-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

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NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **3171162** **-Session- 1992-93**
-Superclass- **RC**

-Title- **OPTICAL INSTRUMENTS ($X^1/_2$)**

-DESCRIPTION-

Purpose	This specialist module is designed to extend the skills and knowledge required in the application of optics. It is suitable for candidates in a wide range of occupational areas, and in conjunction with other Stage 2 Physics modules, could be a preparation for Higher Education.
Preferred Entry Level	3171041 Introducing Waves and Optics (x 1/2) or Standard Grade Physics at Grade 2 7180321 Core Mathematics 3 7180331 Core Mathematics 4 or equivalent.
Outcomes	The candidate should: 1. apply the concepts of geometric optics to solve problems; 2. perform and report on experiments relating to optical instruments.
Assessment Procedures	Acceptable performance in this module will be satisfactory achievement of all the Performance Criteria specified for each Outcome. 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 THE CONCEPTS OF GEOMETRIC OPTICS TO SOLVE PROBLEMS**

PCs

(a) The use of the given terms in explanation is correct.
(b) The application of the concepts of optics to describe and explain or predict a situation is correct.
(c) The application of the concepts of optics to situations involving calculations or equations is correct with respect to the use of units, and obtaining a solution to the appropriate level of accuracy.

IA Structured Questions

4 structured questions to assess the candidate's ability to apply the concepts of geometric optics to solve problems under closed book conditions.

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

(i) refraction;
(ii) thin lenses;
(iii) optical instruments - single lens;
(iv) optical instruments - double lens.

The questions must contain all the items listed below:

(i) PC (a) terms: refractive index, critical angle, total internal reflection;
(b) concepts: laws of refraction, concept of critical angle and total internal reflection;
(c) calculations:

$$n = \frac{\sin\theta_1}{\sin\theta_2};$$

$$\sin\theta_C = \frac{1}{n}.$$

(ii) PC (a) terms: focal length, power of a lens, object distance, image distance, linear magnification.
(c) calculations:

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v};$$

$$P = \frac{1}{f};\ m = \frac{v}{u};$$

(iii) PC (b) concepts: use of a ray diagram to show the nature of the image (real/virtual, upright/inverted, magnified/diminished) for a magnifying glass, camera and projector lens.

(iv) PC (b) concept: final image formed by one of the following: microscope, astronomical telescope, binoculars.

Satisfactory achievement of the Outcome will be demonstrated by the candidate achieving all the Performance Criteria specified for each question.

OUTCOME 2 **PERFORM AND REPORT ON EXPERIMENTS RELATING TO OPTICAL INSTRUMENTS**

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 identified experimental errors are valid, with appropriate means of reduction.
(f) The conclusions drawn are valid.

IA Assignment

One assignment to assess the candidate's ability to perform and report on experiments relating to optical instruments.

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

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: refractive index, critical angle, total internal reflection, focal length, object distance, image distance, linear magnification, power, real, virtual, upright, inverted.

   (b) Application of: laws of refraction, ray diagrams to optical instruments.

   (c) Calculations involving:

$$n = \frac{\sin\theta_1}{\sin\theta_2};\ \sin\theta_c = \frac{1}{n};$$

$$\frac{1}{f} = \frac{1}{u} = \frac{1}{v};$$

$$P = \frac{1}{f};$$

$$m = \frac{v}{u}.$$

2. Experiments could include: finding the focal length of a convex lens using the lens formula; measuring the magnification produced by a convex lens; finding the focal length of a concave lens by combination with a suitable convex lens; construction of a simple telescope.

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.

A range of experimental work should be included within the module to allow a selection of an assignment 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 points throughout the module. Where a candidate is unsuccessful in achieving an Outcome, provision should be made for remediation and reassessment.

Safety should be given due consideration at all times.