

National Unit Specification: general information

UNIT	Combinational Logic (Intermediate 2)
NUMBER	D134 11
COURSE	Electronic and Electrical Fundamentals (Intermediate 2)

SUMMARY

This unit has been designed to introduce candidates to digital electronics. It considers binary representation, basic logic gates and the analysis and synthesis of simple combinational circuits.

This unit offers an introduction to binary systems which is suitable for Intermediate 2. It outlines the function of basic gates and allows for simple design and construction.

OUTCOMES

- 1 Perform simple binary operations.
- 2 Identify the function of logic gates.
- 3 Assemble and investigate a combinational logic circuit.
- 4 Solve combinational logic system problems.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained one of the following:

- Mathematics and either Technological Studies or Physics at grade 3 Standard Grade
- equivalent National units.

Administrative Information

Superclass:	XL
Publication date:	December 1999
Source:	Scottish Qualifications Authority
Version:	03

© Scottish Qualifications Authority 1999

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

Additional copies of this unit specification can be purchased from the Scottish Qualifications Authority. The cost for each unit specification is £2.50 (minimum order £5).

National Unit Specification: general information (cont)

UNIT Combinational Logic (Int 2)

CREDIT VALUE

1 credit at Intermediate 2.

CORE SKILLS

There is no automatic certification of core skills or core skills components in this unit.

Additional information about core skills is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

National Unit Specification: statement of standards

UNIT Combinational Logic (Int 2)

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 the Scottish Qualifications Authority.

OUTCOME 1

Perform simple binary operations.

Performance criteria

- (a) The conversion between decimal and binary quantities is correctly performed.
- (b) The conversion between decimal and hexadecimal quantities is correctly performed.
- (c) The conversion between hexadecimal and binary quantities is correctly performed.
- (d) The operation of binary addition is correctly performed.

Evidence requirements

The candidate could be set short answer questions to test the ability to perform simple binary operations. The test could comprise 8 short answer questions involving numbers with no more than four bits. The questions could be allocated as follows:

- | | | |
|---|------------|--------------|
| 1 | conversion | 6 questions |
| 2 | addition | 2 questions. |

Satisfactory achievement of the outcome will be based on the candidate producing seven correct responses which must include five out of six for point 1 (above) and two out of two for point 2 (above).

National Unit Specification: statement of standards (cont)

UNIT Combinational Logic (Int 2)

OUTCOME 2

Identify the function of logic gates.

Performance criteria

- (a) Logic functions are correctly identified from given BSEN 60617 and ANSI symbols.
- (b) Truth tables are constructed using measurement of input/output conditions.
- (c) Boolean expressions are obtained from the truth tables.

Evidence requirements

The candidate could be presented with a set of logic gates and a supply for each. He/she would then test the input/output levels for NOT function, three input OR, AND, NAND and NOR from which he/she would identify each gate and provide the truth table and Boolean expression for each.

A checklist should be devised to record the candidate's practical activities.

Satisfactory achievement of the outcome will be based on all PCs being met for each of the logic gates.

OUTCOME 3

Assemble and investigate a combinational logic circuit.

Performance criteria

- (a) The assembly of a 3-input logic circuit is correct.
- (b) The construction of the truth table for the assembled circuit is accurate.
- (c) The Boolean expression is correctly derived from the truth table.

Evidence requirements

A diagram of a circuit with a minimum of four gates could be given to the candidate. The candidate would be required to assemble the circuit and test its operation by obtaining the truth table and deriving the Boolean expression.

A checklist would be devised to record the candidate's practical activities.

Satisfactory achievement of the outcome will be based on all PCs being met.

National Unit Specification: statement of standards (cont)

UNIT Combinational Logic (Int 2)

OUTCOME 4

Solve combinational logic system problems.

Performance criteria

- (a) An accurate logic system design is produced.
- (b) The assembly of the system designed is correct.
- (c) The recording of the results and measurement of the system specification in the form of a truth table is accurate.

Evidence requirements

The candidate could be required to design and assemble a practical circuit for a task which would be stated by the teacher or lecturer. The task would be restricted to 3-input variables.

A checklist should be devised to record the candidate's practical activities.

Satisfactory achievement of the outcome will be based on all PCs being met.

National Unit Specification: support notes

UNIT Combinational Logic (Int 2)

This part of the unit specification is offered as guidance. The support notes are not mandatory.

It is recommended that you refer to the SQA Arrangements document for the Intermediate 2 Electronic and Electrical Fundamentals course before delivering this unit.

While the time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON CONTENT AND CONTEXT FOR THIS UNIT

Safety regulations and safe working practices should be observed at all times.

- Decimal, binary and hexadecimal number systems, conversion of integer decimal values to binary to hexadecimal and vice versa.
- Addition of binary integers.
- AND, OR, NOT, NAND and NOR logic gates. BSEN 60617 and ANSI gate symbols. Derivation of truth tables for each gate and the associated Boolean expression.
- TTL and CMOS integrated circuit devices, including their respective series numbers (74XX and 40XX).
- Measurement of logic states and the construction of truth tables for assembled circuits. The production of Boolean expressions derived from the truth tables.
- The design of logic circuits to solve simple practical problems. Implementation of the design. Recording of measurements from the circuits to form truth tables. Testing of the circuits to ensure compliance with the required function.

GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT

This is an introductory unit in digital electronics. It should therefore preferably be taught in an area which allows access to logic devices and their corresponding data sheets. It is recommended that logic tutor boards be used in order to reduce the complexity of wiring circuits.

The use of logic probes to measure logic states in circuits should be encouraged. Candidates should make full use of logbooks to record circuit diagrams and measurements taken.

National Unit Specification: support notes (cont)

UNIT Combinational Logic (Int 2)

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Examples of instruments of assessment which could be used for each outcome are given below.

Outcome 1

The candidate could be set short answer questions to test the ability to perform simple binary operations.

Outcome 2

The candidate could be given a practical exercise from which he/she would identify each logic gate and provide the truth table and Boolean expression for each.

Outcome 3

The candidate could be given a practical exercise that would require the candidate to assemble a given circuit and test its operation by obtaining the truth table and deriving the Boolean expression.

Outcome 4

The candidate could be given a practical exercise that would require the candidate to design and assemble a practical circuit from a given problem. The problem would be restricted to 3-input variables and a checklist should be devised to record the candidate's practical activities.

SPECIAL NEEDS

This unit specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative outcomes for units. For information on these, please refer to the SQA document *Guidance on Special Assessment and Certification Arrangements for Candidates with Special Needs/Candidates whose First Language is not English* (SQA, 1998).