

-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION

GENERAL INFORMATION

-Module Number- 2150096

-Session-1996-97

-Superclass- XL

-Title- FAULT DIAGNOSIS ON BASIC ELECTRONIC CIRCUITS

-DESCRIPTION-

GENERAL COMPETENCE FOR UNIT: Locating faults to component level on basic electronic circuits.

OUTCOMES

1. explain the basic techniques of fault diagnosis on simple electronic circuits;
2. use test equipment to test passive and active components;
3. use diagnostic techniques to locate faults on basic passive circuits;
4. use diagnostic techniques to locate faults on basic analogue circuits;
5. use diagnostic techniques to locate faults on basic combinational and sequential logic circuits.

CREDIT VALUE: 1 NC Credit

ACCESS STATEMENT: Access to this unit is at the discretion of the centre. However it would be helpful if the candidate was competent in the use of electronic test equipment, interpretation of electronic circuit diagrams and had an understanding of the operation of digital and analogue circuits.

This may be evidenced by possession of NC modules:

- | | |
|---------|--|
| 2150410 | Introduction to Electronic Test Equipment and Measurements ($x^1/2$) |
| 2150010 | Combinational Logic |
| 2150220 | Electronic Components and Circuit Assembly Techniques |
| 2150230 | Introduction to Semiconductor Applications |
| 2150240 | Amplification |
- or similar qualifications or experience.

For further information contact: Committee and Administration Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ.

Additional copies of this unit may be purchased from SQA (Sales and Despatch section). At the time of publication, the cost is £1.50 (minimum order £5.00).

NATIONAL CERTIFICATE MODULE; UNIT SPECIFICATION**STATEMENT OF STANDARDS****UNIT NUMBER:** 2150096**UNIT TITLE:** FAULT DIAGNOSIS ON BASIC ELECTRONIC CIRCUITS

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

OUTCOME

1. EXPLAIN THE BASIC TECHNIQUES OF FAULT DIAGNOSIS ON SIMPLE ELECTRONIC CIRCUITS

PERFORMANCE CRITERIA

- (a) Identification of features of non-sequential and sequential techniques of fault diagnosis is correct.
- (b) Explanation of systematic methods of fault location is correct.

RANGE STATEMENT

Fault diagnosis techniques: input to output; output to input; half split.

EVIDENCE REQUIREMENTS

Written and/or oral evidence of the candidate's ability to explain the basic techniques of fault diagnosis on simple electronic circuits across all relevant classes in the range statement.

OUTCOME

2. USE TEST EQUIPMENT TO TEST PASSIVE AND ACTIVE COMPONENTS

PERFORMANCE CRITERIA

- (a) Selection of test equipment is appropriate to the test being undertaken.
- (b) Use of test equipment is correct with respect to the measurement being undertaken.
- (c) Identification of passive component fault is correct.
- (d) Identification of semiconductor component fault is correct.

RANGE STATEMENT

Test equipment: digital and analogue multimeters.

Passive components: resistor; capacitor; inductor; transformer.

Semiconductor components: diode; bridge rectifier; bipolar transistor.

Systematic methods: input to output; output to input; half split.

EVIDENCE REQUIREMENTS

Performance evidence of the candidate's ability to select and use test equipment.

Written and/or oral evidence of the candidate's ability to identify component faults in at least one of each type of component.

OUTCOME

3. USE DIAGNOSTIC TECHNIQUES TO LOCATE FAULTS ON BASIC PASSIVE CIRCUITS

PERFORMANCE CRITERIA

- (a) Diagnosis of fault symptoms is correct.
- (b) Selection of test equipment is appropriate in terms of circuit under test, accuracy and circuit parameters to be measured.
- (c) Use of test equipment is correct with respect to the measurement being undertaken.
- (d) Employment of fault location procedures is appropriate in terms of logicity and efficiency to the circuit under test.
- (e) Location of fault to component level is accurate.

RANGE STATEMENT

Test equipment: analogue or digital multimeter; waveform generator; oscilloscope.

EVIDENCE REQUIREMENTS

Written and/or oral evidence of the candidates ability to: diagnose fault symptoms, employ fault location procedures and locate faults to component level on circuits with a minimum of 6 components and a maximum of 10 components.

Performance evidence of the candidates ability to select and use test equipment.

OUTCOME

4. USE DIAGNOSTIC TECHNIQUES TO LOCATE FAULTS ON BASIC ANALOGUE CIRCUITS

PERFORMANCE CRITERIA

- (a) Diagnosis of fault symptoms is correct.
- (b) Selection of test equipment is appropriate in terms of circuit under test, accuracy and circuit parameters to be measured.
- (c) Use of test equipment is correct with respect to the measurement being undertaken.
- (d) Employment of fault location procedures is appropriate in terms of logically and efficiency to the circuit under test.
- (e) Location of fault to component level is accurate.

RANGE STATEMENT

Test equipment: analogue or digital multimeter; waveform generator; oscilloscope.

Circuits: single-stage common emitter amplifier; single-stage operational amplifier circuit.

EVIDENCE REQUIREMENTS

Written and/or oral evidence of the candidate's ability to: diagnose fault symptoms, employ fault location procedures and locate faults to component level.

Performance evidence of the candidates ability to select and use test equipment.

OUTCOME

5. USE DIAGNOSTIC TECHNIQUES TO LOCATE FAULTS ON BASIC COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS

PERFORMANCE CRITERIA

- (a) Diagnosis of fault symptoms is correct.
- (b) Selection of test equipment is appropriate in terms of circuit under test, accuracy and circuit parameters to be measured.
- (c) Use of test equipment is correct with respect to measurement being undertaken.
- (d) Employment of fault location procedures is appropriate in terms of logicity and efficiency to the circuit under test.
- (e) Location of fault to component level is accurate.

RANGE STATEMENT

Test equipment: logic probe; multimeter; oscilloscope.

Circuits: BJT switch with LED; combinational logic circuit; sequential logic circuit.

EVIDENCE REQUIREMENTS

Oral and/or written evidence of the candidate's ability to: diagnose fault symptoms, employ fault location procedures and locate faults to component level.

Performance evidence of the candidates ability to select and use test equipment.

ASSESSMENT

In order to achieve this unit, candidates are required to present sufficient evidence that they have met all the performance criteria for each outcome within the range specified. Details of these requirements are given for each outcome. The assessment instruments used should follow the general guidance offered by the SQA assessment model and an integrative approach to assessment is encouraged. (See references at the end of support notes).

Accurate records should be made of the assessment instruments used showing how evidence is generated for each outcome and giving marking schemes and/or checklists, etc. Records of candidates' achievements should be kept. These records will be available for external verification.

SPECIAL NEEDS

In certain cases, modified outcomes and range statements can be proposed for certification. See references at end of support notes.

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NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION**SUPPORT NOTES**

UNIT NUMBER: 2150096

UNIT TITLE: FAULT DIAGNOSIS ON BASIC ELECTRONIC CIRCUITS

SUPPORT NOTES: This part of the unit specification is offered as guidance. None of the sections of the support notes is mandatory.

NOTIONAL DESIGN LENGTH: SQA allocates a notional design length to a unit on the basis of time estimated for achievement of the stated standards by a candidate whose starting point is as described in the access statement. The notional design length for this unit is 40 hours. The use of notional design length for programme design and timetabling is advisory only.

PURPOSE The unit aims to introduce elementary faults diagnostic skills on basic electronic circuits.

It is expected that the candidate would have either prior knowledge of the operation of simple analogue and digital electronic circuits or be studying these circuits in tandem with this unit. Furthermore, the candidate should be familiar with the use of basic electronic test equipment.

It is intended as a stand alone unit which could also be used in programmes of study for those working in the electronic test area or within a GSVQ Engineering Programme.

SQA publishes summaries of NC units for easy reference, publicity purposes, centre handbooks, etc. The summary statement for this unit is as follows:

On completion of this unit the candidate will be competent in the use of electronic test equipment in conjunction with fault diagnostic techniques to locate faults to component level on simple analogue and digital electronics.

CONTENT/CONTEXT The following information gives further clarification regarding the context in which the Outcomes and Performance Criteria are to be achieved.

1. A block diagram approach is recommended.
2. Faults should be restricted to open or short circuit, except for resistors, where faults should be restricted to open circuit or high value.

3. Examples of circuits: combinations of integrator, differentiator, clipping, clamping, coupling, dc restorer and resistor networks.
4. Common-emitter amplifier with potential divider bias, coupling and decoupling capacitors. It is suggested that only simple faults (eg open circuit coupling capacitor) be employed. Operational amplifier circuits: inverting, non-inverting and summing.
5. Combinational logic circuit to include: 4 inputs maximum, and a variety of different types of gate, numbering between 8 and 12. Example of sequential logic circuit: 4 stage shift register with SSI devices.

APPROACHES TO GENERATING EVIDENCE This unit should be presented in a laboratory environment. Where possible candidates should work individually. Safe working practices should be emphasised throughout. The candidate should be encouraged to record all fault diagnostic activities.

Candidates should be encouraged to study concurrently units in the fields of electrical principles and both digital and analogue electronics as part of a well balanced programme.

ASSESSMENT PROCEDURES

Assessment Evidence

1. Restricted response questions to cover all performance criteria.
2. Relevant practical exercise to meet all performance criteria. Observation checklist should be used to evidence the candidate's completion of the exercise.
3. Written and/or oral report to assess performance criteria (a), (b), (d) and (e). Observation checklist should be used to assess performance criterion (c).
4. Written and/or oral report to assess performance criteria (a), (b), (d) and (e). observation checklist should be used to assess performance criterion (c).
5. Written and/or oral report to assess performance criteria (a), (b), (d) and (e). Observation checklist should be used to assess performance criterion (c).

PROGRESSION On satisfactory completion of this module, the candidate may progress to NC module 2150136 'Fault Diagnosis on Complex Electronic Circuits and Systems. This unit forms part of the GSVQ in Engineering at Level III. Candidates successfully completing the GSVQ at Level III in Engineering will be able to progress to an HNC/D programme in related disciplines.

RECOGNITION Many SQA NC units are recognised for entry/recruitment purposes. For up-to-date information see the SQA guide 'Recognised Groupings of National Certificate Modules'.

REFERENCES

1. Guide to unit writing. (A018).
2. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment. (B005).
3. Procedures for special needs statements are set out in SQA's guide 'Candidates with Special Needs'. (B006).
4. Information for centres on SQA's operating procedures is contained in SQA's Guide to Procedures. (F009).
5. For details of other SQA publications, please consult SQA's publications list. (X037).

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