Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2025

MECHANICAL ENGINEERING
Semester - VII
ME5752 Mechatronics
(Regulation 2019)

Time: 3 hrs | Max.Marks: 100

CO 1	Identify suitable sensors to develop mechatronics systems
CO 2	Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs
CO 3	Devise appropriate interfacing circuits to connect I/O devices with microprocessor
CO 4	Implement PLC as a controller in a mechatronics system
CO 5	Design an apt mechatronics system for a real time application

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	Why is signal conditioning important in measurement systems?	2	1	2
2	How can the dynamic response of a sensor affect system performance?	2	1	2
3	What is the function of the HOLD pin in the 8085 microprocessor, and how does the processor respond when a HOLD request is received during its operation?	2	2	2
4	How does the 8085 microprocessor differentiate between memory and I/O devices?	2	2	2
5	How does Mode 2 operation of the 8255 PPI differ from Mode 1?	2	3	2
6	While the microprocessor acts as the central processing unit in a control system, why is the 8255 PPI (Programmable Peripheral Interface) required for controlling I/O devices?	2	3	2
7	What is the significance of scan time in a PLC system?	2	4	2
8	What do internal relays refer to in the context of PLC programming?	2	4	2
9	What factors determine the resolution of a servo motor in a motion control system?	2	5	2
10	How does the use of simulation tools benefit the mechatronics system design process?	2	5	2

PART- B (5 x 13 = 65 Marks)

Q. No.	Questions	Marks	CO	BL
11 (a)	Discuss the working principles of potentiometers and capacitive displacement sensors, and evaluate their suitability for different industrial applications.	13	1	3
	OR			

Q. No.	Questions	Marks	CO	BL
11 (b)	Explain the working principles of incremental and absolute shaft encoders with suitable disc schematics. Based on their operational characteristics, recommend the more appropriate encoder for a system that must retain accurate position information after a power failure, and justify your choice.	**13**	1	3
12 (a)	Draw the architecture of the 8085 microprocessor and explain its 16-bit registers.	**13**	2	2
	OR			
12 (b)	Depict the timing diagram of the XTHL instruction. The contents of Stack pointer, HL register pair and Stack top are $CADD_H$, $DARE_H$ and $CAGE_H$ respectively.	**13**	2	2
13 (a)	How can one efficiently generate triangular pulses using a microprocessor? Please provide a detailed explanation of the required hardware setup and the corresponding assembly language program.	**13**	3	3
	OR			
13 (b)	Design an interfacing circuit for a microprocessor-based system that displays four digits on a 7-segment LED display by using multiplexer.	**13**	3	3
14 (a)	Design an automatic water pump control system using a PLC. The system should be designed to automatically turn on the pump when the low-level sensor detects that the water level is below a set threshold. The pump should run for exactly 5 minutes, after which the pump turns off, regardless of whether the water level has risen or not. However, if the water level rises to the high-level sensor within those 5 minutes, the pump should turn off immediately.	**13**	4	3
	OR			
14 (b)	In a production line, design a PLC-based counting system where items move along a conveyor belt and are alternately directed into two lanes: Lane A and Lane B. The system should send 50 items to Lane A and then 30 items to Lane B, repeating this cycle continuously. A sensor counts each item as it passes, and the PLC controls the lane diverter to direct items accordingly.	**13**	4	3
15 (a)	Explain how to design a microprocessor-based control system to move a robot's rotary joint using a stepper motor.	**13**	5	3
	OR			
15 (b)	Design and formulate a car engine management system using a microprocessor as a controller.	**13**	5	3

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16 (a)	Explain how you would design a closed-loop temperature control system for a metal casting process using a microprocessor. What strategies would you implement to overcome challenges such as sensor drift, electrical noise, and the ability of the sensor to withstand the extreme conditions of molten metal without being damaged, ensuring accurate and reliable operation in high-temperature industrial environments.	**15**	3	6