1.	Title of the course	Physical Techniques for Material and Life Sciences
2.	Course number	ID503L
3.	Structure of credits	3-0-0-3
4.	Offered to	PG
5.	New course/modification to	Modification To ID5021/4
6.	To be offered by	Academics
7.	To take effect from	July 2022
8.	Prerequisite	Nil
9.	**Course Objective(s):** Advances in the design of materials with tailored properties are important in diverse fields like material science, structural engineering, medical and biotechnology.Comprehensive knowledge of the physical techniques used to characterize varied materials is therefore important to students of basic and applied sciences, and of various engineering disciplines. This course will provide acquaintance with a wide range of physical techniques used to study physical and chemical properties of materials,including bio-molecules.	
10.	**Course Content:** [a] Various material synthesis methods of bulk single crystals and thin films. [b] Cryogenic physics: different cryostats; and thermodynamic properties: specific heat, thermal expansion, thermal conductivity, DSC, TGA, transport properties, magnetic properties, Hall effect; measurements at extreme conditions: very low temperatures, high pressure and high magnetic fields. [c] Hydrodynamic and microscopic techniques for molecular characterization: diffusion, centrifugation, viscometry, osmosis. [d] Molecular spectroscopy: Fourier transform NMR spectroscopy, 2D NMR and NMR imaging, ESR, Infra-Red and UV-visible spectroscopy, vibrational levels, Rayleigh and Raman scattering, Raman spectroscopy, Stokes and anti-stokes lines. [e] Molecular characterization:X-ray diffraction methods, optical rotatory dispersion, circular dichroism, mass spectrometry.	
11.	**Textbook(s):** 1. Frank Pobell, *Matter and Methods at Low Temperatures*, 3rd Edition, Springer (2007). 2. Nolting Bengt, *Methods in Modern Biophysics*, Springer (2009).	
12.	**Reference(s):** 1. Lain Campbell,Biophysical Techniques, Oxford Univ. Press (2012). 2. Klug H P, Alexander L E, *X-Ray Diffraction Procedures: For Polycrystalline and Amorphous Materials*, 2nd Edition, Wiley-Interscience (1974). 3. Igor N Serdyuk, Nathan R Zaccai and Joseph Zaccai, *Methods in Molecular Biophysics: Structure, Dynamics and Function,* Cambridge Univ. Press, (2007).	