investigated in practice by observing and measuring the waveforms, currents and voltages in actual power supply circuits.

#### OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

The Reading component of the Core Skill *Communication* at SCQF level 5 may be developed in all three Outcomes while candidates are reading materials in all three Outcomes while candidates are reading materials on aspects of power supplies from paper based and electronic sources.

The Writing component of the Core Skill *Communication* at SCQF level 5 may be developed in all three Outcomes while candidates are preparing written responses to formative and summative assessments.

The Using Graphical Information component of the Core Skill *Numeracy* at SCQF level 5 may be developed in all three Outcomes while candidates represent power supplies in a suitable diagram format.

The Critical Thinking component of the Core Skill *Problem Solving* at SCQF level 5 may be developed in all three Outcomes while candidates analyse suitable power supply circuits.

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

### **UNIT        Power Supplies (SCQF level 6)**

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

##### **Opportunities for the use of e-assessment**

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in *SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003)*, *SQA Guidelines on e-assessment for Schools (BD2625, June 2005)*.

The assessment of all three Outcomes is by practical exercises.

The assessments could be carried out using pre-constructed circuits. The circuits should, as far as possible, use discrete components and not integrated circuits. The circuits used should comprise transformation, rectification, smoothing, stabilisation (regulation) and output protection. The tests must include both load regulation and input regulation, and investigating the effects of load faults. The candidate should submit formal reports that evaluate the circuits tested.

##### **DISABLED CANDIDATES AND/OR THOSE WITH ADDITIONAL SUPPORT NEEDS**

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements)