

THE ASSAM ROYAL GLOBAL UNIVERSITY

Course/ Program: Pre -Ph.D., Course Work

Subject: Nanoscience and Nanotechnology

Subject Code:

Semester: Paper III

L-T-P-C:3-0-0-3

Detailed Syllabus:

Modules	Topics / Course content	Hours	Marks
I	Introduction: Background of Nanoscience and Nanotechnology; Physics of Nanomaterials-Free electron theory (qualitative idea), Band Structure and Density of states (DOS) at nanoscale; Low Dimensional Nanostructures-Electron confinement in Rigid potential box, 2 D, 1D and 0 D nanostructures, exciton Bohr radius.	10	25
II	Properties: Physical, Chemical, Optical, Electrical, Mechanical & Functional properties of nanomaterials; Electrical conductivity: Surface scattering, change of electronic structure, Quantum transport-ballistic conduction, Coulomb blockade and tunneling conduction.	10	25
III	Growth techniques of nanomaterials: Top-down and Bottom-up techniques, Lithographic Process-Photolithography, Electron beam lithography, RF-Sputtering, Evaporation, Chemical bath deposition, Chemical Vapour Deposition, and Molecular Beam Epitaxy.	8	20
IV	Characterization tools of nanomaterials: Optical spectroscopy-Absorption and transmission spectroscopy, Photoluminescence (PL), Infrared Spectroscopy, Raman Spectroscopy; Electron microscopy-Scanning Electron Microscopy, Transmission Electron Microscopy-HRTEM; Diffraction and Scherrer Method, Scanning Probe Microscopy, Atomic Force Microscopy; Thermal analysis-TGA, DTA, DSC; Current-Voltage (I-V) measurement method.	12	30
Total		40	100

Text/Reference Books:

1. *Nanostructures and Nanomaterials: Synthesis, Properties, and Applications*; G. Cao, Y. Wang, World Scientific, 2nd Ed., 2011, Singapore
2. *Introduction to Nanotechnology*; C. P. Poole, J. F. J. Owens, Wiley India, 1st Ed., 2003, New Delhi
3. *Introduction to Nanoscience and Nanotechnology*; K. K. Chattopadhyay and A. N. Banerjee, PHI Learning Private Limited, 2009
4. Edelstein A.S., and Cammarata, R.C., *Nanomaterials: Synthesis, Properties and Applications*, Institute of Physics, 1st Ed., 2001, Bristol