higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

COMPUTER INTEGRATED MANUFACTURING
NQF LEVEL 4

(6030324)

4 December 2020 (X-paper)
09:00–12:00

This question paper consists of 4 pages and an information sheet of 2 pages.

293Q1N2004

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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. Write neatly and legibly.

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QUESTION 1

1.1 List the THREE major components of an industrial robot system. (3)

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

1.3 Draw a block diagram to show how two CNC machines, one an industrial robot system and one an industrial robot transfer bed, are connected and controlled by a PLC system. (7)

1.4 Explain the term *intrinsic safety*. (2)

1.5 Name ONE type of drive that can be used to drive the industrial robot spray-painting system in an auto paint shop. (1)

[15]

QUESTION 2

2.1 List the SEVEN steps to follow when creating an NC part program. (7)

2.2 Explain the purpose of working out Euler coordinates before designing an NC drilling program for a CNC mill. (2)

2.3 Explain why one would draw the tool path in relationship to the coordinates in the NC program design process. (2)

2.4 Which FOUR safety precautions should be considered when using a CNC machine tool? (4 × 1) (4)

2.5 Give the SIX steps to follow when installing a CNC machine tool. (6)

2.6 Explain the THREE lamps found on a CNC machine tool. (3 × 2) (6)

2.7 Make a simple drawing to show how a G00 NC code is used to move a machine tool from the machine zero to the workpiece zero position. (3)

[30]

QUESTION 3

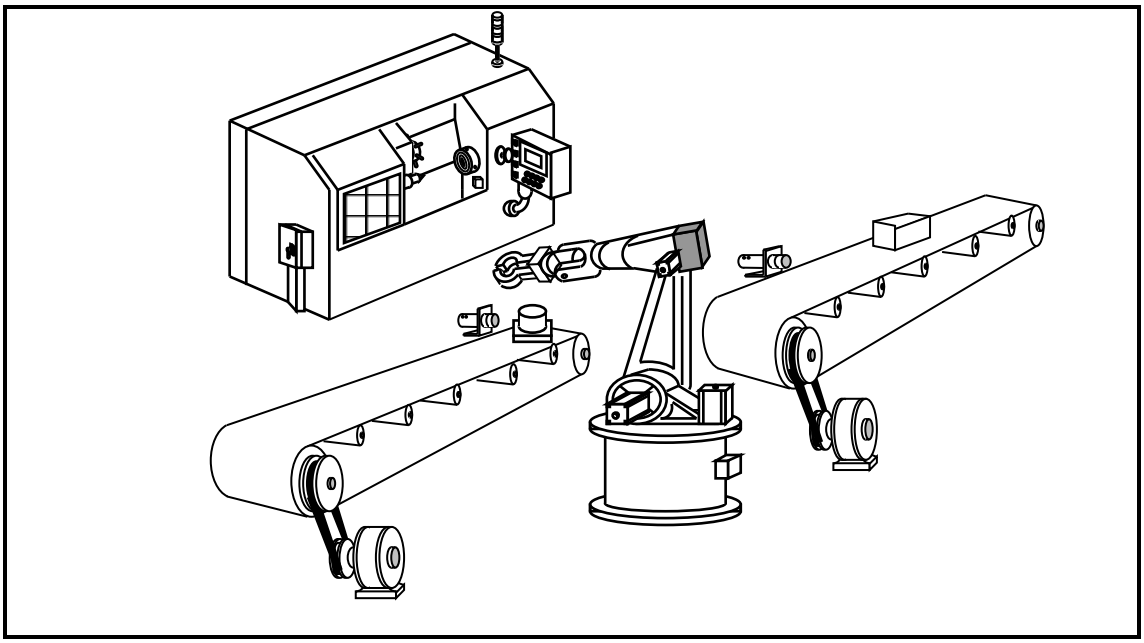
3.1 Give FOUR reasons for using an industrial robot in computer-integrated applications. (4 × 2) (8)

3.2 Draw the basic structure of an industrial robot program. (6)

3.3 Explain why simple English statements are helpful when programming an industrial robot. (2)

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3.4 Study the pictorial depiction of a pick-and-place industrial robot below.



Draw the tool path that the end effecter would follow to complete the 'pick n place' task. (11)

3.5 Name TWO technology commands used in a robot system. (2 × 1) (2)

3.6 Where does the end-effecter fit on a robot manipulator? (1)
[30]

QUESTION 4

4.1 Explain the term *nondestructive testing*. (2)

4.2 Explain the term *maintenance*. (2)

4.3 Explain how automation improves quality in a factory. (3 × 2) (6)
[10]

QUESTION 5

5.1 Draw a block diagram to show how a CAD/CAM design process is integrated into a computer-integrated manufacturing factory. (10)

5.2 List THREE methods of modelling used in a CAD/CAM process. (3 × 1) (3)

5.3 Explain the term *analysis*. (2)
[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**
G20	**Inches**
G21	**Metric**
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	**Wait for input**
G71	**Send output**
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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ADDRESS	DESCRIPTION OF THE (IR) PROGRAMMING CODE
INI_'NAME'	Program start followed by the program name
;	Nonaction: semicolon 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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