



**UTHM**

Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER II  
SESSION 2021/2022**

COURSE NAME : INDUSTRIAL AUTOMATION SYSTEM

COURSE CODE : BND 45903

PROGRAMME CODE : BND

EXAMINATION DATE : JULY 2022

DURATION : 3 HOURS

INSTRUCTION : 1.ANSWER ALL QUESTIONS.  
2.THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK**.  
3.STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION.

THIS QUESTION PAPER CONSISTS OF SIX (6) PAGES

**TERBUKA**

- Q1** (a) Automation can be defined as the technology by which a process or procedure is accomplished without human assistance. Identify **THREE (3)** automation types and discuss its performance in term of variety and quantity. (6 marks)
- (b) Identify **THREE (3)** types of sensors mainly used in the automation and describe their application. (6 marks)
- (c) The concept of automated systems can be applied to various levels of factory operations. Construct a practical diagram containing the process flow for producing a large scale potato chips in an automation factory system. You are required to show the input, output, sensors, stations, quality checking and other related processes in completing the production of the product. Then explain what happen in each process. (13 marks)
- Q2** (a) Describe the importance of actuator in industrial automation. (3 marks)
- (b) Sketch the configuration of a rotating electric motor with label. (5 marks)
- (c) A DC servomotor has a torque constant at 0.088 Nm/A and a voltage constant at 0.12 V/(rad/sec). The armature resistance is 2.3 ohms. A terminal voltage of 30 V is used to operate the motor. Determine:
- (i) The starting torque generated by the motor when the voltage is initially applied. (4 marks)
- (ii) The maximum speed when torque equal to zero. (3 marks)
- (iii) The operating point of the motor when it is connected to a load whose torque characteristic is proportional to speed with a constant of proportionality at 0.011 Nm/(rad/sec). (6 marks)
- (iv) Power delivered by the motor at operating point in unit of Watts. (4 marks)

**TERBUKA**

- Q3**
- (a) Explain how automation can help in improving the safety of worker and improving the product quality.  
(4 marks)
  
  - (b) The first robot reached the world of industry is over 60 years ago. Since then, an industrial robot is widely used in various applications such as welding, assembly, packaging and palletizing.
    - (i) Define an industrial robot.  
(3 marks)
  
    - (ii) Explain **THREE (3)** applications that make industrial robots commercially and technologically important.  
(6 marks)
  
  - (c) **Figure Q3(c)** shows five types of manipulator joints commonly used in industrial robot configuration. Using the notation scheme for defining manipulator configurations, construct a robotic arm diagram of the following robots:
    - (i) Cylindrical Robot, TLO  
(6 marks)
  
    - (ii) SCARA Robot, VRO  
(6 marks)

**TERBUKA**



- Q4** (a) Differentiate the Powered Leadthrough and Manual Leadthrough in industrial robotic programming. (6 marks)
- (b) Given a sequential motion program as **Figure Q4(b)**. Describe the function of WAIT and MOVE. (4 marks)
- (c) **Figure Q4(c)** shows a tank will be filled with two chemicals, mixed, and then drained. When the Start button is pressed, the program will start the Pump 1. Pump 1 runs for 5 seconds, filling the tank with the first chemical, then shuts off. The program then starts the Pump 2 to fill the tank with second chemical until float switch is triggered. After Pump 2 shut off, the program starts the mixer motor to mix these two chemicals for 60 seconds. The program then opens the drain valve and starts Pump 3. Pump 3 shuts off after 8 seconds and the process stops. A manual Stop switch is also available in the system.
- (i) Identify input and output (2 marks)
- (ii) Describe the process using motion diagram (4 marks)
- (iii) Construct the ladder logic diagram for the system (4 marks)
- (d) Illustrate a diagram that shows the interrelated between human and automation system. Your diagram should indicate the controller, power supply, manipulator and vehicle for human and automation system. (5 marks)

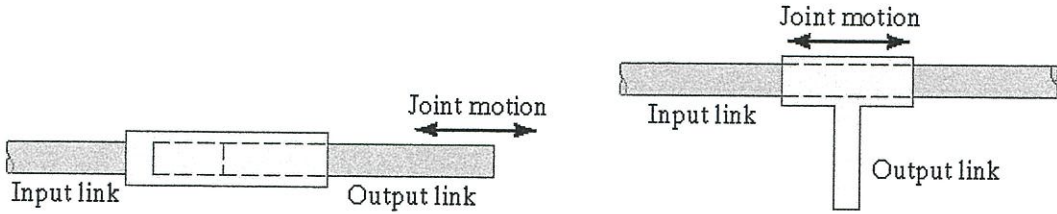
– END OF QUESTIONS –

TERBUKA

**FINAL EXAMINATION**

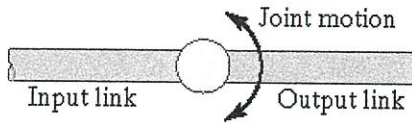
SEMESTER / SESSION : SEM II 2021/2022  
 COURSE NAME : INDUSTRIAL AUTOMATION SYSTEM

PROGRAMME CODE : BND  
 COURSE CODE : BND 45903

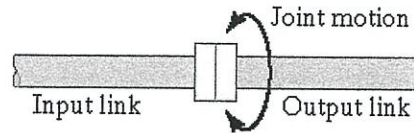


(i) Linear joint (type L)

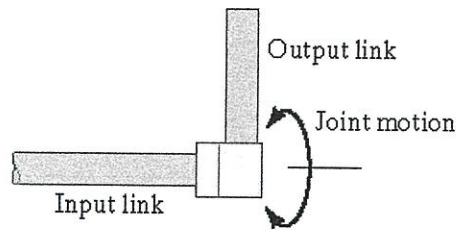
(ii) Orthogonal joint (type O)



(iii) Rotational joint (type R)



(iv) Twisting joint (type T)



(v) Revolving joint (type V)

**Figure Q3(c)**

LABEL	1
WAIT	2.5
MOVE	HOME
MOVE	PICKPOS
OUTPUT	GRIPPER = 1
INC	INT 1
JMP	LABEL 1

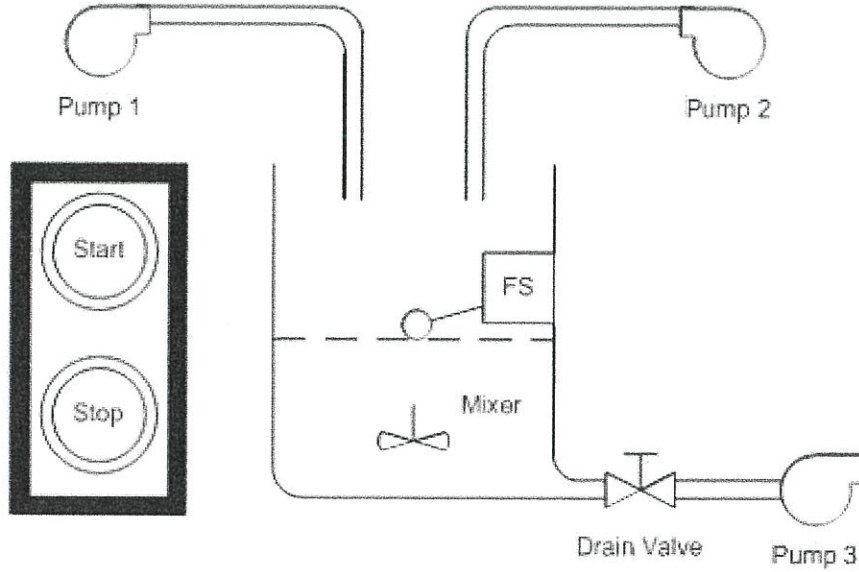
**Figure Q4(b)**

**TERBUKA**

**FINAL EXAMINATION**

SEMESTER / SESSION : SEM II 2021/2022  
COURSE NAME : INDUSTRIAL AUTOMATION SYSTEM

PROGRAMME CODE : BND  
COURSE CODE : BND 45903



**Figure Q4(c)**

**TERBUKA**