Reg. No.																

Question Paper Code	14385

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Seventh Semester

Mechanical Engineering

20MUOE906 - INTRODUCTION TO INDUSTRIAL AUTOMATION

Regulations - 2020

Duration: 3 Hours Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	State the full form of the abbreviation 'ISO' as used in hydraulic system symbols. a) International Organization for Standardization b) Industrial Standard Operations c) Integrated System Output d) International Schematic Outline	*1*	*K1*	*CO1*
2.	Choose the correct statement about the working of a vane pump in a hydraulic system. a) Vanes slide in and out of a rotor to trap and move fluid b) Vanes rotate around a fixed crankshaft c) Vanes use piston strokes to create pressure d) Vanes generate flow using gear meshing	*1*	*K1*	*CO1*
3.	Name the component that converts hydraulic energy into rotary mechanical motion. a) Hydraulic motor b) Hydraulic pump c) Pressure relief valve d) Flow control valve	*1*	*K1*	*CO1*
4.	Name the valve that prevents fluid from flowing back in a hydraulic line. a) Check valve b) Pressure relief valve c) Flow control valve d) Sequence valve	*1*	*K1*	*CO2*
5.	Explain the difference between a unidirectional and a bidirectional rotary actuator. a) Unidirectional rotates in one direction; bidirectional rotates in both directions b) Unidirectional uses air; bidirectional uses oil c) Unidirectional is linear; bidirectional is rotary d) Unidirectional uses high pressure; bidirectional uses low pressure	*1*	*K2*	*CO2*
6.	Describe the function of a pressure balance (counter balance) valve in a hydraulic circuit. a) Prevents load from falling freely by maintaining back pressure on the return side b) Increases flow rate to actuator at high speed c) Stores hydraulic fluid under pressure for emergencies d) Converts linear motion of cylinder into rotary motion		*K2*	*CO2*
7.	Recall the property of air that describes the amount of water vapour present in compressed air. a) Humidity b) Viscosity c) Density d) Compressibility	*1*	*K1*	*CO3*
8.	Name the type of air compressor that uses a flexible membrane to compress air. a) Diaphragm compressor b) Vane compressor c) Reciprocating compressor d) Screw compressor	*1*	*K1*	*CO3*
9.	Summarize the role of a lubricator in a pneumatic FRL unit. a) Adds fine oil mist to compressed air to lubricate downstream pneumatic components b) Removes dust particles from incoming compressed air c) Controls the pressure of compressed air supplied to the circuit d) Stores surplus compressed air to stabilize supply pressure	*1*	*K2*	*CO3*

10.	Define the term 'intensifier circuit' as used in hydraulic systems. a) A circuit that increases fluid pressure beyond the pump's rated pressure b) A circuit that reduces pressure to protect system components c) A circuit that controls the direction of actuator movement d) A circuit that recycles return fluid back to the pump inlet	*1*	*K1*	*CO4*
11.	Recall the purpose of a pressure-reducing circuit in a hydraulic control system. a) Supplies a lower pressure to one branch of the circuit while the main circuit operates at higher pressure b) Increases the speed of the hydraulic actuator c) Directs flow to two actuators simultaneously at full pressure d) Stores energy during idle periods for use during peak demand	*1*	*K1*	*CO4*
12.	Explain how a bleed-off circuit controls actuator speed differently from a meter-in circuit. a) Bleed-off diverts excess pump flow to tank before the actuator; meter-in restricts flow entering the actuator b) Bleed-off increases flow to actuator; meter-in reduces pump speed c) Bleed-off controls return flow; meter-in controls pump delivery pressure d) Bleed-off is used only in pneumatic circuits; meter-in only in hydraulic circuits	*1*	*K2*	*CO4*
13.	State the meaning of the term 'scan cycle' in the operation of a PLC. a) The repeated sequence of reading inputs, executing the program, and updating outputs b) The power-up self-test routine run when a PLC is switched on c) The process of downloading a new program to the PLC memory d) The communication cycle between the PLC and SCADA systems	*1*	*K1*	*CO5*
14.	Name the PLC instruction that counts the number of input pulses and triggers an output after a preset count. a) Counter instruction b) Timer instruction c) Move instruction d) Compare instruction	*1*	*K1*	*CO5*
15.	Interpret the function of a normally closed (NC) contact in a PLC ladder logic rung. a) The contact passes current when its associated coil or input is de-energized (OFF) b) The contact passes current only when its coil is energized (ON) c) The contact permanently allows current regardless of input state d) The contact blocks current at all times until manually reset	*1*	*K2*	*CO5*
16.	Classify the type of PLC memory that stores the user-written ladder logic program. a) Program memory (RAM/EEPROM) b) Input image register c) Output image register d) Data file memory	*1*	*K2*	*CO5*

PART – A (ii) (Short Answer Questions)
(8 × 3 = 24 Marks)

Answer ALL Questions

17.	Describe the working principle of a piston-type hydraulic pump and explain how it generates fluid flow.	*3*	*K2*	*CO1*
18.	Outline the energy losses that occur in a hydraulic system and state the main causes of each.	*3*	*K2*	*CO1*
19.	Explain the working of a pilot-operated sequence valve and describe where it is used in multi-actuator circuits.	*3*	*K2*	*CO2*
20.	Apply the concept of pressure control to describe how a pressure relief valve protects a hydraulic system from overload.	*3*	*K3*	*CO2*
21.	Apply the properties of compressed air to explain why multi-stage compression is necessary in pneumatic systems.	*3*	*K3*	*CO3*
22.	Illustrate the operation of a single actuator pneumatic circuit controlled by a 5/2 directional control valve.	*3*	*K3*	*CO4*
23.	Apply the concept of sequential control to describe the development of a two-cylinder hydraulic circuit where cylinder B extends only after cylinder A has fully extended.	*3*	*K3*	*CO4*

24.		Illustrate a simple PLC ladder logic rung using a start button, stop button, and a motor seal-in circuit, and describe the function of each contact.	*3*	*K3*	*CO5*

PART - B (Descriptive Answer Questions)
(5 × 12 = 60 Marks)
Answer ALL Questions

25.	a)	Illustrate the ISO symbols for the following pneumatic and hydraulic components: single-acting cylinder, double-acting cylinder, air compressor, hydraulic reservoir, and pressure gauge. Describe the function of each component in a fluid power system.	*12*	*K3*	*CO1*
		OR			
	b)	Illustrate the layout of a complete pneumatic power generation system. Describe the purpose of each component from the compressor to the actuator, and explain how the classification of drives — hydraulic, pneumatic, and electric — differs in terms of application and working medium.	*12*	*K3*	*CO1*
26.	a)	Select the appropriate control valves and actuators required to design a hydraulic circuit for a clamp-and-drill machine where two cylinders must operate in sequence. Justify each selection based on load, speed, and directional control requirements.	*12*	*K3*	*CO2*
		OR			
	b)	Illustrate the construction and working of a single-acting hydraulic cylinder and a gear actuator. Apply the knowledge of valve control to describe how manual and mechanical methods are used to operate directional control valves in industrial machines.	*12*	*K3*	*CO2*
27.	a)	Apply the principles of air compression to describe the working of a reciprocating air compressor. Explain the construction and role of the air reservoir in detail.	*12*	*K3*	*CO3*
		OR			
	b)	Describe the construction and working of a sliding vane air motor and a piston air motor. Apply the concept of humidity control to explain how moisture in compressed air affects pneumatic components, and state the measures used to remove it in a practical pneumatic system.	*12*	*K3*	*CO3*
28.	a)	Develop a schematic diagram for a hydraulic accumulator circuit and describe how the accumulator stores and releases energy. Explain how a regenerative circuit is connected to increase the extension speed of a double-acting cylinder and state the conditions under which it is used.	*12*	*K3*	*CO4*
		OR			
	b)	Design and explain a hydraulic circuit for the pick and place robot arm applications	*12*	*K3*	*CO4*
29.	a)	Develop a PLC ladder logic program for an automatic bottle-filling station that starts a fill valve when a bottle sensor detects a bottle, keeps the valve open for a preset time using a timer, then closes the valve and advances a counter. Describe the function of each rung and the role of the timer and counter instructions.	*12*	*K3*	*CO5*
		OR			
	b)	With neat sketch, explain the construction and working of a programmable logic controller used in process industries.	*12*	*K3*	*CO5*