APRIL - 2017

M.Sc. – Semester – 4

Nanoelectronics and Nanomagnetism

Paper code: 10306

[Phys-N402]

Q.1 [a] Write in detail, 'Quantum and classical regimes of electron transport'. [10]
[b]Explain and calculate de Broglie wavelength for electron in matter. [04]

OR

Q.1 [a] Explain concept of length scale for electronic transport in nanomaterial. [06]
[b] Define Coherence length. [02]
[c] Define following terms: Mesoscopic transport, Ballistic transport, Diffusive transport [06]

Q.2 [a] Define density functional theory and its applications. [06]
[b] Explain briefly computational modelling. [04]
[c] What do you understand by molecular dynamics simulations? [04]

OR

Q.2 [a] Define ensembles? Differentiate between microcanonical ensembles, canonical ensemble and grand canonical ensembles. [07]
[b] Define curve fitting and explain briefly the least square fitting method. [07]

Q.3 [a] Explain the Mössbauer effect in detail. [10]
[b] Explain isomer shift with proper diagram. [04]

OR

Q.3 [a] Explain in brief:
(1) Natural line width (2) Doppler broadening (3) Recoil energy loss [06]
[b] Explain Magnetic dipole interaction: magnetic splitting. [04]
[c] Explain Electric quadrupole interaction: Quadrupole splitting. [04]

Q.4 [a] Derive equation for magnetic force and torque for dipolar matter. [08]
[b] Magnetic relaxation in ferromagnetic fluids. [06]

OR

Q.4 [a] Stability requirements of magnetic materials. [10]
[b] Discuss effects of particle size on coercivity of ferromagnetic materials and effects on its magnetic properties . [04]

Q.5 [a] Give basic understanding, applications and challenges of ER fluids. [10]

[b] Write down preparation steps of MR fluids. [04]

OR

Q.5 [a] Discuss forces relevant to the magneto-rheological (MR) fluids. [08]

[b] Explain structure of ER fluids: [06]

a) Fibrillation model

b) Electric double layer model