



## Higher National Unit Specification

### General information

**Unit title:** Biomechanics for Orthotics and Prosthetics (SCQF level 7)

**Unit code:** HE2J 34

**Superclass:** PE

**Publication date:** May 2016

**Source:** Scottish Qualifications Authority

**Version:** 01

### Unit purpose

This Unit is designed to introduce the learner to the terminology relating to movement, planes of reference of the human body and external medical devices. It aims to provide the learner with a good underpinning knowledge of biomechanics as it relates to orthotics and prosthetics. The Unit covers the movement and gait patterns of the human body and underpins the work based Units of the PDA in Rehabilitation Technologies.

### Outcomes

On successful completion of the Unit the learner will be able to:

- 1 Identify the planes of reference of the human body and explain the terminology relating to normal and abnormal motion and associated orthotic and prosthetics external devices.
- 2 Explain the principles of biomechanics as used in orthotics and prosthetics.
- 3 Explain normal human gait and pathological gait and the use of orthotic and prosthetic devices.

### Credit points and level

1 Higher National Unit credit at SCQF level 7: (8 SCQF credit points at SCQF level 7)

## **Higher National Unit specification: General information (cont)**

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### **Recommended entry to the Unit**

Ultimately access to the Unit is at the discretion of the centre, however a knowledge of biomechanics at level 6 would be beneficial. In addition, a familiarity with the working practice of orthotics and prosthetics would help the learner to put the learning in context. It is therefore recommended that this Unit is undertaken by individuals who are currently working in an orthotic or prosthetic area.

### **Core Skills**

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

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

### **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.

This Unit is delivered as part of the PDA Rehabilitative Technologies Group Award, it is recommended that it should be taught and assessed within the subject area of that Group Award.

### **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](http://www.sqa.org.uk/assessmentarrangements).

## Higher National Unit Specification: Statement of standards

**Unit title:** Biomechanics for Orthotics and Prosthetics (SCQF level 7)

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.

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. Learners 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

Identify the planes of reference of the human body and explain the terminology relating to normal and abnormal motion and associated orthotic and prosthetics external devices.

#### Knowledge and/or Skills

- ◆ Planes of reference within the normal anatomical structures
- ◆ Triplanar motion and the planes of axes of joints of the human body
- ◆ Terminology of normal and abnormal motion and resultant deformities of the lower limb
- ◆ Terminology of normal and abnormal motion and resultant deformities of the upper limb
- ◆ Terminology of normal and abnormal motion and resultant deformities of the spine
- ◆ Orthotic and Prosthetic devices

### Outcome 2

Explain the principles of biomechanics as used in orthotics and prosthetics.

#### Knowledge and/or Skills

- ◆ Weight, mass, centre of mass
- ◆ Basic principles from Newton's laws of motion
- ◆ Free body diagrams
- ◆ Resolution of forces, vectors
- ◆ Resultant forces and lever arms
- ◆ Movements and related forces
- ◆ Have a basic understanding of body segment parameters — length, mass, centre of mass

## Higher National Unit Specification: Statement of standards (cont)

**Unit title:** Biomechanics for Orthotics and Prosthetics (SCQF level 7)

### Outcome 3

Explain normal human gait and pathological gait and the use of orthotic and prosthetic devices.

#### Knowledge and/or Skills

- ◆ Basic muscle groups used in normal gait
- ◆ Basic muscle groups involved in the upper limb and trunk
- ◆ Stages of normal gait
- ◆ Gait deviations
- ◆ Body compensations
- ◆ Possible socket interface pressure
- ◆ Orthotic and Prosthetic devices
- ◆ Effect of ground reaction forces on wear and tear of Orthotic/Prosthetic medical devices

#### Evidence Requirements for this Unit

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

### Outcome 1

- ◆ Identify the following planes used in prosthetics and orthotics:
  - Sagittal plane
  - Cardinal plane
  - Transverse plane
- ◆ Identify triplanar motion and planes of axes in the following joints:
  - Ankle
  - Knee
  - Hip
  - Wrist
  - Elbow
- ◆ Explain normal and abnormal motion and the resultant deformities associated with the following terms:
  - Extension
  - Inversion
  - Eversion
  - Pronation
  - Supination
  - Abduction
  - Adduction
  - Rotation
  - Elevation
  - Depression

## Higher National Unit Specification: Statement of standards (cont)

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- ◆ Describe three Orthotic or three Prosthetic devices used to treat the abnormal motion deformities described above.

### Outcome 2

- ◆ Explain weight, mass and centre of mass.
- ◆ Describe Newtons laws of motion
- ◆ Draw one free body diagram showing all forces acting on a limb correctly
- ◆ Calculate the resultant of two forces and show the correct vectors
- ◆ Explain the effects of simple moments at joints on lower or upper limbs and the forces correctly
- ◆ Describe the importance of body segment parameter from a given table with mass and height information correctly

### Outcome 3

- ◆ Identify the basic muscle groups that are used in gait and state whether these are tending to flex, extend, abduct or adduct the limb correctly
- ◆ List the basic muscle groups involved the upper limb and trunk
- ◆ Describe stages of normal gait and the relative position of the ankle, knee and hip positions
- ◆ Explain gait deviations and resultant forces on the Orthotic or Prosthetic device
- ◆ Explain body compensations
- ◆ Identify three possible socket interface pressure areas
- ◆ Describe the effect of ground reaction forces on wear and tear of Orthotic/Prosthetic medical devices



## Higher National Unit Support Notes

**Unit title:** Biomechanics for Orthotics and Prosthetics (SCQF level 7)

Unit Support Notes are offered as guidance and 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 mandatory Unit within the Professional Development Award in Rehabilitation Technologies SCQF level 7. It is designed to meet the knowledge and skills required by learners in preparation for their role as a prosthetic or orthotic technician. The Unit will support learners to understand their clinical role within a defined scope of practice.

This Unit is designed to provide the learner with a good working knowledge of biomechanics as it relates to orthotics and prosthetics. The Unit covers the anatomical planes and axis of the human body and the subject of gait patterns of the human body. The Unit provides underpinning knowledge for the work based Units of the Professional Development Award in Rehabilitation Technologies.

#### Outcome 1

The aim of this Outcome is to examine the various planes and axis used in orthotics and prosthetics to identify body segments and the location of devices. The Outcome will also introduce the learner to the various terms used to describe the normal and abnormal movement of limbs, body segments and joints and the use of external medical devices and their use to correct abnormal movement.

#### Outcome 2

This Outcome investigates the subject of biomechanics and its use within orthotics and prosthetics. The learner will learn about the terms weight, mass and centre of mass they will also learn the basic principles of Newton's laws of motion. They will be expected to understand about free body diagrams and how to work out the resolutions of different forces and vectors. The learner will be introduced to the subject of resultant forces and lever arms and moments about a pivot point and its resultant use in orthotics and prosthetic device manufacture. Finally the Outcome will explain about how these principles apply to body segments and their affect on an orthotic or prosthetic device fitted to these body segments.

## Higher National Unit Support Notes (cont)

**Unit title:** Biomechanics for Orthotics and Prosthetics (SCQF level 7)

### Outcome 3

This Outcome will look at human body movement and the subject of gait. The learner will gain an understanding of the basic muscle groups used in the different stages of gait and what happens when the patients gait deviates from the normal patterns and what effect this can have on an orthotic or prosthetic device fitted to the patient. They will also learn about the subject of ground reaction forces and their effect on an orthotic or prosthetic device fitted to the patient. The learner will also learn about body compensations and the effect of pressure areas on socket fits in Prosthetics.

### Guidance on approaches to delivery of this Unit

Outcome 1 — planes of reference and basic terminology of the human body gives the learner a broad understanding of the different types of human body movement before moving onto knowledge, understanding. This Outcome also allows the learner to identify different types of external medical devices. This Outcome should be taught through a range of theory, group work, presentations and research. This Outcome should be taught first in the Unit.

Outcome 2 — this Outcome looks at the subject of forces and the basic principles of biomechanics and laws surrounding them and how this relates specifically to orthotics and prosthetics. The Outcome covers forces, vectors, moments and vector arms and how these can be related to orthotics and prosthetics and the relevant medical devices manufactured for a patient. This Outcome should be taught through a range of theory, group work, presentations and research. This Outcome should be delivered second.

Outcome 3 — this Outcome looks at the subject of gait normal and abnormal and the different phases of it and the basis muscle groups needed to achieve it. It looks at abnormal gait and how an orthotic or prosthetic device can be used to correct this. This Outcome should be taught through a range of theory, group work, presentations and research. This Outcome should be delivered last.

### Guidance on approaches to assessment of this Unit

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

In order to achieve this Unit, learners are required to submit sufficient evidence to demonstrate they have met the Knowledge and Skills requirements for each Outcome.

An understanding of biomechanics and its application to orthotic/prosthetic practice is a requirement for successful achievement of the Unit.

Evidence can be generated using different types of instruments of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

## Higher National Unit Support Notes (cont)

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It is suggested that the Unit is assessed in the following ways:

**Outcomes 1, 2 and 3** could be assessed using a closed-book e-assessment made up of short answer question and diagrams for labelling.

The learner will be required to demonstrate skills and knowledge for all Outcomes.

### Opportunities for 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 social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

There are opportunities to develop the Core Skills of *Communication* at SCF level 5 in this Unit.

*Communication*: this will be evidenced via the learner's work with individuals and groups in the workplace.



## History of changes to Unit

Version	Description of change	Date

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## General information for learners

### **Unit title:** Biomechanics for Orthotics and Prosthetics (SCQF level 7)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

In this Unit the learner will be introduced to the various planes of reference used in reference to the human body you will also learn the various medical terms used within orthotics and prosthetics to describe movement both normal and abnormal of a body segment or a human joint. You will also learn about weight, masses and forces and how they are applied and measured within orthotics and prosthetics. You will also learn about the forces that act on a body and the effects these have on the type and design of orthotic and prosthetic devices. You will also learn about normal gait patterns and the different stages of gait and how to recognise the position of the various joints during normal gait and how this changes in abnormal gait. You will learn how an orthotic or prosthetic device can be used to correct this abnormal gait and the effect this device can have on the joint systems. You will also gain an understanding about the subject of ground reaction forces and the effect they can have on a human body.

The Unit may be taught and assessed using an online environment but you will be able to draw on examples from your own workplace.

There are no certificated Core Skills in this Unit but you will develop Core Skills in *Communication*.

The British Association of Prosthetists and Orthotists (BAPO) and British Healthcare Trades Association (BHTA) support the qualification that this Unit belongs to the PDA in Rehabilitative Technologies. This qualification is recognised as a training programme for orthotic technicians, prosthetic technicians and orthopaedic footwear technicians.