Syllabus for RPQP34 (Nanotechnology)

Crystallography: Bravais lattice, metallic crystal systems, X-ray diffraction, amorphous, single crystalline and polycrystalline materials, types of bonding, band theory, Statistical Mechanics: MB, BE and FD Statistics, Diffusion, Phase diagram, Nucleation and Growth, Mechanical Properties of Materials: Stress-strain, hardness, fatigue, fracture creep, nanoindentation, ceramic materials, polymer materials, Semiconductors: intrinsic and compound semiconductors, direct and direct band gap, Optical properties of materials, Superconductivity, BCS Theory, Cooper pairs, Josephson effect, Meissner effect. Wave-particle duality, Basic Quantum Mechanics: Schrodinger's Equation , particle in a box, density of states, IR, Raman, MW and UV spectroscopy, Photoelectron Spectroscopy Optical microscopy, Lens defects, Electron Microscopy (TEM-Selected area electron diffraction pattern, SEM), Atomic Force Microscopy, Scanning Tunneling Microscopy, Dielectric and Ferroelectric materials, SQUID, Thin films: deposition techniques and their characterization, Basic idea of nanotechnology : quantum confinement, nanomaterials properties, Graphene, Carbon Nanotube