NIRMA UNIVERSITY

Institute:	**Institute of Technology**
Name of Programme:	**B. Tech. in Electrical Engineering**
Semester:	**V**
Course Code:	**3EE311ME26**
Course Title:	**Applied Electronics and Instrumentation**
Course Type:	**Department Elective – I**
Year of Introduction:	**2025 –26**

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Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to -

1. imbibe the layout, structure and operation of electronic systems (BL4)
2. design sensor based electronic systems (BL5)
3. interface of PLC and microcontroller-based electronic systems (BL4)
4. develop motion control circuits (BL6)

Unit	Contents	Teaching Hours (Total 45)
Unit-I	**Basic Building Blocks of Electronic Systems** Overview of electronic systems: block diagram representation highlighting input, processing, output, and feedback stages, power supply units: fundamentals of signal conditioning circuits	**6**
Unit-II	**Sensors and Interfacing** Introduction to sensors, signal conditioning, interfacing of sensors: voltage, current, temperature, displacement, speed and torque sensors, encoders: types, construction, operation and interfacing, interfacing of auxiliaries with microcontrollers, design examples on temperature, speed, displacement controllers	**12**
Unit-III	**Advanced Sensors and Instrumentation** Introduction to IMU technology: smart phones and wearables, inertial sensing: accelerometers, signal processing and Kalman filtering, gyro for angular motion sensing, gyro-based circuit implementation	**7**
Unit-IV	**Electronic Circuit Protection** Overvoltage and undervoltage protection, overcurrent protection, reverse polarity protection, short circuit protection, ESD protection, inrush current protection, surge protection	**6**
Unit-V	**PLC, Data Acquisition and Communication Protocols** Introduction to PLC, types of PLC and basic architecture, PLC operation, ladder logic, logic functions, basic relay instructions,	**9**

timer/counter instructions, introduction of SCADA, selection criteria for SCADA, hardware selection for SCADA, communication protocols, USB, RS-232, RS-485, ethernet, CAN, Modbus, I2C, SPI, DNP3, Modbus, Profibus, industrial ethernet overview, TCP/IP overview

Unit-VI **Electronic Motion Control** **5**

Overview, working and performance characteristics servo motor and stepper motor, Driver and control circuit: Armature and field control of dc motor, step control of stepper motor and angle control of servo motor using microcontroller.

Self-Study: The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings/ References:

- Paul Horowitz and Winfield Hill, *The Art of Electronics*, , Cambridge University Press
- Ernest O. Doebelin*, Measurement Systems: Application and Design*, , McGraw Hill
- Dave S. Steinberg, *Cooling Techniques for Electronic Equipment*, Wiley-Interscience
- John W. Webb and Ronald A. Reis, *Programmable Logic Controllers: Principles and Applications*, , Pearson
- John-David Warren, Josh Adams, Harald Molle, *Arduino Robotics (Technology in Action)*, Apress,
- Tero Karvinen, Kimmo Karvinen, and Ville Valtokari, *Make: Sensors*, , Make Community LLC
- Jacob Fraden*, Handbook of Modern Sensors: Physics, Design and Implementation*, , Springer

Suggested List of Experiments: Laboratory work will be based on the above syllabus with a minimum 10 experiments to be incorporated. The students in a suitable group size will design and perform one experiment as a part of laboratory work.

Sr. No.	Name of Experiment	Hours
1.	Design and test op-amp-based active filters (LPF/HPF).	2
2.	Design a BCD to 7-segment display decoder.	2
3.	Develop Arduino based sensor data acquisition system.	2
4.	Interfacing of ADC/DAC with Arduino.	2
5.	Build a regulated power supply circuit with IC 78xx/79xx.	2
6.	Interfacing of Inertial Sensor: Accelerometer with Microcontroller.	2
7.	Interfacing of Inertial Sensor: Gyro with Microcontroller.	
8.	Design a temperature controlled DC Fan with Ardurino.	4
9.	Design a position control of Sevomotor with Ardurino.	4
10.	Design a Speed Control of Stepper Motor.	4
11.	Design an electronic control of room light.	4