GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Machine Design

Subject Code :

Subject Name : Mechatronics

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

Prerequisite:	Zeal to learn the subject
Rationale:	This syllabus is formed to create knowledge in Mechatronic systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives a framework of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Students will be able to understand and apply fundamentals of Mechatronics for various mechanical systems	Understand
2	Students will be able to use various types of sensors and controllers for mechanical application.	Apply
3	Students will be able to analyze hydraulic and pneumatic systems.	Analyze
4	Students will be able to understand fundamentals of automation techniques for mechanical systems.	Apply

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit	Content	No. of	% of

GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Machine Design

Subject Code :

Subject Name : Mechatronics

No.		Hours	Weightage
1.	**Introduction:** Introduction to Mechatronics, need and applications, elements of mechatronic systems, role of mechatronics in automation, manufacturing and product development.	04	8
2.	**Sensors and Feedback Devices:** Importance of sensors in Mechatronics, Static and Dynamic characteristics of sensors,errors and output impedance of sensors, transducers for measurement of displacement, strain, position, velocity, noise, flow, pressure, temperature, humidity, vibration, liquid level, vision sensors.	10	22
3.	**Control Elements and Actuators:** On/off push buttons, control relays, thermal over load relays, contactors, selector switches, solid state switches. Mechanical actuators – types of motion, gear trains, belt and chain drives, screw rods, Electrical actuators, solenoids, DC drives and AC variable frequency drives, AC and DC motors, servomotors, stepper motors, linear motors. Hydraulic and Pneumatic controls, functional diagram - control valves, cylinders and hydro motors.	10	22
4.	**Computational Elements and Controllers:** Basic concepts of control systems – open loop, closed loop, semi closed loop control system, NC-CNC-DNC machines, structure, slideways, guideways etc., components of robots, classification, configurations, applications, linear and rotary encoders, timers, counters, microprocessors and microcontrollers: architecture and pin details, introduction to PLC, simple programs for process control application based on relay ladder logic-Supervisory Control and Data Acquisition Systems (SCADA) and Human Machine Interface (HMI).	10	24
5.	**Interfacing System**: Introduction to interfacing of different hard wares in industry, need for networks in industrial plants, hierarchy and structure of networking, RS 232 based network, Ethernet, TCP/IP, MAP/TOP.	05	12
6.	**Applications of Mechatronic Systems:** Introduction to factory automation and integration, design of simple Mechatronics systems, Case studies based on the application of mechatronics like Pick and place Robot, Conveyor basedmaterial handling system, Mechatronics Control in automated Manufacturing, Data Acquisition, autotronics, bionics and avionics.	06	12
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
-	**10**	**30**	**30**	**20**	**10**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Introduction to Mechatronics, Appu Kuttan K.K.,Oxford University Press
2. Mechatronics: Integrated Mechanical Electronic Systems, G.K. Vijayaraghavan, M.S.Balasundaram K.P. Ramachandran, M S.Wiley India.
3. Mechatronics : Principle, Concepts and Applications, Mahalik N.P., McGraw Hill.
4. Fundamentals of Programmable Logic Controllers, Sensors and Communications, Jon Stenersons, Pearson Prentice Hall, 2004.
5. Mechatronics, Bolton W., Pearson Education.
6. Computer Control of Manufacturing Systems, Yorem Koren, McGraw Hill.
7. Introduction to Mechatronic Design, J E Carryer, R M Ohline and T W Kenny, Pearson

(b) Open-source software and website:

1. NPTEL courses

Suggested Course Practical List:

List of Laboratory/Learning Resources Required:

Experiments should be designed to include the contents of the syllabus. The experiments may also include simulation using Matlab or equivalent platform.

1. Control the single acting and double acting cylinders using pilot valves.
2. Continuous reciprocating of single acting and double acting cylinder using pilot valves.
3. Design a pneumatic circuit for sequencing.
4. Actuation of single acting cylinder using ON and OFF delay timer.
5. Servo motor control using open loop and close loop system.
6. Run the stepper motor at different speed and different direction.
7. PLC control of sequencing circuit using PLC ladder diagram.

Suggested Project List:

Suggested Activities for Students: If any

Major Equipment:

1. PLC trainer kit
2. Hydraulic and Pneumatic kit.

Any Other:

* * * * * * *