

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Seventh Semester

Instrumentation and Control Engineering

(Common to Electronics and Instrumentation Engineering)

20ICPC701 - LOGIC AND DISTRIBUTED CONTROL SYSTEM

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
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| 1. In a PLC system, what function does the CPU perform?
(a) Execute user programs (b) Provide power to the system
(c) Connect I/O modules (d) Maintain the PLC's physical structure | 1 | K1 | CO1 |
| 2. Which of the following is a typical application for an analog output module?
(a) Controlling the speed of a motor (b) Turning on a light
(c) Opening a relay (d) Monitoring a switch position | 1 | K1 | CO1 |
| 3. In a PLC, which module would you use to interface with a pressure sensor?
(a) Discrete input module (b) Analog input module
(c) Discrete output module (d) Analog output module | 1 | K1 | CO1 |
| 4. Which timer in a PLC retains its accumulated value even after the rung goes false?
(a) OFF-delay timer (b) ON-delay timer (c) Retentive timer (d) Pulse timer | 1 | K1 | CO1 |
| 5. In Functional Block Diagram, how are input and output signals typically represented?
(a) As circles (b) As arrows (c) As lines (d) As text labels | 1 | K1 | CO2 |
| 6. In structured text, which symbol is typically used to assign a value to a variable?
(a) = (b) := (c) == (d) <= | 1 | K1 | CO2 |
| 7. Which element in sequential function chart indicates the conditions for moving from one step to another?
(a) Step (b) Transition (c) Action (d) State | 1 | K1 | CO2 |
| 8. In instruction list, what does the instruction `ST` typically do?
(a) Starts a process (b) Stores a value in a register
(c) Stops a process (d) Subtracts a value | 1 | K1 | CO2 |
| 9. What is the function of supervisory control in automated systems?
(a) To directly control individual sensors
(b) To oversee and manage automated processes from a central location
(c) To collect data from remote locations
(d) To convert analog signals to digital | 1 | K1 | CO3 |
| 10. What type of control strategy does Direct Digital Control (DDC) primarily use?
(a) Feedback Control (b) Open-loop Control (c) Manual Control (d) Predictive Control | 1 | K1 | CO3 |
| 11. What is the primary purpose of a Data Acquisition System (DAS)?
(a) To control industrial processes
(b) To manage alarm notifications
(c) To provide internet connectivity
(d) To collect, measure, and analyze data from physical phenomena | 1 | K1 | CO3 |
| 12. Which of the following is NOT a typical function of SCADA software
(a) Data Visualization (b) Real-Time Data Processing
(c) Signal Conditioning (d) Alarm Management | 1 | K1 | CO3 |
| 13. Which of the following is a key benefit of DCS over traditional control systems?
(a) Centralized data storage (b) Decentralized control structure
(c) Reduced communication complexity (d) Enhanced field device diagnostics | 1 | K1 | CO4 |

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| 14. Which protocol is commonly used for smart field devices to communicate with a DCS? | 1 | K1 | CO4 |
| (a) HART (b) BACnet (c) Zigbee (d) Modbus RTU | | | |
| 15. The Foundation Field bus (FF) protocol is most suitable for\ | 1 | K1 | CO4 |
| (a) High-speed data transfer (b) Low-bandwidth analog control | | | |
| (c) Serial communication (d) Wireless communication | | | |
| 16. Which of the following is a common feature of Human Interface Stations? | 1 | K1 | CO4 |
| (a) Display of process graphics (b) Network management | | | |
| (c) Temperature monitoring (d) Physical connection to sensors | | | |
| 17. In Networked Control Systems (NCS), the primary advantage of using a network is | 1 | K1 | CO5 |
| (a) Lower hardware cost (b) Centralized control | | | |
| (c) Enhanced flexibility and scalability (d) Simplified programming | | | |
| 18. Which of the following is a critical concern in IoT implementations? | 1 | K1 | CO5 |
| (a) Insufficient bandwidth (b) Data privacy and security | | | |
| (c) Lack of cloud connectivity (d) Outdated hardware | | | |
| 19. Which of the following is a key benefit of cloud-based automation? | 1 | K1 | CO5 |
| (a) Reduced need for cyber security (b) Centralized data access and scalability | | | |
| (c) Limited access to resources (d) Higher latency compared to on-premises solutions | | | |
| 20. Which type of device is NOT typically part of an IoT network? | 1 | K1 | CO5 |
| (a) Sensors (b) Actuators (c) Centralized databases (d) Smart cameras | | | |

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

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| 21. Enlist the advantages of PLC over relay ladder logic. | 2 | K2 | CO1 |
| 22. What is a seal in circuit? | 2 | K1 | CO1 |
| 23. Differentiate between an operator and an operand. | 2 | K2 | CO2 |
| 24. Write the structured text instruction for any two logical operations. | 2 | K1 | CO2 |
| 25. Draw the general block representation of a computer control system. | 2 | K2 | CO3 |
| 26. Justify the need for Digital control in industries. | 2 | K2 | CO3 |
| 27. What is a Distributed Control System (DCS)? | 2 | K1 | CO4 |
| 28. List out the functions performed by Low Level Human Interface and High Level Human Interface. | 2 | K2 | CO4 |
| 29. Deduce the need for cloud based automation. | 2 | K1 | CO5 |
| 30. Write the steps involved in design procedure for plant wide design control. | 2 | K1 | CO5 |

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

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| 31. a) Explain the logic of on delay and off delay timer with neat diagram. | 10 | K2 | CO1 |
| OR | | | |
| b) Design a ladder logic program to control two way traffic using Timer instruction. | 10 | K2 | CO1 |
| 32. a) What is sequential function chart (SFC) and using it implement any one industrial control sequence with a neat flowchart. | 10 | K3 | CO2 |
| OR | | | |
| b) What is structured text programming in PLC? List out the various (i) Bit instruction (ii) Arithmetic instruction (iii) Numerical instruction (iv) Program instruction employed in structured text. | 10 | K2 | CO2 |
| 33. a) Explain with neat diagram Direct Digital Control. Also derive the position algorithm and velocity algorithm. | 10 | K2 | CO3 |

OR

- b) What are the various functional blocks of computer control system? With neat diagram explain the functioning of computer control system. 10 K2 CO3
34. a) Explain the significance of local control unit in DCS with a neat diagram and discuss about the different configurations of LCU with neat diagram. 10 K2 CO4
- OR**
- b) Explain in detail the concept of interfacing between field device and DCS using HART and Foundation fieldbus protocol. 10 K2 CO4
35. a) Discuss in detail about the framework for networked control system. 10 K2 CO5
- OR**
- b) Illustrate the applications of PLC with case study for any one application. 10 K2 CO5
36. a) i) Describe in detail the evolution of DCS. 5 K2 CO4
 ii) Describe in detail about Internet of things (IoT) with neat sketch. 5 K2 CO5
- OR**
- b) i) Compare and analyze the various features of hybrid, centralized and distributed control system architecture. 5 K2 CO4
 ii) Detail the design procedure for plant wide control. 5 K2 CO5