Semester	AUG 2022
Open to semester	7,13,21
Course code	**PH4193/PH6533**
Course title	**Physics at Nanoscales**
Credits	3 /3
Course Coordinator & participating faculty (if any)	Atikur Rahman
Nature of Course	Lectures
Pre-requisites	Solid State Physics, Quantum Mechanics
Objectives (goals, type of students for whom useful, outcome etc)	Physics at Nanoscale aims to provide a flavour of novel physics that emerges in reduced dimensions and how this impacts electronic, optical and magnetic properties of the physical systems. The course also aims to introduce current research trends in this area, keeping in view fundamental aspects as well as technological applications. Useful for senior undergrads and int PhD/ PhD students in physics
Course contents (details of topics /sections with no. of lectures for each)	Session 1: (~12 lectures) Nano-Scaling: Historical perspective / Various length scales with relevance to the associated physical properties. Review of relevant concepts in condensed matter and quantum mechanics. What to expect as one goes from 3D to 2D to1D or 0D? Experimental realization of systems with reduced dimensions. Electronic Transport and Magneto-Transport in quantum-confined systems. Session 2: (~8 lectures) Effect of quantum confinement on the optical properties/ Semiconductors Nanostructures: Band Gap/ Exciton / Plasmons / Qunatum dots/ 2D semiconductors Nano –Magnetism & Spintronics, Masgnetoresistive Memory devices/ Magnetic Tunnel Junctions etc. Bio-nanotechnology / Environmental issues

	Session 3 (~5 lectures) Fabrication & Characterization at nano scale/ introduction to essential analytic techniques including SEM/TEM / AFM and STM. For PhD students: Paper reading & presentations from topics in nano electronics/ nano photonics and nano-magnetism
Evaluation /assessment	End-Sem Examination-40% Mid-Sem Examination-30% Others-30%
Suggested readings (with full list of authors, publisher, year, edn etc.)	The Physics of Low-dimensional Semiconductors: An Introduction, by John H. Davies Quantum Transport: Atom to Transistor, by Supriyo Datta Quantum Transport: Introduction to Nanoscience, by Yuli V. Nazarov, Yaroslav M. Blanter Electronic Transport in Mesoscopic Systems: by Supriyo Datta Transport in Nanostructures, by David K. Ferry, Stephen M. Goodnick, Jonathan Bird Principles of Nanomagnetism, by Alberto P. Guimarães Optics of Nanomaterials, by Vladimir I. Gavrilenko