SQA Advanced Unit Specification

General information for centres

Unit title: Principles of Engineering Systems

Unit code: HV44 47

Unit purpose: This Unit has been designed to provide candidates with a broad knowledge and understanding of a systems approach to the analysis of engineering processes and systems. In this approach equal weighting is given to mechanical and electrical engineering quantities. Candidates will represent electrical, mechanical and electromechanical systems in block diagram format. They will also identify and compare mechanical and electrical quantities found typically in engineering systems. They will calculate typical forms of energy found in an engineering system and undertake an energy audit on a practical engineering system. Candidates will also investigate the properties of materials used in engineering systems and draw typical engineering system output responses to step and sinusoidal inputs.

On completion of the Unit the candidate should be able to:

1 Represent engineering systems in block diagram format.
2 Describe mechanical engineering quantities used in engineering systems.
3 Describe electrical engineering quantities used in engineering systems.
4 Calculate different forms of energy in engineering systems.
5 Compare mechanical and electrical quantities.
6 Undertake an energy and power audit on an engineering system.
7 Investigate the properties of materials used in engineering systems.
8 Draw typical engineering system, and sub-system, responses.

Credit points and level: 2 SQA Credit at SCQF level 7: (16 SCQF credit points at SCQF level 7*).

**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 National 1 to Doctorates.*

Recommended prior knowledge and skills: It is recommended that candidates have a knowledge and understanding of physics and/or technological studies and mathematical concepts and theorems. This may be evidenced by possession of a Higher in Physics and/or Technological Studies and/or Mechatronics and a National Certificate Unit Core Mathematics 4, National 5 Mathematics or SCE Standard Grade Mathematics pass at credit level (1 and 2), or an equivalent level of experience.

Core Skills: There may be opportunities to gather evidence towards the following listed Core Skill components in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Written Communication	SCQF level 6
Critical Thinking	SCQF level 6
Working with Others	SCQF level 5

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: The assessment strategy for this Unit is as follows:

Outcomes 1, 2, 3 and 7 can either be assessed as four separate assignments with four separate reports or a single assignment with a single report based on a single electromechanical system. If the latter approach is adopted then it will be important that candidates make regular submissions in order to obtain feedback on progress. Centres may wish to combine aspects of the assessment of Outcome 1 with the assessment of Outcome 1 in the Engineering Communication unit.

Outcomes 4, 5 and 8 can be assessed by three separate thirty minute tests or a single test covering all three outcomes which should last one hour and thirty minutes. Whichever approach is adopted tests should be conducted under controlled, supervised, closed-book conditions.

Outcome 6 should be assessed by means of an assignment in which candidates conduct an energy audit on a practical engineering system and write up a report based on this audit.

To consolidate knowledge and understanding of engineering systems approaches it is recommended that centres use the same engineering systems, or sub-systems, as are used *in Engineering Communication and Engineering Measurement and System Monitoring* units.

SQA Advanced Unit specification: statement of standards

Unit title: Principles of Engineering Systems

Unit code: HV44 47

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Represent engineering systems in block diagram format

Knowledge and/or skills

- Inputs
- Outputs
- Output/input relationships
- Processes
- Signals
- Energy sources
- Directions of energy/signal flow
- System quantities

Evidence Requirements

All knowledge and/or skills items in this Outcome must be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can for an electrical system, a mechanical system and an electromechanical system identify the following:

- inputs
- outputs
- output/input relationships for each block
- processes
- signals
- energy sources
- directions of energy/signal flow
- system quantities

Evidence should be generated by candidates producing a block diagram for each of the three systems indicating on each diagram the knowledge and or skills items. The assessment should be undertaken as an assignment in which candidates present the three block diagrams. Candidates should do the assignment in their own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Assessment guidelines

Centres may present candidates with the three engineering systems or candidates may present systems of their own choice providing they meet the above knowledge and/or skills requirements.

The types of systems that can be used for assessment purposes include: power station, CD player, motor vehicle, domestic entertainment systems or microwave oven.

Centres may wish to combine aspects of the assessment of Outcome 1 with the assessment of Outcome 1 in the Engineering Communication unit.

It is recommended where possible that the assignments for Outcomes 1, 2, 3 and 7 are linked in that the electromechanical system is used as the basis for the assessment of all four Outcomes. Centres may prefer to have one major assignment covering all four Outcomes. If this is the case it will be important that candidates make regular submissions in order to obtain feedback on progress.

Outcome 2

Describe mechanical engineering quantities used in engineering systems

Knowledge and/or skills

- Work, power and energy

Category A

- mass
- length
- force
- pressure
- temperature

Category B

- flow
- friction
- stress/strain
- velocity and acceleration (linear and angular)
- inertia
- thermal

Evidence Requirements

Evidence for the knowledge and /or skills in Outcomes 2 should be provided on a sample basis. The evidence may be presented in responses to specific questions. Each candidate will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown under the knowledge and/or skills items in the Outcome. In any assessment of Outcome 2, bullet point 1 must always be assessed plus any **two out of five** knowledge and/or skills items from Category A and any **two out of six** knowledge and/or skills items from Category B.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of two out of five knowledge and/or skills items from Category A and a different sample of two out of six knowledge and/or skills items from Category B should be sampled each time the Outcome is assessed. Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to describe the application of each of the knowledge and/or skills items sampled in terms of their effect on a system's operation.

Evidence must be generated by candidates undertaking an assignment and producing a report to cover the sampled Knowledge and/or Skills items. Candidates should do the assignment in their own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Assessment guidelines

It is recommended where possible that the assignments for Outcomes 1, 2, 3 and 7 are linked in that the electromechanical system is used as the basis for the assessment of all four Outcomes. Centres may prefer to have one major assignment covering all four Outcomes. If this is the case it will be important that candidates make regular submissions in order to obtain feedback on progress.

Centres may wish to provide candidates with a format for their reports or leave it to the candidate to decide on the format of the report.

Centres should refer to the appropriate assessment exemplar for guidance on sampling.

Outcome 3

Describe electrical engineering quantities used in engineering systems

Knowledge and/or skills

- Energy and Power

Category A

- Charge
- EMF / Voltage
- Current
- Resistance

Category B

- Inductance
- Capacitance

Evidence Requirements

Evidence for the knowledge and /or skills in Outcomes 3 will be provided on a sample basis. The evidence may be presented in responses to specific questions. Each candidate will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown under the knowledge and/or skills items in the Outcome. In any assessment of Outcome 3, bullet point 1 must always be assessed plus any **two out of four** knowledge and/or skills items from Category A and **one out of two** knowledge and/or skills items from Category B.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of two out of four knowledge and/or skills items from Category A and a different sample of one out of two knowledge and/or skills items from Category B should be sampled each time the Outcome is assessed. Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to describe the application of each of the above knowledge and/or skills items sampled in terms of their effect on a system's operation.

Evidence will be generated by candidates undertaking an assignment and producing a report to cover the sampled Knowledge and/or Skills items. Candidates should do the assignment in their own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Assessment guidelines

It is recommended where possible that the assignments for Outcomes 1, 2, 3 and 7 are linked in that the electromechanical system is used as the basis for the assessment of all four Outcomes. Centres may prefer to have one major assignment covering all four Outcomes. If this is the case it will be important that candidates make regular submissions in order to obtain feedback on progress.

Centres may wish to provide candidates with a format for their reports or leave it to the candidate to decide on the format of the report.

Centres should refer to the appropriate assessment exemplar for guidance on sampling.

Outcome 4

Calculate different forms of energy in engineering systems

Knowledge and/or skills

Category A

- Potential
- Kinetic
- Pressure
- Flow
- Heat/Thermal

Category B

- Real Power
- Apparent Power
- Reactive Power
- Heat/Thermal

Evidence Requirements

Evidence for the knowledge and /or skills in Outcomes 4 should be provided on a sample basis. The evidence may be presented in responses to specific questions. Each candidate will need to demonstrate that she/he can answer correctly questions based on a sample of the items shown under the knowledge and/or skills items in the Outcome. In any assessment of Outcome 4 **three out of five** knowledge and/or skills items from Category A and **three out of four** knowledge and/or skills items from Category B should be sampled each time the Outcome is assessed.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of three out of five knowledge and/or skills items from Category A and three out of four knowledge and/or skills items from Category B should be sampled each time the Outcome is assessed. Candidates must provide a satisfactory response to all items.

Where sampling takes place, a candidate's response can be judged to be satisfactory where evidence provided is sufficient to meet the requirements for each item by showing that the candidate is able to calculate the sampled quantities correctly.

Evidence for this Outcome should be assessed by candidates sitting a written test lasting 30 minutes conducted under supervised, controlled conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates should be supplied with a formula sheet containing energy formulae and should be permitted to use a scientific calculator during the assessment.

Assessment guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome can be combined with the assessments for Outcomes 5 and 8 to form a single assessment paper, details of which are given under the Assessment Guidelines of Outcome 8. It is strongly recommended that a graphical approach is taken for the assessment of active power, apparent power and reactive power.

Outcome 5

Compare mechanical and electrical quantities

Knowledge and/or skills

- Energy storage elements
- Power dissipative elements
- External inputs
- Power transfer mechanisms

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can compare an electrical and mechanical system in term of the quantities specified under the knowledge and/or skills items above.

Evidence for this Outcome should be assessed by candidates sitting a written test lasting 30 minutes conducted under supervised, controlled conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring any textbooks, handouts or notes to the assessment.

Assessment guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome can be combined with the assessments for Outcomes 4 and 8 to form a single assessment paper, details of which are given under the Assessment Guidelines of Outcome 8.

Outcome 6

Undertake an energy and power audit on an engineering system

Knowledge and/or skills

- Energy sources
- Energy transfer mechanism
- Losses
- Efficiency (both sub-system and system levels)

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can conduct an energy audit on an electromechanical system and undertake the following:

- identify all energy sources
- identify all energy transfer mechanisms
- identify and estimate energy losses in the system
- estimate system and/or subsystem efficiency
- suggest actions to improve efficiency

Evidence will be generated by candidates undertaking an assignment and producing a report to cover the sampled Knowledge and/or Skills items. Candidates should do the assignment in their own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Evidence Requirements

Centres should select systems for audit that are practicable and manageable in terms of the complexity of the system.

Centres may wish to provide candidates with a format for their reports or leave it to the candidate to decide on the format of the report.

Outcome 7

Investigate the properties of materials used in engineering systems

Knowledge and/or skills

- Mechanical properties
- Electrical properties
- Fluid properties
- Thermal properties

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that, for a system or systems, they can:

Identify types of materials that have been used and their choice in terms of their key properties and discuss possible alternative materials.

Evidence will be generated by candidates undertaking an assignment and producing a report to cover the sampled Knowledge and/or Skills items. Candidates should do the assignment in their own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist should be used to record oral evidence of the candidate's knowledge and understanding.

Assessment guidelines

It is recommended where possible that the assignments for Outcomes 1, 2, 3 and 7 are linked in that the electromechanical system is used as the basis for the assessment of all four Outcomes. Centres may prefer to have one major assignment covering all four Outcomes. If this is the case it will be important that candidates make regular submissions in order to obtain feedback on progress.

Centres may wish to provide candidates with a format for their reports or leave it to the candidate to decide on the format of the report.

Outcome 8

Draw typical engineering system, and sub-system, responses

Knowledge and/or skills

- Input (step only)
- Output (over-damped, critically damped, under-damped and oscillatory)
- Natural frequencies

Evidence Requirements

All knowledge and/or skills items in this Outcome should be assessed.

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that, for an electrical and mechanical system, they can

- identify system responses for a range of system parameters
- estimate key output parameters (peak overshoot, settling time, steady state error, time lag)
- compare responses for the different systems

Evidence for this Outcome should be assessed by candidates sitting a written test lasting 30 minutes conducted under supervised, controlled conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates should be supplied with a formula sheet and should be permitted to use a scientific calculator during the assessment.

Assessment guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome can be combined with the assessments for Outcomes 4 and 5 to form a single assessment paper which should be taken at one single assessment event lasting one and half hours. This assessment paper should be conducted under supervised, controlled conditions.

Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates should be supplied with a formula sheet and should be permitted to use a scientific calculator during the assessment.

Administrative Information

Unit code: HV44 47

Unit title: Principles of Engineering Systems

Superclass category: XA

Date of publication: November 2017

Version: 01

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

SQA Advanced Unit specification: support notes

Unit title: Principles of Engineering Systems

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 80 hours.

Guidance on the content and context for this Unit

This 2-credit, SCQF Level 7 Unit has been written as one of the four mandatory Principles/ Technology units within the SQA Advanced Certificate in Engineering Systems. The other three mandatory units are *Engineering Communication*, *Engineering Measurement and Systems Monitoring* and *Mathematics for Engineering 1: Mechanical and Manufacturing* which are all 1 credit SQA Advanced units at SCQF Level 7. It is important that all four units are seen as providing an integrated programme of study covering a systems approach to the analysis of engineering processes and systems. As such every opportunity should be sought to combine the delivery and assessment of the four units.

The emphasis in the four units should be on allowing candidates to develop knowledge and understanding of basic ideas and concepts involved in engineering systems rather than on any mathematical treatment of systems. Equal emphasis should be given to mechanical and electrical concepts, ideas and quantities.

In designing this Unit, the unit writers have identified the range of topics expected to be covered by lecturers. The writers have also given recommendations as to how much time should be spent on each Outcome. This has been done to help lecturers decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for centres to use this list of topics it is strongly recommended that they do so to ensure continuity of teaching and learning, and because the assessment exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

A list of topics is given below. Lecturers are advised to study this list of topics in conjunction with the assessment exemplar pack so that they can get a clear indication of the standard of achievement expected of candidates in this Unit.

Outcome 1 — Represent Engineering Systems in block diagram format (8 hours)

- Explain systems approach to engineering.
- Represent inputs, outputs, output/input relationships, processes, signals, energy sources, directions of flow and system quantities in block diagram format.
- Illustrate examples of electrical, mechanical and electromechanical systems in block diagram forma
- Formative assessment on block diagram representations

Outcome 2 — Describe mechanical engineering quantities used in engineering systems (10 hours)

- Explain the concept of mechanical work, energy and power
- Explain the following mechanical engineering quantities: mass, length, force, pressure and temperature (relate to known standards where applicable — for example, definition of a metre and a Kelvin).

- Explain the following mechanical engineering quantities: flow, friction, stress/strain, velocity and acceleration (both linear and angular), inertia and heat.
- Relate the above concepts and quantities to their influence on engineering system operations.

Outcome 3 — Describe electrical engineering quantities used in engineering systems (10 hours)

- Explain the concept of electrical energy and power (to include power in dc circuits and active, apparent and reactive power in ac circuits).
- Explain the following electrical quantities: charge, emf/voltage, current and resistance.
- Explain the following electrical quantities: inductance and capacitance.
- Relate the above concepts and quantities to their influence on engineering system operations.

Outcome 4 — Calculate different forms of energy in engineering systems (10 hours)

- Calculate the following forms of mechanical energy: potential, kinetic, pressure, flow and heat/thermal (relate calculations to the presence of the energy forms within engineering systems).
- Calculate the following forms of electrical energy: real power (for both dc and ac cases), apparent, reactive and heat/thermal (for both dc and ac cases).

Candidates should be supplied with energy formula sheet.

Outcome 5 — Compare mechanical and electrical quantities (8 hours)

This is a critical Outcome in the Unit as it allows candidates to understand that while engineering systems can at first sight be very different many of the concepts, ideas and behaviours that underpin their operation are very similar. For example, the concepts, ideas and behaviours that underpin a spring, mass and damper mechanical system are very similar to a series electrical circuit resistance, inductance and capacitance system when, for example, subjected to an external step change input. Emphasis should be placed on these similarities with regard to various quantities: for example:

- force/pressure — EMF as external inputs
- fluid/heat flow — electrical current
- friction as a form of mechanical resistance generating heat — electrical resistance generating heat
- storage of potential energy as in a dam with the storage of electrostatic energy in a capacitor
- storage of kinetic energy in, say, a flywheel with magnetic energy in an inductor

The concept of energy transfer should also be fully explored as this is a critical aspect of the operation of many engineering systems (eg mechanical to electrical energy, electrical to mechanical energy, electrical energy to heat energy etc.).

Outcome 6 — Undertake an energy and power audit on an engineering system (12 – hours)

- Identify and explain the need for different types of energy sources within engineering systems.
- Explore the various types of energy transfer mechanisms that can exist in an engineering system.
- Explain the different types of losses that can occur in engineering systems.
- Estimate the magnitudes of such losses in different engineering systems.
- Explain the concept of efficiency as applied to an engineering system, or sub-system.
- Estimate efficiencies in different engineering systems.
- Explain the concept of an energy audit on an engineering system.
- Undertake an energy audit on a practical engineering system and prepare a report.

Outcome 7 — Investigate the properties of materials used in engineering systems (14 hours)

- Investigate typical materials used in engineering systems in terms of their key mechanical properties (eg malleability; ductility; toughness; hardness; tensile, compressive and shear stress, fatigue, creep, toxicity, stability, wear resistance where relevant) and identify why these materials have been selected for use in the system in preference to other materials.
- Investigate typical materials used in engineering systems in terms of their electrical properties (eg resistivity, conductivity, permeability, permittivity, current handling capability, breakdown voltage) and identify why these materials have been selected for use in the system in preference to other materials.
- Investigate typical materials used in engineering systems in terms of their flow properties (eg viscosity, flow resistance) and identify why these materials have been selected for use in the system in preference to other materials.
- Investigate typical materials used in engineering systems in terms of their thermal properties (eg conduction/insulation properties, conductivity, specific heat capacity, radiation properties) and identify why these materials have been selected for use in the system in preference to other materials.

Outcome 8 — Draw typical engineering system, and sub-system, responses (8 hours)

- Explain the concept of step input.
- Review typical system responses to step inputs: over damped, critically damped, under damped and oscillatory.
- Identify key output parameters: peak overshoot, settling time, steady state error, time lag.

Guidance on the delivery and assessment of this Unit

This Unit may be delivered by a combination of lecturing, group work, investigation (including the use of the Internet), practical investigation and computer simulation.

It is important that emphasis throughout the Unit is placed on a systems approach to engineering processes and systems with equal weighting being given to mechanical and electrical engineering concepts, ideas and quantities. Furthermore, every opportunity should be used during the delivery of the Unit to compare mechanical and electrical concepts, ideas and quantities with a view to identifying similarities between the concepts, ideas and quantities.

In Outcome 1 it is important that candidates are exposed to a range of engineering systems so that they get a clear appreciation of the large range engineering systems in use. Systems can range in size from small to large: for example, CD players or laptop computer to a power station.

Industrial visits may prove useful in allowing candidates to observe a number of different engineering systems in operation.

Computer simulation software may be used to illustrate a number of interesting features of engineering systems (eg production of block diagrams, system output responses etc.)

The energy audit in Outcome 6 may be conducted on an engineering system operating in a centre such as a heating system or heating, ventilating and air conditioning system or a refrigeration system.

Candidates will have opportunities to develop their written communication skills through the preparation of an assignment report or reports. Critical thinking skills should be developed through the use of investigations and formative assessments which allows the candidates to explore various aspects of engineering systems including comparison of mechanical and electrical concepts and quantities, identification of different energy sources and losses etc. Candidates may be allowed to develop their Working with Others core skills through the use of appropriately structured group discussions.

Details on the approaches to assessment are given under Evidence requirements and Assessment guidelines under each Outcome in the SQA Advanced Unit specification: statement of standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates. Given the range of assessment in this Unit it is strongly recommended that candidates are provided with clear details about assessment at the beginning of the Unit (submission dates for assignments, dates and times when written tests will take place etc.).

Opportunities for developing Core Skills

There may be opportunities to gather evidence towards the following listed Core Skill components in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Written Communication	SCQF level 6
Critical Thinking	SCQF level 6
Working with Others	SCQF level 5

Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangement would be required to be put in place to ensure that the written test (s) was conducted under controlled, supervised conditions.

For information on normal open learning arrangements, please refer to the SQA guide *Assessment and Quality Assurance of Open and Distance Learning (SQA 2000).*

Equality and inclusion

This unit specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence.

Further advice can be found on our website www.sqa.org.uk/assessmentarrangements.

General information for candidates

Unit title: Principles of Engineering Systems

There are very many different types of engineering systems that you will find both in the home and in industry. For example, your CD player, the pc in the home and the power station that produces the electricity to power all appliances in the home are all examples of engineering systems. In this Unit you will study Engineering from an engineering systems approach in which equal treatment will be given to mechanical and electrical engineering ideas and quantities.

In Outcome 1 you will learn about a common way of representing engineering systems: namely block diagram format. In Outcomes 2 and 3 you will study a range of mechanical and electrical quantities which arise in engineering systems, while in Outcome 5 you will compare these quantities with a view to identifying similarities between them. In Outcome 4 you will calculate different forms of energy that occur in engineering systems while in Outcome 6 you will conduct an energy audit on a practical engineering system. In Outcome 7 you will learn about materials commonly used in engineering systems and why these materials are preferred to other materials. In Outcome 8 you will explore typical engineering system responses to common external stimulation (eg step and sine wave inputs).

The Unit will be delivered by a balance of lecturing, group work, investigation work and computer simulation.

Assessment will comprise of a combination of assignment work and written test. Please ask your lecturer for more details about the assessments in this Unit.