

## Higher National Unit Specification

### General information for centres

**Unit title:** Building Management Systems

**Unit code:** DP0Y 34

**Unit purpose:** The purpose of this unit is to develop the candidate understanding of the principles, application and use of Building Management Systems (BMS). It will enable candidate to interpret the management and control requirements of a building, develop practical schemes for the specification and installation of BMS in complex buildings and maximise the benefits derived from the use of Building Management Systems.

On completion of the Unit the candidate should be able to:

- ◆ Investigate the management and control needs of buildings and the characteristics of Building Management Systems
- ◆ Investigate BMS hardware and functions
- ◆ Produce and analyse designs for BMS installations and generate BMS software to achieve control strategies
- ◆ Evaluate BMS installations to optimise the performance and benefits derived from the system.

**Credit points and level:** 1 HN Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

**Recommended prior knowledge and skills:** Candidates require a basic understanding and knowledge of building services engineering science and technology. Such understanding and knowledge may be evidenced by the possession of a National Certificate in Building Services Engineering or a related subject. The unit includes the basic principles necessary to allow candidates possessing other qualifications or experience to succeed in this unit.

**Core skills:** There may be opportunities to gather evidence towards core skills in this Unit, although there is no automatic certification of core skills or core skills components.

**Context for delivery:** This unit was developed for the HNC in Building Services Engineering. If this Unit is delivered as part of another group award (s), it is recommended that it should be taught and assessed within the context of the group award (s) to which it contributes.

## General information for centres (cont)

**Assessment:** It is possible to assess candidates either on an individual Outcome basis, combinations of Outcomes or by a single holistic assessment combining all Outcomes. The assessment paper/s should be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be conducted under supervised, controlled conditions. A single assessment covering all outcomes should not exceed 2 hours in duration. It should be noted that candidates must achieve all the minimum evidence specified for each Outcome in order to pass this Unit.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

## Higher National Unit specification: statement of standards

**Unit title:** Building Management Systems

**Unit code:** DP0Y 34

The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

(If you think holistic assessment is the best assessment strategy for the Unit and you wish to state *Knowledge and/or Skills* and *Evidence requirements* for the Unit as a whole, please add the following statement here: ‘Please refer to *Knowledge and/or skills for the Unit* and *Evidence requirements for the Unit* after the Outcomes.’)

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Investigate the management and control needs of buildings and the characteristics of Building Management Systems

#### Knowledge and/or skills

- ◆ Management and control requirements for buildings
- ◆ Power generation and load management control for buildings
- ◆ Requirement for fire detection
- ◆ Maintenance
- ◆ Characteristics of Building Management Systems

#### Evidence requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ analyse the control and management requirements of buildings and their installations to evaluate the functions of a building which might be managed via a BMS installation
- ◆ justify the appropriateness of the decision to use a BMS installation within given buildings
- ◆ identify the functions performed by typical BMS installations and the main components and configurations.

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of five** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

## Higher National Unit specification: statement of standards (cont)

**Unit title:** Building Management Systems

### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 2, 3, 4 to form a single assessment paper.

### Outcome 2

Investigate BMS hardware and functions.

### Knowledge and/or skills

- ◆ Fixed hardware components of BMS installations
- ◆ Control Functions

### Evidence requirements

Candidates will need evidence to demonstrate their skills and/or knowledge by showing that they can:

- ◆ explain the operation and application of fixed hardware components associated with BMS installations
- ◆ specify the installation requirements of BMS fixed hardware and wiring
- ◆ evaluate the features and applications of BMS configurations and network arrangements
- ◆ explain the control requirements and arrangements to achieve various control functions via BMS installations.

In any assessment of this Outcome **all** knowledge and/or skills items should be included.

Candidates must provide a satisfactory response to all items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 3, 4 to form a single assessment paper.

## Higher National Unit specification: statement of standards (cont)

**Unit title:** Building Management Systems

### Outcome 3

Produce and analyse designs for BMS installations and generate BMS software to achieve control strategies.

#### Knowledge and/or skills

- ◆ BMS system design and specification
- ◆ BMS Software

#### Evidence requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ analyse given mechanical and electrical building services installations and apply control logic to design suitable BMS installations
- ◆ produce control points count schedules, controls installation schematic and logic drawings for given installations
- ◆ produce BMS component and equipment lists, schedules and specifications for given installations
- ◆ apply BMS software procedures to achieve required control strategies
- ◆ develop commissioning schedules for BMS installations.

In any assessment of this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

#### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 2, 4 to form a single assessment paper.

### Outcome 4

Evaluate BMS installations to optimise the performance and benefits derived from the system.

#### Knowledge and/or skills

- ◆ System operation
- ◆ Maintenance and Planned Preventive Maintenance (PPM) Data
- ◆ Energy management and optimisation techniques

## Higher National Unit specification: statement of standards (cont)

**Unit title:** Building Management Systems

### Evidence requirements

Candidates will need evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ analyse BMS settings, identify where modifications or adjustments are required and modify accordingly
- ◆ interrogate BMS installations to obtain building and system performance reports
- ◆ appraise BMS reports and data as a basis to inform planned preventative maintenance strategies
- ◆ appraise BMS reports and data as a basis to inform energy management and optimisation strategies.

Evidence for the knowledge and /or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **two out of three** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to both items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

### Assessment guidelines

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment for this outcome might be combined with that for Outcomes 1, 2, 3 to form a single assessment paper.

## **Administrative Information**

<b>Unit code:</b>	DP0Y 34
<b>Unit title:</b>	Building Management Systems
<b>Superclass category:</b>	TH
<b>Date of publication:</b>	August 2005
<b>Version:</b>	01
<b>Source:</b>	SQA

© Scottish Qualifications Authority 2005

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.

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

## Higher National Unit specification: support notes

### Unit title: Building Management Systems

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

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

### Guidance on the content and context of this Unit

This unit is intended to develop a candidate understanding of the principles and practices of Building Management Systems in buildings. The unit is intended for those candidates who are, or will be involved in the design, installation or operation of systems in commercial buildings. Candidate undertaking this unit should, in addition to the requirements for design and selection of BMS, be required to undertake critical evaluation of the effectiveness of installed systems. Learning experiences should allow for integration of content from all elements in the unit.

This unit may be linked with all of the optional units concerned with the various mechanical or electrical building services units.

Recommended time allocations to each outcome are given as guidance towards the depth of treatment which might be applied to each topic. This guidance has been used in the design of the assessment exemplar material provided with the unit.

#### 1. Management and control needs of buildings and the characteristics of Building Management Systems (15 hours)

*Management and control requirements for buildings:* identifying environmental control requirements of buildings provided with heating, mechanical and natural ventilation, and air conditioning installations. Lighting control requirements and strategies for various types of buildings, lamps and luminaires

*Power generation and load management control for buildings:* need for control of power generation, maximum demand, power factor and other load management techniques used in modern commercial and industrial buildings

*Requirement for fire detection:* access control and security systems within modern commercial buildings. Need for lift and escalator control. Potential for integration of fire, access and security systems

*Maintenance:* requirements of plant and systems within buildings. Criteria for determining the type and frequency of maintenance for typical applications. Need for and the techniques used to monitor energy sources and consumption within typical buildings. Criteria for setting realistic energy targets for buildings. Balancing the benefits of BMS installations against the financial implications. Criteria to justify the decision to use a BMS as opposed to more conventional control strategies

*Characteristics of Building Management Systems:* terms associated with BMS. Functions performed by typical BMS, analogue and digital control, environmental monitoring, plant switching, data monitoring and logging, reporting. Types and configuration of BMS, the role of BMS within intelligent buildings



## **Higher National Unit specification: support notes (cont)**

**Unit title:** Building Management Systems

### **2 BMS hardware and functions (5 hours)**

*Fixed hardware components of BMS installations:* types, operation, characteristics and application of analogue and digital condition sensors, actuators and metering devices. BMS control panel components including power supplies and conditions, switching and protection equipment. Wiring requirements, techniques and installation specification. Earthing requirements. Wiring configuration including LAN, WAN, networks, LON-Works and BACNET. System Integration and types of intelligent processors

*Control Functions:* identification of control requirements, configurations and techniques to achieve optimisation, compensation, sequencing, plant switching, cascade control, night time cooling via BMS installations

### **3 Designs for BMS installations and generate BMS software (10 hours)**

*BMS system design and specification:* application of control logic to given M&E services installation proposals. Planning of control strategies and panel locations for installations. Production of controls installation, schematic and logic drawings. Control symbols and annotation of drawings. Production of control points count schedules. Selection of suitable outstations and intelligent controllers for given installations from manufacturers' information. Production of BMS equipment schedules and specifications

*BMS Software:* identification of node numbers and functions from controls logic drawings. Use of BMS software to produce programmes to suit the required hardware and control strategies. BMS installations commissioning requirements, procedures and documentation

### **4 Optimise the performance and benefits (10 hours)**

*System operation:* system logic for installed equipment. Analysis of settings and operating conditions on installed equipment. Methods and techniques for monitoring and making adjustments to BMS settings such as time schedules, set points etc via both central and local BMS equipment. Methods and techniques for interrogating BMS installations to obtain building and system performance reports

*Maintenance and PPM Data:* use of BMS as part of a planned preventative maintenance programme. Extraction of plant running times, production of maintenance reports, monitoring of plant breakdown, alarm strategies, integration of BMS reports into PPM regimes

*Energy management and optimisation techniques:* monitoring of physical energy usage of buildings, use of exceptions reports, data analysis and alarms strategies. Interpretation of BMS reports to reduce energy resource demands. Use of BMS data in the selection of energy tariffs, load shedding, and plant switching strategies. Use of BMS data in monitoring plant efficiency performance and life expectancy. Optimisation of plant and buildings energy performance

## **Higher National Unit specification: support notes (cont)**

**Unit title:** Building Management Systems

### **Guidance on the delivery and assessment of this Unit**

#### ***Opportunities for developing Core Skills***

This unit can be delivered as a standalone package, but it is recommended that wherever possible the unit should be integrated with other units within the programme to produce a more holistic approach to building services. It is envisaged that outcomes be treated consecutively but their contents integrated.

Where available, evidence from the workplace can also be incorporated to enhance the learning outcomes, provided that this evidence is appropriate and authenticated as the candidate own work.

It is recommended that evidence for learning outcomes is achieved through well-planned course work, assignments and projects. Assessment may be formative and summative and both may feature as part of the process. Although assessments must be focused on the individual achievement of each student, group work and role-play activities may contribute to the assessment. Integrative assignments and project work will help to link this unit with other related units.

The volume of evidence required for each assessment should take into account the overall number of assessments being contemplated within this unit and the design of the overall teaching programme.

In designing the assessment instrument/s, opportunities should be taken to generate appropriate evidence to contribute to the assessment of Core Skills units.

### **Open Learning**

Given that appropriate materials exist this unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessment/s were conducted under controlled, supervised conditions.

### **Candidates with additional support needs**

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support 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 Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website [www.sqa.org.uk](http://www.sqa.org.uk)

## **General information for candidates**

### **Unit title:** Building Management Systems

On completion of the Unit you should be able to:

- ◆ Investigate the management and control needs of buildings and the characteristics of Building Management Systems
- ◆ Investigate BMS hardware and functions
- ◆ Produce and analyse designs for BMS installations and generate BMS software to achieve control strategies
- ◆ Evaluate BMS installations to optimise the performance and benefits derived from the system.

Evidence that you can satisfy the knowledge and skill elements of this unit will be obtained by assessment in controlled, supervised conditions to which you will not be allowed to bring textbooks, handouts or notes to the assessment.