

-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

**Hanover House
24 Douglas Street
GLASGOW G2 7NQ**

NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number-	3171062	-Session-	1992-93
-Superclass-	RC		

-Title-	WAVES (x¹/₂)
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-DESCRIPTION-

Purpose	This module is designed to extend the skills and knowledge required in the field of waves. It is suitable for candidates in a wide range of occupational areas, and in conjunction with Stage 2 and Stage 3 Physics modules, could be a preparation for Higher Education.
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Preferred Entry Level	3171131 Optics or Higher Grade Physics and Higher Grade Mathematics.
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Outcomes	The candidate should: 1. apply and interpret the concepts of waves to explain wave phenomena; 2. perform, predict and report on experiments relating to waves.
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Assessment Procedures	Acceptable performance in this module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.
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The following abbreviations are used below:

PC Performance Criteria
IA Instrument of Assessment

Note: The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory.)

**OUTCOME 1 APPLY AND INTERPRET THE CONCEPTS OF WAVES
TO EXPLAIN WAVE PHENOMENA**

- PCs
- (a) The use of the given terms in explanations is correct.
 - (b) The application of the concepts of waves to describe or predict a situation is correct.
 - (c) The application of the concepts of waves to situations involving calculations or equations is correct with respect to the use of units, and obtaining a solution to the appropriate level of significance.
 - (d) The construction of the given wave phenomena is complete and correct.

IA Structured Questions and Assignment

3 structured questions under closed book conditions and 1 assignment to assess the candidate's ability to apply and interpret the concepts of waves to explain wave phenomena.

The 3 structured questions should be allocated to Performance Criteria (a), (b) and (c) and the assignment should be allocated to Performance Criterion (d).

There should be one structured question on each of the following topics:

- (i) standing waves.
- (ii) variations of the amplitude of a travelling wave with respect to time.
- (iii) variations of the amplitude of a travelling wave with respect to position.

All the items listed below must be contained within the 3 structured questions:

- (i)
 - (a) terms: node, antinode, harmonics.
 - (b) calculations: fundamental and overtones of either a pipe or a string.
- (ii)
 - (a) terms: amplitude.
 - (b) concepts: wave form with respect to time, phase relationship.
 - (c) calculations: $y = A \sin(\omega t - f)$
- (iii)
 - (a) concepts: wave form with respect to position
 - (b) calculations: $y = A \sin 2\pi(\frac{t}{T} - \frac{x}{l})$

The assignment must cover 2 applications of Huygen's principle by scaled geometric construction of wave phenomena.

The candidate should produce 2 appropriate and accurate scaled diagrams.

Satisfactory achievement of the Outcome will be demonstrated by the candidate achieving all the Performance Criteria within the 3 questions and the assignment.

OUTCOME 2 PERFORM, PREDICT AND REPORT ON EXPERIMENTS RELATING TO WAVES

PCs

- (a) The setting up of the equipment is in accordance with the given specification.
- (b) The experimental procedures carried out are correct and safe.
- (c) The recording of the procedures, relevant observations and measurements is complete and accurate with numerical uncertainties where appropriate.
- (d) The presented data is in an appropriate format.
- (e) The identification of valid experimental errors in absolute and percentage terms is correct.
- (f) The calculation and presentation of the overall uncertainty is correct and in the appropriate format.
- (g) The conclusion(s) and prediction(s) drawn are valid within the limits of experimental uncertainty.

IA Assignment

An assignment to assess the candidates ability to perform, predict and report on experiments relating to waves.

The candidate will be required to carry out a specified experiment and prepare a scientific report to cover the Performance Criteria (c) to (g). The report must be structured and include the following sections: aims, procedures, readings and results, uncertainties and conclusions.

A checklist should be devised to ensure a reliable interpretation of the candidate's practical performance in relation to Performance Criteria (a) and (b).

Satisfactory achievement of the Outcome will be demonstrated by the candidate achieving all the Performance Criteria.

**The following sections of the descriptor are offered as guidance.
They are not mandatory.**

CONTENT/CONTEXT

Corresponding to Outcomes 1-2:

1.
 - (a) Correct use of the following terms: travelling wave, stationary wave, phase difference, node, antinode, superposition, beats, reflection, refraction, diffraction, interference, harmonics.
 - (b) Application of: waveforms, principle of superposition, phase relationships, travelling and standing waveforms, application of Huygen's principle, phase change on reflection.
 - (c) Calculations involving: $y = A \sin 2\pi\left(\frac{t}{T} - \frac{X}{\lambda}\right)$
 $y = A \sin(\omega t - kx)$, harmonics in pipes and strings.
 - (d) Construction by scaled diagrams: reflection, refraction, single slit diffraction, two slit interference.
 2. Experiments could include: wavelength in stretched string, wavelength of sound waves and microwaves using stationary waves, frequency using beats.
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SUGGESTED LEARNING AND TEACHING APPROACHES

A candidate-centred, resource-based learning approach is recommended. Concepts should be developed and reinforced by practical work integrated throughout the module. Teaching strategies designed to encourage independent study should be employed.

A range of experimental work should be included within the module to allow a selection of assignments to be presented for summative assessment purposes.

The candidate should be encouraged to document all observations and results of experiments in a folio of work.

During the work of the module candidates should have several opportunities to develop their practical and problem-solving skills. Each candidate should be assessed at appropriate parts throughout the module. Where a candidate is unsuccessful in achieving an Outcome, provision should be made for remediation and reassessment.
