UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	ELECTRICAL MACHINE AND DRIVE INTEGRATION SYSTEM
COURSE CODE	:	BBJ 21005
PROGRAMME CODE	:	BBJ
EXAMINATION DATE	:	JULY / AUGUST 2023
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	:	1. ANSWER **ALL** QUESTIONS.
		2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
		3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK.

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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Q1 (a) List **three (3)** of examples applications of the Programmable Logic Controller (PLC).

(3 marks)

(b) Explain the **two (2)** advantages of using PLC compared to hard-wired.

(4 marks)

(c) With the aid of a diagram, discuss the architecture of PLC.

(8 marks)

(d) **Figure Q1(d)** presents a diagram of motor control using PLC. Based on the figure, draw the ladder diagram for controlling the motor based on the inputs and outputs assigned.

(10 marks)

Q2 (a) List **five (5)** power electronic components that are commonly used in a Variable Frequency Drive (VFD).

(5 marks)

(b) Discuss **three (3)** the differences between a VFD and a Soft Starter.

(6 marks)

(c) Discuss the working principle of a VFD with the aid of a diagram.

(8 marks)

(d) **Figure Q2(b)** shows a diagram of the connector layout of VFD. Write the connector labels if the VFD wants to connect to a three-phase induction motor. The labels should be included the power supply.

(6 marks)

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Q3   (a)   State the acceptable voltage range for an induction motor if the supply is 400 V.

(2 marks)

(b)   Determine the value of the full load current of a three-phase induction motor. The specifications of the motor are as follows: Horsepower = 1.5 Hp; cos θ = 0.75; efficiency = 0.9; frequency = 50 Hz; and connection in the terminal box = Δ.

(3 marks)

(c)   Discuss **five (5)** strategies for selecting the AC motor.

(10 marks)

(d)   Explain **five (5)** steps for the selection of the three-phase VFD.

(10 marks)

Q4   (a)   State the signal to control the speed of a motor.

(1 mark)

(b)   Discuss the working principle of a DC drive with the aid of a diagram.

(8 marks)

(c)   Determine the optimal model of VFD (the specifications in Table Q4(b) in Appendix) to be connected to a 7 Hp induction motor. The specifications of the motor are as follows:

Hz = 60	Hz = 50
Volt = 380-480Δ	Volt = 380-415Δ
Rpm = 3470-3525	Rpm = 2900-2920
Cos θ = 0.88	Cos θ = 0.86

(8 marks)

(d)   Explain the procedures to perform preventive maintenance for the VFD.

(8 marks)

- END OF QUESTION -

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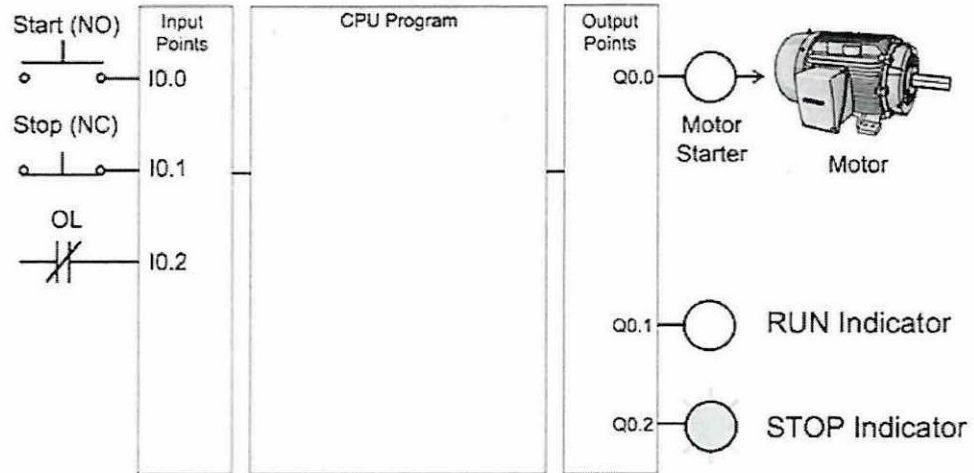COURSE NAME   : ELECTRICAL MACHINE   COURSE   : BBJ21005
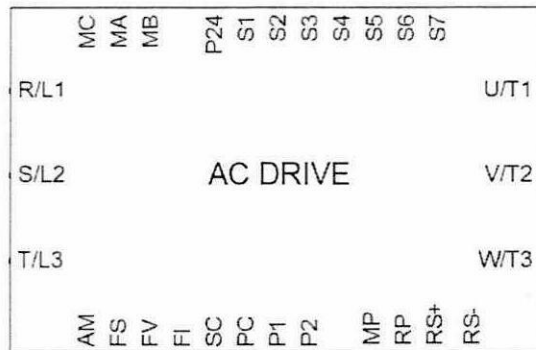   AND DRIVE SYSTEM   CODE
                      INTEGRATION

Figure Q1(d)

Figure Q2 (d)

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Table Q4(c)

Model	Supply voltage (V)	Rated output current (A)
A20010	1-phase, 200-240	10
A20015	1-phase, 200-240	15
A20020	1-phase, 200-240	20
A38010	3-phase, 380-480	10
A38015	3-phase, 380-480	15
A38020	3-phase, 380-480	20

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