-SQA-SCOTTISH QUALIFICATIONS AUTHORITY

HIGHER NATIONAL UNIT SPECIFICATION

GENERAL INFORMATION

-Unit Number- **2610177**

-Superclass- **VE**

-Title- **COMPUTER AIDED MANUFACTURE**

-DESCRIPTION-

GENERAL COMPETENCE FOR UNIT: Applying cost comparisons and identifying requirements of computer aided manufacturing systems.

OUTCOMES

1. the cost of manufacturing a given component in batches of ten using traditional and CNC methods is calculated;

2. describe the requirements of current automated handling devices;

3. identify modern tooling systems and the requirements of tool libraries;

4. identify the benefits of adaptive control and its monitoring requirements for CNC machines.

CREDIT VALUE: 1 HN Credit

ACCESS STATEMENT: Access to this unit is at the discretion of the centre. The candidate should have an awareness of a range of manufacturing processes, experience of CNC programming and use of simple spreadsheets. This may be evidenced by possession of relevant NC modules:

64703 Manufacturing Processes 1
74698 CNC Part Programming

or similar qualifications or experience.

For further information contact: Committee and Administration Unit, SQA, Hanover House, 24 Douglas Street, Glasgow G2 7NQ.

Additional copies of this unit may be purchased from SQA (Sales and Despatch section). At the time of publication, the cost is £1.50 (minimum order £5.00).

HIGHER NATIONAL UNIT SPECIFICATION

STATEMENT OF STANDARDS

UNIT NUMBER: 2610177

UNIT TITLE: COMPUTER AIDED MANUFACTURE

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. THE COST OF MANUFACTURING A GIVEN COMPONENT IN BATCHES OF TEN USING TRADITIONAL AND CNC METHODS IS CALCULATED.

PERFORMANCE CRITERIA

(a) Planned operational sequences are produced in accordance with established practice for both traditional and CNC methods to achieve manufacturing specification.
(b) Using both methods of manufacture, the cost is compared accurately within the range.
(c) The overall effects on both manufacturing methods are accurately compared within the range.

RANGE STATEMENT

Operational Sequences: profile; angles faces; radii.

Costs: loading; machining; tool change; tooling; total manufacturing.

Manufacture methods: production time; economic batch size; lead time; tooling costs.

EVIDENCE REQUIREMENTS

Written evidence is required to show that the candidate can compare the cost of manufacturing a given component using traditional and CNC methods, as specified in performance criteria (a) to (c).

OUTCOME

2. DESCRIBE THE REQUIREMENTS OF CURRENT AUTOMATED HANDLING DEVICES

PERFORMANCE CRITERIA

(a) Benefits of automated handling devices are correctly stated.
(b) Applications of the range of automated handling devices are correctly stated.
(c) Suitable controlled handling devices are selected and indicated correctly in annotated sketches showing materials flow for the given applications.
(d) A handling device is controlled effectively by creating a program.
(e) From a given AGV system layout calculate correctly the systems requirements within the range.

RANGE STATEMENT

Devices: fork lift trucks; conveyor belts; programmable logic controllers; special purpose pallets; robots; automatic guided vehicles.

Applications: flexible manufacturing cell; assembly line; automated warehouse.

AGV system: total time per delivery per vehicle; number of deliveries per vehicle per hour; number of vehicles required; handling efficiency; required handling system capacity.

EVIDENCE REQUIREMENTS

Written and/or oral evidence of the candidate's ability to describe the requirements of computer controlled handling devices and systems, as specified in performance criteria (a) to (d).

Written and/or oral evidence of the candidate's ability to calculate the AGV system layout as specified in performance criterion (e).

OUTCOME

3. IDENTIFY MODERN TOOLING SYSTEMS AND THE REQUIREMENTS OF TOOL LIBRARIES

PERFORMANCE CRITERIA

(a) Applications of the range of tooling systems are correctly stated.
(b) Reasons for establishing tool libraries are correctly stated.
(c) Information contained in a tool, data file is described accurately.

(d) Using a devised code, correctly initiate a tool library identification system to suit the given tools and information required within the range of a tool library.

RANGE STATEMENT

Systems: preset; qualified; ISO; block tooling as information carrier.

Library: tool family; tool identification within the family; tool diameter; tool holder; tool setting length; tool material.

Tool data: tool family; tool; usage to date; tool life; re-ordering; maximum and minimum speeds and feeds.

Six tools: right hand sliding and facing; left hand sliding and facing; undercutting; face mill; 'd' drill; boring.

EVIDENCE REQUIREMENTS

Written and/or oral evidence of the candidate's ability to identify the requirements of modern tooling, as specified in performance criteria (a) to (c).

Written and/or oral evidence of the candidate's ability to devise an effective coding and tool library system as specified in performance criterion (d).

OUTCOME

4. IDENTIFY THE BENEFITS OF ADAPTIVE CONTROL AND ITS MONITORING REQUIREMENTS FOR CNC MACHINES

PERFORMANCE CRITERIA

(a) The benefits of adaptive control are correctly identified.
(b) An annotated sketch of an adaptive control system for a CNC machine tool, showing the measured variables is produced correctly.
(c) Tool monitoring devices and techniques are correctly identified within the range.
(d) A programme sub routine to incorporate effective tool monitoring is correctly created.
(e) The benefits of the integration of tool library and tool data files combined with tool monitoring are correctly identified.

RANGE STATEMENT

Benefits: remote manufacturing; in processes checking; improvement of production rate; reduction of machining time.

Range: probe table mounted; probe spindle mounted; power output monitoring.

EVIDENCE REQUIREMENTS

Written and/or oral evidence of the candidate's ability to identify tool monitoring requirements for CNC machines, as specified in performance criteria (a) to (c).

Written and/or practical evidence of the candidate's ability to produce a sub routine as specified in performance criterion (d).

Written and/or oral evidence of the candidate's ability to describe the benefits of integration as specified in performance criterion (e).

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.

A pass with merit may be awarded to candidates who have successfully achieved all the outcomes and performance criteria and in so doing have consistently demonstrated superior performance with respect to spreadsheet layout and applications.

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.

HIGHER NATIONAL UNIT SPECIFICATION

SUPPORT NOTES

UNIT NUMBER: 2610177

UNIT TITLE: COMPUTER AIDED MANUFACTURE

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 unit may be taken as a free-standing unit in a wide variety of programmes. It is particularly suitable for candidates undertaking programmes in manufacturing systems.

On completion of this unit, the candidate will have an understanding of the use of computers in effective costing, use of handling devices, identifying requirements of modern tooling, their ability to monitor systems and adjust their control.

CONTENT/CONTEXT Learning should take place in a practical environment where a range of systems can be demonstrated and candidates can gain hands on experience. Videos and work visits should be used to supplement areas where direct experience is not possible.

Corresponding to Outcomes 1-4:

1. Prepared planning layouts for given component part being manufactured by both tradition and CNC machining systems should be analysed. A spreadsheet layout along the lines of:

    - cutter diameter
    - number of teeth on cutter
    - cutting speed
    - length of cut to be taken on component
    - cutter approach length
    - cutter over - run length
    - feed rate per tooth
    - machine rate per hour
    - time taken to return machine table to start position
    - time taken to unload and load part
    - cost of replacing cutter at end of tool life
    - time taken to replace cutter

should be constructed allowing the calculation of actual costs of manufacture. Costs consideration should be limited to cutter size, feed and speeds, machining times, rate per hour, set-up time and tool life.

On comparison of these costs it would be appropriate at this stage to discuss the overall effects of manufacture cost, production time, economic batch size, lead time and tooling costs.

2. A general survey of computer aided handling devices should be attempted emphasising their benefits and their need, due to the continuing surge towards integration in present day manufacturing systems. Highlight their use by showing typical layouts of material movement in various systems i.e. manufacturing cell, automated warehouse and assembly lines.

   Give examples of system layout using AGV and calculate system requirements.

   A simple approach to programming of a device should be demonstrated.

3. Demonstration of the range of tooling systems e.g. block system with inserted chip giving tool life record, should be used along with an example of tool library. Discussion on the role of tool data file should be attempted with emphasis at this stage placed on the development of integration of the systems. Attempt layout of a tool library using a suitable coding system.

4. A general survey of tool monitoring devices should be attempted emphasising their benefits and their need, due to remote machining. A feed back system should be demonstrated if possible, if this is not available in the centre then it should be through a works visit or video presentation. Through this means discussion could be stimulated on the ability of the system to continually monitor machining and make adjustments to existing programmes, i.e tool wear, replacement etc.

   The use of a probe in monitoring tool selection should be demonstrated by a simple subroutine inserted into a main line programme, checking tool and tool holder are at the correct settings.

APPROACHES TO GENERATING EVIDENCE As the presenter or candidate decides that the required skills have been mastered, discrete pieces of work should be completed which cover the requirements of each outcome. The order in which this is done could be a sequential presentation of outcomes 1 and 2, with 3 and 4 being integrated.

ASSESSMENT PROCEDURES

Outcome 1

A course study based on the given component and working from a pre-described economic batch size the candidate compiles a spreadsheet programme which compares the cost of manufacture (Note only machining costs considerations

described in content/context) by traditional and CNC machining. Having established results comment can then be made on production time, economic batch size, lead time and tooling costs. The completed study should consist of candidates written comments on prescribed points (Approx. 200 words per item) and a computer print out of programme results.

Outcome 2

A series of short answer questions asking the candidate to describe two present day needs for computer control of handling devices, state typical applications of the range and two given applications select suitable handling devices. An exercise in performing an application with a handling devices, where the candidate will gain this control by writing a simple programme.

Outcomes 3 and 4

A case study and short answer questions asking the candidate to analyse links between tool selection, tool library and tool data files and tool monitoring with particular reference to integration of systems.

PROGRESSION This unit would be useful for candidates intending to attempt an HNC/D in manufacture or mechanical engineering.

RECOGNITION Many SQA HN units are recognised for entry/recruitment purposes. For up-to-date information see SQA guide “HN/D frameworks.

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.