

-SQA- SCOTTISH QUALIFICATIONS AUTHORITY
NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION

GENERAL INFORMATION

-Module Number- **3250963** **-Session-1993-94**
-Superclass- **VE**
-Title- **PROCESS CONTROL AND FAULT DIAGNOSIS**

-DESCRIPTION-

GENERAL COMPETENCE FOR UNIT: Explaining the principles, main features and application of control systems in process plant, describing the fundamentals of computer control and applying simple fault diagnosis techniques to process systems.

OUTCOMES

1. explain the principles and main features of simple control systems;
2. explain applications of control systems in process plant;
3. describe the fundamentals of computer control;
4. apply simple fault diagnosis techniques to process systems.

CREDIT VALUE: 1 NC Credit

ACCESS STATEMENT: 3150513 Instrumentation of Processes;
 3252013 Plant Services 1;
 3251673 Industrial science 1.

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NATIONAL CERTIFICATE MODULE: UNIT SPECIFICATION**STATEMENT OF STANDARDS****UNIT NUMBER:** 3250963**UNIT TITLE:** PROCESS CONTROL AND FAULT DIAGNOSIS

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 PRINCIPLES AND MAIN FEATURES OF SIMPLE CONTROL SYSTEMS

PERFORMANCE CRITERIA

- (a) The definition of the principles of open loop and closed loop control systems is correct.
- (b) The definition of basic terminology used in control systems is correct and in accordance with British Standard specifications.
- (c) The description of the main features of control system components is correct.
- (d) The explanation of the main control actions (modes) is correct.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to define the principle of open loop and closed loop control, basic terminology used in control systems, describe the main features of control system components and explain main control actions.

OUTCOME

2. EXPLAIN APPLICATIONS OF CONTROL SYSTEMS IN PROCESS PLANT

PERFORMANCE CRITERIA

- (a) The explanation of the factors affecting the selection of control valve type, flow characteristic and methods of actuation is correct.
- (b) The explanation of methods of simple feedback control and advanced control of process plant is correct.

- (c) The explanation of the use of alarm, fail safe and trip systems in enhancing safe operation of plant is correct.

RANGE STATEMENT

The range for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to explain factors affecting the selection of control valve type, flow characteristics, methods of activation, methods of simple feedback control and advanced control.

Written evidence of the ability to explain the use of alarm, fail safe and trip systems.

OUTCOME

- 3. DESCRIBE THE FUNDAMENTALS OF COMPUTER CONTROL**

PERFORMANCE CRITERIA

- (a) The identification of the advantages of digital control is correct.
(b) The definition of basic terminology used in computer control systems is correct.
(c) The identification of the elements of a computer control system is correct.
(d) The description of the elements of a computer control system is correct.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to identify advantages of digital control, define basic computer control terminology and identify and describe elements of a computer control system.

OUTCOME

- 4. APPLY SIMPLE FAULT DIAGNOSIS TECHNIQUES TO PROCESS SYSTEMS**

PERFORMANCE CRITERIA

- (a) The definition of terms used in fault diagnosis is correct and in accordance with the appropriate British Standard.
- (b) The explanation of fault location techniques is correct.
- (c) The application of fault location and diagnosis techniques to process and instrument fault conditions is correct.

RANGE STATEMENT

The range statement for this outcome is specified within the performance criteria.

EVIDENCE REQUIREMENTS

Written evidence of the ability to define terms used in fault diagnosis, explain fault location and apply fault location and diagnosis techniques.

ASSESSMENT RECORDS

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 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** 3250963**UNIT TITLE** PROCESS CONTROL AND FAULT DIAGNOSIS

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 This module is suitable for a range of processing industries and could form part of the National Certificate Group Award in Processing. It would be appropriate for inclusion in full time or part-time programmes.

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

This module will enable you to understand the features of simple control systems as well as their application in process plant. You will also learn about computer control and be able to apply simple fault diagnosis techniques.

CONTENT/CONTEXT Corresponding to Outcomes:

1. Signal types (pneumatic, electronic, digital), transmission, operating range in control systems.

Open loop systems: applications, limitations.

Closed loop systems: application, limitations, advantages.

Comparison of both systems in terms of accuracy, stability, error or disturbance activated.

Definition of basic terms used in control (B.S.S 1523).

Control actions: step, proportional, integral, derivative.

Effect of lags in process, measurement system, control loop components.

Limitations of the respective control modes.

Reasons for offset. Use of 2 term P + I, P + D, and 3-term control PID. Response of systems to a step change for each of the above control actions (graphical representation).

2. Construction and operational features of the main types of valve used in process control. eg: butterfly, globe, ball.

Factors affecting control valve selection.

Valve characteristics. Applications where linear, equal percentage and quick opening valves are desirable.

Valve actuators. Solenoid. Diaphragm motives, positioners fail safe operation.

Simple feedback control. Feed forward control.

Cascade and ratio control.

Alarm systems. Fail safe and trip systems.

3. Component parts of a microcomputer.

Signal types and interconversion.

Interface devices, memory, communications peripherals, data logging and scanning.

Glossary of terminology used in computer control.

Supervisory and direct digital control.

Distributed control.

Advantages of using digital devices for 2 and 3 term control.

Representation of simple computer control loops by means of block diagram.

4. Glossary of terms used in fault location/diagnosis. B.S.S.1523 Differences between fault and symptoms. Process faults, instrumentation/control fault. Collection and analysis of data.

Fault location techniques: progressive and random search. Input-output testing, half split techniques.

Use of algorithms.

Application of the above in case studies involving process faults and measuring and control system faults.

APPROACHES TO GENERATING EVIDENCE A candidate-centred, resource-based learning approach is recommended. The outcomes in this module need not be taught separately and it is likely that an integrated approach will be used. The outcomes do not need to be tackled in the order shown.

During the work of the module, candidates should have several opportunities to develop 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.

ASSESSMENT PROCEDURES Centres may use instruments of assessment which are considered by tutors/trainers to be the most appropriate. Examples of Instruments of Assessment are as follows:

- OUTCOME 1 It is recommended that for Performance Criteria (a) to (c) restricted response questions are used. A structured question could be set for Performance Criterion (d).
- OUTCOME 2 Structured questions could be used here to assess all the performance criteria.
- OUTCOME 3 Restricted response questions could be used to assess these performance criteria for these 3 outcomes.
- OUTCOME 4 An assignment could be used here within which the candidate could produce a report covering the performance criteria.

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

REFERENCES

1. Guidelines for Module Writers.
2. SQA's National Standards for Assessment and Verification.
3. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
4. Procedures for special needs statements are set out in SQA's guide 'Students with Special Needs'.

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