**Condensed Matter Physics Lab and Computational Condensed Matter Physics**

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Course Outcome for Condensed Matter Physics Lab:

1. Remembering: Recall the principles of band gap determination using UV-VIS spectroscopy and apply the method to analyze a semiconductor sample.
2. Understanding: Explain the concept of magnetoresistance and analyze the data obtained for different magnetic fields in a given semiconductor material.
3. Applying: Utilize X-Ray powder diffractometer to determine precise lattice parameter and grain size of crystalline materials.
4. Analyzing: Evaluate the temperature dependence of the Hall coefficient for metal/semiconductor and draw conclusions based on the data.
5. Evaluating: Assess the size analysis of nanocrystalline powder specimen prepared by a chemical route and interpret the results.
6. Creating: Design an experimental setup and utilize the four probe technique to determine the band gap of a semiconductor material.

Course Outcome for Computational Condensed Matter Physics:

1. Remembering: Recall the fundamental principles of Hartree-Fock and Density Functional Theory for quantum mechanical modeling of materials.
2. Understanding: Explain the Kohn-Sham equation, Exchange-Correlation energy functionals, and the Hellmann-Feynman theorem in computational condensed matter physics.
3. Applying: Utilize atomic pseudopotentials, basis sets like plane waves and augmented basis sets for plane wave based DFT calculations.
4. Analyzing: Analyze the electronic problem using simplified approaches like Tight Binding Methods and the Slater-Koster approach.
5. Evaluating: Evaluate different interatomic potentials from semi-empirical to many-body systems for atomistic modeling of materials.
6. Creating: Design and perform Monte Carlo and Molecular Dynamics simulations, and apply the Hybrid QM-MM method for materials modeling.
7. Remembering: Recall the principles of Ehrenfest, Born-Oppenheimer, and Car-Parrinello molecular dynamics in computational condensed matter physics.

Hands-on Experience:

1. Apply theoretical knowledge gained in the lab to real-world scenarios during visits to facilities in and around Kolkata and potentially outside Kolkata.
2. Collaborate with peers to conduct experiments, gather data, and analyze results for a comprehensive learning experience.