higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

COMPUTER INTEGRATED MANUFACTURING
NQF LEVEL 4

(6030324)

20 November 2019 (X-Paper)
09:00–12:00

This question paper consists of 6 pages, an information sheet of 2 pages and 1 addendum.

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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. Keep subsections of questions together.
5. Use the G&M NC-codes and industrial robot-programming pseudo codes on the INFORMATION SHEET.
6. Complete the ADDENDUM and submit it with the examination script.
7. Write neatly and legibly.

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QUESTION 1

1.1 Computer-Integrated systems use integrated automated processing systems to produce products.

Explain how control between the various processes is achieved. (2)

1.2 FIGURE 1 shows a Computer-Integrated Manufacturing (CIM) system.

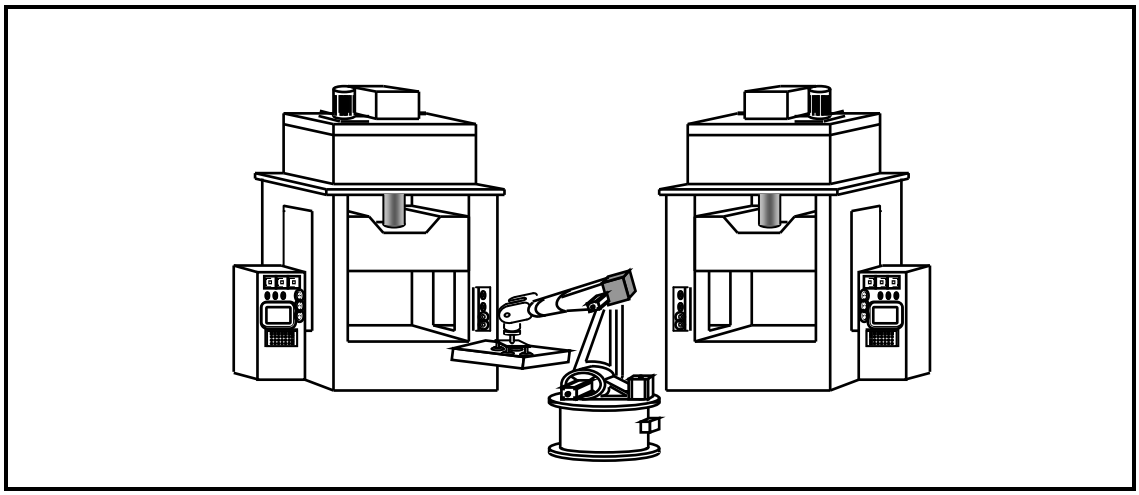


FIGURE 1

1.2.1 List the THREE processes that make up the CIM system in the correct sequence. (3)

1.2.2 Draw a block diagram that will represent the communication between the various processes and a PLC. (7)

1.3 Explain why Flexible Manufacturing Systems (FMS) is an asset to a company with respect to world-class manufacturing (WCM). (3)

[15]

QUESTION 2

2.1 List FOUR factors to consider when writing a CNC-coded program to machine a component. (4)

2.2 Explain the relevance of an engineering drawing when writing an NC-coded program. (2)

2.3 List the FOUR steps to follow when completing a CNC NC-setup sheet. (4)

2.4 Explain a safety consideration when using a vice with moveable jaws to determine the datum reference. (2)

2.5 FIGURE 2 shows a spacer to be manufactured.

A hole of 12 mm in diameter must be drilled into the middle of a mild-steel block having dimensions of 60 × 60 × 10.

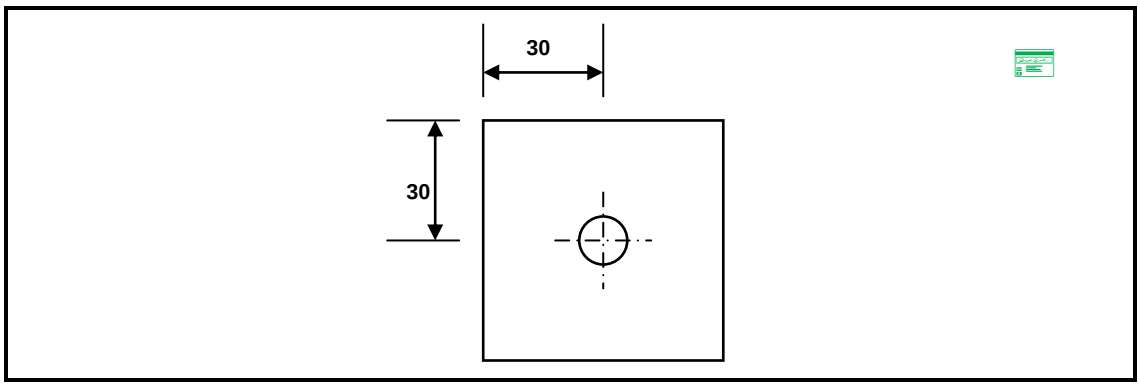


FIGURE 2

2.5.1 Complete the setup sheet on the ADDENDUM (attached) to machine the work part in a CNC mill. (10 × 1) (10)

2.5.2 Write the CNC NC-code to drill the spacer in FIGURE 2. (8 × 1) (8)

[30]

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QUESTION 3

3.1 Explain the function of the robot manipulator in an industrial robot system. (2)

3.2 List FOUR end-effecters that can be attached to the robot flange. (Any 4 × 1) (4)

3.3 FIGURE 3 shows a CIM system.

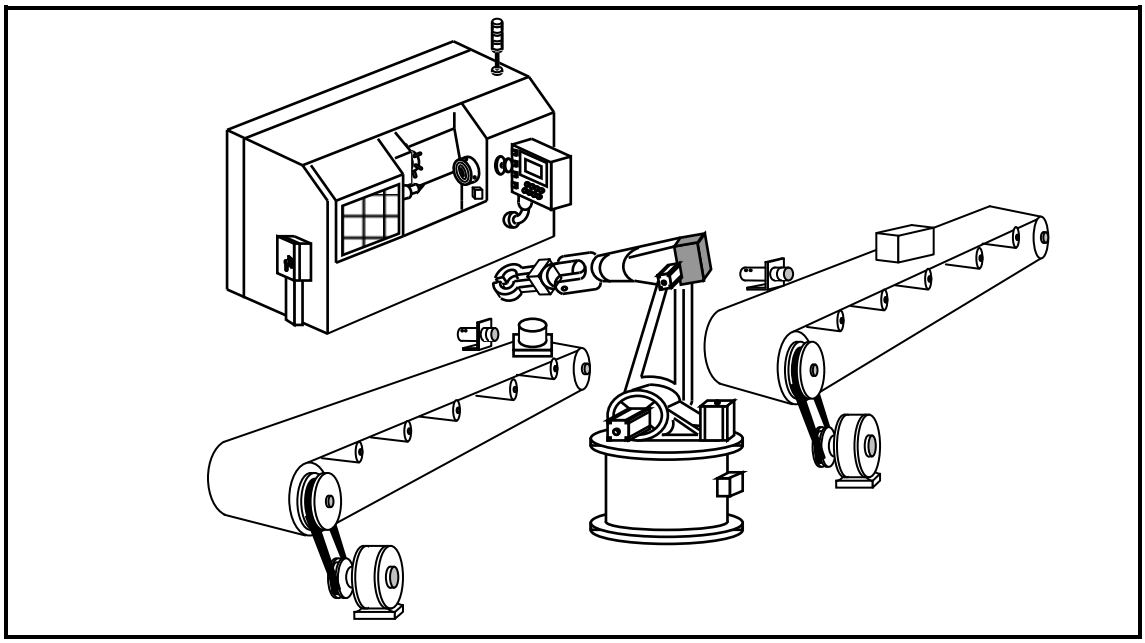


FIGURE 3

Write simple statements that will enable the robot to move a workpiece from conveyor 1 to the CNC-machine for processing and then collect the processed workpiece from the CNC-machine and place it on conveyor 2. (5)

3.4 With reference to FIGURE 3, draw the robot trajectory it will follow to pick up the workpiece from Press 1 and place it in Press 2. (15)

3.5 Industrial robot programming like PLC-programming is considered to be sequential control programming.

Explain the difference between *event-based* and *time-based* control. (2 + 2) (4)

[30]

QUESTION 4

4.1 Give THREE ways in which computer-integrated manufacturing improves quality. (3)

4.2 Explain the duties of an operator to ensure quality at a work cell. (Any 3 × 1) (3)

4.3 Explain how a quality-control chart is used to ensure quality. (2)

4.4 Explain when control code will be modified to ensure quality. (2)
[10]

QUESTION 5

5.1 CAD can be used for more than just producing engineering drawings.

List FOUR other purposes of using CAD. (4)

5.2 Give FOUR benefits of distributed control in CAD/CAM systems. (Any 4 × 1) (4)

5.3 Draw a block diagram that will represent distributed control of a CAD/CAM system. (7)
[15]

TOTAL: 100

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INFORMATION SHEET

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: semicolon followed by a comment**
P1- Pn	**Numbering of the programming points**
HOME	**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**

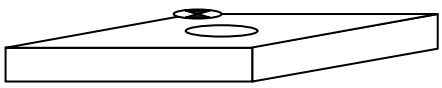
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ADDENDUM **EXAMINATION NUMBER:** | | | | | | | | | | | | | |

CENTRE NUMBER: | | | | | | | | | |

CNC machine tool setup sheet				
Part name: 2.5.1.1		**Date: 09/2013**		**Setup instructions/notes**
Part number: 2.5.1.2		**Page: 1**		**1.** *The part datum point is to*
Operation: 2.5.1.3		**Prog: 1234**		**2.** *setup as shown in the*
Machine: EMCO 55 MILL				**3.** *setup drawing*
Sect	**Tool description**	**Off-set**	**Insert**	**4.**
1	2.5.1.4			**5.**
				6.
				7.
				8.
				Required fixtures:
				Pneumatic vice
Sketch of setup				
2.5.1.5 – 2.5.1.10				



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