

COURSE TITLE : **INDUSTRIAL AUTOMATION AND MECHATRONICS**
COURSE CODE : **5027**
COURSE CATEGORY : **E**
PERIODS/WEEK : **4**
PERIODS/SEMESTER : **72**
CREDITS : **4**

TIME SCHEDULE

| MODULE | TOPICS | PERIODS |
|---------------|--|----------------|
| 1 | Introduction to Mechatronics | 17 |
| | Test I | 1 |
| 2 | Sensors and Transducers | 17 |
| | Test II | 1 |
| 3 | Actuators | 17 |
| | Test III | 1 |
| 4 | Programmable Logic controls Mechatronic systems | 17 |
| | Test IV | 1 |
| | Total | 72 |

OBJECTIVES

MODULE I

1.1.0 Introduction to Mechatronics

- 1.1.1 Define automation
- 1.1.2 Explain the advantage and disadvantages of automation
- 1.1.3 Explain fixed , programmable and integrated automation
- 1.1.3 Define mechatronics
- 1.1.4 Explain advantages of mechatronics
- 1.1.5 Explain mechatronic system
- 1.1.6 Explain measurement system and control system
- 1.1.7 Explain open loop and closed loop system
- 1.1.8 Distinguish traditional and Mechatronics design
- 1.1.9 Explain the elements of product design.

MODULE II

2.1.0 Understand sensors and transducers

- 2.1.1 Describe the performance terminology
- 2.1.2 Explain static and dynamic characteristics
- 2.1.3 Explain displacement, position, proximity
- 2.1.4 Explain eddy current proximity sensors
- 2.1.5 Explain inductive proximity switch
- 2.1.6 Explain optical encoders
- 2.1.7 Explain incremental encoders
- 2.1.8 Explain tachogenerator
- 2.1.9 Explain fluid pressure measurement devices
- 2.1.10 Explain liquid flow sensors
- 2.1.11 Explain liquid level sensors
- 2.1.12 Explain temperature sensors
- 2.1.13 Explain light sensors
- 2.1.14 Explain the selection of sensors
- 2.1.15 Inputting data by switches – mechanical switches
- 2.1.16 Explain debouncing of mechanical switches.

MODULE III

3.1.0 Understand actuators

- 3.1.1 Explain actuation system
- 3.1.2 Explain hydraulic and pneumatic power supplies
- 3.1.3 Explain direction control valves
- 3.1.4 Explain pressure control valves
- 3.1.5 Explain hydraulic and pneumatic cylinders.- single acting and double acting – cylinder sequencing.
- 3.1.6 Explain process control valve.
- 3.1.7 Explain electrical actuation systems
- 3.1.8 Explain solid state switches .
- 3.1.9 Explain solenoid principle of working.
- 3.1.10 Explain basic principles of D C motors A C motors and Stepper Motor.

MODULE IV

4.1.0 Programmable Logic Control

- 4.1.1 Understand programmable logic control.
- 4.1.2 Explain the basic structure – input – output processing
- 4.1.3 Explain ladder diagram
- 4.1.4 Explain mnemonics
- 4.1.5 Explain timers – internal relays and counters
- 4.1.6 Explain working of shift register
- 4.1.7 Explain master and jump controls
- 4.1.8 Explain data handling
- 4.1.9 Explain selection of PLC
- 4.1.10 Explain micro controller functions – 8051

4.2.0 Understand Mechatronics systems

- 4.2.1 Explain fault detection techniques
- 4.2.2 Explain common hardware faults
- 4.2.3 Describe possible design solutions
- 4.2.4 Explain timed switch
- 4.2.5 Explain bath room scale.

CONTENT OUTLINE

MODULE I

Theory of Mechatronics

Automation – definition – need, advantages and disadvantages of automation-Types of automation.

Mechatronics – Definition-advantages-Mechatronic system-measurement and control system-Open loop and close 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 out put impedance. Displacement, position and proximity sensors – eddy current proximity sensors, inductive proximity sensors -optical encoders- incremental encoders tachogenerators- 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.

Electrical actuation systems: Electrical systems, mechanical switches, solid state switches -diodes – thyristors – triacs – bipolar transistors, solenoids
principle of working, types, specification and control of DC motor – AC motors , Stepper motors.

MODULE IV

Programmable Logic Controller

Basic structure – Input / Output processing – Programming – mnemonics – Timers, internal relays and Counters – shift register – Master and jump controls – Ladder logic circuit -Data handling– selection of PLC – Microcontrollers and applications.

Mechatronics systems and Fault finding

Fault finding - Fault detection techniques – common hardware faults.- Possible design solutions – Timed switch - bathroom scales.

TEXT BOOKS

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|--------------------------------|------------------------------------|
| 1. Mechatronics ,Third Edition | - W.Bolton –Pearson Education Asia |
| 2. A Text book of Mechatronic | - R.K Rajput |

REFERENCES:

- | | |
|---|---|
| 1. Industrial Automation and Robotics | - Kushdeep Goyal and Deepak Bandari. |
| 2. Mecchatronics | - K.P.Ramachandran and E.K.Vijayaraghavan |
| 3. Mechatronics | - N. Shanmugam, Anuradha Publications |
| 4. Mechatronics in Manufacturing System | - D. S. Kumar, Satya Prakasan & Tech India Pub. |
| 5 .Microprocessor and Micro controller | - By R.Theagaraja – Scitech Publications. |
| 6. Micro controller and application | - By Dr. R.Theagaraja – Scitech Publications. |