

## MECHATRONICS

<b>Course Code</b>	22MEMD2T6B	<b>Year</b>	I	<b>Semester</b>	II
<b>Course Category</b>	Programme Elective	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits</b>	4	<b>L-T-P</b>	4-0-0	<b>Prerequisites</b>	
<b>Continuous Internal Evaluation:</b>	40	<b>Semester End Evaluation:</b>	60	<b>Total Marks:</b>	100

**Course outcomes:** At the end of the course, the student will be able to:

CO	Statement	BTL	Units
CO1	Understand the fundamentals of mechatronics systems in a synergistic framework	L2	1
CO2	Select appropriate sensors and transducers to devise an instrumentation system for collecting information	L3	2
CO3	Design a control system for effective functioning of Mechatronics systems using digital electronics, microprocessors, microcontrollers and Programmable logic controllers	L4	3
CO4	Determine the performance of a Mechatronics system	L3	4

**Contribution of Course outcomes towards achievement of programme outcomes & Strength of correlations (High:3, Medium: 2, Low:1)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	1	1				1				2	1
CO 2	3	3	2	1	1				1				2	1
CO 3	3	3	2	1	1				1				2	1
CO 4	3	3	2	1	1				1				2	1

<b>Syllabus</b>		
<b>Unit</b>	<b>Contents</b>	<b>Mapped CO</b>
<b>1</b>	OVERVIEW OF MECHATRONICS: History of Mechatronics, Scope and Significance of Mechatronics systems, elements of mechatronics systems, needs and benefits of mechatronics in manufacturing. CASE STUDIES: Design of pick and place robot, Barcode, Washing machine, Car engine management system, automated manufacturing system, Automatic camera, Automatic parking system, Safety devices and systems.	<b>CO1</b>
<b>2</b>	SENSORS: Classification of sensors basic working principles, Displacement	<b>CO2</b>

	<p>Sensor -Linear and rotary potentiometers, LVDT and RVDT, incremental and absolute encoders. Strain gauges. Force/Torque –Load cells. Temperature – Thermocouple, Bimetallic Strips, Thermistor, RTD, Accelerometers, Velocity sensors –Tachometers, Proximity and Range sensors –Eddy current sensor, ultrasonic sensor, laser interferometer transducer, Hall Effect sensor, inductive proximity switch. Light sensors –Photodiodes, phototransistors, Flow sensors –Ultrasonic sensor, laser Doppler anemometer tactile sensors –PVDF tactile sensor, micro-switch and reed switch Piezoelectric sensors, vision sensor.</p> <p>ACTUATORS: Electrical Actuators: Solenoids, relays, diodes, Thyristors, Triacs, BJT, FET, DC motor, Servo motor, BLDC Motor, AC Motor, stepper motors. Hydraulic &amp; Pneumatic devices – Power supplies, valves, cylinder sequencing. Design of Hydraulic &amp; Pneumatic circuits. Piezoelectric actuators, Shape memory alloys.</p>	
3	<p>DIGITAL ELECTRONICS: Number systems, BCD codes and arithmetic, Gray codes, self-complimenting codes, Error detection and correction principles. Boolean functions using Karnaugh map, Design of combinational circuits, Design of arithmetic circuits. Design of Code converters, Encoders and decoders. SIGNAL CONDITIONING: Operational amplifiers, inverting amplifier, differential amplifier, Protection, comparator, filters, Multiplexer, Pulse width Modulation Counters, decoders. Data acquisition – Quantizing theory, Analog to digital conversion, digital to analog conversion. CONTROLLERS: Classification of control systems, Feedback, closed loop and open loop systems, Continuous and discrete processes, control modes, Two step Proportional, Derivative, Integral, PID controllers.</p>	CO3
4	<p>PLC PROGRAMMING: PLC Principles of operation PLC sizes PLC hardware components I/O section Analog I/O section Analog I/O modules, digital I/O modules CPU Processor memory module Programming. Ladder Programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output. Application on real time industrial automation systems BASIC SYSTEM MODELS &amp; ANALYSIS: Modelling of one and two degrees of freedom Mechanical, Electrical, Fluid and thermal systems, Block diagram representations for these systems. Dynamic Responses of System: Transfer function, Modelling Dynamic systems, first order systems, second order systems.</p>	CO4

### Learning Resources

**Text Book(s):**

1. Mechatronics, (5th edition) by W. Bolton, Addison, Wesley Longman Ltd, 2010
2. Introduction to Mechatronics and Measurement systems (4th edition) by Alciatore David G & Histan Michael B, Tata McGraw Hill, 2006

**References:**

1. Introduction to Robotics Analysis, Systems (2nd edition), Applications by Saeed B Niku, Pearson Education India, PHI, 2003.
2. Mechatronics System Design (3rd edition) by Devdas Shetty & Richard Kolk, PWS Publishing, 2009.