ELECTRONIC INSTRUMENTATION
DSE (Electronics) Sem III
(For Physics and Electronics as core subjects)

Total Credits: 04 (Credits: Theory: 02, Practical: 02)
Total Hours: Theory: 30, Practical: 60

Course Objective

• This course aims to provide an exposure on basics of measurement and instrumentation and its various aspects and their usage through hands-on mode.
• It also aims to provide exposure of various measurement instruments such as power supply, oscilloscope, multivibrators, signal generators are discussed in detail.
• It also aims to develop an understanding of virtual instrumentation and transducers.

Course Learning Outcomes

At the end of this course, students will have understanding of:
• basic principles of the measurement and errors in measurement, specifications of basic Measurement instruments and their significance with hands on mode.
• principles of voltage measurement, advantages of electronic voltmeter over conventional multimeter in terms of sensitivity etc.
• measurement of impedance using bridges, Power supply, Filters, IC regulators and Load and line regulation.
• Specifications of CRO and their significance, the use of CRO and DSO for the measurement of voltage (dc and ac), frequency and time period.
• Multivibrators, working circuits of Astable and monostable multivibrators.
• Phase Locked Loop (PLL), Voltage controlled oscillators and lock-In amplifier.
• explanation and specifications of Signal and pulse Generators
• the Interfacing techniques, Audrino microcontroller & interfacing software, Understanding and usage of Transducers.

Unit 1 (12 Lectures)

Measurements: Shielding and grounding. Electromagnetic Interference. Basic Measurement Instruments: DC measurement-ammeter, voltmeter, ohm meter, AC measurement, Digital voltmeter systems (integrating and non-integrating). Digital Multimeter; Block diagram principle of measurement of I, V, C. Measurement of Impedance- A.C. bridges, Measurement of Self Inductance (Anderson's bridge), Measurement of Capacitance (De-Sauty’s bridge), Measurement of frequency (Wien's bridge).

Unit 2 (6 Lectures)

Power supply: Using IC Regulators (78XX and 79XX), Line and load regulation, Short circuit protection. Idea of switched mode power supply (SMPS) & uninterrupted power supply (UPS). Oscilloscope: Block Diagram, CRT, Deflection (Qualitative). Screens for CRT, Oscilloscope probes, measurement of voltage, frequency, and phase by Oscilloscope. Digital Storage Oscilloscope.

Unit 3 (4 Lectures)

Multivibrators (IC 555): Block diagram, Astable & Monostable multivibrator circuits. Signal Generators: Function generator (Black Box Approach)

Unit 4 (8 Lectures)
Virtual Instrumentation: Introduction, Interfacing techniques (RS 232, GPIB, USB). Idea about Audrino microcontroller & interfacing software like lab View). Transducers: Classification of transducers. Measurement of temperature (RTD, semiconductor IC sensors), Light transducers (photo resistors & photovoltaic cells).

PRACTICALS-LAB: ELECTRONIC INSTRUMENTATION LAB
"Sessions on the construction and use of specific measurement instruments and experimental apparatuses used in the lab, including necessary precautions.
Sessions on the review of experimental data analysis, sources of error and their estimation in detail, writing of scientific laboratory reports including proper reporting of errors. Application to the specific experiments done in the lab."
At least 08 experiments from the following
1. Measurement of resistance by Wheatstone bridge and measurement of bridge sensitivity.
2. Measurement of Capacitance by De Sauty's bridge.
3. Design a regulated power supply of given rating (5 V or 9V).
4. To determine the Characteristics of LVDT.
5. To determine the Characteristics of Thermistors and RTD.
6. Measurement of temperature by Thermocouples.
7. To design an Astable Multivibrator of given specification using IC 555 Timer.
8. To design a Monostable Multivibrator of given specification using IC 555 Timer.
9. To design and study the Sample and Hold Circuit.
10. To plot the frequency response of a microphone.
11. Glow an LED via USB port of PC.
12. Sense the input voltage at a pin of USB port and subsequently glow the LED connected with another pin of USB port.
References for Theory
Essential Readings
1. Electronic Instrumentation and Measurement Techniques, W.D. Cooper and A. D. Helfrick, Prentice Hall (2005).
2. Measurement Systems: Application and Design, E.O.Doebelin, McGraw Hill Book - fifth Edition (2003).
3. Electronic Devices and Circuits, David A. Bell, Oxford University Press (2015).

Additional Readings
1. Instrumentation Devices and Systems, S. Rangan, G. R. Sarma and V. S. Mani, Tata McGraw Hill(1998).

References for Laboratory
1. "Measurement and Instrumentation Principles", Alan S. Morris, Elsevier (Butterworth Heinmann-2008).
2. Basic Electronics: A text lab manual, P.B.Zbar, A.P.Malvino, M.A.Miller,