Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY 2023

INDUSTRIAL AUTOMATION [ICE 3252]

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

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1)   Describe the significance of individual components of PLC with its architecture. [CO1, PO1, 2, BL2]   (5)

A)

B)   Without simplification develop the instruction list program and ladder logic for the Boolean   (3)
     expression given below. [CO3, PO1,2,3,6, BL 5]

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

C)   Provide necessary inputs and illustrate the working of MVM instruction. [CO2, PO1, 2, 3, 6, BL 3]   (2)

2)   Develop a ladder logic and FBD program for the logic circuit given below. [CO3, PO1,2,3,6, BL 3]   (5)

A)
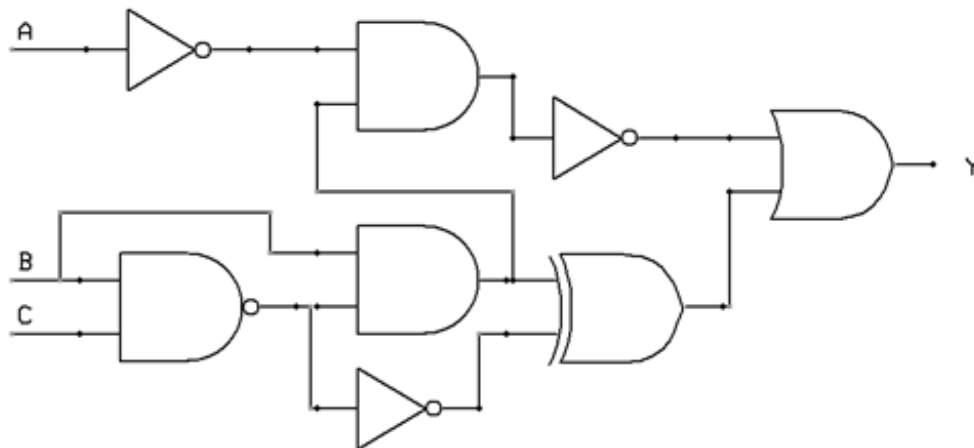
B)   Draw the structure of automation pyramid. Illustrate the role of PLC/DCS in Control level and   (3)
   SCADA in Operations level. [CO4, PO 1,2 BL3]

C)   Differentiate between device bus network and process bus network in industrial communication.   (2)
     [CO4, PO 1,2 BL3]

3)   A product moves continuously down an assembly line through a conveyor that has four stations, as   (5)
     shown in below Figure.

A)
     • The process has a Start, Stop and Reset buttons to control the sequence of operations.

- Start button is used to start the process, Stop is for emergency shut down and Reset, to reset the entire operations.

- As the product enters the inspection zone, where its presence is sensed by the proximity switch, the conveyor stops and inspection timer turns ON for 5 minutes.

- The inspector examines it and activates a reject button if the product fails inspection after the inspection duration.

- If the product is defective, reject status lights come on at stations 1, 2, and 3 respectively to tell the assembler to ignore the part.

- When a defective part reaches station 4, a diverter gate is activated to direct that part to a reject bin.

- Using PLC bit shift register, develop a program to implement this process. [CO3, PO 1,2,3,6 BL4]
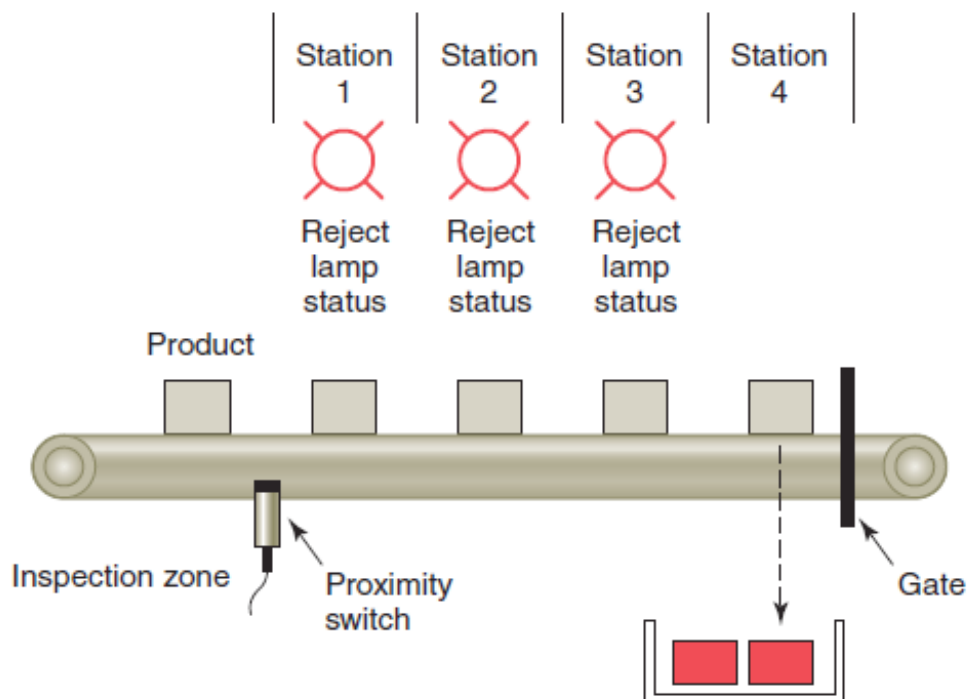
| B) | What are the layers of the OSI reference model used in PROFIBUS? How are these layer functions used in distributed peripherals, process automation, and fieldbus message specifications? [CO4, PO 1,2 BL2] | (3) |

| C) | With an example analyse how parity bit is used for error checking. [CO4, PO 1,2 BL4] | (2) |

| 4) | Generate a 16 bit CRC code for the data frames 03 08H. [CO4, PO 1,2 BL3] | (5) |

A)

| B) | What is the use of software system in DCS? Explain the types with relevant examples. [CO5, PO 1,2 BL2] | (3) |

| C) | Explain the features of Alarm analysis in DCS. [CO5, PO 1,2 BL2] | (2) |

| 5) | How does the generalised distributed control system works? Provide the block diagram to illustrate its functions [CO5, PO1,2 BL3] | (5) |

A)

| B) | What are the differences between the Single loop LCU, Dual LCU, and Multiple loop LCU architecture configurations in a DCS system and how do they affect the system's performance and | (3) |

scalability? [CO5, PO1,2 BL3]

C)   Distinguish between high-level and low-level operator interfaces in a distributed control system.   (2)
[CO5, PO1,2 BL3]

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