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THE OPEN UNIVERSITY OF SRI LANKA

FACULTY OF ENGINEERING TECHNOLOGY

BACHELOR OF TECHNOLOGY– LEVEL 06

FINAL EXAMINATION –2010

LIBRARY
01 NOV 2011

MEX6270 – FACTORY AUTOMATION

DATE : ***01 APRIL 2011***
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.*
4. *Commence to answer each question on a **fresh page***

Question 01

(1.1) Explain what is meant by a 'Factory' and discuss the application of automation technology within this environment.

(1.2) Briefly explain the evolutionary stages of automation. Elaborate your answer by drawing example/s for each of the above stages.

(1.3) Why is it often considered a difficult task of automating a discrete part manufacturing plant as opposed to a continuous process manufacturing plant? Elaborate your answer by taking examples from the relevant industry.

Question 02

(2.1) Draw a typical data acquisition system employed in controlling a plant or device and discuss the role of sensors in such a system. Quote an example to explain your answer.

(2.2) A bottling plant uses an automated bottle-filling system. Briefly describe the operation of such a system and identify the types of sensors and transducers that are required for smooth operation and maintenance of product specifications. You should clearly justify the selection of the above mentioned components (sensors/transducers) and their role in the system.

(2.3) Describe types of sensors classified based on the mode of operation. Give examples for each of the above mentioned types.

Question 03

(3.1) What are tactile sensors? Discuss the applicability of such sensors in the field of factory automation.

(3.2) Explain what is meant by static and dynamic characteristics in relation to sensor specifications. Give examples for each of the characteristics described.

(3.3) The following specifications are given for a strain gauge.

- Ranges :70 – 1000 kPa, 2000 – 70,000 kPa
- Supply voltage : 10V d.c. or a.c. r.m.s
- Full range output: 40 mV
- Non-linearity and hysteresis : ±0.5% full range output
- Temperature range: -52 ^{0}C to +125 ^{0}C in operation

Explain the significance of the above specifications with regard to the strain gauge.

Question 04

(4.1) What is an actuation system? Briefly explain the types of actuation systems used in factory automation.

(4.2) *Some devices used as actuators are complete automated systems in themselves.* Elaborate on the statement by taking suitable examples.

(4.3) Briefly describe the operation and types of fractional HP synchronous motors.

Question 05

(5.1) What are industrial networks? Give reasons for them to be more prevalent in modern industrial environment?

(5.2) Distinguish between device busses and process busses, and discuss the applicability of such busses in the context of industrial networks.

(5.3) Explain the purpose of fieldbus in the context of industrial communication.

Question 06

(6.1) What are the functions of computers in relation to open-loop and closed-loop control systems in industrial control?

(6.2) Explain the control system hierarchy of a large scale automated industrial plant. Indicate the response time and the complexity within its respective levels.

(6.3) *Derivative control is never used alone as a control mode in control systems, instead it is used in conjunction with proportional control.* Explain.

Question 07

(7.1) What makes an industrial robot different from other automated machines used in factory automation? Elaborate your answer by taking suitable examples.

(7.2) Illustrate the main types of robots based on physical geometrical configurations. Explain the applicability of each configuration in industrial applications.

(7.3) Discuss the different methods employed in programming industrial robots.

Question 08

(8.1) What is Numerical Control? Distinguish Numerical Control (NC) machines from Computer Numerical Control (CNC) machines.

(8.2) Describe the different methods of positioning employed in CNC machine tools.

(8.3) Discuss the applicability of CNC technology in factory automation.

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