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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017**

COURSE NAME : MANUFACTURING CONTROL
TECHNOLOGY
COURSE CODE : BDD40803
PROGRAMME : 4 BDD
EXAMINATION DATE : JUNE 2017
DURATION : 3 HOURS
INSTRUCTION : ANSWER FIVE (5) QUESTIONS
FROM SIX (6) QUESTIONS
PROVIDED

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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BDD 40803.

- Q1** (a) Manufacturing systems are divided into THREE (3) categories, according to worker participation. Discuss these **THREE (3)** with help of sketching.
- (6 marks)
- (b) Compare and explain **TWO (2)** differences between an open and closed loop systems. Give examples to explain your answer.
- (6 marks)
- (c) Waze application are widely used in the smartphone in helping users to navigate during driving in the city. As an engineer in a startup company, you are required to propose and design an assist signaling system that automatically turn the car signal depending to the car direction based on Waze application.
- (13 marks)
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- Q2** (a) Sensors are important elements in manufacturing control system. *Table Q2(a)* is an example of thermocouple data sheet. Distinguish and discuss the thermocouple's sensor parameters in the sense of sensitivity, accuracy and data range. Then, select the best thermocouple type to measure a boiler which store liquid in the range of 1000 °C-2000 °C.
- (5 marks)
- (b) Explain and illustrate the function and position of sensors and actuators in a closed loop control system.
- (5 marks)
- (c) There are five types of robotic joints. Define these five joints with appropriate diagram. Figure 2(c) shows a material loading process between 2 conveyer. Evaluate and propose a robotic movement with suitable joints that can execute the process.
- (5 marks)
- (d) Actuator is one of the main component in industrial automation. Differentiate and compare **THREE (3)** different actuators in hydraulic, pneumatic and motor systems by discussing the working principle, advantages and disadvantages.
- (10 marks)

- Q3** (a) Discrete process control systems deal with parameters and variables that are discrete and that change values at discrete moments in time. Define and describe the function of NAND and NOR gate? Produce the truth table of these two logic gates. (4 marks)
- (b) Construct the ladder logic diagrams for the following Boolean logic equations:
- (i) $Y=(X1 + X2) \cdot X3$
(ii) $Y=(X1 + X2) \cdot (X3 + X4)$ (4 marks)
- (c) An aging test workstation as shown in **Figure 3(c)** is required to determine the functionality and the reliability of a motor system that can rotate forward and backward. The motor requires 12V for its operation. The motor is used to produce a linear motion via rack and pinion gear system. When a start button is pressed, the motor will rotate in clockwise (CW) direction for 2 second or when it hit limit switch 1 (LS1). Once stopped, it will pause for 1 seconds. Then the motor will rotate counter clockwise (CCW) for another 2 seconds or hit the limit switch 2 (LS2). The aging test will stop after the counter hit 10000 times of operation.
- (i) Draw a motion diagram for the sequence. (4 marks)
- (ii) Construct a wiring diagram for the system. (3 marks)
- (iii) Develop the necessary lines of ladder logic to operate the system. (10 marks)
- Q4** (a) Flexible manufacturing system (FMS) consist of several machine tools along with part and tool handling devices. Briefly explain **THREE(3)** FMS components and give the example on each compnents to perform several function. (5 marks)

(b) In order to implement Flexible Manufacturing System (FMS), there are several flexibility criteria need to be considered. Compare 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)

(c) Supervisory Control and Data Acquisition (SCADA) is widely used in industrial processes including chemical, metallurgy, power generation and distribution. Data Access and control is among the major concerns in the implementation of SCADA system. Using appropriate diagrams, justify why the Data Access is needed and how does OLE for Process Control (OPC) overcome the problem?

(10 marks)

Q5 (a) In logistic industry, material handling is a crucial activity in bussiness area. In designing material handling system several factors need to be considered. Discuss in detail these **FOUR(4)** considerations in material handling system design.

(9 marks)

(b) There are several industry standards with regards to identification technology. Describe and distinguish the industry standard listed below. Include the advantages, disadvantages and the relevant application of each technology. Finally, as an engineer select the most appropriate standard for application in monitoring staff availability.

- (i) IEC 14443
- (ii) IEC 7816
- (iii) IEC 18092
- (iv) IEC 15693

(16 marks)

- Q6 (a) Describe the **THREE (3)** phases of shop floor control and provide a brief definition for each activity. Sketch the **THREE (3)** integration phases in shop floor system. (10 marks)
- (b) Inventory control attempts to compromise in keeping inventory at minimum level, in the extreme, zero inventory. Differentiate the **THREE (3)** major costs of holding inventory. (6 marks)
- (c) Enterprise resource planning (ERP) is computer software system that organizes and integrates all data and business functions of an organization. Discuss **TWO (2)** group modules of ERP classification and the advantage on each groups. (4 marks)
- (d) A workpart costing RM90 is process through factory. The manufacturing lead time for the part is 10 weeks, and the total time spent in processing during lead time is 25 hours for all operations at a rate of RM30 perhour. Non operation costs total RM60 during the lead time. The holding cost rate used by the company for work in process is 25%. The plant operates 40 hours per week processed through the factory. Determine the holding cost per part during the manufacturing lead time. (5 marks)

END OF QUESTION

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Thermocouple Type	Names of Materials	Useful Application Range
B	Platinum 30% Rhodium (+)	2500 -3100F
	Platinum 6% Rhodium (-)	1370-1700C
C	W5Re Tungsten 5% Rhenium (+)	3000-4200F
	W26Re Tungsten 26% Rhenium (-)	1650-2315C
E	Chromel (+)	200-1650F
	Constantan (-)	95-900C
J	Iron (+)	200-1400F
	Constantan (-)	95-760C
K	Chromel (+)	200-2300F
	Alumel (-)	95-1260C
N	Nicrosil (+)	1200-2300F
	Nisil (-)	650-1260C
R	Platinum 13% Rhodium (+)	1600-2640F
	Platinum (-)	870-1450C
S	Platinum 10% Rhodium (+)	1800-2640F
	Platinum (-)	980-1450C
T	Copper (+)	-330-660F
	Constantan (-)	-200-350C

Table Q2(a)

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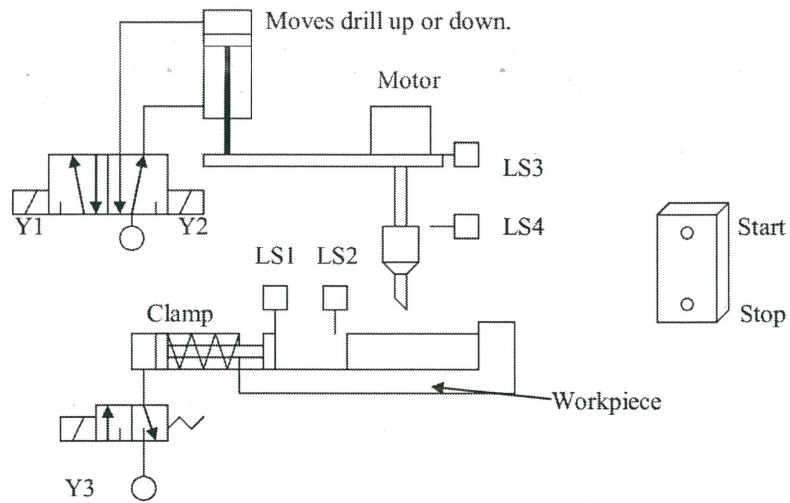


FIGURE Q3(C)