COURSE TITLE : INDUSTRIAL AUTOMATION & MECHATRONICS
COURSE CODE : 6025
COURSE CATEGORY : E
PERIODS/WEEK : 5
PERIODS/SEMESTER : 75
CREDITS : 5

TIME SCHEDULE

Module	Topic	Periods
1	Industrial Automation Mechatronics. Traditional design and mechatronic design process.	18
2	Sensors and Transducers	18
3	Control valves Actuators	18
4	Programmable Logic Controller. Fault finding techniques Mechatronic system case study	21
TOTAL		**75**

COURSE OUTCOME

Sl.No.	Student will be able to
1	Understand Industrial Automation and its Applications
2	Understand the mechatronic system, usage and advantages of mechatronics.
3	Comprehend the traditional Automation and mechatronic system
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
7	Understand the techniques of Fault finding in mechatronic system
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 reasons for automation
- 1.1.3 Explain the advantage and disadvantages of automation
- 1.1.4 Explain fixed, programmable and integrated automation
- 1.1.5 Describe basic elements of an automated system
- 1.1.6 Describe 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 mechatronic products
- 1.2.4 Explain 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 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 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 inductive proximity (sensor) switch
- 2.2.3 Explain optical encoders
- 2.2.4 Explain incremental encoders
- 2.2.5 Explain absolute encoders
- 2.2.6 Explain tachogenerator

2.3.0 Describe the fluid pressure measurement devices

- 2.3.1 Explain liquid flow sensors
- 2.3.2 Explain liquid level sensors
- 2.3.3 Explain temperature sensors
- 2.3.4 Explain light sensors

2.3.5 Explain the selection of sensors
2.4.0 Inputting data by switches - mechanical switches.
2.5.0 Explain 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 hydraulic and pneumatic power supplies
3.1.3 Explain control valves with their symbolic representation
3.1.4 Explain directional, pressure and flow control valves
3.1.5 Explain process control valve
3.1.6 Explain pilot operated control valve

3.2.0 Explain linear actuators

3.2.1 Describe the hydraulic and pneumatic cylinders
3.2.2 Explain control of single acting and double acting cylinder
3.2.3 Explain control valve operating a lift system
3.2.4 Explain pressure sequence valve- A sequencing system
3.2.5 Describe Sequencing of two double acting cylinder
3.2.6 Describe rotary actuators

3.3.0 Explain electrical actuation systems

3.3.1 Explain mechanical switches
3.3.2 Explain solid state switches
3.3.3 Explain basic principles of D C motors A C motors

MODULE IV

4.1.0 Understand the concepts of Programmable Logic Controllers

4.1.1 Define the programmable logic controller
4.1.2 Describe features of PLC
4.1.3 Explain the basic components of PLC with block diagram
4.1.4 Explain input - output processing
4.1.5 List the programming language of PLC
4.1.6 Explain ladder diagram
4.1.7 Explain mnemonics
4.1.8 Explain timers - internal relays and counters
4.1.9 Explain working of shift register
4.1.10 Explain master and jump controls
4.1.11 Explain data handling
4.1.12 Explain selection of PLC
4.1.13 Explain 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 common fault detection techniques with measurement, control system and Data communication systems.
4.2.2 Explain 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 and disadvantages of automation-Types of automation fixed, programmable and integrated automation-their advantage and disadvantage -basic elements of an automated system- future challenge of automation-

Mechatronics - Definition-advantages-Mechatronic system-mechanical, electrical, electronic and computer system-measurement system-sensor ,signal conditioning and display system-control system-Open loop and close loop system- advantages and dis advantages of open loop and closed loop system.

Traditional and mechatronic design -elements of design procedure

MODULE- II

Sensors and Transducers:

Sensors and Transducers - Performance terminology- range and span -error - accuracy - sensitivity - hysteresis error - non linearity error - reproducibility - stability - dead band - resolution and output impedance. Displacement, position and proximity sensors - eddy current proximity sensors, inductive proximity sensors –proximity switches -micro switch ,reed switch, photo sensitive switch and mechanical switch- optical encoders- incremental and absolute encoders- tachogenerator- fluid pressure measurement devices - diaphragm, bellows and 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 and photo resistors - selection of sensors - inputting data by switches - mechanical switches - debouncing of mechanical switches

MODULE III

Actuators

Actuation systems ,Pneumatic and Hydraulic System , 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. 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 .Basic principle , working principle of AC and DC motors, principle of working, and types of Stepper motors.

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 and Fault finding
Fault finding - Fault detection techniques - common hardware faults. - Possible design solutions -Timed switch - bathroom scales.
Course Content **Describe Stepper Motor.**

TEXT BOOKS

1. Bolton - Mechatronics - Pearson Third edition
2. R.K.Rajput - A textbook of mechatronics - Education asia.
3. A.K.Gupta, S.K.Arora - Industrial automation and mechatronics - Laxmipublication PVT Ltd.
4. Ganesh hedge - Mechatronics - Laxmi publication PVT Ltd.

REFERENCES

Kushdeep Goyal & Deepak Bandari - Industrial Automation & Robotics-S.K.Kataria & sons
K.P.Ramachandran – Mechatronics – wiley India Pvt Ltd - E.K.Vijayaraghavan- Mechatronics in Manufacturing System- John wiley and sons R.Theagaraj- Microprocessor and Micro controller- Scitech Publications.
N. Shanmugam- Mechatronics- , Anuradha Publications
D. S. Kumar, Satya Prakasan & Tech India Pub.
Bolton - Mechatronics, Pearson Education Asia ThirdEdition -