| Reg. No. | | | | | | | | | | | | | | | | |
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| Question Paper Code | 13944 |
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**

Seventh Semester

**Electronics and Instrumentation Engineering**

(Common to Instrumentation and Control Engineering)

**20ICPC701 - LOGIC AND DISTRIBUTED CONTROL SYSTEM**

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 1. | The basic component of a PLC system that executes control instructions is called:<br>(a) Input module (b) Output module (c) CPU (d) Power supply | 1 | K1 | CO1 |
| 2. | In ladder logic programming, the symbol '--\|\|--' represents:<br>(a) Normally open contact (b) Normally closed contact (c) Coil (d) Timer | 1 | K2 | CO1 |
| 3. | Which of the following is a graphical programming language used for PLC?<br>(a) C++ (b) Ladder Diagram (c) Assembly (d) Python | 1 | K2 | CO2 |
| 4. | Sequential Function Chart (SFC) is used for:<br>(a) Boolean logic (b) Continuous process<br>(c) Sequential process (d) Arithmetic operation | 1 | K2 | CO2 |
| 5. | Which component of SCADA system gathers field data?<br>(a) Master terminal unit (b) Remote terminal unit<br>(c) Operator station (d) Control console | 1 | K2 | CO3 |
| 6. | In SCADA architecture, the master station is mainly responsible for:<br>(a) Data acquisition (b) Field operation<br>(c) Signal amplification (d) Control valve actuation | 1 | K2 | CO3 |
| 7. | The field control station in DCS is used to:<br>(a) Provide power (b) Control loops locally<br>(c) Perform maintenance (d) Store operator logs | 1 | K1 | CO4 |
| 8. | Which protocol is commonly used in interfacing smart field devices with DCS?<br>(a) HART (b) HTTP (c) FTP (d) SMTP | 1 | K1 | CO4 |
| 9. | Plant-wide control strategy deals with:<br>(a) Single equipment control (b) Entire plant control<br>(c) Motor speed (d) Instrument calibration | 1 | K2 | CO5 |
| 10. | The concept of Cloud-based automation is primarily associated with:<br>(a) Offline process (b) Data sharing via internet (c) Manual control (d) Relay logic | 1 | K1 | CO5 |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

| | | Marks | K – Level | CO |
|---|---|---|---|---|
| 11. | List the main parts of a PLC system. | 2 | K1 | CO1 |
| 12. | Discuss the functions of input/output modules in PLC. | 2 | K2 | CO1 |
| 13. | Differentiate between Ladder and Function Block programming. | 2 | K2 | CO2 |
| 14. | Explain any two mathematical functions used in PLC programming. | 2 | K2 | CO2 |
| 15. | Outline the basic components of a SCADA system. | 2 | K2 | CO3 |
| 16. | Define Direct Digital Control (DDC). | 2 | K1 | CO3 |
| 17. | Summarize the key features of a Distributed Control System. | 2 | K2 | CO4 |
| 18. | Outline the functions of operator and engineering stations in DCS. | 2 | K2 | CO4 |
| 19. | Define the term 'Safety PLC'. | 2 | K1 | CO5 |
| 20. | Interpret two industrial applications of IoT in automation. | 2 | K2 | CO5 |
| 21. | Show the importance of communication protocols in automation. | 2 | K2 | CO3 |
| 22. | Discuss two advantages of networked control systems. | 2 | K2 | CO5 |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

| | | | | | |
|---|---|---|---|---|---|
| 23. | a) | Explain the architecture and working of a PLC with neat diagram. | *11* | *K2* | *CO1* |
| | | **OR** | | | |
| | b) | Develop a ladder logic diagram for a tank filling system using level sensors and pumps. Explain the sequence of operation. | *11* | *K2* | *CO1* |
| 24. | a) | Develop a Functional Block Diagram (FBD) program in a PLC to implement a temperature control system for a heat exchanger process.<br>The system uses a temperature sensor (T1) to measure process temperature.<br>A setpoint (SP) value is entered by the operator.<br>A PID block controls the output to the heater element (H1) to maintain the desired temperature.<br>Include logic for high-temperature alarm activation if temperature exceeds a safety limit.<br>Draw the Functional Block Diagram, label all blocks (PID, comparator, limiter, etc.), and explain the program flow. | *11* | *K4* | *CO2* |
| | | **OR** | | | |
| | b) | Design a sequential function chart (SFC) program using a PLC to automate a two-tank batch mixing process, where:<br>• Tank 1 is filled with Liquid A until Level Sensor L1 is activated.<br>• After that, Valve V2 opens to transfer Liquid A into Tank 2.<br>• Once transfer is complete and Level Sensor L2 is ON, Agitator M1 runs for 10 seconds for mixing.<br>• After mixing, Pump P1 drains Tank 2 and resets the system to its initial state.<br>Develop the SFC diagram showing transitions and actions and briefly explain each step's control logic. | *11* | *K4* | *CO2* |
| 25. | a) | Describe the architecture of a SCADA system and its functional components with a neat sketch. | *11* | *K2* | *CO3* |
| | | **OR** | | | |
| | b) | Discuss data acquisition and supervisory control functions in SCADA with neat diagram. | *11* | *K2* | *CO3* |
| 26. | a) | Explain the hardware architecture of a typical Distributed Control System with necessary diagram. | *11* | *K2* | *CO4* |
| | | **OR** | | | |
| | b) | Illustrate how HART-enabled smart transmitters are integrated with DCS. | *11* | *K2* | *CO4* |
| 27. | a) | Explain plant-wide control and cloud-based automation with examples. | *11* | *K2* | *CO5* |
| | | **OR** | | | |
| | b) | Discuss the role of IoT in modern industrial automation with necessary diagrams. | *11* | *K2* | *CO5* |
| 28. | a) | There are three machines, each with its own start stop button. Only one may run at a time. Develop the ladder logic diagram. | *11* | *K4* | *CO1* |
| | | **OR** | | | |
| | b) | Develop a ladder logic program using a PLC to control a conveyor belt system where:<br>• The conveyor starts when a Start push button is pressed and stops when a Stop button is pressed.<br>• If an object is detected by a proximity sensor, the belt should stop automatically for 5 seconds and then restart.<br>• Include necessary interlocks and timer instructions in your logic.<br>Draw the ladder diagram and explain the operation sequence. | *11* | *K4* | *CO1* |