Higher National Unit specification

General information for centres

Unit title: Marine Engineering: Mathematics

Unit code: F910 33

Unit purpose: The Unit is designed to enable candidates to know, understand and apply algebraic techniques to manipulate expressions and solve equations commonly found in marine engineering. It also provides candidates with an opportunity to develop the knowledge and skills of basic calculus. The Unit also allows candidates the opportunity to develop the necessary knowledge and skills to analyse trigonometric functions and their graphs.

On completion of the Unit candidates should be able to:

1   Apply algebraic techniques to manipulate expressions and solve equations commonly found in marine engineering.
2   Apply the techniques of differential and integral calculus
3   Analyse trigonometric functions and their graphs.

Credit points and level: 1 HN Credit at SCQF level 6: (8 SCQF credit points at SCQF level 6*).

*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 and understanding of mathematical concepts and theorems. This may be evidenced by possession of the National Qualifications Unit Mathematics for Science (F3T8 11) at SCQF level 5 or Standard Grade Mathematics at SCQF level 5.

Core Skills: The achievement of this Unit gives automatic certification of the following:

♦   Using Number at SCQF level 6

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 in contributes.

Assessment: It is possible to assess candidates either on an Outcome by Outcome basis or by a single holistic assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out under supervised, controlled conditions.

Higher National Unit specification: statement of standards

Unit title: Marine Engineering: Mathematics

Unit code: F910 33

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

Apply algebraic techniques to manipulate expressions and solve equations commonly found in marine engineering

Knowledge and/or Skills

♦ Numerical evaluation of expressions
♦ Simplification of algebraic expression
♦ Changing the subject of formula
♦ Solving equations
♦ Using indices, and exponential and logarithmic functions
♦ Using scientific /engineering notation

Evidence Requirements

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

♦ Solve quadratic equations.
♦ Solve simultaneous equations in two variables
♦ Change the subject of two equations one of which should include exponents.
♦ Evaluate numerical expressions which include logarithmic functions.
♦ Simplify an expression which contains powers and indices
♦ Evaluate a numerical expression which contains scientific notation.

Evidence for the knowledge and / or skills in this Outcome will be provided by an examination taken at a single assessment event lasting forty minutes and carried out under supervised, controlled conditions. In any assessment of this Outcome all of the knowledge and/or skills items should be tested.

In order to ensure that candidates will not be able to foresee the assessment, a different examination is required each time the Outcome is assessed. Candidates will not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be permitted to use scientific calculators during the assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Marine Engineering: Mathematics

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 Outcomes 2 and 3 to form a single assessment paper, details of which are given under Outcome 3.

Outcome 2

Apply the techniques of differential and integral calculus

Knowledge and/or Skills

♦ Differentiation of various functions using standard derivatives
♦ Indefinite and definite integration of various functions using standard integrals

Evidence Requirements

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

♦ Differentiate standard functions to include { $ax^n, \sin ax, \cos ax, \ln x, e^x$ }
♦ Determine the coordinates and the nature of the turning points of a given cubic function.
♦ Integrate standard functions to include { $ax^n, \sin ax, \cos ax, e^x$ }
♦ Determine a definite integral

Evidence for the knowledge and / or skills in this Outcome will be provided by an examination taken at a single assessment event lasting thirty minutes and carried out under supervised, controlled conditions. In any assessment of this Outcome all of the knowledge and / or skills items should be tested.

In order to ensure that candidates will not be able to foresee the exact form of the assessment, a different examination is required each time the Outcome is assessed. Candidates will not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be permitted to use scientific calculators 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 Outcomes 1 and 3 to form a single assessment paper, details of which are given after Outcome 3.

Higher National Unit specification: statement of standards (cont)

Unit title: Marine Engineering: Mathematics

Outcome 3

Analyse trigonometric functions and their graphs

Knowledge and/or Skills

♦ Sine and cosine waves only (determine period, amplitude, phase shift and the equation)
♦ Trigonometric equations of sine and cosine waves only (phase angle expressed in degree and radians, multiple angles)

Evidence Requirements

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

♦ Using a standard trigonometric equation establish the amplitude, period and phase shift.
♦ Using a standard wave form establish the amplitude, period and phase shift.
♦ Solve trigonometric equations.

All of the above must use radians and degrees

Evidence for the knowledge and / or skills in this Outcome will be provided by an examination taken at a single assessment event lasting thirty minutes and carried out under supervised, controlled conditions. In any assessment of this Outcome all of the knowledge and / or skills items should be tested.

In order to ensure that candidates will not be able to foresee the exact form of the assessment, a different examination is required each time the Outcome is assessed. Candidates will not be allowed to bring any textbooks, handouts or notes to the assessment. Candidates will be permitted to use scientific calculators 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 Outcomes 1 and 2 to form a single assessment paper for the Unit, details of which are given below.

If it is decided to use a single holistic assessment, then the single assessment paper could be taken at a single assessment event lasting one hour and forty minutes and carried out under supervised, controlled conditions. Evidence for the knowledge and/or skills items for all three Outcomes will be provided by an examination. The evidence may be presented in response to specific questions.

In order to ensure that candidates will not be able to foresee the exact form of the assessment, a different examination is required each time the Unit is assessed.

Administrative Information

Unit code: F910 33

Unit title: Marine Engineering: Mathematics

Superclass category: RB

Original date of publication: August 2010

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History of changes:

Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Marine Engineering: Mathematics

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

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

1   Apply algebraic techniques to manipulate expressions and solve equations commonly found in marine engineering.
2   Solve problems involving differentiation and integration function.
3   Analyse trigonometric functions and their graphs.

This Unit is at SCQF Level 6 and has been incorporated within the new HNC/D Marine Engineering awards. This Unit is mandatory at both HNC and HND levels. It is considered that a Unit in Mathematics is essential to support other areas of work in the new awards, notably Mechanical and Marine Principles.

A Unit Mathematics for Engineering 2 has been included as a mandatory Unit in the second year of the new HND Marine Engineering awards to support studies undertaken in other areas of the HND.

In designing this Unit Unit writers have identified the range of subjects they would expect to be covered by lecturers. Recommendations are also given 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 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 across the Mathematics Units and because the assessment exemplar pack for this Unit is based on the knowledge and / or skills and list of topics in each Outcomes.

Guidance on the delivery and assessment of this Unit

As this Unit provides core mathematical principles which underpin much of the studies done in the HNC/D Marine Engineering awards it is recommended that the Unit be delivered towards the start of these awards.

A list of topics is given below. Lecturers are advised to study this lost 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.

Higher National Unit specification: support notes (cont)

Unit title: Marine Engineering: Mathematics

Outcome 1

Apply algebraic techniques to manipulate expressions and solve equations commonly found in engineering (16 hours)

- Solve quadratic equations.
- Solve simultaneous equations in two variables
- Change the subject of two equations one of which should include exponents.
- Evaluate numerical expressions which include logarithmic functions.
- Simplify an expression which contains powers and indices
- Evaluate a numerical expression which contains scientific notation

Outcome 2

Apply the techniques of differential and integral calculus (12 hours)

- Differentiate standard functions to include { ax^n, $\sin ax$, $\cos ax$, $\ln x$, e^x }
- Determine the coordinates and the nature of the turning points of a given cubic function.
- Integrate standard functions to include { ax^n, $\sin ax$, $\cos ax$, e^x }
- Determine a definite integral

Outcome 3

Analyse trigonometric functions and their graphs (12 hours)

- Using a standard trigonometric equation establish the amplitude, period and phase shift.
- Using a standard wave form establish the amplitude, period and phase shift.
- Solve trigonometric equations.

The Unit has been written to allow sufficient time for candidates to practise what they have learnt through appropriate formative assessment exercises.

Details on approaches to assessment are given under Evidence Requirements and Assessment guidelines under each Outcome in the Higher National Unit specification: statement of standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

The content of this Unit is such that it is recommended that if the Unit is assessed by one holistic assessment instrument then assessment takes place at the end of the Unit delivery time.

Opportunities for developing Core Skills

The achievement of this Unit gives automatic certification of the following:

- Using Number at SCQF level 6

Higher National Unit specification: support notes (cont)

Unit title: Marine Engineering: Mathematics

Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of in-line support. However, with regard to assessment, planning would be required be the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessment whether done at a single or a multiple events was conducted under controlled, supervised conditions.

To keep administrative arrangements to a minimum, it is recommended that a single assessment paper (taken by candidates at a single assessment event) be used for distance learning candidates.

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: Marine Engineering: Mathematics

This Unit has been designed to allow you to develop your knowledge, understanding and skills in Marine mathematics. If you have studied these subjects before, the early parts of this Unit will provide you with an opportunity to revise the techniques you have learnt in previous courses.

By the end of this Unit you will be expected to apply algebraic techniques to manipulate expressions and solve equations commonly found in marine engineering. You will also be expected to solve problems using vectors and finally you will be expected to analyse trigonometric functions and their graphs.

In Outcome 1 you will be introduced to applying algebraic techniques to manipulate expressions and solve equations commonly found in marine engineering that would underpin any further studies you would complete in the mathematics subject area.

In Outcome 2 you will be introduced to the techniques of differential and integral calculus.

In Outcome 3 you will learn how to analyse trigonometric functions and their graphs.

The precise form the assessment will take will depend on the centre where you are taking the Unit. It is possible for the Unit to be assessed completely at one assessment event or in parts at three assessment events. Please ask your lecturer what form your assessment will take. If the Unit is assessed at one assessment event, such assessment which will take place at the end of the Unit, will comprise one assessment paper lasting one hour and forty minutes and will take place under supervised, controlled conditions. The assessment will be conducted under closed-book conditions in which you will not be allowed to bring any textbooks, handouts or notes to the assessment. You will be permitted to use scientific calculators during the assessment.