Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: Mechatronics System Design **Semester: VIII**

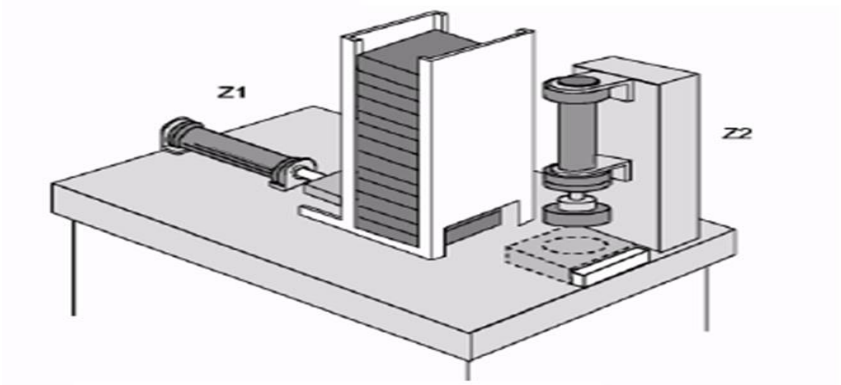
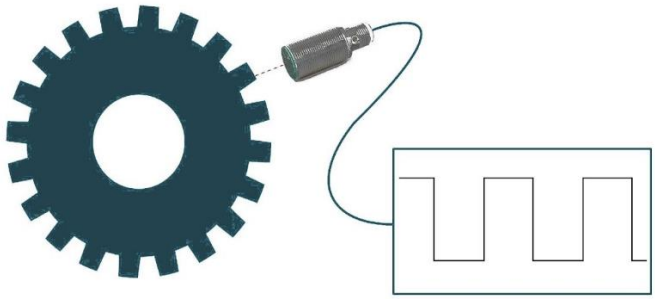
Program: B. Tech (Mechatronics Engineering) **Time : 03 hrs.**

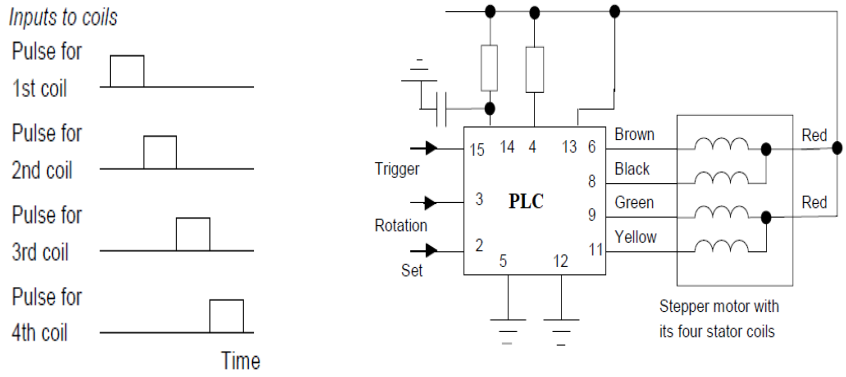
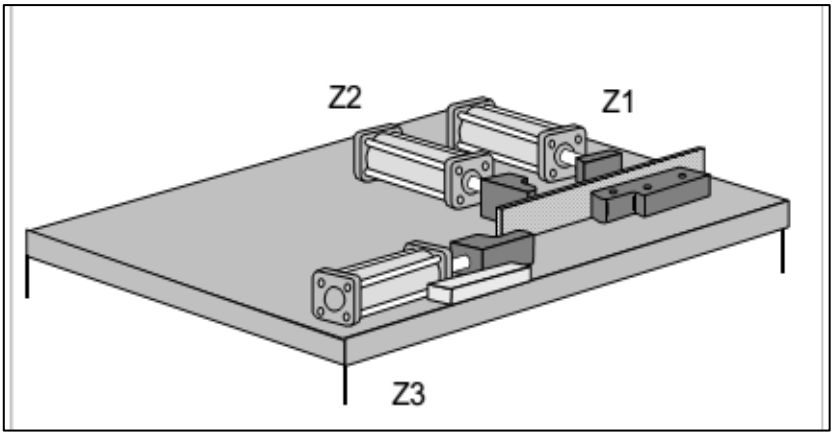
Course Code: MECH 4033 **Max. Marks: 100**

Instructions: All section questions are compulsory.

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	What is meant by a system in mechatronics? List out different applications of mechatronics.	**4**	**CO1**
Q 2	Compare the functions of series-wound DC motor and shunt wound DC motor.	**4**	**CO1**
Q 3	Explain different types of control systems and explain them briefly.	**4**	**CO2**
Q 4	Describe the block diagram modeling method utilized in the design of mechatronics systems.	**4**	**CO3**
Q 5	State the static and dynamic characteristics of the simplified measuring system used in mechatronics system design.	**4**	**CO2**
SECTION B **(4Qx10M= 40 Marks)**			
Q 6	Describe the thermocouple effect, including suitable junction materials, typical temperature ranges, and approximate accuracies for various types of thermocouples. During experiments with a copper-constant thermocouple, it was found that c = 3.75 x 10-2 mV/°C and k =4.50x10-5 mV/°C2. If T1 =100°C and the cold junction T2 is kept in ice, compute the resultant electromotive force developed across the thermocouple. **OR** Compare the control system performance for a mechatronics system with convention control and a system with PLC/Microcontroller control.	**10**	**CO5**
Q 7	Design a pneumatic circuit and relay logic circuit for the stamping device shown in the below figure. After actuating the start button switch sequence will execute. Assume 2nd cylinder Z2 requires 1.5 minutes to do stamping work. Also, assume all cylinder's default position is the home position. Consider a 5/2 spring return directional control valve. (Hint: Seq is A + B + A - B -)	**10**	**CO3**

	 Example: Stamping Device		
Q 8	Illustrate the operation of an RPM sensor alongside a concise diagram and elucidate its principle of operation. Elaborate on the sensor's utility in determining the rotational speed of a system. In the provided scenario, a tachometer incorporates a magnetic pulse sensor positioned adjacent to an iron gear affixed to an engine flywheel, as depicted in the accompanying figure. The gear comprises 30 teeth. Given that the pulse readout registers 25 pulses every half-second, compute the RPM of the motor shaft. 	**10**	**CO4**
Q 9	What are the stages in designing a mechatronics system? Explain each stage in designing a mechatronics system with proper examples.	**10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	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 program to rotate the stepper motor 10 times clockwise and 10 times in a counterclockwise direction.	**20**	**CO5**

			
Q 11	Design a mechatronics system for a bottling system where bottles are segregated by height when moving on a conveyor system. Explain the different parts required for the process in detail with a neat sketch. **OR** The bending device for sheet metal parts is 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. For the above sequence design draw a pneumatic circuit and relay logic circuit shown in the below figure. Assume all cylinder default position is home position. Consider a 5/2 impulse directional control valve. 	**20**	**CO4**