Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: Programmable Logic Controller & HMI **Semester:** VI

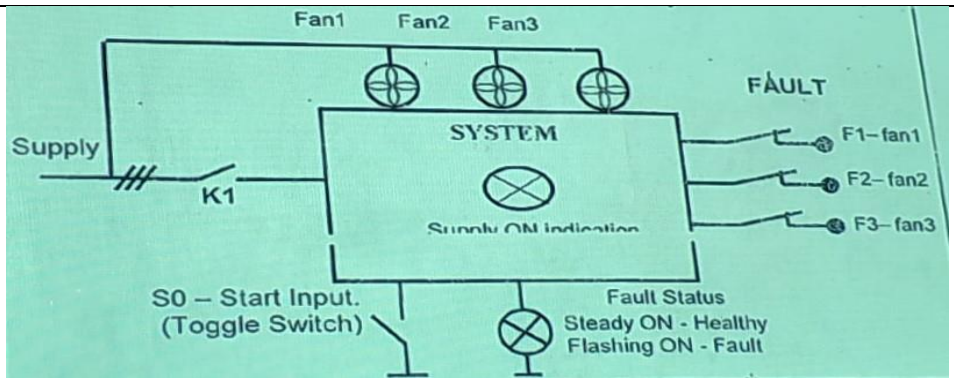
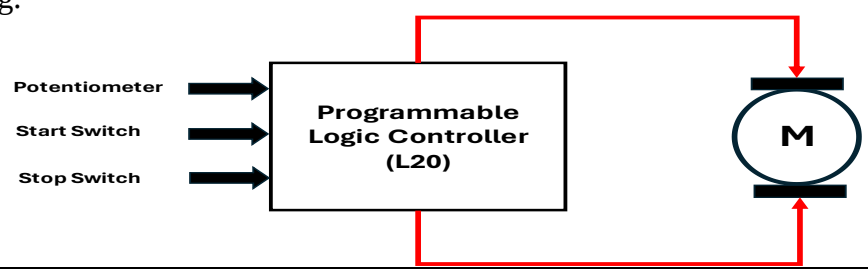
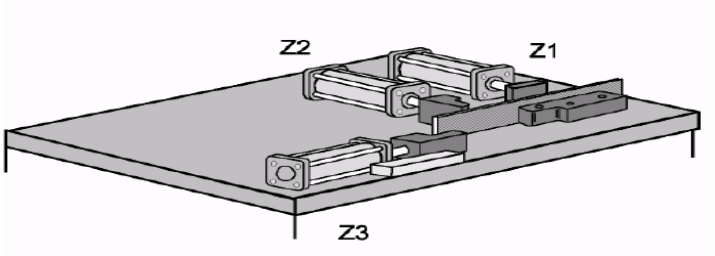
Program: B. Tech (Mechatronics Engineering) **Time:** 03 hrs.

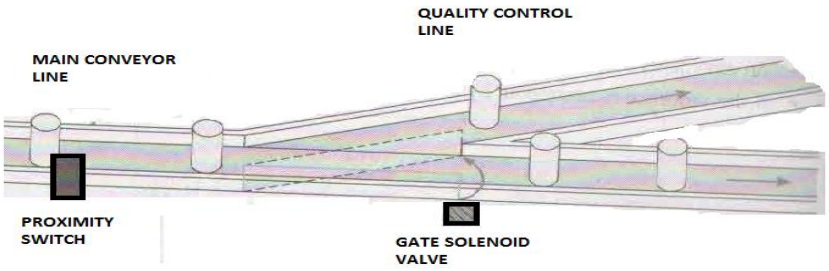
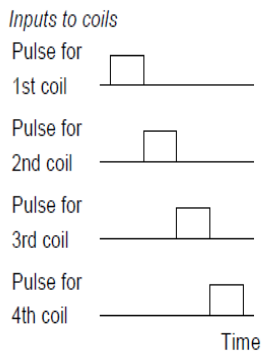
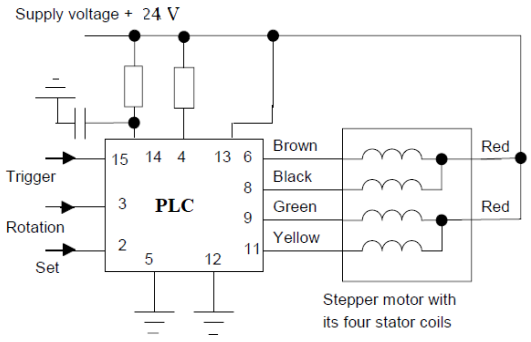
Course Code: ECEG 3055 **Max. Marks: 100**

Instructions: This question paper has three sections, Section A, Section B, and Section C.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Define onboard and inline I/O's. Explain different onboard and inline I/O's used in PLC.	4	CO1
Q 2	Compare the different memory storage characteristics of any variable in the memory element.	4	CO2
Q 3	Outline the sequence of events involved in a single PLC scan cycle.	4	CO3
Q 4	Describe the similarities and differences between PLC ladder logic and relay ladder logic.	4	CO3
Q 5	Explain the set/reset coil with a neat diagram and explain them briefly.	4	CO 1
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Illustrate the process of setting up analog inputs and output ports for all the configurations in L20 PLC. **OR** Write a ladder logic program to make the bulb ON/OFF continuously with one input switch. Assume ON and OFF time is 3 milliseconds.	10	CO3
Q 7	Write a ladder logic program for the following conditions: 1. When start input S0 is given then the following should happen • Fan1 and Fan2 should come ON • Mains contactor(K1) should Close • System on Lamp(L1) should come ON 2. When Fan1 and Fan2 fails, the standby fan Fan3 should come ON 3. When two fans out of provided three fans fail then the following should happen • Mains contactor (K1) should drop • System ON lamp(L1) should flash at 5 Hz frequency	10	CO4

			
Q 8	Design and Implement Ladder logic algorithm for double acting pneumatics cylinders with overlapping sequence using PLC (A+ B+ A- B-).	**10**	**CO 4**
Q 9	Create a PLC ladder diagram and hardware setup to control a DC motor using the Pulse Width Modulation (PWM) technique. Employ a potentiometer to adjust the duty cycle, thereby altering the motor speed. Ensure the selection of a suitable relay, as depicted in the provided figure, to match the current rating. 	**10**	**CO 4**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Design a hydraulic circuit and write a ladder program to implement the bending device for sheet metal parts to be performed on a workpiece. The sequence of motion of cylinders is: a. Cylinder 1 clamp the workpiece b. Cylinder 2 performs bending operation on a workpiece c. Cylinder 2 return backs d. Cylinder 3 performs bending operation on a workpiece e. Cylinder 3 return backs f. Cylinder 1 unclamps the workpiece. (Consider the appropriate directional control valve and the default position is the home position)  Example of application: "Bending aluminum into hooks"	**20**	**CO5**

Q 11	Write a program to implement the process illustrated in the below figure. An up-counter must be programmed as part of a batch counting operation to sort parts automatically for quality control. The counter is installed to divert 1 part out of every 1000 for quality control or inspection purposes. The circuit operates as follows: **1)** A START/STOP pushbutton station is used to turn the conveyor motor ON/OFF **2)** A proximity sensor counts the parts as they pass on the conveyor. **3)** When a count of 1000 is reached, the counter's output activates the gate solenoid, diverting the part to the inspection line. **4)** The gate solenoid is energized for 2 seconds, which allows enough time for the part to continue to the quality control line. **5)** The gate returns to its normal position when the 2-second time period ends. **6)** The counter reaches 0 and continues to accumulate counts. **7)** A RESET pushbutton is provided to reset the counter manually.  **OR** For the stepper motor, consider minimum step angle is 1o and the pulse train to run the motor is generated by the PLC. a) How many pulses are required to rotate the motor through 10 complete revolutions? b) If it is desired to rotate the motor at a speed of 25 rev/min, what pulse rate must be generated by the robot controller? Write a ladder logic program to rotate the stepper motor 10 times clockwise and 10 times in a counterclockwise direction.   	**20**	**CO5**