Higher National Unit specification

General information for centres

Unit title: Marine Engineering: Naval Architecture

Unit code: F911 34

Unit purpose: This Unit is designed to enable candidates to develop their knowledge and understanding of Naval Architecture. The Unit will allow candidates to apply the Principles of Naval Architecture.

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

1 Perform calculations on Hydrostatic data
2 Calculate Small Angle Stability
3 Derive formulae and solve problems involving ships Propellers and Resistance

Credit points and level: 1 HN credit at SCQF level 7: (8 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 Access 1 to Doctorates.*

Recommended prior knowledge and skills: Candidates should have knowledge of Mathematics and/or Physics. This may be demonstrated by possession of Mathematics and/or Physics at SCQF level 6 or possession of a NC Engineering Group Award at SCQF level 6.

Core Skills: There are opportunities to develop the Core Skills of *Numeracy*, *Communication* and *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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: Assessment should be carried out in supervised conditions. Each Outcome could be assessed separately in a paper which lasts no more than one hour. However, the assessment could take place as one assessment event which combines all Outcomes.
Each Outcome could comprise of four questions taken on a sample basis as laid out in the Evidence Requirements for each Outcome.

Higher National Unit specification: statement of standards

Unit title: Marine Engineering: Naval Architecture

Unit code: F911 34

Outcome 1

Perform calculations on Hydrostatic data

Knowledge and/or Skills

- Buoyancy and Displacement
- Change in Draught due to Density
- Wetted surface areas
- Coefficients of Form
- Tonnes per centimetre immersion TPC
- Simpson's Rule

Evidence Requirements

Evidence for the knowledge and/or skills items in Outcome 1 should be provided on a sample basis. Each candidate will need to demonstrate that they can answer correctly questions based on a sample of the knowledge and skills items. In any assessment of this Outcome, **four out of six** knowledge and/or skills items should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of four out of six knowledge and/or skills items are required each time the Unit 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 the candidate is able to:

- Calculate Displacement and Buoyancy
- Calculate changes in draught due to Density
- Calculate Wetted Surface Area
- Calculate Coefficients of Form
- Calculate TPC
- Determine Areas, Volumes and Centres using Simpson's Rule.

Where calculations are performed the candidate must:

- Apply appropriate formulae.
- Apply the principles of the calculation.
- Show all working through a calculation.
- Ensure the answer should derive from the application of the formula and correct application of the principles of the calculation.
- Evidence should be generated through closed-book assessment of one hour duration in supervised conditions.
- No formula sheets are to be used during this Outcome.
- Use of scientific calculators is allowed.

Assessment Guidelines

Outcome 1 could comprise of four calculation questions taken on a sample basis as laid out in the Evidence Requirements for each Outcome.

Outcome 2

Calculate Small Angle Stability

Knowledge and/or Skills

- Centres of Gravity
- Vertical Centre of Gravity
- Longitudinal Centre of Gravity
- Effect of bilging a mid-ship compartment
- Small angle stability
- Angle of List
- Inclining Experiment

Evidence Requirements

Evidence for the knowledge and/or skills items in Outcome 2 will be provided on a sample basis. Each candidate will need to demonstrate that they can correctly answer questions based on a sample of the knowledge and skills items listed in the Outcome. In any assessment of this Outcome, **four out of seven** knowledge and/or skills items should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of four from seven knowledge and/or skills items are required each time the Unit 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 the candidate is able to:

- Calculate positions of Centre of Gravity for any loaded condition of a ship
- Calculate position of Vertical Centre of Gravity
- Calculate position of Longitudinal Centre of Gravity
- Calculate change of draught due to bilging
- Calculate small angle stability
- Calculate Angle of List
- Calculate and explain the inclining experiment.

Where calculations are performed the candidate must:

- Apply appropriate formulae.
- Apply the principles of the calculation.
- Show all working through a calculation.
- Ensure the answer should derive from the application of the formula and correct application of the principles of the calculation.

- Evidence should be generated through closed-book assessment of one hour duration in supervised conditions.
- No formula sheets are to be used during this Outcome.
- Use of scientific calculators is allowed.

Assessment Guidelines

Outcome 2 could comprise of four calculations questions taken on a sample basis as laid out in the Evidence Requirements for each Outcome.

Outcome 3

Derive formulae and solve problems involving ships' Propellers and Resistance

Knowledge and/or Skills

- Components of ship's resistance
- Frictional Resistance
- Residual resistance
- Admiralty Coefficients
- Fuel Coefficients
- Understand basic propeller terminology
- Propeller calculations involving thrust, effective and delivered power
- Propeller calculations involving real and apparent slip.

Evidence Requirements

Evidence for the knowledge and/or skills items in Outcome 3 will be provided on a sample basis. Each candidate will need to demonstrate that they can correctly answer questions based on a sample of the knowledge and skills items. In any assessment of this Outcome, **four out of eight** knowledge and/or skills items should be sampled.

In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of four from eight knowledge and/or skills items are required each time the Unit 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 the candidate is able to:

- Explain components of ship's resistance.
- Explain friction resistance.
- Explain residuary resistance.
- Derive formulae and calculate Admiralty Co-efficient.
- Derive formulae and calculate Fuel Co-efficient.
- Explain four Propeller terms.
- Calculate thrust, effective and delivered power.
- Calculate real and apparent slip.

Higher National Unit specification: statement of standards (cont)

Unit title: Marine Engineering: Naval Architecture

Where calculations are performed the candidate must:

- apply appropriate formulae.
- apply the principles of the calculation.
- show all working through a calculation.
- ensure the answer should derive from the application of the formula and correct application of the principles of the calculation.

Evidence should be generated through closed-book assessment of one hour duration in supervised conditions. No formula sheets are to be used during this Outcome. Use of scientific calculators is allowed.

Assessment Guidelines

Outcome 3 could comprise of four questions which are a combination of calculation and explanation taken on a sample basis as laid out in the Evidence Requirements for each Outcome.

Administrative Information

Unit code: F911 34

Unit title: Marine Engineering: Naval Architecture

Superclass category: XQ

Original date of publication: August 2010

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History of changes:

Version	Description of change	Date

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Marine Engineering: Naval Architecture

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 has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

1 The use of concepts and theorems to solve problems on Hydrostatic data.
2 The use of concepts and theorems to calculate Small Angle stability.
3 The use of concepts and theorems to solve problems involving ships' Propellers and Resistance.

In designing this Unit the Unit writers have identified the range of topics they would expect to be covered. Recommendations are given as to how much time should be spent on each Outcome. This has been done to help lecturers to decide what depth of treatment should be given to the topics attached to each of the Outcomes. Whilst it is not mandatory for a centre to use this list of topics it is strongly recommended that it does so to ensure continuity of teaching and learning across the Naval Architecture Unit. The list of topics is given below. Lecturers are advised to study this list of topics in conjunction with the knowledge/skills section of this document so that they can get a clear indication of the standard of achievement expected of candidates in this Unit.

1 Perform calculations on Hydrostatic data

- Understand the principles of flotation
- Use TPC in calculating displacement and effect of addition of masses on draught
- Calculate change in draught due to change in water density
- Define coefficients of form and their uses
- Define wetted surface area and calculate its value
- Apply Simpson's Rule and calculate Areas, Volumes and Centres.

2 Calculate small angle stability

- Calculate the position of the centres of gravity of a ship under any condition
- Define the term stability
- Understand the importance of the Centre of Buoyancy, Centre of Gravity and transverse metacentre with regards to stability
- Calculate the change in mean draught due to bilging, the effect of permeability and transverse stability

3 Derive formulae and solve problems involving ships' Propellers and Resistance

- Understand the factors involved in the resistance to motion exerted by water on a ship moving through it.
- Understand propeller terminology
- Use Admiralty Coefficient as an appropriate method of estimating power.
- Calculate the variation in fuel consumption with speed and the fuel required to be loaded for a given voyage.

Higher National Unit specification: support notes (cont)

Unit title: Marine Engineering: Naval Architecture

Guidance on the delivery and assessment of this Unit

This Unit could be delivered by a combination of class teaching, tutorial work and practical laboratory work where appropriate. The latter is seen as particularly important as it provides candidates with an opportunity to relate theoretical knowledge to a practical context. The Unit has been designed to incorporate sufficient time to allow lecturers to teach all the core Naval Architecture principles.

Where this Unit is incorporated into other Group Awards it is recommended that it be delivered in the context of the specific occupational area(s) that the award is designed to cover.

The Unit has been written in such a way that there is sufficient time built in to allow candidates to practise what they have learnt through formative assessments.

Details on the approaches to assessment are given under Evidence Requirements and Assessment Guidelines of the Higher National Unit specification: statement of standards section. It is recommended that this section is read carefully before proceeding with assessment of candidates.

Opportunities for developing Core Skills

In all Outcomes each of the assessments require the candidate to be able to solve problems. This will give the candidate the opportunity to develop the component 'Using Number' of the Core Skill *Numeracy* at SCQF level 6. The specific Core Skill elements that the candidate will have to complete are 'Decide on the steps and operations to be carried out to solve a complex problem' and 'Carry out a number of sustained, complex calculations'.

In completing each Outcome candidates may have the opportunity to develop the component 'Planning and organising' of the Core Skill *Problem Solving* at level 6 in Outcome 2. Candidates will have the opportunity to simulate problems using laboratory work and develop a strategy. The specific Core Skill elements that the candidate may have to complete are 'Develop a plan' for stability of a vessel.

In Outcome 3 candidates will explain residuary and frictional resistance. This will allow candidates to develop the component 'Written Communications' of the Core Skill *Communication* at SCQF level 6. Candidates will develop the specific elements 'Present all essential ideas/information and supporting detail in a logical and effective order' and 'Use conventions which are effective in achieving the purpose of the piece and adapted as necessary for the target audience'.

Open Learning

This Unit is suitable for Open Learning use although assessment would have to take place under controlled conditions.

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**

General information for candidates

Unit title: Naval Architecture

This Unit has been designed to allow you to develop knowledge, skills and understanding in Naval Architectural principles and concepts as used in Marine Engineering.

This Unit will also allow you the opportunity to develop the necessary knowledge and skills to evaluate Naval Architecture as used in marine applications.

The Unit may consist of three assessment papers lasting no more than one hour per paper. The assessment will be conducted under closed-book conditions in which you will not be allowed to take notes, textbooks etc into the assessment. However, you will be allowed to use a scientific calculator. You may sit assessment papers at the end of each Outcome.

This Unit will enable you to:

1 Perform calculations on Hydrostatic data
2 Calculate Small Angle Stability
3 Derive formulae and solve problems involving ships' Propellers and Resistance