



# ANDHRA UNIVERSITY

## TRANS-DISCIPLINARY RESEARCH HUB

### MECHATRONICS

#### UNIT I

**Introduction to Mechatronics:** What is mechatronics, integrated design issues in mechatronics, Mechatronics key elements, the mechatronics design process, advanced approaches in mechatronics, Examples of mechatronics systems.

**Sensors and transducers:** Sensors and transducers, Selection of sensors, Performance terminology, Displacement, position, tactile and proximity, Velocity and motion, Force and torque, Fluid pressure, Liquid flow, Liquid level, Temperature and Light sensors.

#### UNIT II

**Actuation systems:** Pneumatic and hydraulic systems - Control Valves, Cylinders, Rotary actuators - Mechanical Actuation systems: Types of motion, Kinematic chains, Cams, Gears, Ratchet and pawl - Electrical Actuation systems: Mechanical switches, Solid-state switches, Solenoids-Stepper Motors - DC brushed motors – DC brushless motors - DC servo motors - 4-quadrant servo drives, PWM's - Pulse Width Modulation – Variable Frequency Drives- Electro-pneumatic Actuation Systems - Electro-hydraulic Actuation Systems.

#### UNIT III

**Microcontrollers:** 8051 Microcontroller ,micro processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications.

**Programmable Logic Controllers :** Basic Structure - Programming : Ladder diagram - Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling - Analog input / output - PLC Selection - Application.

#### UNIT IV

**Basic System Models:** System building blocks- Mechanical, Electrical, Fluid and thermal. System transfer functions- First and second order systems, Frequency response.

**Signal conditioning:** The operational amplifier, digital signals: Digital Signal Processing – Low pass , high pass , notch filtering, analogue and digital signals, D to A and A to D converters- Filtering Noise using passive components – Resistors, capacitors

#### UNIT IV

**Data presentation elements:** Magnetic and optical recording, Displays, Data acquisition and measurement systems, Testing and calibration.

**Advanced applications in mechatronics-Case studies:** A pick-and – place robot, Car park barriers, Digital Camera, Car engine management, bar code reader

#### Text Book:

1. Mechatronics -Electronic control systems in mechanical and electrical engineering by William Bolton, Pearson Education, Asia, XI-Edition, 2013.
2. Mechatronics System Design by DevdasShetty and Richard A. Kolk, P.W.S. Publishing Company, 2001.
3. A text book of Mechatronics by Er.R.K. RAJPUT ., S.CHAND publications.

#### References:

1. Introduction to Mechatronics and Measurement Systems by David G. Alciatore and Michael B. Hstand, Tata McGraw Hill Company Ltd.
2. A text book of Mechatronics by NitalgourPremchandMahalik ., McGraw Hill publications.



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MODEL QUESTION PAPER

## MECHATRONICS

**Time: 3 Hours**

**Max. Marks: 100**

Answer Any **FIVE** questions only

All Questions Carry Equal Marks

- 1 a. What is mechatronics? What are the key elements in mechatronics? Explain? 10  
b. Describe the working principle of LVDT with neat diagrams? Mention its applications? 10
- 2 a. What are the elements in Electro-pneumatic actuation system? Explain their functions with neat diagrams? 10  
b. How the gears and cams are acting as actuating device? Explain? 10
- 3 a. Describe the structure of microprocessor with neat diagram? 10  
b. Explain, how the PLC are selected? Mention its applications? 10
- 4 a. Describe the principle of low pass , high pass , notch filtering with neat diagrams? 10  
b. A system has an output  $x$  which varies with time when subject to a step input of  $y$  and is described by  
$$\frac{d^2x}{dt^2} + 10\frac{dx}{dt} + 25x = 50y$$
  
What is i. The undamped frequency, ii The damping ratio
- 5 a. What are the different types of displays? Explain? 10  
b. Describe the working of pick-and – place robot with neat diagram? 10
- 6 a. What is a strain gauge and strain gauge factor? How the strain gauges are used to measure the force? Explain with neat diagrams? 10  
b. What are the different timers? Explain? 10
- 7 a. Describe the working of DC servomotor with neat diagrams? Mention their applications? 10  
b. What are the different types of mechanical switches used for actuation? Explain? 10
- 8 a. Describe principle of operation of hot wire anemometer with neat diagrams? 10  
b. How the digital signals are converted to analog signals? Explain? 10