UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME : MANUFACTURING CONTROL TECHNOLOGY

COURSE CODE : BDD 40803

PROGRAMME CODE : BDD

EXAMINATION DATE : JULY 2022

DURATION : 3 HOURS

INSTRUCTION : 1. ANSWER **ALL** QUESTIONS

2. THIS FINAL EXAMINATION IS A **ONLINE** ASSESSMENT AND CONDUCTED VIA **CLOSE BOOK**

3. STUDENTS ARE PROHIBITED TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE FINAL EXAMINATION CONDUSTED VIA CLOSED BOOK

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

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Q1 (a) Manufacturing system are distinguished by the types of operations they perform between processing operations on individual work units and assembly operations to join individual parts into assembled entities. Classify three additional parameters of the product that affect the operations performed in the manufacturing system.

(6 marks)

(b) Design of the machine cell is critical in celullar manufacturing. The cell design determines to a great degree of the performance of the cell. Compare three type of machine cells and layout with aid of sketching.

(6 marks)

(c) The objective behind weight-based rank order clustering (ROC) algorithm is to create workload balanced machine cells and associated part numbers. The part machined incidence matrix according **Table Q1(c)** lists the routings of ten parts that are being considered for cellular manufacturing in a machine shop. Parts are identified by letters and machines are identified numerically. For the data given, evaluate the rank order clustering technique to the part-machine incidence matrix to identify logical part families and machine groups.

(8 marks)

Q2 (a) A computer numerical machine plane may be defined by looking at the machine from standard operating position. For a vertical machining center, there are three standard views, viewed perpendicularly.The face of the workpiece to have a circular milling operation (G02, G03, G12, G13) done to it must have two of the three main axes (X, Y and Z) selected. One of three G codes is used to select the plane, G17 , G18 and G19 . Sketch and write of three different of G codes of designated plane axis selection when programming G02 in computer numerical control(CNC).

(6 marks)

(b) The letter symbols for the five joint types can be used to define a joint notation system for the robot manipulator. By using the notation scheme for defining manipulator configuration , sketch the robot based on TRT, VVR, TRL and LVL notation.

(4 marks)

(c) A pick and place robot require to performs a loading and unloading operation for moving part from P2 to P3 according to **Figure Q2(c)**. Initial program need to set with maximum of movement speed. Hand gripper need to wait 2 seconds for the completion of arrival and after grasps of

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workpiece. Evaluate with aid of textual robot programming language to accomplish this movement.

(10 marks)

Q3 (a) Discrete Process Control (DPC) is employed for processes involving only discrete inputs and discrete outputs and their associated instrumentation devices. DPC can be further classified into open loop control and sequential control with interlocks.Discuss the discrete control categories and give and example of binary sensors and actuators used in DPC with interpretation.

(4 marks)

(b) In a milk factory, a programmable logic control(PLC) automatically fills two milk tanks. As shown in **Figure Q3(b)**, each milk tank has two floater switches, up and down, which provide the signals "fill" and "empty" respectively. The specifications of operation are the following:

(i) The automatic filling of the tanks is energized/de-energized by pressing the ON and OFF buttons respectively. The indication lamp H0 shows the operation state.

(ii) Only one milk tank may be filled at a time. If the two tanks are simultaneously empty, then the first tank fills first.

(iii) When the PLC receives an "empty" signal (S1 or S3), then the electrovalve V1 or V2 opens immediately and the central electrovalve V0 opens after 5 s. Then, when the signal "fill" (S2 or S4) is received, the electrovalve V0 closes immediately and the electrovalve V1 or V2 closes after 10 s.

(iv) All electrovalves close immediately after the press of the OFF button.

Evaluate a connection of the electro-pneumatic diagram and subsequently, support or justify your answer with required PLC ladder program.

(16 marks)

Q4 (a) Material handling operations should be mechanized and or automated where feasible to improve operational efficiency, increase responsiveness, improve consistency and predictability, decrease operating costs, and eliminate repetitive or potentially unsafe manual labor. Discuss three factors that influence the design of the material handling system and example on these design factors characteristics

(6 marks)

(b) Barcode readers work by using a beam of light to read the black and white pattern printed on the adhesive tag. On the other hand, RFID (or Radio-Frequency Identification) leverages radio waves to transmit data from RFID chips to the readers. Provide six factors comparison between bar codes and

RFID and justify on RF identification tag selection with example of application.

(8 marks)

(c)   The market is primarily driven by factors, such as technological advancements along with widening applications of AIDC technologies in healthcare applications such as asset management, patient management, and inventory management. Additionally, the growing acceptance of advanced technologies, in the healthcare supply chain, hospitals, and patient management, also encourage the demand for AIDC devices for Covid 19 vaccine management. Evaluate three AIDC technology for monitoring the organizationin in healthy.

(6 marks)

Q5   (a)   Industrial revolution 4.0(IR 4.0) also sometimes referred to as internet of thing(IOT)or smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and supply chain management. Discuss three justification to understand the value of IR4.0 in manufacturing cases with example of application.

(6 marks)

(b)   To create faster, more flexible and efficient processes, the Fourth Industrial Revolution also referred to as Industry 4.0, promotes the union of physical and digital resources, connecting machines, systems and assets as a way to produce higher quality items at reduced costs.. Interpret the definition and examples of the concepts that define the future vision of IR4.0 below;

(i)   Cloud Computing
(ii)   Augmented Reality
(iii)   Big Data Analysis

(6 marks)

(c)   The internet of things(IoT) operates around a vast network. Various components are involved which work together to form a cohesive system. Based on collected data from connected products, autonomous actions are performed by the devices. Multiple entities involved in this entire process together to form the complex IoT ecosystem. Write the four major of IoT components and sketch the example of application on IoT components integration to reprent the IR 4.0 concept.

(8 marks)

- END OF QUESTION –

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Machines	Parts							
	A	B	C	D	E	F	G	H
1	1							
2		1					1	
3			1		1			1
4		1				1	1	
5			1					1
6						1	1	
7	1			1				
8			1		1			

Table Q1(c) Part Machine Incidence Matrix
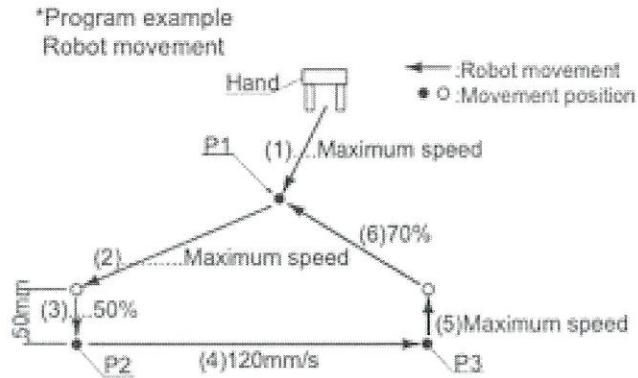
Figure Q2(c) Pick and place robot

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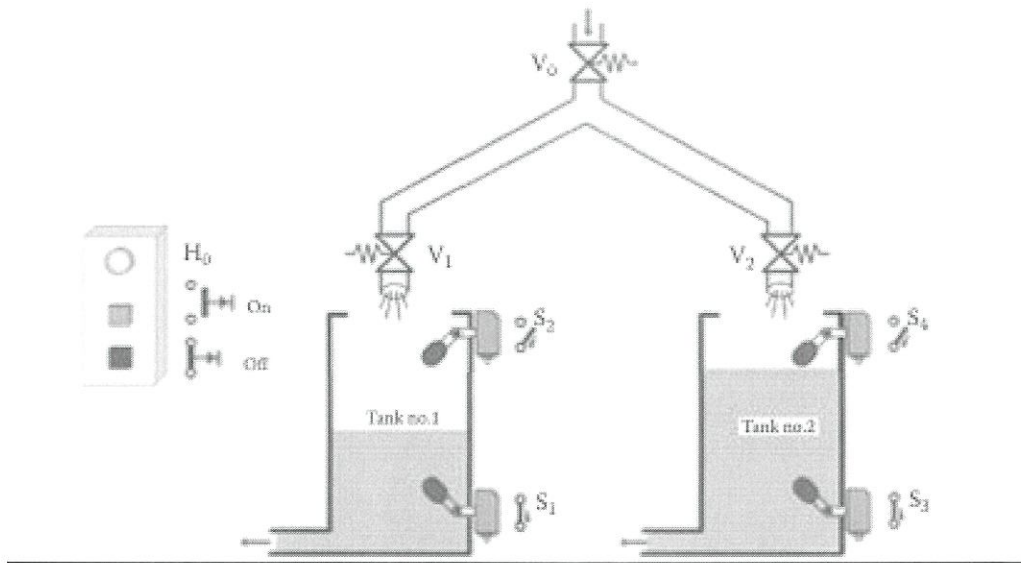   TECHNOLOGY

Figure Q3(b) Two milk tanks with automatic filling