

M. Tech. in Nano Sc. & Tech. 2nd Sem. Exam – 2018

Semiconductor Nanostructures & Nanoparticles

Time: 3 hours

Full Marks: 100

Answer any *four* questions

1. How electronic and nucleus contributions to the specific heat depend on temperature?
How will you determine different contributions?
Derive an expression for the temperature dependence of nucleus contribution to specific heat of a nanosheet.

2 + 3 + 20
2. Define dielectric constant of a material.
What are the technological importances of dielectric constant of any material?
Derive an expression for the electron contribution to dielectric constant of any material.
How does the particle size effect on electronic contribution to dielectric constant?

2 + 3 + 12 + 8
3. “Electrical conductivity initially increases with temperature, but finally it decreases with it” – explain.
Derive an expression for such variation.

5 + 20
4. How will you calculate band structure of any semiconducting materials using linear combination of atomic orbitals?
How does the band gap vary with size of a semiconducting nanoparticle?
Derive an expression for it.

15 + 2 + 8
5. Define surface tension of any material.
Why surface tension is technologically an important parameter?
Discuss bond order – length – strength (BOLS) principle to discuss size dependence of surface tension of any material.
What is exciton? What is the charge of exciton? Why all the materials don't show excitonic property?

2+ 2+ 15 + 2 + 2 + 2+ 2