National Unit Specification: General Information

UNIT Robotics: An Introduction (Intermediate 2)

NUMBER D998 11

COURSE

SUMMARY
This is an introductory half module designed to provide the candidate with a foundation in robotics as a basis for further study in robotics or in a related area of technology such as computer manufacturing systems.

OUTCOMES

1 Identify the advantages of using robots in industrial applications.
2 Describe robot anatomy.
3 Operate a simple robotic system.

RECOMMENDED ENTRY
No formal entry qualifications.

CREDIT VALUE.
0.5 credit at intermediate 2

CORE SKILLS
Information on the automatic certification of any core skills in this unit is published in *Automatic Certification of Core Skills in National Qualifications* (SQA, 1999).

Administrative Information

Superclass: VE

Publication date: December 1998

Source: Scottish Qualifications Authority

Version: 02 (*Version 01 is National Certificate Module 74710*)

National unit specification: statement of standards

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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
Identify the advantages of using robots in industrial applications.

Performance Criteria
(a) The advantages and disadvantages of using humans in industrial applications are stated correctly.
(b) The advantages and disadvantages of using robots in industrial applications are stated correctly.

Evidence Requirements
Written and/or oral evidence of the candidate's ability to identify a minimum of 3 advantages and disadvantages for PC(a) and a minimum of 3 advantages and disadvantages for PC(b).

OUTCOME 2
Describe robot anatomy.

Performance Criteria
(a) The descriptions of Cartesian, cylindrical, polar and articulate arm geometrics are correct.
(b) The description of the wrist movements using the three axes is correct.
(c) The applications for given end-effectors are correctly stated.
(d) The applications for given sensors are correctly stated.
(e) The comparison of the drive mechanisms used in robots is correct.

Note on range for the outcome
Drive mechanisms: pneumatic; hydraulic; electric.

Evidence Requirements
Written, graphical and/or oral evidence of the candidate's ability to describe robot arms, as specified in PCs (a) and (b).

Written evidence to show matching of three end-effectors and three sensors to suitable applications, as specified in PCs (c) and (d).

Written and/or oral evidence of the comparison of different drive mechanisms, as specified in PC(e).

National unit specification: statement of standards (cont)

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OUTCOME 3
Operate a simple robotic system.

Performance Criteria
(a) The descriptions of methods to program robots are correct.
(b) The selection of programming methods for given robot applications is correct.
(c) The operation of a simple robotic system is in accordance with manufacturers specifications, using correct programming technique.

Evidence Requirements
Written and/or oral evidence of the candidate's ability to describe a minimum of 4 programming methods used to program robots, as specified in PC(a).

Written and/or oral evidence to match the four programming methods to given applications, as specified in PC(b).

Evidence of actual performance of the candidate's ability to complete practical exercises in setting up, programming and operating one simple pick-and-place robotic operation. This should be in accordance with manufacturers/suppliers instructions.

National unit specification: support notes

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

GUIDANCE ON CONTENT AND CONTEXT
Corresponding to Outcomes 1-3

1 Humans: Wages are demanded, exert power for limited time (teabreaks needed), cannot operate in hazardous environment, low speed, inconsistent performance due to physiological and psychological fatigue, unit costs do not reduce as production increases.

Robots: Increased production quality and productivity, ability to operate in hazardous environment, reduction in training costs, flexibility – can often be introduced with minimum change to existing plant, improved company image.

2 2.1 Motions of robots such as, SCARA, Cincinnati T^3 and PUMA.

Articulate is identified by three axes: waist axis, shoulder axis and elbow axis.

2.2 Wrist movements – Pitch, roll and yaw

2.3	<u>End Effectors</u>	<u>Applications</u>
	Mechanical grippers	Pick and place Assembly of parts
	Vacuum grippers	Holding contoured, perforated and difficult surfaces e.g. car windscreen
	Magnetic grippers	Lifting sheet of metal
	EOAT	Drilling, polishing

2.4	<u>Sensors</u>	<u>Applications</u>
	Tactile sensors	To detect work pieces
	Force sensors	To measure assembly force
	Vision sensors	To recognise objects, their positions and orientations
	Smell sensors	Drugs, explosives and gas detection
	Taste sensors	Food industry for quality control

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2.5 In the comparison of drives; could be included different types of robots, robot cells and their work envelopes.

3 3.1

Programming Method	Application
Lead through	Paint spraying (spot welding, drilling, assembly)
Drive through	Machine loading and unloading Packing bottles in boxes (spot welding, drilling)
Off-line using HLL (Relies on accuracy of robot)	Adhesive application De-burring castings (machine loading and unloading)
Co-ordinate entry	Arc welding Palletising (Adhesive application)

3.2 Practical exercises in setting up, programming and operating one simple pick-and-place robotic operation.

GUIDANCE ON TEACHING AND LEARNING APPROACHES

This module should be presented in a laboratory equipped with a robotic arm which can be programmed (re-programmed) by software and manual data inputs or a 'teach mode' program. Films, video tapes and, where possible work visits should be used to supplement lectures and provide information for case studies.

Manufacturers' catalogues, brochures and pamphlets should be readily available.

To ensure efficient utilisation of equipment and maximum "hands-on" experience, it is suggested that this module should be run in parallel with other control or computing modules.

GUIDANCE ON APPROACHES TO ASSESSMENT

Instruments of Assessment

OC1 Structured questions
OC2 Structured questions
OC3 Structured questions AND practical exercise used in conjunction with an observation checklist

National unit specification: support notes (cont)

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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* (SQA, 1998).