Higher National Unit Specification

General information for centres

Unit title: Robotics and Animatronics: An Introduction

Unit code: DW8W 34

Unit purpose: This Unit is designed as an introduction to enable candidates to develop knowledge and understanding of Robotics and Animatronics as an application area within Mechatronics. The Unit provides candidates with the understanding of the use of sensors, control and actuators to perform functions as part of a robotic or animatronic system.

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

1. Describe and evaluate a robotic and animatronic system principles
2. Identify and describe the input, control and output stages of a typical system
3. Describe the basic applications of motors and encoders
4. Construct and evaluate a fast prototype of a practical robotic/animatronic application

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: It would be an advantage for candidates to have a basic knowledge and understanding of mechanical, electrical/electronic, and control systems set in a mechatronic application context. Typical Units that could prove useful include the Units in the National Course C028 12 Higher Mechatronics. However, entry requirements are at the discretion of the centre.

Core Skills: There may be opportunities to gather evidence towards the following listed Core Skill components in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Problem Solving	SCQF level 6
Using Information Technology	SCQF level 6
Numeracy	SCQF level 6
Working with Others	SCQF level 6

General information for centres (cont)

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: The assessment for Outcomes 1, 2 and 3 of this unit should be combined into one assessment paper. This paper should be taken by candidates at a single assessment event which should last 1 and a half hours. The assessment paper should be composed of a suitable balance of short answer, restricted response and structured questions covering the content of Outcomes 1, 2 and 3. This assessment should be closed book and conducted under controlled and supervised conditions.

Assessment of Outcome 4 should be carried out by means of a project involving practical analysis, selection, fast prototyping, testing and evaluation. The project brings together subsystems to do a limited task and then produce a brief report of 500 words minimum which should be completed in the candidate's own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate's own work. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist could be used to record evidence of the candidate's knowledge and understanding.

Higher National Unit specification: statement of standards

Unit title: Robotics and Animatronics: An Introduction

Unit code: DW8W 34

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

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

Describe and evaluate a robotic and animatronic system principles**.**

Knowledge and/or skills

- The basic requirements of a robotic system
  - programmability
  - task
  - safety
- Function and form in robotics and animatronics
  - types of function
  - intelligence and decision making
  - functional realisations
  - form requirements

Evidence Requirements

Each candidate will need to demonstrate that he/she can answer questions based on a sample of the items shown under the knowledge and skills item in the Outcome. Where sampling is used, in order to ensure that the candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge and/or skills items is required each time the Outcome is assessed.

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

Describe the basic elements of a robotic system by showing that they can answer questions based on a sample of two out of three basic requirements of a robotic system

- programmability (a range of programs)
- task (a range of tasks)
- safety (work envelope, guarding and interlock, stop)

Distinguish between different functions and forms of robotics and animatronics by showing that they can answer questions based on a sample of two out of four functions and form in robotics and animatronics

- types of function (single task, multiple tasks, repetition, fixed or variable)
- intelligence and decision making (preset, dynamic, learning and adapting)
- functional realisations (capability differing from nature or predecessors)
- form requirements (analogous, appearance, motion, interaction)

Unit title: Robotics and Animatronics: An Introduction

Assessment guidelines

Evidence for the knowledge and skills in Outcome 1 is combined with Outcome 2 and Outcome 3 and should be provided on a sample basis. Details of this assessment are given under Outcome 3. The evidence may be presented in response to specific questions.

This assessment should be closed book and conducted under controlled and supervised conditions.

Outcome 2

Identify and describe the input, control and output stages of a typical system

Knowledge and/or skills

- System approach
  - input/control/output

- Inputs and sensor types
  - command/switch
  - level sensor
  - sound sensors
  - vision sensors
  - touch sensors
  - proximity sensors
  - feedback
  - analogue/digital

- Control strategies
  - manual, automated or programmed
  - time based, sensor based
  - interpreting inputs, responding predetermined, branched (if, do else)
  - flowcharts and other descriptive tools

- Outputs and actuators types
  - visual
  - audible
  - positional, velocity and acceleration

Evidence Requirements

Each candidate will need to demonstrate that he/she can answer questions based on a sample of the items shown under the knowledge and skills items shown in the Outcome. Where sampling is used, in order to ensure that the candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge and/or skills items is required each time the Outcome is assessed.

Higher National Unit specification: statement of standards (cont)

Unit title: Robotics and Animatronics: An Introduction

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

Describe the basic system approach

- Identify three out of eight input and sensor types
  - command/switch
  - level/sensor
  - sound sensors
  - vision sensors
  - touch sensors
  - proximity sensors
  - feedback
  - analogue/digital
- Describe two out of four Control strategies
  - Manual, automated or programmed
  - Time based, sensor based
  - Interpreting inputs, responding predetermined, branched (if, do else)
  - Flowcharts and other descriptive tools
- Identify two out of three outputs and actuators types
  - visual
  - audible
  - positional, velocity and acceleration

Assessment guidelines

Evidence for the knowledge and skills in Outcome 2 is combined with Outcome 1 and Outcome 3 and should be provided on a sample basis. The evidence may be presented in response to specific questions. Details of this assessment are given under Outcome 3.

This assessment should be closed book and conducted under controlled and supervised conditions.

Outcome 3

Describe the basic applications of motors and encoders.

Knowledge and/or skills

- Motors
  - DC permanent magnet
  - Stepper
  - Servo
  - Hydraulic and Pneumatic

- Linear and Rotary Encoder Characteristics
  - Relative
  - Absolute

Unit title: Robotics and Animatronics: An Introduction

Evidence Requirements

Each candidate will need to demonstrate that he/she can answer questions based on a sample of the items shown under the knowledge and skills items shown in the Outcome.

Where sampling is used, in order to ensure that the candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge and/or skills items is required each time the Outcome is assessed.

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

- Describe the basic characteristics and application of motors by showing that they can answer questions based on a sample of two out of four motors
  - DC permanent magnet - basic characteristics and usage
  - Stepper motors - basic characteristics and usage
  - Servo motors - basic characteristics and usage
  - Hydraulic and pneumatic motors - basic characteristics and usage

- Describe one out of two linear and rotary encoder characteristics
  - Relative (basic characteristics and application)
  - Absolute (basic characteristics and application)

Assessment guidelines

Evidence for the knowledge and skills in Outcome 3 is combined with Outcome 1 and Outcome 2 and should be provided on a sample basis. The evidence may be presented in response to specific questions.

The assessment for Outcomes 1, 2 and 3 is combined to form a single assessment paper. This paper should be taken at a single assessment event lasting 1 and a half hours and carried out under controlled, supervised conditions and closed book. Such a paper should compose of an appropriate balance of short answer, restricted response and structured questions.

Where sampling is used, in order to ensure that the candidates will not be able to foresee what items they will be questioned on, a different sample of knowledge and/or skills items is required each time the Outcome is assessed.

Outcome 4

Construct and evaluate a fast prototype of a practical robotic/animatronic application.

Knowledge and/or skills

- Task analysis
- Subsystem selection
- Fast prototyping
- System testing
- Process Evaluation

Higher National Unit specification: statement of standards (cont)

Unit title: Robotics and Animatronics: An Introduction

Evidence Requirements

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

Candidates are to be given a sequence of tasks for a simple robotic/animatronic application. Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that from the basic functional requirements and task sequence they can:-

- Analyse sequence of tasks
- Select appropriate input, control and output subsystems to carry out sequence
- Construct a fast prototype
- Test prototype against given sequence of tasks
- Produce a process evaluation

The simple robotic/animatronic application must have at least five subsystems with at least one input, one control and one output subsystem. See support notes for exemplar subsystems.

Evidence of this process will be that candidates will construct a fast prototype such that at least three out of the five subsystems work correctly and complete a report of 500 words minimum which includes:

- Analysis of sequence of tasks
- Justification of choice of input, control and output subsystems
- Details of construction highlighting key aspects of fast prototype
- Test results against given sequence of task including discussion of any subsystems not working if applicable
- An evaluation of the process undertaken

In addition to reporting there is likely to be elements of research and experimentation which will be needed prior to the fast prototyping. The fast prototyping should have at least five subsystems and it is important to note that the fast prototyping artefact can be considered as acceptable if three out of the five subsystems work correctly.

Assessment Guidelines

The task of carrying out an analysis, design and project build based on the bringing together of subsystems to do a limited task will result in various activities. In addition to reporting there is likely to be some research and experimentation which will be needed prior to the fast prototyping of elements. The report of 500 words minimum should be completed in the candidate’s own time.

Centres should make every reasonable effort to ensure the assignment solution is the candidate’s own work. If supervisor or technician support has been provided then this should be clearly acknowledged. Where copying or plagiarism is suspected candidates may be interviewed to check their knowledge and understanding of the subject matter. A checklist could be used to record oral evidence of the candidates’ knowledge and understanding.

Administrative Information

Unit code: DW8W 34

Unit title: Robotics and Animatronics: An Introduction

Superclass category: VE

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Source: SQA

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: Robotics and Animatronics: An Introduction

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 for this Unit

The purpose of the Unit is to enable candidates to develop knowledge and understanding of Robotics and Animatronics as an application area within Mechatronics. The Unit provides candidates with the understanding of the use of sensors, control and actuators to perform functions as part of a basic robotic or animatronic system. It includes a practical fast prototyping project to explore a simple robotic/animatronic application.

Allocated delivery times are for guidance purposes only.

Outcome 1 (8 hours)

The aim of this Outcome is to provide a basic understanding of robotic and animatronic system principles.

Basic elements of a robotic/animatronic system should be explored starting with possible definitions of what a robotic system could be. Example definitions might include, 'A programmable entity able to do a task'. 'A machine capable of changing behaviour based on inputs', etc. The key here is the discussion of the different elements of form, capability, physical realisation, responsiveness to inputs, ability to change behaviour or actions, etc. As a mechatronic system, the expected characteristics such as mechanical elements, electrical/electronic elements, control/software aspects and a system are shown as relevant and expected in a robotic system. Importantly though, it is key to recognise that any robotic system normally encountered will be only a much simplified system compared with natural counterparts. So a robotic arm and gripping hand will have only a few actuators and sensors compared with the human arm and hand. The robotic system is much reduced in terms of scope but is greatly enhanced by careful focus on the key parameters such as force, velocity or repeatability at the expense of other capabilities or features.

The issue of safety is raised early on as any work with robotic and animatronic systems should have inherent safety considerations included whether the realisation is a basic small model/prototype or a fully developed industrial/commercial system.

The function and form of robotics and animatronics systems are then explored. The types of function involve issues of the number of tasks (single task/multiple tasks) and how many times it is required to do them (repetition). A further variation concerns whether the task is fixed (the same every time) or variable (potentially changed from a previous time). The next aspect explored is the intelligence or decision making capability which can vary over a spectrum from preset through dynamic (changes depending on changed circumstances) through to learning and adaptive behaviours where behaviour changes over time to produce a more effective or efficient response. The next area concerns the natural tendency to make a realisation analogous to nature or predecessors. So for instance a picking up task might be expected to involve a gripper type action similar to our hands or a motion requirements leading to legs. Robotic and animatronic systems may follow nature or predecessors but other solutions may be suitable such as magnetic or wheels — a human may be expected to rotate their waist to place an object on a bench behind them whereas a robot may rotate a shoulder joint. Finally form requirements are explored. These are perhaps more important in animatronics than robotics but increasing human interaction with robots may increase the importance of this aspect.

Form requirements may include analogous (the need to appear humanoid, have eyes (a robot that 'sees' using a pinhole camera may be technically advanced but confusing if people cannot work out how the robot 'sees' which, of course, conversely could be an advantage in a security type application), appearance (size, shape, format, coverings), motion (linear, rotary, combined) and interaction (input and output, responding to senses or producing a response for the senses).

Outcome 2 (8 hours)

This Outcome considers the input, control and output sections of typical systems. This systems approach of input/control/output is familiar to mechatronic engineers. Each of the different three aspects is explored in turn.

The input types should include commands sent to a system whether by a simple switch, set of switches or other more complicated method. Some inputs consist of changes in levels, sounds (simple sound inputs only as command and speech are covered in the Unit Robotics and Animatronics, vision (simple visual inputs only as coded commands and recognition are covered in the Unit Robotics and Animatronics, touch (tactile) or proximity sensor outputs. Other inputs may be provided by including feedback about the system and may be in either analogue and/or digital form. When considering exemplar sensors then a 'fact-file' approach could be useful. Such an approach would enable candidates to know some basic facts about characteristics and realisations which would enable them to identify a sensor or suggest a sensor for a particular application. By its very nature the recorded information may be incomplete, indicative and generalised but the wide range of types of devices could be usefully summarised and made more available for helping in the solution of robotic and animatronic problems. The emphasis should be on practical usage and characteristics rather than detailed technical design or principle issues which is generally beyond the scope of this Unit.

The control strategies section should consider the topic from a Robotics and Animatronics point of view rather than from a more generalised mechatronic or control theory viewpoint. The general scheme of control in terms of manual, automated or programmed should be explored and discussed. Issues such as manual could be of value where capability, access or precision may need extending such as in using a robot to handle radioactive materials or in keyhole surgery. The issue of automated systems could be of value where tasks are repetitive and predictable such as in a packing or bottling plant. Issues such as programmability could be where a variety of responses and actions may be followed perhaps based on situations, options, histories and changing preferences. Additionally the differences between time based and sensor based should be explored and contrasted with reference to open and closed loop control systems included. Here, time based have inherent simplicity but can suffer from time delays as allowances must be made for maximum time needed for a task to be completed. In contrast, the sensor based has more knowledge of the situation based on feedback but at a cost of added complexity and the sensors themselves. The issue of how inputs are interpreted and the subsequent response should be explored as this often determines the scope and flexibility of a particular system whether responding in a predetermined fashion or whether a variety of possible outcomes are possible based on situational tests through branching (if, do else). Finally the issue of how the processes and sequences can be described communicated and documented should be explored through flowcharts and other descriptive tools methodologies being considered. The emphasis here should be on basic flowchart structures with action boxes (do something), and tests (if test then do something else do something else) rather than on a surfeit of detailed flowchart symbols and rules. Examples of another descriptive tool might be some form of structured English or professional methodology, tool or language.

The output and actuators section should consider the various types covered by the list with practical examples of each and possibly a 'fact-file' approach similar to that described for inputs. Examples of indicators might include lamps, LEDs or simple flags. Examples of audible outputs might include sounders giving tones or pulses or simple clicks. The indicators should appeal to the visual aspects whereas the sounders should appeal to the audible aspects. Position, velocity and acceleration should be explained relative to one another, e.g., velocity being the rate of change over time of distance in a direction. The important link between position, velocity and acceleration as expressed in differentiation and integration should be mentioned.

Outcome 3 (6 hours)

This Outcome considers the basic operation and characteristics of a range of motor types and encoders. The emphasis here is on their main characteristics and how they can be used. A brief compare and contrast together with a 'Fact-file' approach should prove useful. In context the main issues covered may include:
DC permanent magnet motor (precision and powerful with high power magnets in addition to the simple low cost version),
Stepper motors (predictability and open loop potential, aspects of detent and limitations),
Servomotors (both precision feedback systems incorporation into motors and pulse operated modeller's servos (e.g., Radio controlled model boats) should be covered),
Hydraulic and pneumatic (similarities and differences such as power, precision, maintenance and costs)

Encoders should be described as providing information about position (and by derivation speed and acceleration). The differences between incremental and absolute should be highlighted (in terms of operation and the effect of power loss) and also the key factor of rotary or linear configuration with brief mention of how mechanically how a rotary action can be transformed to a linear and vice verse.

Outcome 4 (16 hours)

Outcome 4 is much concerned with a fast prototype. A fast prototyping here is considered as a technique of quickly producing a basic /skeletal model which demonstrates the key principles of the real thing. This model may be deficient in some aspects but is able to perform with limitations such as power, distance, smoothness, reliability, precision, repeatability, etc.

This Outcome considers and practices the initial stages of a practical analysis and fast prototyping project based on bringing together subsystems to do a limited task. There should be elements of research and experimentation which will be needed prior to the fast prototyping but the time and effort limitations of the Outcome and assessment must be remembered. The fast prototyping should be carried out with an emphasis more likely to be on improvised constructions using material to hand or construction kits than on precision engineering, machining and assembly. The use of commercial 'engineering kits' technical toys, scientific tools or construction kits should be encouraged owing to the speed with which ideas and concepts can be proposed, built, explored, characterised and modified. The use of pre-designed or constructed modules should also be considered provided their basic function, characteristics and limitations are understood by each candidate.

There is the statement that ‘the fast prototype should have at least five subsystems and it is important to note that the fast prototyping artefact can be considered as acceptable if three out of the five subsystems work correctly. The choice of three out of five is because there are many factors outside a candidate’s (or supervisor’s) control which may impair performance. The emphasises should be on the need to concentrate on understanding what is occurring and potential issues rather than chasing elusive performance which may well be unachievable within the limitations and constraints.

The importance of the brief report should be emphasised as an important record, a reflective exercise and means of clear communication. Sections should be included covering the analysis of sequence of tasks (what should happen when), justification of choice of input, control and output subsystems (how can the tasks be carried out), details of construction highlighting key aspects of fast prototype (how was the fast prototype constructed including safety considerations), test results against given sequence of task including discussion of any subsystems not working if applicable (how well the prototype performed (or didn’t)) and a brief evaluation of the strengths and weaknesses process(es) undertaken .

The actual detailed topic or problem can be from a wide range of situations and scenarios. Common scenarios include such exemplar systems such as line followers, responsive animations, maze solvers/explorers, etc. may be appropriate but more diverse scenarios should not be excluded provided they provided a suitable vehicle for learning and assessment. In addition to a new problem, it may also be appropriate to consider the needs to modify or enhance an existing solution and/or to consider part of a larger project being tackled by the presenting centre or by a team of candidates. In the latter case where team participation is considered then all the expected aspects of relative individual contribution, shared work, understanding or whole and candidate’s particular part, etc. should be considered and addressed.

Exemplar subsystems could include:

sound detection (detects frequency, voice, music or handclap etc.)
light detection (level, colour, IR, UV, etc.)
movement detection (tactile, proximity, beam sensor, ultrasonic, etc.)
control (logic function, single repetitive, etc.)
sound output (tone, tune, click, etc.)
motion (moves, oscillates, open valve, etc.)

Guidance on the delivery and assessment of this Unit

This Unit has two aspects to its delivery and assessment. The first aspect concerns developing knowledge and understanding which is found within all Outcomes and the second is practical exercise and associated reporting which is in Outcome 4. Outcomes 1, 2 and 3 are assessed by an appropriate balance of short answer, restricted response and structured questions. Outcome 4 is assessed by the construction a fast prototype such that at least three out of the five subsystems work correctly and the completion of a report of 500 words minimum with specified content.

Higher National Unit specification: support notes

Unit title: Robotics and Animatronics: An Introduction

This Unit should be delivered by a combination of lecturing, group and individual working, and demonstrations. There are important statements contained in 'Guidance on the Content and Context for this Unit – Outcome 4' that describe the role and format of the practical work.

Opportunities for developing Core Skills

Candidates are working in a context which requires that they research and design original robotics and animatronics applications to a specific brief. All elements of the Core Skill of Problem Solving, namely planning and organising, critical thinking, and reviewing and evaluating will be developed and enhanced as candidates undertake the Unit. As they seek design solutions they must analyse the sequence of tasks and select and justify appropriate subsystems to carry out requirements while working within available resources and to timescales. Identifying and considering the variables and analysing the relative significance of each before constructing a fast prototype will provide opportunities to develop creative skills to an advanced level. Analysing and evaluating the process will be a critical aspect of underpinning knowledge and understanding. Candidates could be provided with checklists to support them in identifying appropriate evaluative methods.

Although skills in using Information Technology are not discretely assessed candidates will develop understanding of programs in robotic and animatronics control systems. It may be useful if they are able to conduct on line research on current commercial work in robotics and animatronics before undertaking design work. Accuracy in the interpretation and communication of graphic information underpins the competencies developed in the Unit. Some candidates may benefit from formative opportunities to further develop the effectiveness of their analysis and application of graphic data, and the use of software packages or on-line tutorials to enhance skills may be useful. Use of current software to check technical accuracy of written reports is good practice.

Candidates may benefit from awareness raising on approaches to team working as an essential aspect of the Design Process. There are practical opportunities to foster skills in group co-operative working and oral communication as candidates discuss proposed solutions and:

- analyse the task and its component elements
- negotiate the nature and scope of goals, roles and responsibilities taking account of all resources including strengths and weaknesses of individuals
- negotiate rules for effective management of the group and task
- demonstrate the use of working methods consistent with available resources
- demonstrate and explain methodology to others
- review and evaluate their own performance in working with others

Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of online support. However, with regards 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, whether done at a single or multiple events, was conducted under controlled, supervised conditions.

For information on normal open learning arrangements, please refer to the SQA guide *Assessment and Quality of Open and Distance Learning* (SQA 2000).

Higher National Unit specification: support notes

Unit title: Robotics and Animatronics: An Introduction

Candidates with disabilities and/or additional support needs

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 on Alternative Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs,* which is available on SQA's website: **www.sqa.org.uk**.

General information for candidates

Unit title: Robotics and Animatronics: An Introduction

This Unit has been designed to help you to learn about Robotic and Animatronic Systems in an engineering context. The Unit has been designed to be interesting, challenging and potentially fun!

The Unit builds on general understanding of mechatronic systems and this extends to cover the application to robotic and animatronic systems. The Unit has theoretical, application and practical aspects.

You will need to learn the language (terms) used, key elements that make up such systems and some of the characteristics of elements.

The Unit contains a look at what is a robotic and animatronic system. In the same section, you will explore what they might do and how they may change their behaviour in response to inputs. How they are controlled is considered and the different ways they may choose to act is covered as is how their behaviour can be recorded. Their choices may result in various actions and how these are output is an associated topic.

To produce movement or motion then various types of motors are used. You will get to know about these and what each type is best suited for. Also you will explore about how you can know about a change in position.

Towards the end of the Unit there is an opportunity for some practical analysis and a fast prototyping mini project based on bringing together subsystems to do a limited task. Your centre should be able to tell you about possible examples of this. This part should be interesting, challenging and enjoyable. To record what you have done a brief report is needed. The fast prototyping approach means that you should be able to 'try things out' and 'get something going' quickly.

As you learn about robots then the issue of safety and safe working will be emphasised and at all times you should keep safety in mind when working with robots whether in a recreational or engineering context.

It is likely that during the teaching of the Unit you will be provided with basic information on the topic. You may find it valuable to supplement this with additional information relevant to the subject area. For the selection of robots to do a particular task, you will be required to analyse this information and judge its value in supporting any views you wish to put forward. Thus, another benefit of taking the Unit is that you will be encouraged to develop or enhance new skills in research, analysis and critical thinking. There is no single right way to solve a particular technical issue or to solve a business problem, so you need to develop judgement as to which may be the most appropriate in practice and for a particular situation.

During the Unit, you will be provided with examples and background materials to illustrate how the various aspects are important. If you do have previous experience or knowledge in this area then your lecturer or instructor may encourage you to use this knowledge to set in context the information you receive during the teaching of the Unit. They may also ask you to share this knowledge with the rest of your class so that others can benefit from your experiences.

By the end of the Unit you will be expected to have a clearer understanding of many factors involved in using robotic and animatronic systems in a variety of contexts.

General information for candidates

Unit title: Robotics and Animatronics: An Introduction

The precise form that the assessments will take will depend on the centre where you are taking the Unit. The assessment for Outcomes 1, 2 and 3 of this Unit is combined into one closed book assessment lasting 1 and a half hours. Assessment of Outcome 4 involves a project involving practical analysis, selection, fast prototyping, testing and evaluation. The project brings together subsystems to do a limited task and then produce a report of 500 words minimum which should be completed in your own time. The fast prototyping should have at least five subsystems and is considered as acceptable if three out of the five subsystems work correctly.