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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

**SEVENTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION**
**JANUARY/FEBRUARY 2021**
**SUBJECT: NANOTECHNOLOGY (ECE - 4029)**

**TIME: 3 HOURS** **MAX. MARKS: 50**

**Instructions to candidates**

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Estimate number of surface atoms and percentage surface atoms with respect to volume atoms in 1.4 nm and 2 nm diameter Pt nanoparticles. Given that Pt is found in FCC structure with constant 0.391nm. Comment on the results.

1B. How close packed crystal structures are formed and why they are named that? Compare and contrast those structures. Which close packed structure is beneficial for the self - assembly technique of formation of nanostructures

(5+5)

2A. How can we distinguish the low-dimensional structures? What are the criterion for semiconductor nanoparticles to be "quantum" particles?

2B. Calculate total energy, binding energy of exciton in the first orbital, placed in GaAs matrix. Compare it with that in the CdSe matrix. Given that, Rydberg's constant is 13.6eV, effective mass of the exciton is 0.058 $m_o$ and $\varepsilon$=12.4 in GaAs and 0.1 $m_o$ and $\varepsilon$=9.4 in CdSe matrix. Comment on the result.

(5+5)

3A. How can formation of semiconductor (InAs) quantum dot on GaAs can be monitored from initial stages?

3B. Describe a methodology to form periodic nanostructures on a given substrate and characterisation of the same.

(5+5)

4A. How can we prepare graphene oxide powder in large quantities? Explain how substrate thermal conditions effect of formation of graphene in CVD techniques.

4B. How can the anisotropy of nanostructure be determined? Explain the experiment which determines the colour of metallic nanostructures?

(5+5)

5A. Compare and contrast different fabrication techniques for CNT. What special conditions are required for obtaining single walled carbon nanotubes?

5B. How the graphene and carbon nanotubes are related conceptually and also in the properties and preparation techniques.

(6+4)