GENERIC ELECTIVES (GE-1)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Instrumentation	4	3	-	1	Class XII passed with Maths/Applied Maths	Idea about basic circuit elements like R, C and L, Ammeter, Voltmeter

Learning Objectives

The Learning Objectives of this course are as follows:

- Explain the importance and working principle of different electronic measuring instruments.
- Use the complete knowledge of various instruments and transducers to make measurements in the laboratory.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Familiarize with the working principle of different measuring instruments
- Understand measuring instruments used in the laboratory like oscilloscopes, signal generators
- Understand working principle of transducers
- Familiarize with the working principle of data acquisition devices and biomedical instruments.

SYLLABUS OF ELGE-4A Total Hours- Theory: 45 Hours, Practicals: 30 Hours

UNIT – I (10 Hours)

DC and AC indicating Instruments: Accuracy and precision, Types of errors, PMMC galvanometer, sensitivity, Loading effect , Conversion of Galvanometer into ammeter, Voltmeter and Shunt type ohmmeter, Multimeter.

UNIT – II (12 Hours)

Oscilloscopes: CRT, wave form display and electrostatic focusing, time base and sweep synchronisation, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Dual trace oscilloscope, DSO :Block diagram, principle and working, Advantages and applications, CRO specifications (bandwidth, sensitivity, risetime).

Signal Generators: Function generators.

UNIT – III (10 Hours)

Transducers: Basic requirements of transducers, Transducers for measurement of nonelectrical quantities: Types and their principle of working , measurement of Linear displacement, Acceleration, Flow rate, Liquid level, strain, Force, Pressure, Temperature.

UNIT – IV (13 Hours)

Data acquisition systems: Block diagram, brief description of preamplifier, signal conditioner, instrumentation amplifier, A/D and D/A converter blocks, computer-controlled test and measurement system.

Bio-medical instrumentation: Bio-Amplifiers: Different types of Bio-OP-Amps, Electrodes for ECG , block diagram of ECG system, brief analysis of graphs.

Practical component (if any) – Instrumentation

(Hardware and Circuit Simulation Software)

Learning outcomes

The Learning Outcomes of this course are as follows:

- To measure various electrical parameters.
- To measure characteristics of various sensors and transducers.
- Understand ECG pattern.
- Prepare the technical report on the experiments carried.

LIST OF PRACTICALS (Total Practical Hours – 30 Hours)

1. Design of ammeter and voltmeter using galvanometer.
2. To determine the Characteristics of resistance transducer - Strain Gauge
3. To determine the Characteristics of LVDT.
4. To determine the Characteristics of Thermistors and RTD.
5. Measurement of temperature by Thermocouples and study of transducers like AD590 (two terminal temperature sensor), PT-100, J- type, K-type.

6. Characterization of bio potential amplifier for ECG signals.
7. Measurement of heart sound using electronic stethoscope. Study on ECG heart rate monitor /simulator
8. Study of pulse rate monitor with alarm system.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than seven.

Essential/recommended readings

1. Electrical and Electronics Measurement and Instrumentation Sahwany A.K.
2. Handbook of biomedical instrumentation: Khandpur R S, TMH
3. Electron measurements and instrumentation techniques: Cooper W D and Helfric A D, PHI, 1989.
4. Biomedical instrumentation and measurements: Leslie-Cromwell, Fred J Weibell, Erich A Pfieffer, PHI, 1994.
5. Mechatronics – principles and applications, Godfrey C Onwubolu, Elsevier, 2006

Suggestive readings

1. Electrical Measurement in Measuring Instruments. Goldwing E.W. and Widdies
2. Measurement systems applications and design: Doeblin E O, McGraw Hill, 1990.
3. Instrumentation devices and systems: Rangan, Sarma, Mani, TMH
4. Instrumentation measurement and analysis: Nakra B C, Chaudry K K, TMH

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.