

-SQA-SCOTTISH QUALIFICATIONS AUTHORITY

HIGHER NATIONAL UNIT SPECIFICATION

GENERAL INFORMATION

Unit Number	D3PY 04
Unit Title	INDUSTRIAL CONTROL SYSTEMS
Superclass Category	VE
Date of publication (month and year)	
Originating Centre for Unit	Cleveland Open Learning Unit

DESCRIPTION

Analysing the operation of control systems

OUTCOMES:

1. analyse the composition of feedback control systems;
2. appraise the stability of control systems;
3. appraise the response of control systems;
4. analyse the operational characteristics of control valves;
5. analyse the operation of control systems.

CREDIT VALUE: 1 HN Credit

ACCESS STATEMENT:

Although access to this unit is at the discretion of the centre, it would be beneficial if the candidate possessed competence in basic instrumentation and mathematics. This may be evidenced by possession of Industrial Instrumentation at National Certificate level or relevant experience and Mathematics at National Certificate level or similar.

Additional copies of this unit can be obtained from: The Administrative Services Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ (Tel: 0141-242 2166).

At the time of publication, the cost is £2.50 (minimum order £5.00)

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STATEMENT OF STANDARDS

Unit number:

Unit title: INDUSTRIAL CONTROL SYSTEMS

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 the standards are mandatory and cannot be altered without reference to SQA.

OUTCOME

1. ANALYSE THE COMPOSITION OF FEEDBACK CONTROL SYSTEMS

PERFORMANCE CRITERIA

- (a) Block diagrams are correctly produced for simple feedback control systems.
- (b) Closed loop transfer functions are derived correctly from data presented in block diagram form.

RANGE STATEMENT

Composition: input; error detector; controller; controlled element; process; detecting element; feedback loop.

EVIDENCE REQUIREMENTS

Written and graphical evidence showing ability to produce block diagrams of two different control systems. Written evidence showing ability to derive transfer functions for systems which collectively employ all the elements listed in the range.

OUTCOME

2. APPRAISE THE STABILITY OF CONTROL SYSTEMS

PERFORMANCE CRITERIA

- (a) The effects of positive and negative feedback on the performance of control systems are correctly explained.
- (b) Calculations relating to the response of systems to common disturbance patterns are correct for given conditions.

RANGE STATEMENT

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Disturbance patterns: step disturbance; sinusoidal disturbance.
Response calculations: effect of distance velocity and transfer lags; time constant; phase lag.

EVIDENCE REQUIREMENTS

Written evidence showing ability to explain the effects of feedback on control system performance.
Written evidence showing ability to carry out calculations relating to system response as indicated in the range.

OUTCOME

3. APPRAISE THE RESPONSE OF CONTROL SYSTEMS

PERFORMANCE CRITERIA

- (a) Selection of a control action is appropriate to a given set of conditions.
- (b) Calculations relating to common control actions are correct for given data.
- (c) Descriptions of controllers are sufficient to explain their operations.

RANGE STATEMENT

Control actions: proportional control; integral action; derivative action.
Calculations of: proportional band setting; offset; bias value; system output; controller output; 'ultimate cycle' settings.

EVIDENCE REQUIREMENTS

Written evidence showing ability to select control actions appropriate to given conditions. Written evidence showing ability to correctly calculate control action values as indicated in the range. Written and graphical evidence showing ability to describe pneumatic and electronic controllers.

OUTCOME

4. ANALYSE THE OPERATIONAL CHARACTERISTICS OF CONTROL VALVES

PERFORMANCE CRITERIA

- (a) Identification of valve flow/lift characteristics is correct in terms of the respective function.
- (b) The sizing of a control valve is correct in terms of given data.
- (c) Descriptions of undesirable operational effects are correct in terms in flow conditions.

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RANGE STATEMENT

Valve characteristics:	equal percentage; linear; quick opening.
Sizing data:	flow rate; pressure drop; working fluid; cv data.
Operational effects:	cavitation; noise generation; flashing.

EVIDENCE REQUIREMENTS

Written evidence showing ability to identify valve characteristics. Written evidence showing ability to correctly 'size' a control valve. Written evidence showing ability to correctly describe undesirable operational effects.

OUTCOME

5. ANALYSE THE OPERATION OF CONTROL SYSTEMS

PERFORMANCE CRITERIA

- (a) Description of the response of a control system to the physical disturbance of a process variable is correct in terms of given conditions.

RANGE STATEMENT

Control systems:	cascade; ratio control; 'split range' control.
Disturbances:	feed-forward disturbance; feedback disturbance.

EVIDENCE REQUIREMENTS

Written evidence showing ability to describe control system response to physical disturbances.

MERIT

To gain a pass in this unit, a candidate must meet the standards set out in the outcomes, performance criteria, range statements and evidence requirements.

To achieve a merit in this unit, a candidate must demonstrate a superior or more sophisticated level of performance. In this unit this might be shown in the following ways:

- (a) demonstrating an ability to use a number of different performance criteria in an integrative way.

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

Proposals to modify outcomes, range statements or agreed assessment arrangements should be discussed in the first place with the external verifier.

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SUPPORT NOTES

Unit Number

Unit Title

INDUSTRIAL CONTROL SYSTEMS

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.

CONTENT/CONTEXT

The following information gives further clarification regarding the context in which the outcomes and performance criteria are to be achieved.

Corresponding to the outcomes:

1. Examples of simple control systems include liquid level control, flow control, temperature control, differential linkage.

REFERENCES

1. Guide to unit writing.
2. For a fuller discussion on assessment issues, please refer to SQA's Guide to Assessment.
3. Information for centres on SQA's operating procedures is contained in SQA's Guide to Procedures.
4. For details of other SQA publications, please consult SQA's publications list.

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