Analog System

Semester- III	Subject Code: BS31606	Lectures: 60

Objectives:

The syllabus aims in equipping the students,

- To understand basics of analog electronics
- To study different types of sensors and discuss their role in electrical and electronic system.
- To understand different types of signal conditioning circuits
- Discuss the need for interfacing circuitry to make the signals produced by sensors, compatible with the system to which they are connected.
- To learn data conversion techniques
- To apply knowledge of analog systems in different applications

Unit 1: Analog Electronic System	14

- Introduction of analog electronic systems. Definition of sensors and transducers. Classification of sensors: Active and passive sensors.
- Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility.
- Temperature sensors LM-35, Thermocouple, pH sensor, optical sensor (LDR), Passive Infrared sensor (PIR), Accelerometer sensor, LVDT, tilt sensor, touch screen sensor(Capacitive type), ultrasonic sensor.

Unit 2: Signal Conditioning	14

- Introduction to signal conditioning, Signal conditioning of passive sensors using Wheatstone 's bridge, Level Shifter,
  Amplification: Inverting and non inverting Amplifier.
  Instrumentation amplifier: Three OP-amp configurations.
- Filters: active and passive filters, Concept of Order of filters.
  Working principle of Single order Op-Amp based Low Pass Filter, High Pass Filter, Band Pass Filter, Notch Filter, and Band reject filter.

Unit 3: Data Converters	**12**
• Need of data convertors. • Digital to Analog Converter (DAC): Resistive divider, R-2R ladder, Parameters: Linearity, resolution, accuracy, full-scale output voltage. • Analog to Digital Converter (ADC): Types of ADC- Flash, Successive approximation, dual slope, Parameters of ADC: Linearity, resolution, conversion time, accuracy. • Applications of DAC and ADC.	

Unit 4: Case studies	**8**
• Temperature monitoring system using LM35 • Intruder detector system using PIR sensor • Water Level Indicator system using float switch • Electrocardiograph system (ECG).	

***Contact hours – 12 hours**

Recommended Text / Reference Books:

1. Dr. A. D. Shaligram, ***Sensors & Transducers***, CTC publications.
2. Ramakant Gaikwad, ***Op-Amps and Linear Integrated Circuits***, PHI: 4th Ed.
3. H. S. Kalsi, ***Electronic Instrumentation***, TMH: 2nd Ed.
4. Albert D. Helfrick, William D. Cooper, ***Modern Electronic Instrumentation and Measurement Techniques***, PHI publications
5. K.A. Bakshi, A. V. Bakshi and U. A. Bakshi, ***Electronic measurements***, Technical publications.
6. A.K. Sawhney: Dhanpat Rai & Sons, ***A Course in Electrical and Electronic measurements and Instrumentation***, Educational & technical publishers.
7. R. Khandpur, ***Handbook of Biomedical instrumentation***, Tata McGraw Hill Publications 2003.