Program : **Diploma in Mechanical Engineering / Tool and Die Engineering / Manufacturing Technology**	
Course Code : **6021A**	Course Title: **Mechatronics**
Semester : **6**	Credits: **4**
Course Category: **Program Elective**	
Periods per week: **4 (L:3 T:1 P:0)**	Periods per semester: **60**

Course Objectives:

- To provide knowledge about mechatronics in manufacturing systems and industries.
- To identify various mechanical, hydraulic, pneumatic, and electrical actuation systems, as well as various types of sensors and their applications.
- To gain an understanding of digital communications concepts and to create PLC programs.
- To Familiarize with the principles, characteristics, and applications of robotics and automation systems.

Course Prerequisites:

Topic	Course code	Course name	Semester
Knowledge of basic Fluid mechanics & Fluid power.		Fluid mechanics & Fluid Power	3
Knowledge of basic Electrical & Electronics		Fundamentals of Electrical engineering	3

Course Outcomes:

On completion of the course, the students will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Describe various types of sensors and their applications.	13	Understanding
CO2	Explain the various mechanical, hydraulic, pneumatic, and electrical actuation systems.	16	Understanding

CO3	Explain the basic PLC architecture and PLC programming concepts.	15	Applying
CO4	Describe automation & and robotics systems with specific emphasis on robotic design factors	14	Applying
	Series Test	2	

CO – PO Mapping:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						2
CO2	2						2
CO3	3						2
CO4	3						2

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline:

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Describe various types of sensors and their applications.**		
M1.01	Explain the Importance of Mechatronics and its applications in modern industries.	2	Understanding
M1.02	Familiarize Control systems and their types; Open and Closed-loop control System; Measurement systems; and Measurement System terminology.	3	Understanding
M1.03	Identify Different types of sensors	4	Understanding
M1.04	Explain the Selection of sensors	1	Understanding
M1.05	Identify the Application of sensors and controllers in washingmachines and automatic water level controllers.	3	Understanding

Contents:
Mechatronics; Importance of Mechatronics and its applications in modern industries; Control systems and their types; Open and Closed-loop control Systems; Measurement systems; Measurement System terminology – Sensors-different types - Displacement, Position & Proximity Sensors; Force Sensors; Fluid ; Flow Sensors; Liquid Level Sensors; Temperature Sensors; Selection of Sensors. Application of sensors and controllers in the washing machine and automatic water level controller.

CO2	**Explain the various mechanical, hydraulic, pneumatic and electrical actuation systems.**		
M 2.01	Introduce Mechanical actuators - kinematic chain, Geneva mechanism, and Mechanical aspects of motor selection.	2	Understanding
M 2.02	Familiarize Hydraulic and Pneumatic System, - power supply layout- Control valves: Directional control valves-spool valve, poppet valve- pilot operated valve - directional valve	3	Understanding
M 2.03	Familiarize Pressure control valves -pressure regulating valves -pressure limiting valves and pressure sequence valves- Flow control valves	2	Understanding
M 2.04	Identifying different types of Cylinders. - Single-acting and double acting - cylinder sequencing	2	Understanding
M 2.05	Familiarize Process control valve - diaphragm actuators - rotaryactuators. Semi rotary actuators.	2	Understanding
M 2.06	Describe Electrical actuation systems: mechanical switches-Relays, solid state switches - diodes - thyristors - triacs - bipolar transistors, Solenoids.	3	Understanding
M2.07	Explain the Working principle of Stepper motors.	1	Understanding
M2.08	Discuss the application of lift operation (Basic only).	1	Understanding
	Series Test – I	1	

Contents:

Mechanical actuators - kinematic chain, Geneva mechanism, Mechanical aspects of motor selection. Hydraulic and Pneumatic System, -power supply layout- Control valves: Directional control valves- spool valve, poppet valve- pilot operated valve -directional valve,Pressure control valves -pressure regulating valve -pressure limiting valve, and pressure sequence valves. Flow control valves. Cylinders. - Single-acting and double-acting -cylinder sequencing- Process control valve - diaphragm actuators - rotary actuators. Semi rotary actuators. Electrical actuation systems: mechanical switches- Relays, solid state switches - diodes -thyristors - triacs - bipolar transistors, Solenoids- working principle of Stepper motors. Application of lift operation (Basic only).

CO3	**Explain the basic PLC architecture and PLC programming concepts.**		
M3.01	Explain Programmable Logic Controller (PLC): - Basic block diagram of PLC.	2	Understanding
M3.02	Discuss Input/output processing; PLC Programming: Ladder diagram, its logic functions, Latching andSequencing.	3	Applying
M3.03	Familiarize PLC mnemonics.	2	Understanding

M3.04	Discuss Timers, Internal relays and Counters; Shiftregisters; Master and Jump Controls.	3	Understanding
M3.05	Explain Data handling; Analog input/output; and Selection of PLC.	2	Applying
M3.06	Discuss about Timed switch, Wind-screen wiper motion, Bathroom scale; Arduino board, Raspberry Pi board, and its basic application.	3	Understanding

Contents:

Programmable Logic Controller (PLC): Definition; Basic block diagram of PLC; Input/output processing; PLC Programming: Ladder diagram, its logic functions, Latching and Sequencing; PLC mnemonics; Timers; Internal relays and Counters; Shift registers; Master and Jump Controls; Data handling; Analog input/output; Selection of PLC. Timed switch, Wind-screen wiper motion, Bath room scale; Arduino board, Raspberry Pi board, its basic application.

CO4	**Describe automation & and robotics systems with specific emphasis on robotic design factors.**		
M4.01	Discuss Automation and robotics-robotic Systems - anatomy Classification and its Future Prospects.	2	Understanding
M4.02	Identify Robotic Applications in Manufacturing: Materialtransfer, Machine loading & and unloading.	3	Understanding
M4.03	Discuss Processing operations, Assembly and inspection,Robot Activation, and feedback Components.	3	Understanding
M4.04	Explain Programming for Robots: Methods, Robot designfactors.	3	Applying
M4.05	Identify Case studies of Mechatronics systems: pick-and-place robot and Car park barrier system	3	Understanding
	Series Test – II	1	

Contents:

Automation & Robotics, Robotic System & Anatomy Classification, Future Prospects. Robotic Application in Manufacturing: Material transfer, Machine loading & and unloading, Processing operations, Assembly and inspectors- Robot Activation and feedback Components, Programming for Robots: Methods, Robot design factors. Case studies of Mechatronics systems: A pick-and-place robot, Car park barrier

Text / Reference:

T/R	Book Title/Author
T1	Mechatronics – W. Bolton, Pearson Education India.
R1	A Text Book on Mechatronics – R.K.Rajput, S.Chand& Co, New Delhi.
R2	Mechatronics – M.D.Singh& Joshi, Prentice Hall of India.
R3	Mechatronics – HMT, Tata McGraw Hill, New Delhi.
R4	Mechatronics System – Devadas Shetty, PWS Publishing
R5	Exploring Programmable Logic Controllers with applications – Pradeep Kumar Srivatsava, BPB Publications.

Online Resources:

S.No	Website Link
1	https://youtu.be/zVVITxiec7g
2	https://youtu.be/8Qiy2nf4sp0
3	https://youtu.be/Xl2nWDcy0To
4	https://nptel.ac.in/course.html