UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	MANUFACTURING CONTROL TECHNOLOGY
COURSE CODE	:	BDD40803
PROGRAMME	:	BDD
EXAMINATION DATE	:	JULY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) As a process Engineer, there are need to evaluate on existing plant should be grouped into machine cells according in **Table Q1(a)**. Apply the rank order clustering technique to the part machine incidence matrix which need to identify logical part families and machine groups. Part are identified by letter, and machines are identified numerically

(8 marks)

(b) Flexible manufacturing system(FMS) consist of several machine tools along with part and tool handling devices. Briefly explain **TWO(3)** FMS components and give the example on each compnents to perform several function.

(2 marks)

(c) While variations abound in what specifically constitutes flexibility, there is a general consensus about the core elements. Evaluate the flexibility criteria according to following levels of manufacturing flexibility:

(i) Material handling flexibility
(ii) Operation flexibility
(iii) Volume flexibility
(iv) Product flexibility
(v) Program flexibility

(10 marks)

Q3 (a) Nearly all industrial robots have mechanical joints that can be classified into one of five types: two types that provide tranlational motion and three types that provide rotary motion. By using the notation scheme for defining manipulator configuration , sketch the robot based on TRT, VVR, OLO, TRL and LVL notation.

(5 marks)

(b) A robot manipulator can be divided into two sections: a body arm assembly and a wrist assembly. Discuss with aid of sketching the robot body arm configuration listed below.

(i) SCARA robot
(ii) Jointed body and arm assembly

(5 marks)

(c) A vertical 6 axis robot a required to perform the pick and place operation to designated position for moving part from P2 to P3 according to **Figure Q3(c)**. Initial robot program (1) need to move with joint interpolation to P1. The speed movement need to set half to maximum speed when moves (2) and wait or 1 seconds for the completion of arrival to target position before closes hand (4) in linear interpolation (3 to 4) . Robot need to waits 0.5 seconds and after that set movement in linear to maximum speed during

lift up workpiece (5) and retracted workpiece to 100mm hand direction in half speed (6 and 8) at P3 with performing positioning delay in 0.1 seconds (7). Evaluate with aid of textual robot programming language to accomplish this movement.

(10 marks)

Q4 (a) Demonstrate the ladder logic diagrams for the following Boolean logic equations:

(i) $Y=(X1 \cdot X2)\ X3$
(ii) $Y=(X1 + X2) \cdot (X3 + X4)$

(4 marks)

(b) Paint spraying system where boxes are fed by gravity through a feeder magazine one at a time onto a moving conveyor belt as indicate at **Figure Q4(c)**. Upon the start signal, boxes are pushed towards the conveyor by valve 1. This is a cylinder which extends and retracts which operates switches S1 and S2 respectfully. A spraying nozzle paints each box as it passes under the paint spray controlled by valve 2. A sensor (S3) counts each box being sprayed. When 6 boxes have been painted the valve 2 shuts off (paint spray) and valve 1 (cylinder) stops moving boxes onto the conveyor. Three seconds later the conveyor stops moving and the hopper with its load moves forward (valve 3) where it is emptied. Support the necessary lines of ladder logic programming , electrical I/O and electropneumatic circuit based on IEC61131 Standard to operate paint spraying system.

(16 marks)

Q5 (a) Materials transport equipment commonly used to move parts and other materials in manufacturing and warehouse facilities. Differentiate **FIVE (5)** categories of material transport system principal features and kind of applications for each equipment category

(10 marks)

(b) The disadvantages of magnetic stripes in factory floor operations is doesn't work in distance thus requiring close contact to the reader.Provide **TWO (2)** justifications on magnetic stripes of selection and give example where this technology can be applied .

(4 marks)

(c) Many of Automatic Identification and Data Capture (AIDC) technologies require no human involvement in the data capture and entry process. AIDC are being used increasingly to collect data in material handling and manufacturing applications. Describe the AIDC technologies below.

Include the advantages and disadvantages of each technology with example of application in material handlings.

(i) Bar Codes technologies
(ii) RFID Technologies.

(6 marks)

Q5 (a) In the past few decades, a fourth industrial revolution has emerged, known as Industry 4.0. Industry 4.0 takes the emphasis on digital technology from recent decades to a whole new level with the help of interconnectivity through the Internet of Things (IoT), access to real-time data, and the introduction of cyber-physical systems. Discuss **THREE (3)** justification to understand the value of industrial revolution 4.0 in manufacturing cases with example of application.

(6 marks)

(b) There are nine main pillars of the Fourth Industrial Revolution, also referred to as Industry 4.0(IR 4.0). These pillars outline the new technology manufacturers are using to improve all areas of production processes. Interpret the definition and examples of the concepts that define the future vision of IR4.0 below;

(i) Additive Manufacturing
(ii) Autonomous Robot
(iii) Big Data

(6 marks)

(c) The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Sketch and define the application and component of IoT which promise to bring immense value into our lives.

(8 marks)

- END OF QUESTION -

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Machines	Parts A	B	C	D	E	F
1	1				1	
2				1		1
3	1	1				
4			1	1		
5		1			1	
6			1	1		1

Table Q1(a) Part Machine Incidence Matrix

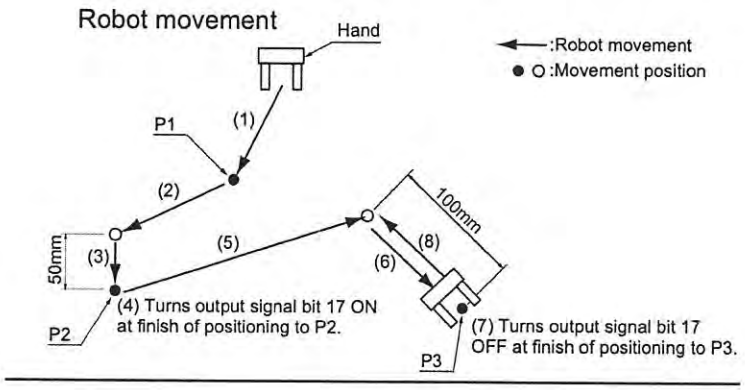

Figure Q3(c) Pick and place robot

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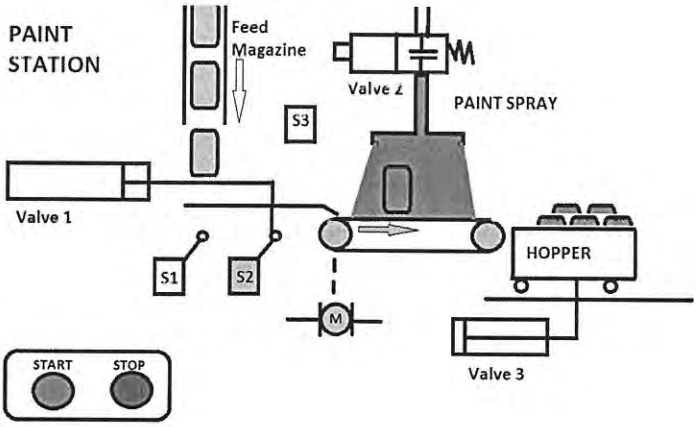

FIGURE Q4(c) : Spray Station