Question Paper

Exam Date & Time: 04-May-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

VI Semester B.Tech End Semester Examinations April/May 2024

INDUSTRIAL AUTOMATION [ICE 3252]

Marks: 50 **Duration: 180 mins.**

Descriptive Questions

Answer all the questions.

1) Illustrate with the help of a block diagram the step-wise procedure involved during the data transfer from field to PLC. [CO1, PO1, PO2, PO3, PO6, BL2] (3)

A)

B) Identify and explain with neat schematic the electrical circuit used to protect PLC from surge electrical signals. [CO1, PO1, PO2, PO3, PO6, BL3] (3)

C) The proportional mode of a controller has Kp = 2.4, input range of 0 to 255, and setpoint of 130. The output maximum is 180, and the output fraction with no error is 0.45. (4)

a. Determine the output for no error?

b. Determine the output for a set point of 124.

[CO1, PO1, PO2, PO3, PO6, BL4]

2) Identify the appropriate instruction that can be used in product quality check application. Explain how it differ from other program flow control instructions. [CO4, PO1, PO2, PO3, PO6, BL3] (3)

A)

B) List the OSI layers used in Profi -bus and discuss the OSI layer that detects the error during data transmission? [CO5, PO1, PO2, PO3, PO6, BL4] (3)

C) Develop a ladder logic and instruction list (IL) to control the motor output as per the given requirement. Make use of start and stop pushbuttons, 4 switches to turn on and off 2 motors (M), and a buzzer (B) (4)

[CO2, PO1, PO2, PO3, PO6, BL5]

3) Demonstrate the Modbus communication mode to communicate with more than one device at a time with the help of timing diagram. [CO4, PO1, PO2, PO3, PO6, BL4] (3)

A)

B) Without simplification, develop the instruction list program and ladder logic for the Boolean expression given below (3)

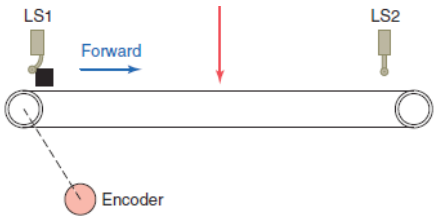
$$Z = A.\overline{B} + \overline{C(\overline{A} + B)} + A.B.\overline{C}$$

[CO3, PO1, PO2, PO3, PO6, BL5]

C) Develop a ladder logic program to execute the industrial control process shown in the below figure. The sequence of operation is as follows: (4)

- Product reaches in position (limit switch LS1 contacts close).
- The start button is pressed and the conveyor motor starts to move the product forward towards position *A* (limit switch LS1 contacts open when the actuating arm returns to its normal position).
- The conveyor moves the product forward to position *A* and stops (position detected by 8 rising edge triggered output pulses from the encoder, which are counted by an up-counter).
- A time delay of 10 s occurs, after which the conveyor starts to move the product to limit switch LS2 and stops (LS2 contacts close when the actuating arm is hit by the product).
- An emergency stop button is used to stop the process at any time.

If the sequence is interrupted by an emergency stop, counter and timer are reset automatically.



[CO3, PO1, PO2, PO3, PO6, BL5]

4) Distinguish device specific and common practice HART commands. [CO5, PO1, PO2, PO3, PO6, BL4] (3)

A)

B) Emphasize the significance of individual components of PLC with pictorial representation of PLC architecture [CO 4, PO 1,2,3,5,12, BL2] (3)

C) Generate Cyclic Redundancy check (CRC) value for a data 11100111 11011101. At the receiver the data is received as 11100111 11011101. Analyze whether the error is detected by CRC or not with justification. [CO3, PO1,PO2,PO6, BL4] (4)

5) A motor will be controlled by two push buttons. The Go push button will start the motor and the Stop push button will stop it. If the Stop push button was used to stop the motor, then Go push button must be thrown twice to start the motor. When the motor is active a light should be turned on. Develop the instruction list and ladder logic. [CO 2, PO 1,2,3,5,12, BL2] (3)

A)

B) Illustrate the application of MCR instruction with proper ladder diagram. [CO 3, PO 1,2,3,5,12, BL2] (3)

C) Write the structured text and ladder logic to find the sum of the squares of first ten odd numbers (don't use the formula). [CO 4, PO 1,2,3,5,12, BL2] (4)

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