The Open University of Sri Lanka
Faculty of Engineering Technology
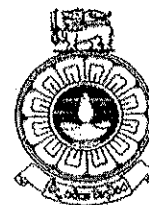
Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX6270 Factory Automation**
Academic Year	:	2016/2017
Date	:	10th November 2017
Time	:	9.30am – 12.30pm
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.

2. This question paper consists of 8 questions. Answer **5 questions** only. All questions carry equal marks..

3. Answers should be written on the answer books provided by the Examinations Division.

4. It is EXTREMELY IMPORTANT that you do not remove the question paper or any part of the paper from the examination hall. Please attach the question paper along with the answer book.

5. Please write your index number in the space provided on the answer book. **Do not write your name.**

6. Commence to answer each **new question on a fresh page.**

7. In case of a doubt consult the supervisor or an invigilator conducting the examination.

Question 01

(a) Mechanization and automation are two different approaches adopted in industry in order to enhance the effectiveness of a task performed by a machine or a system. Briefly explain these two approaches employed in the industry by taking suitable examples, giving emphasis to their applicability.

(b) The industry and factories are two areas in which the benefits of automation technologies could be successfully realized. Discuss the potential differences between industrial automation and factory automation.

(c) Discuss the applicability of automation in the apparel industry. Clearly mention the areas in which automation technologies could be applied and not applied.

Question 02

(a) Industries such as crude oil refinement, process industries and mass scale production industries successfully employed primitive technologies as compared to the modern technologies used in to-days factories, as means of automation. Explain how these primitive technologies are capable of successfully automating such industries mentioned above.

(b) Discuss the main challenges faced when trying to implement automation technologies in the modern factory environment. You may elaborate on your answer by taking a suitable example from the industry.

(c) Discuss the need for automation from the perspective of a modern day factory environment.

Question 03

(a) Explain the control system hierarchy of a large scale automated industrial plant. Indicate the relationship among the various levels, its complexity and response times within these levels of hierarchy.

(b) Explain the need for having signal conditioning devices or systems in control systems employed in factory automation. Elaborate by taking suitable examples.

(c) Discuss how application of computers and its related technologies have potentially enhanced the controlling and monitoring of large scale industrial plants or factories.

Question 04

(a) Briefly describe the importance of having sensing or instrumentation systems in factory automation.

(b) Describe and give examples for sensors classified based on the mode of operation.

(c) Three load cells are used to measure the level of a highly toxic and corrosive liquid contained in a cylindrical vessel. The vessel has a height of 3m and an inner diameter of 1m (You may neglect the wall thickness). The liquid has a density of 1250 kg/m^3. It is required to detect a minimum variation in the liquid level of 10 cm. Determine the main parameters and values of the load cells, which can be employed to achieve the above task.

Question 05

(a) Actuation systems play a vital role in factory automation. What is an actuation system? Discuss the pros and cons of different actuation systems employed in factory automation.

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

(c) A simple lifting mechanism is designed by using two push button 2/2 valves and a cylinder. When one button is pressed, the load is raised while the other button is pressed the load is lowered. Using standard pneumatic symbols, propose a method of accomplishing the above task.

Question 06

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

(b) Explain the reason/s why derivative control is never used alone as a control mode in control systems, instead it is used in conjunction with proportional control.

(c) Discuss the significance of control bandwidth in relation to the performance of an industrial control system, particularly at device level.

Question 07

(a) What are industrial networks and give reasons for them to be more prevalent in modern industrial/factory environment.

(b) Briefly explain the RS485, RS422 and RS232 communication protocols and discuss the pros and cons of using them in factory automation.

(c) Discuss the significance of AS-i communication in relation to industrial communication systems and indicate its available components.

Question 08

(a) Discuss the applicability of CNC technology in relation to factory automation.

(b) Distinguish absolute programming from incremental programming in relation to CNC programming. Discuss the applicability of each of the two methods in relation to material removal processes.

(c) Explain how adaptive control can be utilized in CNC machine tools for an effective material removal process.

END