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## Mechanisms and Structures

**SCQF:** level 6 (6 SCQF credit points)

**Unit code:** J29J 76

### Unit outline

The general aim of this Unit is to develop a deep understanding of mechanism and structures. Learners will analyse and explore mechanical and structural engineering problems and design, simulate, construct, test and evaluate solutions.

Learners who complete this Unit will be able to:

- 1 Investigate a range of complex mechanisms and structures
- 2 Develop mechanical or structural solutions to solve complex problems

This Unit is available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Unit Support Notes* which provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in *Unit Assessment Support*.

### Recommended entry

Entry to this Unit is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- ◆ Mechanisms and Structures (National 5)

## **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. For further information please refer to the *Unit Support Notes*

# Standards

## Outcomes and assessment standards

### Outcome 1

The learner will:

#### **1 Investigate a range of complex mechanisms and structures by:**

- 1.1 Using the systems approach to analyse mechanisms and structures
- 1.2 Describing or producing diagrams of a range of complex structures
- 1.3 Describing or producing diagrams of a range of complex mechanisms
- 1.4 Investigating the properties of a range of materials used in mechanisms and structures

### Outcome 2

The learner will:

#### **2 Develop mechanical or structural solutions to solve complex problems by:**

- 2.1 Identifying key aspects of the problem
- 2.2 Applying knowledge and understanding of structures, materials and/or mechanisms
- 2.3 Carrying out calculations to assist the selection of materials or component sizes
- 2.4 Designing structures and/or mechanisms
- 2.5 Simulating or building mechanisms and/or structures
- 2.6 Testing and evaluating solutions

## Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used.

For this Unit, learners will be required to demonstrate technological skills, knowledge and understanding of mechanisms and structures.

Evidence of Outcomes may take many forms, including oral or written evidence, or may be demonstrated by carrying out practical tasks. Evidence of Outcomes and Assessment Standards may be generated during one or more activities. Although learners are expected to develop a range of mechanical and structural solutions for Outcome 2, evidence is only required for one.

Exemplification of assessment will be provided in *Unit Assessment Support*.

**Advice and guidance on possible approaches to assessment is provided in the Unit Support Notes.**

## Assessment standard thresholds

If a candidate successfully meets the requirements of the specified number of Assessment Standards they will be judged to have passed the Unit overall and no further re-assessment will be required.

The specific requirements for this Unit is as follows:

- ◆ 7 out of 10 Assessment Standards must be achieved.

It should be noted that there will still be the requirement for candidates to be given the opportunity to meet all Assessment Standards. The above threshold has been put in place to reduce the volume of re-assessment where that is required.

# Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Unit where there are appropriate opportunities.

## 2 Numeracy

- 2.1 Number processes
- 2.3 Information handling

## 4 Employability, enterprise and citizenship

- 4.2 Information and communication technology (ICT)

## 5 Thinking skills

- 5.3 Applying
- 5.4 Analysing and evaluating

Amplification of these is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work*. The level of these skills should be at the same SCQF level of the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the *Unit Support Notes*.

## Appendix: unit support notes

These support notes provide advice and guidance on approaches to delivering and assessing this unit. They are intended for teachers and lecturers who are delivering this unit. They should be read in conjunction with:

- ◆ the *unit specification*
- ◆ the *unit assessment support packs (UASP)*

<b>Calculations</b>	<p>Manipulating and combining given formulae to obtain answers</p> <p>Solving structural problems using trigonometric functions and substitution in simultaneous equations</p>
<b>Drive systems</b>	<p>Selection of appropriate drive systems (including simple and compound gear trains, belt drives and chain drives) in different contexts.</p> <p>The purpose of couplings (rigid and flexible — all types), radial and thrust bearings (plain, ball, roller, journal) and joints in shafts</p> <p>Purpose of friction in brakes and clutches</p> <p>Calculation of torque: <math>T = Fr</math></p>
<b>Pneumatics</b>	<p>Sequential control circuits, with up to two cylinders</p> <p>Electro-pneumatic control circuits</p>
<b>Structures and forces</b>	<p>Resolving triangle/polygon of forces, resultant/equilibrium</p> <p>Calculation of reaction forces in simply supported beams where loads are not exclusively horizontal or vertical, with hinge and roller supports, with uniformly distributed loads</p> <p>Use of nodal analysis to calculate the size and nature of forces in frames</p>
<b>Materials</b>	<p>Properties of materials: brittleness, elasticity, ductility, plasticity, strength, malleability</p> <p>Calculation of Young's Modulus of elasticity</p> <p>Calculation of factor of safety</p> <p>Use of strain gauges</p> <p>Stress/strain (load/extension) graphs</p> <p>Calculation of elastic strain energy: <math>E_s = \frac{1}{2} Fx</math></p>

# Administrative information

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**Superclass:** XH

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## History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
2.0	Level changed from Higher to SCQF level 6. Unit support notes added. Assessment standard threshold added.	Qualifications Manager	September 2018
3.0	Unit code updated	Qualifications Manager	July 2019

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Note: readers are advised to check SQA's website: [www.sqa.org.uk](http://www.sqa.org.uk) to ensure they are using the most up-to-date version of the Unit Specification.

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