

Name of the Department/Centre: Physics

Course Type (Please tick appropriate box):

Major	<input type="checkbox"/>	Discipline Specific Core	<input type="checkbox"/>	Ability Enhancement	<input type="checkbox"/>
Minor	<input type="checkbox"/>	Multidisciplinary	<input checked="" type="checkbox"/>	Skill Enhancement	<input type="checkbox"/>
Value Added	<input type="checkbox"/>	Any other	<input type="checkbox"/>		<input type="checkbox"/>

Semester - II

Course Title – Experimental Techniques

Course Type – Multidisciplinary Course

Course Code - 24-PHY-T-156

Maximum Marks: 100

Course Level – 100

Total Credits – 3

Classes /week – 3

Prerequisite – Physics in class XII

Course Advisor's Name :

Course Advisor's Email :

Expected Learning Outcome –

After completing this course, the students will be able to -

1. Apply measurement principles and data analysis techniques.
2. Understand signal processing and system response.
3. Design and characterize thin film materials.
4. Develop vacuum systems for various applications.
5. Integrate knowledge of measurement, signals, and materials for industrial applications.

Reference Books:

1. Electrical Measurements & Electronic Measurements : A.K. Sawhney
2. Modern electronic Instrumentation and measurement techniques : Helfrick Cooper
3. Electronic test instruments: analog and digital measurements: R. A. Witte
4. Instrumentation, devices and systems : Rangan, Sarma and Mani
5. Electronic Instrumentation : H. S. Kalsi .

Course Syllabus

Unit I: Measurements and Data processing

Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Gaussian distribution.

Recording and analysis of data, data uncertainty, Error: - accuracy and precision, computer-aided data acquisition

Unit II: Signals, Systems and Shielding

Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise, Methods of safety grounding. Energy coupling. Grounding. Shielding: Electrostatic shielding. Electromagnetic Interference.

Unit III: Thin Film Growth and Characterization Techniques

Physical vapour deposition, thermal evaporation, e-beam evaporation, sputtering, pulsed laser deposition, molecular beam epitaxy, MOCVD, thin film technology for industrial applications. UV-Vis absorption spectroscopy, FTIR spectroscopy, Photoluminescence.

Unit IV: Vacuum Systems

Characteristics of vacuum: Gas law, Mean free path. Application of vacuum. Vacuum system-Chamber, Mechanical pumps, Diffusion pump & Turbo Modular pump, Pumping speed, Pressure gauges (Pirani, Penning, ionization)