Introduction to PLCs

1. **What is a PLC?**
   Write a brief explanation (50-100 words) of what a Programmable Logic Controller (PLC) is, including its primary function in industrial automation.

2. **List the Advantages of Using PLCs**
   Identify and describe at least three advantages of using PLCs over traditional relay-based control systems.

Controllers and Hardware

3. **Identify PLC Components**
   Match the following PLC components with their descriptions:

   - **CPU**
   - **Power Supply**
   - **Input/Output Modules**
   - **Communication Interfaces**

a. Provides the necessary power for the PLC system.
b. Central processing unit that executes the control program.
c. Interfaces for connecting sensors and actuators.
d. Interfaces for communication with other devices and networks.

4. **Hardware Specifications**
   Given the specifications below, identify whether they describe a CPU, Power Supply, Input Module, or Output Module:

   - **Specification A**: 24 V DC power input, 120 V AC output.
   - **Specification B**: 8 digital inputs, 24 V DC.
   - **Specification C**: Ethernet and RS-485 communication ports.
   - **Specification D**: 32-bit processor, 1 GHz clock speed.

PLC Architecture

5. **PLC Architecture Diagram**
   Draw a simple block diagram of a PLC system, labeling the CPU, Power Supply, Input/Output Modules, and Communication Interfaces.

6. **Describe PLC Scan Cycle**
   Explain the steps involved in a typical PLC scan cycle, including input scan, program execution, and output scan.

PLC Systems

7. **Types of PLC Systems**
   Compare and contrast the following types of PLC systems:
   - Compact PLC
   - Modular PLC
   - Rack-mounted PLC

Include details on their typical use cases and scalability.

8. **PLC Application Example**
   Describe a real-world application where a PLC might be used. Include details on the inputs, outputs, and the control process.

Programs

9. **Basic Ladder Logic Programming**
   Write a simple ladder logic program to turn on a motor when a start button is pressed and turn it off when a stop button is pressed. Use standard ladder logic symbols for contacts and coils.

10. **Describe Programming Languages for PLCs**
    Provide a brief description of the following PLC programming languages:
    - Ladder Logic
    - Function Block Diagram (FBD)
    - Structured Text (ST)
    - Instruction List (IL)
    - Sequential Function Chart (SFC)