THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF ENGINEERING TECHNOLOGY

BACHELOR OF TECHNOLOGY – LEVEL 06

FINAL EXAMINATION – 2009

MEX6270 – FACTORY AUTOMATION

DATE : *03 APRIL 2010*
TIME : *1400HRS -1700HRS*
DURATION : *THREE HOURS*

PLEASE READ THE FOLLOWING INSTRUCTIONS BEFORE ANSWERING THE PAPER

INSTRUCTIONS:

1. *This paper consists of eight questions. Answer any **five questions only.***
2. *Each question carries equal marks.*
3. *Answers should be written on the answer books provided by the Examinations Division.*

Question 01

(1.1) Briefly discuss the potential benefits that can be achieved by employing automation technology in a factory.

(1.2) Describe taking suitable examples, the structure of an automated industrial plant or factory.

(1.3) Distinguish between Mechanization and Automation. Elaborate on the applicability of these technologies within a factory environment.

Question 02

(2.1) Why do sensors play a major role in factory automation? Elaborate on your answer by taking suitable examples.

(2.2) Taking suitable examples distinguish between analogue and digital sensors. Discuss the suitable application areas in a process where these sensors can be successfully employed.

(2.3) Distinguish between an absolute and incremental optical encoder and state how these encoders detect the direction of rotation.

Question 03

(3.1) Why is impedance a significant characteristic when selecting a sensor for a particular application? Explain the effects caused by not selecting a sensor in accordance with the above characteristic.

(3.2) Differentiate between sensitivity and cross-sensitivity in relation to sensors. What are the qualitative values of sensitivity and cross-sensitivity for a measuring device to be highly effective?

(3.3) What instrument ratings would you consider crucial in developing an analogue device to measure the angular position of an application related to the control of a kinematic linkage system such as a robotic manipulator? Discuss their significance.

Question 04

(4.1) Explain the term 'Primitive Communication' in relation to industrial communication systems.

(4.2) Discuss briefly the configuration of a typical industrial communication network in a large scale industrial automated plant.

(4.3) Distinguish between device buses and process busses commonly found in an industrial automated plant. Discuss the applicability of each of the above busses within an industrial communication network.

Question 05

(5.1) What makes AC motors preferred over DC motors in the application of drive systems used in factory automation?

(5.2) Explain the operation of a stepper motor and state how it differs from the operation of a conventional AC or DC motor.

(5.3) Discuss the pros and cons of using fluid power actuation in factory automation applications.

Question 06

(6.1) What are the most commonly used control schemes employed in industrial automation? Discuss the applicability of the above schemes in respect to process control.

(6.2) Simple on-off control schemes are used in many industrial applications. Discuss the applicability of such control schemes in industry.

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

Question 07

(7.1) Discuss the control system hierarchy of a large scale automated plant. Indicate clearly the relationship among the various levels, response time and the complexity within its respective levels.

(7.2) What are the requirements that need to be satisfied in order for a control system to operate successfully in a given situation? Explain briefly.

(7.3) Define the term "SCADA" in the context of industrial control systems and discuss the necessity of having such a system.

Question 08

(8.1) Explain why the speed resolution of a shaft encoder depends on speed itself. What are some other factors which affect the speed resolution?

(8.2) What is hysteresis in an optical encoder? List out some causes of hysteresis and discuss the ways of minimizing hysteresis.

(8.3) An incremental encoder disk has 5000 windows. The word size of the output data is 12 bits. What is the angular resolution of the device? Assume that quadrature signals are available but that no interpolation is used. How would you propose to improve the resolution of the encoder?

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