BSP801					Experimental Techniques					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
4	0	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To provide a detailed account of some common experimental techniques in physics areas of research.
- To introduce the basic working principles, the operational knowhow, and the strength and the limitations of various techniques.
- To demonstrate the ability to communicate orally and in writing the outcome ofthe experimental results.
- To develope the experimental skills required to handle sophisticated instruments.

UNIT 1 :STRUCTURAL CHARACTERIZATION AND IMAGING TECHNIQUES **16 Hrs.**

X-ray diffraction (XRD), electron and neutron diffraction, elementary ideas of photoelectron spectroscopy (PES), basic principal of atomic resolution electron microscopy, scanning electron microscopy (SEM), scanning tunneling and atomic force microscopy (STM, AFM) techniques. Data acquisition and analysis of the mentioned techniques.

UNIT 2: OPTICAL CHARACTERIZATION AND SPECTROSCOPIC TECHNIQUES **14 Hrs.**

Near and farInfrared and ultraviolet / visible (IR, UV/Visible) absorption spectroscopy, Raman and Fluorescence spectroscopy,Fourier-transform infrared spectroscopy (FTIR).Data acquisition and analysis of the mentioned techniques.

UNIT 3: PHYSICAL PROPERTY MEASUREMENTS **14 Hrs.**

Intensive and extensive properties, physical property measurements (DSC, DTA, TGA), transport properties (R-T, I-V), low conductivity measurement (Dielectric Spectroscopy), magnetic properties of bulk and nano phases of material (VSM).Data acquisition and analysis of the mentioned techniques.

UNIT 4: Accelerators and Detectors **16 Hrs.**

Particle and radiation interaction with material,Rutherford back scattering (RBS), Accelerators –LINAC, Van de Graaff, Synchrocyclotron, Pelletron; Introduction to particle induced x-ray emission (PIXE) and particle induced gamma-ray emission (PIGE). Detectors: thermal, photon and electron detectors, GM counters, Soild State and scintillation detectors, multi-channel analyzers (MCA).Data acquisition and analysis of the mentioned techniques.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Describe the phenomenological background of the techniques used and assess their applications.

CO2: Identify the assumptions underlying any experimental measurements made in the physics laboratory.

CO3: Determine and explain the limitations of the hypothesis behind experimental measurements.

CO4: Design and carry out an experiment on his/her own.

CO5: Work with advanced scientific measurement equipments (under supervision), and implement quantitative and qualitative data processing.

CO6:Demonstrate the ability to communicate orally and in writing the outcome of experiment results and results from relevant scientific literature.

TEXT/REFERENCE BOOKS

1. J.M. Hollas (1986), Modern Spectroscopy, John Wiley & Sons.
2. Colin N Banwell(2017), Introduction to Molecular Spectroscopy, McGraw-Hill.
3. Gareth Thomas and Michael J. Goringe (1979), Transmission Electron Microscopy of Materials, John Wiley.
4. B. D. Cullity &S.R. Stock (2014), Elements of X-ray Diffraction, Pearson Education Limited.
5. M.T. Bray, Samuel H. Cohen and Marcia L. Lightbody(1993), Atomic Force Microscopy/Scanning Tunneling Microscopy, Plenum Press.
6. William R. Leo (1994), Techniques for Nuclear and Particle Physics Experiments: A How-to Approach, Springer.
7. G. F. Knoll (2010), Radiation Detection and measurement, Wiley.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs**

Part A/Question: 3 Questions from each unit, each carrying 3 marks 36 Marks

Part B/Question: 2 Questions from each unit, each carrying 8 marks 64 Marks