higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

COMPUTER-INTEGRATED MANUFACTURING
NQF LEVEL 4

(6030324)

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09:00–12:00

This question paper consists of 4 pages and 2 information sheets.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
COMPUTER-INTEGRATED MANUFACTURING
NQF LEVEL 4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Use only a black or blue pen.
5. All drawings and diagrams must be clearly and neatly labelled and drawn to IEC standards.
6. A pencil may be used for the drawings.
7. Write neatly and legibly.

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QUESTION 1

1.1 What does the term *Computer-Integrated Manufacturing* (CIM) mean? (1 × 2) (2)

1.2 Name THREE forms of equipment used in CIM systems. (3 × 1) (3)

1.3 Draw a flow chart to show SIX crucial steps followed when planning a CIM system. (6 × 1) (6)

1.4 Write out the names of the following systems that are applied in a CIM system, and explain the difference between these systems:

1.4.1 FMS system

1.4.2 DNC system

(2 × 2) (4)

[15]

QUESTION 2

2.1 Explain the meaning of the following CNC codes:

2.1.1 G-codes

2.1.2 M-codes

2.1.3 Technical codes

(3 × 2) (6)

2.2 Explain why it is necessary to determine a tool path for an NC-coded application. (1 × 2) (2)

2.3 Explain the difference between the following CNC commands by making a drawing of each type of command for a lathe:

2.3.1 Incremental positioning

2.3.2 Absolute positioning

(2 × 3) (6)

2.4 Draw the Cartesian system used by a CNC mill showing the direction of the movements. (6 × 1) (6)

2.5 Explain the following basic G-codes:

2.5.1 G00

2.5.2 G01

2.5.3 G02

(3 × 2) (6)

2.6 Explain why a CNC machine will not start if the door is not closed. (1 × 2) (2)

2.7 Name TWO types of CNC machine application software available in the market. (2)

[30]

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QUESTION 3

3.1 Explain the difference between *Cartesian* and *Articulated* industrial robots. (2 × 2) (4)

3.2 Name FIVE industrial robot applications. (5 × 1) (5)

3.3 Explain what is doing the work in an industrial robot application. (1 × 2) (2)

3.4 Make a drawing that shows the hazardous areas in the work cell of an industrial robot. (4 × 2) (8)

3.5 Make a drawing that represents each of the following motion commands:

3.5.1 Point-to-point (PTP) – air command

3.5.2 Circular command – CIRC

3.5.3 Linear command – LIN

3.5.4 Continuous command – CONT

(4 × 2) (8)

3.6 Name THREE types of commands that can be found in industrial robot application software. (3 × 1) (3)

[30]

QUESTION 4

4.1 Name FOUR types of quality control. (4)

4.2 What are the FOUR steps used to manage quality control? (4)

4.3 Explain the purpose of quality in manufacturing. (2)

[10]

QUESTION 5

5.1 Explain how CAD and CAM are used in a CIM system. (2)

5.2 State the difference between the *output of a CAD application* and that of the *CAM application*. (2 × 2) (4)

5.3 Draw and name the THREE geometric models used in CAD/CAM applications. (3 × 2) (6)

5.4 Draw a simplified block diagram of a CAD/CAM/CNC system. (3)

[15]

TOTAL: 100

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INFORMATION SHEETS

G-CODES	
CODE	**FUNCTION**
G00	Rapid positioning, point-to-point, high rate
G01	Linear interpolation, controlled feed rate
G02	Circular interpolation CW
G03	Circular interpolation CCW
G04	Dwell for program duration
G17	XY plane select (milling)
G18	XZ plane select (milling)
G19	YZ plane select (milling)
G24	Radius programming (lathe)
G28	Return to reference point
G29	Return from reference point
G32	Thread cutting (lathe)
G40	Cutter compensation cancel
G41	Cutter compensation left
G42	Cutter compensation right
G70	Inch units
G71	Metric units
G90	Absolute dimension
G91	Incremental dimension
G94	Feed rate (inches per minute)
G95	Feed rate (inches per revolution)

M-CODES	
CODE	**FUNCTION**
M00	Program stop
M01	Optional stop
M02	End of program
M03	Spindle on CW
M04	Spindle on CCW
M05	Spindle off
M06	Tool change
M07	Mist coolant off
M08	Flood coolant on
M09	Coolant off
M19	Orient spindle
M30	End of program, reset program

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TABLE 1.1	
ADDRESS	**DESCRIPTION OF THE (IR) PROGRAMMING CODE**
INI_'NAME'	**Program start followed by the program name**
;	**Non-action: semi-colon followed by a comment**
P1- Pn	**The numbering of the programming points**
HOME	**The HOME position of the industrial robot manipulator**
PTP	**Undefined motion (air movement)**
LIN	**Linear motion (straight-line movement)**
CIRC	**Circular motion (curve/radius-line movement)**
CONT	**Continuous motion around a programmed point**
WAITFOR_T	**Wait for a time delay to elapse**
WAITFOR_I	**Wait for input from PLC**
SEND_O	**Send output to PLC**
GRIPPER_O	**Open the gripper**
GRIPPER_C	**Close the gripper**

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