higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

COMPUTER-INTEGRATED MANUFACTURING
NQF LEVEL 4

15 November 2022

This marking guideline consists of 6 pages.

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INSTRUCTIONS TO MARKERS

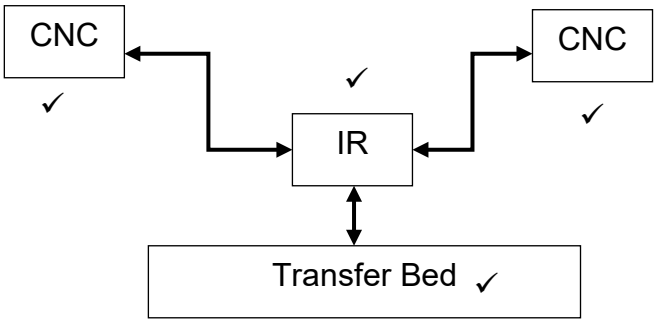
1. Mark all the questions.
2. Follow the answers according to the numbering system used in this question paper.
3. Use only a red pen.
4. Put your ticks and crosses neatly and legibly.

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QUESTION 1

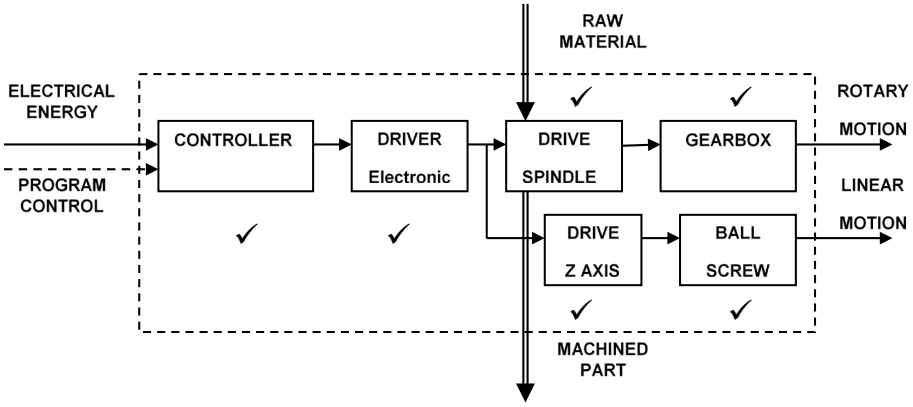
1.1
- Design and Engineering (CAD)
- Process Planning (ERP)
- Automated Material Handling (AMH)
- Manufacturing (CAM) (4)

1.2



(Marker to use discretion)
(1 mark for the correct data flow) (5 × 1) (5)

1.3



(Marker to use discretion)
(Marks to be awarded if the energy, data and material flow are correct) (6 × 1) (6)
[15]

QUESTION 2

2.1 2.1.1 Preparatory codes or G-codes are used to control cutting-tool motion.

2.1.2 M-codes are basically switching codes that turn a function on or off that can only be used once in a program line.

(2 × 2) (4)

2.2
- Sequence numbers – used to identify a new block in a program
- Characters – a single alphanumerical character
- Words – a series of characters defining a single function
- Blocks – series of words defining a single instruction (4)

2.3 Line 1: Select a cutting tool.
Line 2: Select either absolute or incremental motion.
Line 3: Rapidly move the cutting tool to the part reference point.
Line 4: Turn coolant on.
Line 5: Select proper feed rate and spindle speed.
Line 6: Select part's cutting coordinates.
Line 7: Turn the spindle and coolant off.
Line 8: Move cutting tool to the clearance position.
Line 9: Select new cutting tool.
Line 10: …… (8 × 1) (8)

2.4 %✓
; Drilling
;10810
N05 G90, G21✓
N10 G00, X0 Y0 X+1, S1000, F400, T01, M03✓
N15 G01, X30 Y30 Z+1 M08✓
N20 G01, X30 Y30 Z-12✓
N25GO1 X30 Y30 Z +1 M09✓
N30 G28 M05✓
N35 M30✓ (8)

2.5
- Emergency stop buttons
- Safety guard and interlock switch
- Axes travel limit switches
- Software limits
- Automatic tool retraction and spindle stop for tool changing
- Pilot lights
- Machine lockout key switch (Any 6 × 1) (6)

[30]

QUESTION 3

3.1
- There must be at least two people present when working with a robot system (buddy system).
- The electrical system must be checked before energising the robot for the first time.
- Never work on a robot system unless you have been authorised to do so.
- Never disarm or deactivate any safety devices.
- Report any broken or damaged parts of the robot system.
- Make use of safety glasses or shields when working with welding-type end-effectors.
- Never leave a robot system unattended; ensure that it is turned off first.
- Never enter the work envelope (unless the robot system has been put in manual/teach mode) for maintenance, or program development, or program touch ups.
- Consider the robot work envelope when programming.
- Ensure that all pinch points are considered.
- Ensure that housekeeping is adhered to on a regular basis. (Any 6 × 1) (6)

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3.2 That is if the robot is to be moved manually. It has to be moved on purpose by ensuring the enabling switched is activated at the same time as the motion teach button. This enabling button is also known as the 'dead man's switch'; if something happens to the robot user, the robot motion would stop. (2)
(Marker to use discretion)

3.3 The teach pendant is essentially a human-machine interface used for:

- Communication between the robot system and the operator or programmer (system or programming errors);
- to master the robot system;
- to set up tool coordination;
- to teach programmed motion points to the controller. (Any 2 × 1) (2)

3.4
```
INI
; Moving work piece over obstacle
P0 PTP HOME
P1 PTP
P2 LIN
P3 SET GRIPPER OPEN
P4 LIN
P5 SET GRIPPER CLOSED
P6 LIN
P7 LIN
P8 LIN
P9 LIN
P10 SET GRIPPER OPEN
P11 LIN
P12 PTP HOME
```
(Any 14 × 1) (14)

3.5 The manipulator is the mechanical arm of the robot system, and it only moves the end effector to various positions as desired by the program code. (2)

3.6 Event-based control is when an action is required due to an external event detected by the sensor.

Time-based control is achieved by means of a timer or counter. (2 × 2) (4)
[30]

QUESTION 4

4.1
- Automated equipment not getting tired during the day, do not lose concentration and do not make mistakes
- Automated production lines reducing damage or breakages due to incorrect handling
- Automated processes resulting in less material wasted and less reworking, thus improving the product output (3 × 2) (6)

4.2
- Equipment maintenance
- Equipment operation and programming
- Product changes (3)

4.3 Quality Control Chart (1)

[10]

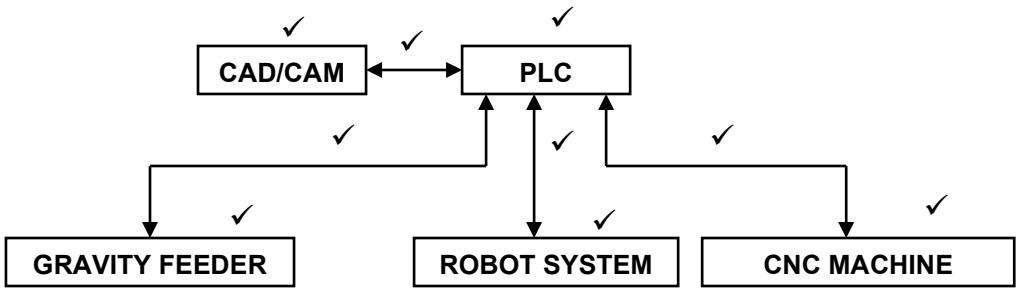
QUESTION 5

5.1 5.1.1 Drawing (1)

5.1.2 Product/work piece (1)

5.1.3
- Auto Cad
- Solid Works
- Fusion 360
- Solid Edge CAM Pro
- GibbsCAM (Any 1 × 1) (1)

5.2



(Marker to use discretion)
(ONE mark for the arrow heads correctly drawn in) (10× 1) (10)

5.3
- To reduce the production/delivery time
- To reduce costs associated with parts and other auxiliaries
- To reduce storage space
- To reduce time to start production
- To reduce machining time
- To reduce time to market (on the design/redesign and production)

(Any 2 × 1) (2)

[15]

TOTAL: 100

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