National Unit Specification: general information

UNIT Transformation and Rectification (SCQF level 5)

CODE F5JY 11

SUMMARY

This Unit introduces candidates to the operation of the (ideal) transformer and to rectifier circuits, which are used to transform (convert) alternating electrical energy (ac) to direct electrical energy (dc).

This Unit is suitable for candidates wishing to embark upon 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 ac to dc conversion. Candidates will be able to understand the principles of operation of transformers and also of simple power supply circuits.
This Unit may form part of a National Qualification Group Award or may be offered on a freestanding basis.

OUTCOMES

1 Investigate safely the operation of a transformer with a resistive load to confirm its operation.
2 Investigate safely the operation of diode rectifier circuits with a resistive load to record and interpret their operation.

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:

- Standard Grade in a Science or Technology subject — General Level
- NQ Unit *Fundamental Electronics* (SCQF level 5)
- NQ Unit *Electrical Principles* (SCQF level 5)
- NQ Unit *Electronic Test Equipment and Measurement* (SCQF level 5)
- NQ Unit *Electrical Testing and Measurement* (SCQF level 5)

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 5*).

**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.

This Unit provides opportunities for candidates to develop aspects of the following Core Skill:

- Numeracy (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

Investigate safely the operation of a transformer with a resistive load to confirm its operation.

Performance Criteria

(a) Correctly predicts voltages and currents for given transformer configurations.
(b) Confirm, through safe measurement, the operation of a transformer.

OUTCOME 2

Investigate safely the operation of diode rectifier circuits with a resistive load to record and interpret their operation.

Performance Criteria

(a) Correctly and safely investigates the operation of half-wave rectifier circuits using test equipment.
(b) Correctly and safely investigates the operation of full-wave bridge rectifier circuits using test equipment.
(c) Correctly and safely investigates the operation of full-wave bi-phase rectifier circuits using test equipment.

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.

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

The required written and/or recorded oral evidence, generated under closed-book conditions for all Outcomes, is as follows:

For Outcome 1:

Two investigations are to be carried out, one for a step down transformer and one for a step up transformer. For each investigation, the candidate is required to sketch the input and output waveforms labelling amplitude and phase, and to compare these measured values with those predicted from knowledge of the turns ratio of the transformer.

For Outcome 2:

Three investigations are to be carried out, one each for half-wave, full-wave bridge and full–wave bi-phase. The investigations are to be carried out **without** smoothing. The candidate is required to select the correct circuit for each investigation from a variety available. For each investigation, the candidate is required to sketch the input and output waveforms, paying particular attention to amplitude and frequency, and to correctly interpret these waveforms.

National Unit Specification: support notes

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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 an optional Unit within the National Certificates in Electrical Engineering and Electronic Engineering, at SCQF level 5. 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 is intended to be practical in nature, with the candidate investigating the function of the transformer and its application in the rectification of alternating waveforms.

It is not intended that the candidate studies the construction of the transformer or the mechanisms for loss within the transformer (eddy current, hysteresis and leakage) although it can be mentioned that although the transformer is a relatively efficient device some losses do occur.

The forward and reverse characteristics of rectifier diodes can be explained, resulting in the practical (as opposed to ideal) waveforms obtained.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

Learning and teaching should be via practical exercises.

Although assessment is carried out using pre-constructed circuits, teaching and learning should include the candidate constructing the circuits using discrete components on strip-board and patchboard. This increases the candidate's familiarity with component identification and handling, and with the rectifier circuits under investigation.

OPPORTUNITIES FOR CORE SKILL DEVELOPMENT

Numeracy skills will be naturally enhanced as candidates demonstrate that they can understand, apply and convey information in graphic and numerical forms. They must carry out a number of investigations during which they interpret and sketch input and output waveforms and compare measured values. They have to confirm the operation of a transformer, and then use test equipment to check and record the operation of full-wave bi-phase rectifier circuits. Formative activities should be a series of practical exercises which will increase confidence and familiarity with the interpretation and presentation of number and graphics in electronic engineering contexts.

National Unit Specification: support notes (cont)

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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 communications 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 to be carried out via practical exercises, as specified under Evidence Requirements.

The assessment of Outcomes 1 and 2 should be individual practical exercises, with that of Outcome 1 lasting no more than 1 hour, and that of Outcome 2 lasting no more than 2 hours. The investigations should be carried out using pre-constructed circuits. The results of the investigations should be recorded on pro formas supplied by the centre.

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**