

**Basic Sciences, Civil, Electrical & Mechanical Engineering**  
**PhD/M.Tech**

Course Code. :	<b>PH225002/ CH225002</b>	<b>Ph. D./M.Tech.</b>
Course Title :	Modern Techniques for Material Characterization	
Credits:	L T P C 3 1 0 4	
Prerequisites (if any)	Nil	
Course Coordinator	Dr. Dheeraj Kumar Singh (Physics)	
Course Objective	The course “Modern Techniques for Material Characterization” is designed to understand the working principle and study the applicability of the most important methods used in materials characterization.	
Course Contents	<p><b>Spectroscopic characterization:</b> Introduction and necessity of characterization techniques, Raman Spectroscopy, IR Spectroscopy, UV-vis absorption spectroscopy, Fluorescence spectroscopy, Nuclear magnetic resonance, Mass spectroscopy, X-ray photoelectron spectroscopy.</p> <p><b>Thermal method of analysis:</b> Thermo-gravimetric analysis (TGA), Differential thermal analysis (DTA), Differential scanning calorimetry (DSC)</p> <p><b>Probing bulk and nano-structure:</b> X-ray Diffraction (XRD), Transmission electron microscopy (TEM), High resolution Transmission electron microscopy (HRTEM),</p> <p><b>Surface structure and topography:</b> Scanning electron microscopy (SEM), Scanning tunneling microscopy (STM), Atomic force microscopy (AFM)</p>	
Text books/ References	<ol style="list-style-type: none"> <li>1. The Raman Effect: A Unified Treatment of the Theory of Raman Scattering by Molecules. Derek A. Long, John Wiley &amp; Sons Ltd, 2002.</li> <li>2. Modern Spectroscopy: J.M. Hollas, 4<sup>th</sup> Edition, John Wiley &amp; Sons Ltd, 2004.</li> <li>3. Applications of absorption spectroscopy of organic compounds: J.R. Dyer, PHI, Eastern Economy Edition, 1978.</li> <li>4. Introduction to Spectroscopy: D.L. Pavia, G.M. Lampman, G.S. Kriz, J.A. Uyvyan, Books/Cole Cengage Learning 4<sup>th</sup> Edition, 2009.</li> <li>5. Handbook of Spectroscopy: G. Gauglitz, T. Vo-Dinh, Willey, 2003.</li> <li>6. Physical Methods for Chemists: R.S. Drago, 2<sup>nd</sup> Edition, 1977.</li> <li>7. Principles and Applications of Thermal Analysis: P. Gabbott, Blackwell Publishing Ltd, 2008.</li> <li>8. Elements of X-ray diffraction: B.D. Cullity and S.R. Stock: 3<sup>rd</sup> Edition Pearson, 2014.</li> <li>9. Electron Microscopy and Analysis: P.J. Goodhew, J. Humphreys, R. Beanland: 3<sup>rd</sup> Edition, Taylor &amp; Francis, 2001.</li> <li>10. Scanning Probe Microscopy the Lab on a Tip: H.J Hug, Meyer, Ernst, R. Bennewitz, Springer, 2004.</li> <li>11. Physics of Image Formation and Microanalysis: L. Reimer, Springer 1998.</li> </ol>	