National Unit Specification: general information

UNIT Power Electronics (SCQF level 6)

CODE F5JH 12

SUMMARY

This Unit introduces candidates to the devices used in the control of electrical power flow, and to typical applications of these devices.

This Unit is suitable for candidates wishing to progress a career in electrical and/or electronic engineering. It is also relevant to candidates studying other branches of engineering, science or technology, requiring knowledge of power electronic devices.

Candidates will be able to list the devices used, explain their functions and how they can be protected from damage caused by overheating during operation. Practical applications are discussed, along with practical exercises demonstrating these applications.

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

OUTCOMES

1 List and explain the function of, the principal active devices used in the control of electrical power flow.
2 Explain the need for protection of the power devices, and describe methods of so doing.
3 Identify typical applications of the principal devices used in the control of electrical power flow, and explain the operation of the circuits.
4 Demonstrate the operation of typical circuits used in the control of electrical power flow.

Administrative Information

Superclass: XL

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National Unit Specification: general information (cont)

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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* (SCQF level 6)
- NQ Unit: *Transformation and Rectification* (SCQF level 5)

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

UNIT Power Electronics (SCQF level 6)

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

List and explain the function of, the principal active devices used in the control of electrical power flow.

Performance Criteria

(a) Correctly list the principal devices used in the control of electrical power flow.
(b) Correctly explain gate triggering techniques.
(c) Briefly explain correctly the function of the principal devices used in the control of electrical power flow.

OUTCOME 2

Explain the need for protection of the power devices, and describe methods of so doing.

Performance Criteria

(a) Correctly explain the need for the protection of power devices.
(b) Correctly describe methods of protecting power devices.

OUTCOME 3

Identify typical applications of the principal devices used in the control of electrical power flow, and explain the operation of the circuits.

Performance Criteria

(a) Correctly list typical applications of the principal devices used in the control of electrical power flow.
(b) For a given circuit, correctly describe the operation of typical applications of the principal devices used in the control of electrical power flow.

OUTCOME 4

Demonstrate the operation of typical circuits used in the control of electrical power flow.

Performance Criteria

(a) Correctly demonstrate the operation of relevant circuits, using appropriate test equipment.
(b) Correctly record and analyse the results of the tests.

National Unit Specification: statement of standards (cont)

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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 written and/or recorded oral evidence is as follows:

Outcome 1

Devices: Power transistor, thyristor, triac, diac
Gate triggering techniques: burst firing, phase control
Functions: current amplification, controlled conduction (either unidirectional or bidirectional)

Outcome 2

Need: to prevent overheating
Methods: cooling fans, heatsinks

Outcome 3

The candidate is required to list the four applications given (ie power amplification, controlled rectification, motor speed control, dimmerstat).

For a sample of TWO from the applications list given the candidate is required to describe the operation.

Outcome 4

The evidence required is a report in which, for TWO of the applications listed, the candidate is required to demonstrate the operation, and correctly record and interpret the results of practical tests.

Pre-built circuits should be used.

National Unit Specification: support notes

UNIT Power Electronics (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 Unit is an optional Unit in the National Certificate in Electronic Engineering, at SCQF level 6. It may also form part of other National Qualification Group Awards in engineering and can also be taken as a free standing Unit.

This Unit introduces the candidate to the principal devices used to control the flow of electrical power and it is intended that it concentrates on practical common applications of power electronic devices.

It is NOT intended that the candidate be subjected to a rigorous discussion on the characteristics and construction of the devices.

It also discusses the various means of ensuring that the devices are not destroyed by excessive heat during their operation.

These devices are used in a variety of applications in both electronic and electrical engineering, and the candidate will be able to use the fundamental knowledge gained by undertaking this Unit when undertaking more specialised study at higher levels in their chosen field.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Learning and Teaching should concentrate on the practical applications of the devices, and therefore should be as 'hands on' as possible. There is a tendency when teaching power electronic devices to spend a lot of time initially on the internal construction of the devices and their operating characteristics. It is intended that in this Unit the emphasis be on the function of the devices and on their safe working limits.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

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

The Writing component of the Core Skill *Communication* at SCQF level 5 may be developed in all four 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 four Outcomes while candidates represent and analyse suitable power electronic circuits in diagram format.

National Unit Specification: support notes (cont)

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The Critical Thinking component of the Core Skill *Problem Solving* at SCQF level 5 may be developed in Outcome 4 while candidates analyse suitable power electronic circuits.

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)*.

Assessment is a combination of written test and practical exercises.

Outcomes 1, 2 and 3 should be assessed by a single written test lasting one hour, but it would be possible to carry out the assessment of these Outcomes at appropriate points in the delivery of the Unit. The total time for the assessment of these Outcomes should be no more than one hour.

Outcome 4 should be assessed by a practical exercise and report. The practical exercise should last no more than two hours.

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**