The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Mechanical Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: DMX6570 Factory Automation**
Academic Year	: 2017/18
Date	: 18ᵗʰ January 2019
Time	: 0930-1230hrs
Duration	**: 3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.

2. This question paper consists of **Eight (8)** questions in **Seven (3)** pages.

3. Answer any **Five (5)** questions only. All questions carry equal marks.

4. Answer for each question should commence from a new page.

5. Relevant charts/ codes are provided.

6. This is a Closed Book Test (CBT).

7. Answers should be in clear hand writing.

8. Do not use a Red color pen.

Question 01

01) Application of automation in a manufacturing organization or a factory may not necessarily imply that world class standards in manufacturing are achieved. A comprehensive study would have to be performed within the manufacturing organization before the related technologies could be applied and the potential benefits realized. Elaborate on the above statement by taking suitable examples.

02) Automation was employed even at very early stages in process type manufacturing industries. However, until recently, it was not used in discrete part manufacturing industries. Elaborate your answer by suitable example.

Question 02

01) Distinguish between Mechanization and Automation as means of achieving enhanced operation in modern manufacturing machinery. Discuss the suitability of each approach with suitable examples.

02) Discuss how of Mechatronics has contributed in achieving higher standards in Factory Automation. Site example to justify your answer.

Question 03

01) Explain the role of sensors in Factory Automation.

02) What is meant by static and dynamic characteristics in relation to sensor specifications? Give examples for each of the characteristics described.

03) A diaphragm type pressure sensor has the following specifications;

   - Ranges: 0 to 1500 kPa, 0 to 25000 kPa
   - Non-linearity error: ±0.15% of full range
   - Hysteresis error: ±0.05% of full range

   Estimate the total error due to non-linearity and hysteresis for a reading of 1200 kPa on the 0 to 1500 kPa range.

Question 04

01) Consider a simple liquid level control system for a vessel. Draw the block diagram for the closed loop control. Identify the input, output, manipulating variable and disturbance for this case.

02) Simple on-off controllers are widely employed in the field of industrial/factory automation. Explain situations where these types of controllers are best suited in an industrial application.

03) Derivative control is never used alone as a control mode in control systems employed in factory automation; instead it is used in conjunction with proportional control. Explain.

Question 05

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

02) Why are fluid actuation systems widely used in factory automation? Discuss with an appropriate example.

03) A hydraulic cylinder is to be used to move a work-piece out of a conveyer belt through a distance of 40 mm in 10 s. A force of 20 kN is required to move the work-

piece. Determine the required working pressure and the flow rate of the hydraulic fluid, if a piston diameter of 100 mm is used.

Question 06

01) Explain the significant role played by industrial communication systems in factory automation.

02) Briefly describe the levels of communication systems within a large scale industrial plant.

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

Question 07

01) Explain how you would justify for the need of an industrial robot for a particular application. Elaborate by taking a suitable example.

02) Briefly explain the common types of industrial robots based on its geometrical configuration. Discuss each of their applicability in the industry.

03) Discuss the different methods employed in programming industrial robots.

Question 08

01) Explain the importance of utilizing automation for production support systems. In order to achieve a world class excellence in production. Elaborate using suitable examples.

02) Automated Guided Vehicles (AGV) offer superior performance in reducing the material handling time in automated factories. However, in some instances, AGV's are used in conjunction with manually operated material handling equipment. Discuss situations where AGV's can be used in conjunction with manually operated material handling equipment in order to achieve the best automated solution for factory automation.

END