PPH308 INSTRUMENTATION AND EXPERIMENT DESIGN

L	T	P	Cr
3	1	0	3.5

Course Objectives: To understand, analyze and implement the fundamental experimentation.

Data Interpretation and Analysis: Precision and accuracy, Errors in measurements: Statistical and systematic, Error analysis, Propagation of errors. Frequency distributions, Probability distributions: mean and variance, Probability densities: Normal distribution, Log-Normal distributions. Curve Fitting: least square method, Linear and non linear, Chi-square test.

Transducers: Sensors and Transducers: Temperature, Pressure, Vibration, Magnetic Field, Force and Torque, Optical.

Measurements: Resistance: DC Measurements: Wheatstone Bridge, The Kelvin Bridge, Potentiometers, AC Measurements: Inductor and capacitor equivalent circuits, AC operation of a Wheatstone bridge, Capacitance Measurement: The resistance ratio bridge, The De Sauty Bridge, Wein Bridge. Inductance Measurement: The Maxwell Bridge, Parallel Inductance bridge, Anderson bridge. Voltage Measurement: AC and DC, Current Measurement: AC and DC. Resistivity Measurement: 2-probe, 4-probe and Van-der-Paw measurements.

Signal Conditioning and Noise: Signal Conditioning, Analog signal conditioning: Operational amplifiers, Instrumentational amplifiers, precision absolute value circuits, True RMS to DC converters. Phase sensitive detection: Lock in amplifier, Box-car integrator, Spectrum analyzer. Noise in Circuits: Probability Density Functions, The Power Density Spectrum, Sources of noise, Noise limited resolution of Op-amp, minimum resolvable DC current, Coherent interference and its sources, Ground loops and their prevention. Introduction to Digital signal conditioning. The Fast Fourier Transformer, Sampling time and Aliasing, Voltage and Current sources.

Course learningoutcomes: Students will have achieved the ability to:

1. to analyze and fit the experimental data. Different kind of errors coming in data will also be analyzed.
2. explain principle, theory and application of various sensors and transducers.
3. explain the basic principle and importance of the different AC and DC measurement techniques.
4. explain the concepts of signal conditioning and noise analysis.

Recommended Books

1. *Sayer, M., Mansingh, A., Measurement, Instrumentation and Experiment Design in Physics and Engineering, Prentice Hall of India (2000).*
2. *Northrop, Robert, B., Introduction to Instrumentation and Measurements, CRC, Taylor & Frances (2005).*
3. *Murthy, D.V.S., Transducers and instrumentation, Prentice Hall of India (2008).*
4. *Johnson, Richard A., Miller and Freund's Probability and Statistics for Engineers, Dorling Kingsley (2005)*
5. *Horowitz P. and Hill, W., The Art of Electronics, Cambridge University Press (2006)*
6. *Helfrick, A.D., Cooper, W.D., Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India (2007).*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	30
2	EST	45
3	Sessionals (May include assignments/quizzes)	25