

## **PH 409: EXPERIMENTAL TECHNIQUES IN PHYSICS (3-0-0:3)**

### **Data Analysis for Physical Sciences**

Population and sample, data distributions probability, probability distribution, distribution of real data, the normal distribution, from area under a normal curve to an interval, distribution of sample means, the central limit theorem, the t distribution, the log-normal distribution, assessing the normality of data, population mean and continuous distributions, population mean and expectation value, binomial distribution, Poisson distribution and Gaussian distribution.

### **Error and Uncertainties**

Error analysis, true value and error, precision and accuracy, random and systematic errors, uncertainty in measurement, propagation of errors, combining uncertainties, expanded uncertainty, relative standard uncertainty, coping with outliers, weighted mean, least squares fitting, linear and nonlinear curve fitting, chi-square test.

### **Physical Measurements**

Types of instruments, performance and their characteristics, instruments calibration, noise and signals, length and angle measurements; pressure, level and density measurements; flow measurement, temperature and humidity measurements; mass, force and torque measurements.

### **Transducers**

Classification of transducers - Principle, construction and working of thermistor, LVDT, resistive and capacitive transducers, photoelectric transducer, piezoelectric transducer, measurement of non-electrical quantities: strain, displacement, temperature, pressure, magnetic fields, vibration, optical and particle detectors.

### **Textbooks and References:**

1. A. Bevan, "Statistical Data Analysis for the Physical Sciences", Cambridge University Press.
2. F. James, "Statistical Methods in Experimental Physics", World Scientific Publishing Company.
3. D. Placko, "Fundamentals of Instrumentation and Measurement", ISTE Ltd.
4. A. S. Morris, "Measurement and Instrumentation Principles", Butterworth-Heinemann.