UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	MOTION CONTROL
COURSE CODE	:	BEH 41202
PROGRAMME	:	BEJ
EXAMINATION DATE	:	DECEMBER 2014/JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) Motion control has been widely applied in industries since last decades. Identify in which applications motion control has been implemented.

(5 marks)

(b) Draw the diagram for a basic motion control system.

(6 marks)

(c) Sequencing, speed control and point to point control are the three categories of industrial motion. Explain each of them in details.

(9 marks)

Q2 (a) With an appropriate diagram, explain the working principle of a DC motor operation.

(5 marks)

(b) Consider a position profile for motion controller as shown in Figure **Q2**. The point-to-point motion in the position profile is designed to move the shaft rotation from θ_{start} = 20 deg to θ_{end} = 5 deg with the actuator limitation of maximum velocity ω_{max} = 20 deg/s and maximum acceleration α_{max} = 10 deg/s^2. Design a velocity profile that satisfies these constraints.

(15 marks)

Q3 (a) The field of DC motors can be a permanent magnet or using a field circuit. Explain clearly the classification of DC motor using permanent magnet.

(6 marks)

(b) In designing a motion control system, the nameplate of a DC motor provides important information necessary for correctly applying the actuator to the particular applications. Figure **Q3** shows the characteristics of a DC motor manufactured by SIEMENS.

(i) Describe briefly what horse power is.

(4 marks)

(ii) Determine the maximum torque at base speed and the speed of an unloaded motor at 125 VDC.

(10 marks)

Q4 (a) Name the major components of a radio control (RC) servo motor as shown in Figure **Q4**.

(6 marks)

(b) Radio control (RC) hobby servos are small actuators designed for remotely operating model vehicles such as cars, airplanes, and boats. Moreover, its ability to rotate and maintain at certain position or angle according to control pulses from a single signal wire also makes servo motor popular in robot building.

(i) Construct a block diagram of RC servo motor with the major components

(7 marks)

(ii) produce a flow chart to demonstrate its operation.

(7 marks)

Q5 A stepper motor (or step motor) is a brushless DC motor, synchronous electric motor that can divide a full rotation into a large number of steps.

(a) Sketch a diagram of stepper motor control system.

(5 marks)

(b) Draw a diagram of the 4-lead bipolar control

(8 marks)

(c) Using the diagram in **Q5 (b)**, produce a table to explain how to move a stepper motor in terms of step operation.

(7 marks)

-END OF QUESTION -

FINAL EXAMINATION

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Position Profile for Shaft

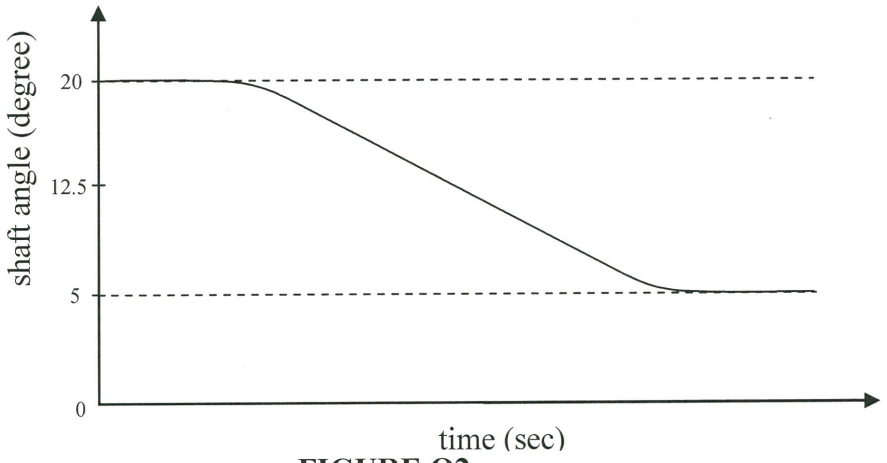

FIGURE Q2

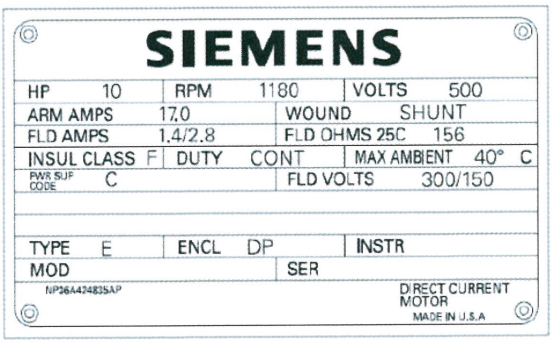

FIGURE Q3

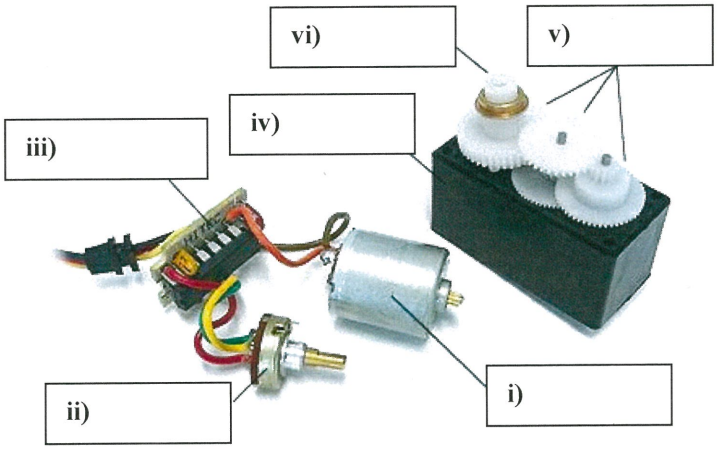

FIGURE Q4