COURSE TITLE : INDUSTRIAL AUTOMATION & MECHATRONICS
COURSE CODE : 6025
COURSE CATEGORY : E
PERIODS/ WEEK : 4
PERIODS/ SEMESTER : 60
CREDIT : 4

TIME SCHEDULE

MODULE	TOPIC	PERIODS
1	Industrial Automation. Mechatronics. Traditional design and mechatronic design process.	15
2	Sensors and Transducers	15
3	Control valves Actuators	15
4	Programmable Logic Controller. Fault finding techniques Mechatronic system case study	15
TOTAL		60

COURSE OUTCOME :

sl.no.	sub	student will be able to
1	1	Understand the Industrial Automation and its Applications
	2	Understand the mechatronic system, usage and advantages of mechatronics.
	3	Comprehend the traditional Automation and mechatronic system
2	4	Understand the principles of sensors and transducers.
	5	Comprehend the working of Control valves and actuators
	6	Understand the concepts of Programmable Logic Controllers
3	7	Understand the techniques of Fault finding in mechatronic system
4	8	Comprehend the Mechtronic system approach with case study.

SPECIFIC OUTCOME

MODULE I

1.1.0 Understand the Industrial Automation and its Applications
1.1.1 Define automation
1.1.2 Describe the reasons for automation
1.1.3 Explain the advantage and disadvantages of automation
1.1.4 Explain the fixed, programmable and integrated automation
1.1.5 Describe the basic elements of an automated system
1.1.6 Describe the future challenges of automation
1.2.0 Understand the mechatronic system, usage and advantages of mechatronics
1.2.1 Define Mechatronics

1.2.2 List the advantages and disadvantages of mechatronics
1.2.3 Explain the mechatronic products
1.2.4 Explain the mechatronics block diagram
1.2.5 Describe the application of mechatronics in engineering

1.3.0 Comprehend the traditional Automation and mechatronic system

1.3.1 Explain the traditional Automation system
1.3.2 Explain mechatronic system
1.3.3 Describe the measurement system
1.3.4 Describe elements of measurement system
1.3.5 Describe the elements of control system

1.4.0 Explain the open loop and closed loop control system

1.4.1 Describe the elements of closed loop control system
1.4.2 Distinguish open loop and closed loop control system

1.5.0 Distinguish traditional and Mechatronics design

1.5.1 Describe the elements of product design

MODULE II

2.1.0 Understand the principles of transducers and sensors

2.1.1 Define sensors and transducers
2.1.2 Explain the static and dynamic characteristics
2.1.3 Describe the performance terminology

2.2.0 Describe the displacement, position, proximity sensors

2.2.1 Explain eddy current proximity sensors
2.2.2 Explain the inductive proximity (sensor) switch
2.2.3 Describe the optical encoders
2.2.4 Illustrate the incremental encoders
2.2.5 Explain the absolute encoders
2.2.6 Explain the tachogenerator

2.3.0 Describe the fluid pressure measurement devices

2.3.1 Explain the liquid flow sensors
2.3.2 Explain the liquid level sensors
2.3.3 Illustrate the temperature sensors
2.3.4 Describe light sensors
2.3.5 Explain the selection of sensors

2.4.0 Describe the Inputting data by switches - mechanical switches

2.5.0 Explain the debouncing of mechanical switches.

MODULE III

3.1.0 Comprehend the working of Control valves and actuators

3.1.1 Describe the actuation system
3.1.2 Describe the hydraulic and pneumatic power supplies
3.1.3 Explain the control valves with their symbolic representation
3.1.4 Illustrate the Directional, pressure and flow control valves
3.1.5 Explain the process control valve
3.1.6 Illustrate the pilot operated control valve

3.2.0 Explain the linear actuators

3.2.1 Describe the hydraulic and pneumatic cylinders
3.2.2 Explain the control of single acting and double acting cylinder
3.2.3 Describe the control valve operating a lift system

3.2.4 Explain the pressure sequence valve- A sequencing system

3.3.0 Describe the Sequencing of two double acting cylinder

3.3.1 Describe the rotary actuators

3.3.2 Explain the electrical actuation systems

3.3.3 Explain the mechanical switches

3.3.4 Explain the solid state switches

3.3.5 Explain the basic principles of D C motors A C motors

3.3.6 Describe the Stepper Motor.

MODULE IV

4.1.0 Understand the concepts of Programmable Logic Controllers

4.1.1 Define the programmable logic controller

4.1.2 Describe the features of PLC

4.1.3 Explain the basic components of PLC with block diagram

4.1.4 Explain the input - output processing

4.1.5 List the programming language of PLC

4.1.6 Illustrate the ladder diagram

4.1.7 Explain the mnemonics

4.1.8 Explain the timers - internal relays and counters

4.1.9 Describe the working of shift register

4.1.10 Explain master and jump controls

4.1.11 Describe the data handling

4.1.12 Explain the selection of PLC

4.1.13 Explain the microprocessor and micro controller with block diagram.

4.1.14 Distinguish between microprocessor and micro controller.

4.2.0 Understand the techniques of Fault finding in mechatronic system

4.2.1 Explain the common fault detection techniques with measurement, control system and data communication systems.

4.2.2 Explain the common hardware faults

4.2.3 Describe the Fault detection techniques in microprocessor

4.3.0 Comprehend the Mechatronic system approach with case study

4.3.1 Explain the Possible mechatronic design solutions.

4.3.2 Explain the principle of timed switch and bath room scale.

CONTENT DETAILS

MODULE I

Theory of Mechatronics

Automation - definition – need- advantages- disadvantages of automation- Types - automation fixed- programmable- integrated automation- their advantage - dis advantage - basic elements of an automated system- future challenge of automation

Mechatronics - Definition- advantages- Mechatronic system- mechanical - electrical - electronic -computer system - measurement system – sensor – signal conditioning -display system - control system - Open loop - closed loop system – advantages - disadvantages - open loop - closed loop system - traditional and mechatronic design - elements of design procedure.

MODULE II

Sensors and Transducers:
Sensors - Transducers - Performance terminology- range and span -error - accuracy -sensitivity - hysteresis error - non linearity error - reproducibility - stability - dead band - resolution - output impedance- Displacement- position-proximity sensors - eddy current proximity sensors-inductive proximity sensors–proximity switches-micro switch -reed switch- photo sensitive switch- mechanical switch- optical encoders- incremental - absolute encoders- tachogenerator- fluid pressure measurement devices – diaphragm- bellows -tube pressure sensors - liquid flow sensors - orifice plate- turbine meters - float sensors- temperature sensors -bimetallic strips-resistance temperature detectors - thermistors - thermo couples- light sensors -photo diodes-photo transistors-photo resisters - selection of sensors - inputting data by switches - mechanical switches - debouncing of mechanical switches.

MODULE III

Actuators
Actuation systems -Pneumatic - Hydraulic System- Directional control valves- spool valve- poppet valve - pilot operated valve -directional valve- Pressure control valves -pressure regulating valve -pressure limiting valve -pressure sequence valves- Cylinders- - Single acting and double acting -cylinder sequencing- Process control valve - diaphragm actuators - rotary actuators- semi rotary actuators.

Electrical actuation systems- Electrical systems- mechanical switches- solid state switches -diodes - thyristors - triacs - bipolar transistors- solenoids- action of electric motor- Basic principle- working principle of AC and DC motors- Stepper motors- types- working principle.

MODULE IV

Programmable Logic Controller-definition –block diagram- Input / Output processing - Programming - mnemonics - Timers, internal relays and Counters - shift register - Master and jump controls - Ladder logic circuit -Data handling- selection of PLC – Microprocessor and Microcontrollers – Applications-Mechatronics systems -Fault finding**-** Fault detection techniques - common hardware faults- Possible design solutions -Timed switch - bathroom scales.

TEXT BOOKS

1. Mechatronics Third edition — Bolton- pearson
2. A textbook of mechatronics — R.K.Rajput- Education asia
3. Industrial automation and mechatronics — A.K.Gupta, S.K.Arora- Laxmipublication PVT Ltd

REFERENCES

1. Industrial Automation and Robotics — N. Shanmugam, Anuradha Publications
2. Mechatronics — D. S. Kumar, Satya Prakasan & Tech India Pub