The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Diploma in Technology/Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX6270 – FACTORY AUTOMATION**
Academic Year	:	2012/13
Date	:	23rd August 2013
Time	:	0930 – 1230 Hrs
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 8 questions. All questions carry equal marks.
3. Answer any 5 questions only.

Q1. (a) Distinguish between Mechanization and Automation as means of achieving enhanced operation of modern manufacturing machinery. You may site suitable examples from the industry to elaborate on your answer.

(b) Automation was employed even at very early stages in process type manufacturing industries. However, until recently, it was used in discrete part manufacturing industries. Explain.

(c) Briefly explain the application of automation in the context of a Factory and an Industry.

Q2. (a) Distinguish between sensitivity and cross-sensitivity in relation to sensors. Give an example where cross-sensitivity will be of importance in selecting a sensor.

(b) Accuracy and precision are two performance characteristics of sensors that are closely related. Discuss the application of these two performance characteristics in relation to industrial sensors.

(c) Assume that you are given the task of developing an analog device for measuring the angular position in an application related to control of a kinematic linkage system in a machine. What instrument ratings would you consider crucial in this application? Discuss their significance in relation to the performance of the developed instrumentation system.

Q3. (a) What are the sensors available for measuring displacement/position in an industrial application? Briefly discuss the operation of one such sensor.

(b) State five (05) factors that need to be taken into consideration when selecting a displacement/position sensor for a particular application.

(c) Explain the operational principle of an accelerometer and discuss an industrial application.

Q4. (a) What is an actuation system in relation to factory automation? Discuss the types of actuation systems commonly employed in factory automation.

(b) Briefly explain the types of directional control valves employed in fluid actuation systems.

(c) A simple lift system for an industrial application is to be designed by using two push button 2/2 valves and a cylinder. When one button is pressed, the load is lifted while the other button is pressed, the load is lowered. Using pneumatic symbols, proposed a method to accomplish the above mentioned task. (Hint: Draw the pneumatic circuit diagram)

Q5. (a) Briefly explain the operational principle of a brushless d.c. permanent magnet motor that are commonly used in industrial applications.

(b) Two separate d.c. motors are to be employed in an industrial application that requires:

(i) a high torque at low speeds for the movement of large loads,

(ii) a torque which is almost constant regardless of speed.

Suggest the suitable forms of d.c. motors that can ne employed to accomplish the above two conditions. Justify your answer.

(c) Distinguish between variable reluctance stepper motors and permanent magnet stepper motors.

Q6. (a) Explain the control system hierarchy of a large scale automated industrial plant. Indicate the response time and the complexity within its respective levels. You may use a neatly drawn sketch to elaborate.

(b) Explain the significance of control bandwidth, in the performance of an industrial control system.

(c) Briefly explain the typical control modes that are commonly employed at device level in the context of closed loop control mechanisms. (Hint: Control modes – the manner in which the control unit reacts to the error signal and the way in which it rectifies the error)

Q7. (a) What are the common types of LAN topologies used in communication networks? Discuss pros and cons of each of the above types of topologies.

(b) Briefly explain the two categories of device level bus systems employed in industrial communication bus systems.

(c) Even though Control Area Network (CAN) was originally developed for automobile communication networks, it is now employed in industrial communication systems as well. Explain the features of CAN systems and discuss the reasons for these systems to be employed in industrial communications.

Q8.(a) Explain the common types of drive mechanisms employed in CNC machine tools.

(b) What are the general characteristics of products to be machined by using CNC machine tools?

(c) It is often required to accommodate tool offsets (length and/or diameter) when programming CNC machines. Explain the significance of tool offset in CNC programming.

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