UNIVERSITI KUALA LUMPUR
MALAYSIAN INSTITUTE OF INDUSTRIAL TECHNOLOGY

SPECIAL EXAMINATION

JANUARY 2016 SEMESTER

COURSE CODE	:	JCB 20703
COURSE TITLE	:	DISTRIBUTED CONTROL SYSTEM
PROGRAMME LEVEL	:	BACHELOR
DATE	:	01 JUNE 2016
TIME	:	3.00 PM - 6.00 PM
DURATION	:	3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. This question paper consists of ONE (1) section.
4. Answer FOUR (4) questions in Section A.
5. Please write your answers on the answer booklet provided.
6. Please answer all questions in English only.

THERE ARE 5 PAGES OF QUESTIONS EXCLUDING THIS PAGE.

SECTION A (Total: 100 marks)

INSTRUCTION: Answer FOUR (4) questions ONLY.
Please use the answer booklet provided.

Question 1

(a) SCADA is an automation control system that is used in industries such as energy, oil and gas, water and power. In your own words, describe the definition of SCADA system.

(8 marks)

(b) Define **THREE (3)** characteristic of processes that have a potential to implement SCADA system.

(6 marks)

(c) In a chemical process plant, the status of an open/closed ball valve, the number of cubic meters of gas that have passed through a meter and the temperature of a heated liquid must be gathered. Examine the parameters that can be gathered by SCADA system and example of end devices that can be selected based on each process.

(6 marks)

(d) The incident happened at a steam-electric power station where the hot water and steam leaking from a broken pipe detected by the Remote Terminal Unit (RTU) in a Master-Slave SCADA system. Since this is an extremely serious condition, analyze the action that RTU can do to notify the MTU without waiting for the next scan.

(5 marks)

Question 2

(a) Describe **TWO (2)** special features of chemical processes in oil and gas processing which can increase the cost of many of the sensors used in this process.

(4 marks)

(b) In Distributed Control System, equipment is separated in functional areas and is installed in different work areas of a process plant. The plant operator monitors and manipulates the set-points of the process parameter from central control room. The operator views the process information transmitted from the processing area and displayed on the computer terminal and also changes control conditions from a keyboard.

i. Based on the above statement, sketch the schematic diagram of the Distributed Control System.

(4 marks)

ii. Describe **ONE (1)** communication method used for distributed system data highway.

(6 marks)

(c) Data link layer is used to ensure data can be exchanged between devices. It governs not only network access and data format, but also mechanism to ensure data security. Two methods are used for regulating access, which is central bus control and de-centralized bus control. Differentiate **THREE (3)** differences between these two methods of bus control.

(6 marks)

(d) Carrier Sense Multiple Access/Collision Detection (CSMA/CD) Bus Access method, Token Passing model (IEEE 802.2) and Master-Slave method are example of de-centralized bus control method. Choose one de-centralized control method which is suitable for sensor/actuator application and justify your answer.

(5 marks)

Question 3

(a) For many years, Distributed Control System have provided multi-disciplined controllers for logic sequential and process control, Human Machine Interface (HMIs), custom applications, and business integration on one platform. In your own words, explain the definition of Distributed Control System.

(5 marks)

(b) Distributed control system offer the features and capabilities, which greatly foster their acceptance over analog or centralized computer control systems. Discuss **SIX (6)** features of Distributed Control Systems.

(12 marks)

(c) Cyber Physical System (CPS) is a system of collaborating computational elements controlling physical entities. Discuss in details in term of reliability, safety and functionality of CPS system by giving an example in industrial application.

(8 marks)

Question 4

(a) Nowadays, almost any production line, machine function, or process can be greatly enhanced using Programmable Logic Controller (PLC) as one of the industrial control system. Briefly describe the definition of Programmable Logic Controller using simple block diagram.

(4 marks)

(b) For the application in typical factory environment, state **SIX (6)** advantages of Programmable Logic Controller (PLC) based control system comparing with PC-based control system.

(6 marks)

(c) Figure 1 shows the sketch of a drilling process that requires the drill press to turn on only if there is a part present and the operator has one hand on each of the start switches. This precaution will ensure that the operator's hand are not in the way of the drill. Based on Figure 1, list out I/O devices involved in this process.

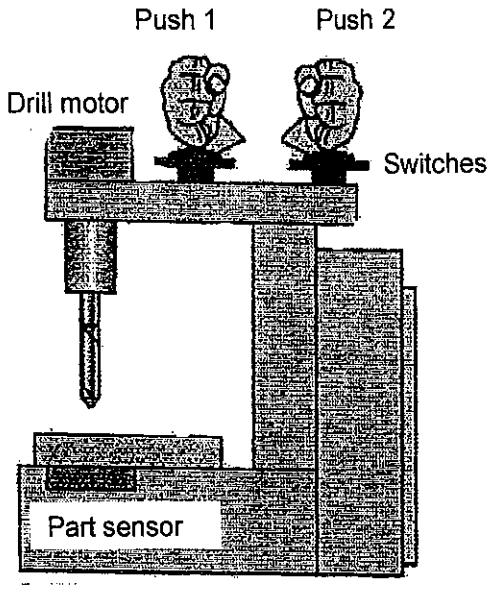

Figure 1

(5 marks)

(d) The main challenges facing the current and modern SCADA system are complexity, scalability, security, reliability, flexibility, interoperability, robustness, and legacy systems. In your opinions, select **FOUR (4)** challenges and discuss each challenge in terms of reasons and consequences.

(10 marks)

Question 5

(a) Discuss **FIVE (5)** advantages of Cyber Physical Systems.

(5 marks)

(b) In the past, the various Distributed Control System manufacturer have their proprietary components which does not talk to different makes of distributed control systems. Efforts have been made to develop International field-bus standard, one which is open and flexible enough to accommodate the natural growth of industrial plants. Choose one example of the international field-bus standard and explain it in details.

(5 marks)

(c) Evaluate the capability of Distributed Control System implemented in industrial automation in order to optimize all aspect of process control.

(15 marks)

END OF EXAMINATION PAPER