5. What is an Interrupt System and Interlock in Computer Process Control? Explain

Interrupt:	System:
------------	---------

An Interrupt System is a mechanism in computer process control where the CPU is notified immediately when a specific event occurs, temporarily suspending the current task to handle the event.

Working:

- When a sensor/device detects a critical condition (like over-temperature), it sends an interrupt signal.
- The CPU pauses current execution, saves its state, and executes an interrupt service routine (ISR).
- Once the event is handled, the CPU resumes the previous process.

Advantages of Interrupts:

- Immediate response to critical events
- Reduces the need for constant polling
- Improves real-time performance of control systems

Interlock in Process Control:

An Interlock is a safety mechanism designed to prevent the execution of unsafe actions in a process.

Purpose:

- Ensures safe operation by enforcing conditions before allowing actions.
- Can be hardwired (using relays) or software-based.

Example:

- In a boiler, if the pressure exceeds limit, the interlock will shut down the burner.
- A motor wont start unless the safety door is closed.

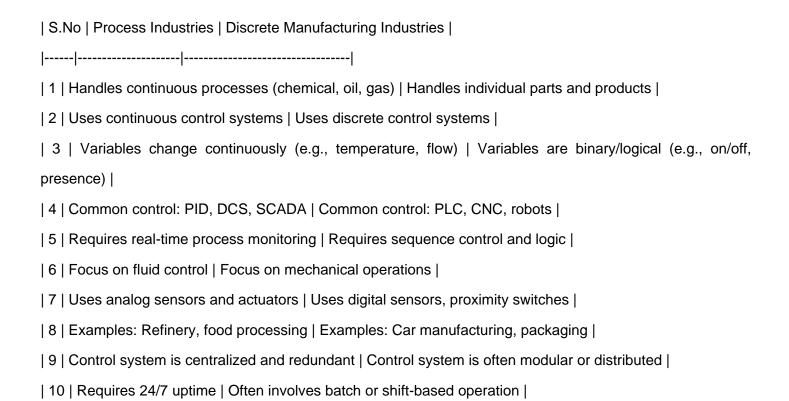
Types:

- Safety Interlocks: Prevent hazards.
- Process Interlocks: Maintain correct process sequence.
- Mechanical/Electrical Interlocks: Use hardware components.
- Software Interlocks: Logic coded in PLC or control software.

Summary:

Interrupts handle event-driven actions, while interlocks enforce safe sequencing and conditions in automation systems.

6. Difference Between Control System in Process Industries and Discrete Manufacturing Industries (10 Points)



7. Write Capabilities of Computer Control Systems

Computer-controlled	systems	play	а	critical	role	in	automation	due	to	their	flexibility,	intelligence,	and
precision.													

Major Capabilities:

- 1. Monitoring and Data Logging:
 - Continuously monitor variables (temperature, speed, etc.) and record data for analysis.
- 2. Real-Time Control:
 - Quick processing of inputs and generation of outputs for precise control.
- 3. Fault Detection & Diagnosis:
 - Detect abnormal events or failures and alert or take corrective actions.
- 4. Process Optimization:
 - Optimize process parameters using feedback and algorithms.
- 5. Communication:
 - Interface with other systems (SCADA, PLC, HMI, ERP) using protocols like Modbus, OPC.
- 6. Scheduling and Coordination:
 - Manage task sequences, machine scheduling, and material flow.
- 7. Flexible Programming:
 - Easily reprogrammed to adapt to new processes or changes.
- 8. Human-Machine Interface (HMI):
 - Provide operators with graphical interfaces to control and monitor processes.

- 9. Alarm and Safety Handling:
 - Manage critical situations and execute emergency stop actions.
- 10. Integration:
 - Seamlessly integrates with robotics, sensors, AI, and IoT systems.

8. Explain Requirements of Control Systems

Functional Requirements:

For a control system to function effectively in an industrial environment, it must meet several technical and operational requirements:
Technical Requirements:
Accuracy and Precision: Must maintain the process variable at or near the desired value.
Stability: The system should not oscillate or become unstable after disturbances.
Speed of Response: Quick response to input or environmental changes is essential.
4. Reliability: - Should work continuously without failures.
5. Robustness:- Must handle variations or disturbances in the process.
Scalability: Should be expandable for future needs or upgrades.
7. Real-time Operation:Inputs should be processed within required time constraints.

 Sensor and Actuator Inte 	erface:
--	---------

- Connect to and control field devices.

2. Feedback Mechanism:

- Must have a loop for comparing actual vs. desired values.

3. Programmability:

- Should allow users to define logic, thresholds, and sequences.

4. User Interface (HMI):

- Clear and intuitive interface for operator interaction.

5. Communication:

- Support for standard protocols and networking with other systems.

Safety and Compliance:

- Must follow industrial standards (IEC, ISO).
- Include interlocks, fail-safes, and alarms to prevent hazards.