Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

SEVENTH SEMESTER BTECH. (E & C) DEGREE END SEMESTER EXAMINATION
MARCH 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 5 nm Pt nano- particle. Given that atomic wt. of Pt is 190 and density is 21.5 gm/cm ^{3}. Comment on the results

1B. How can we distinguish the low-dimensional nanostructures? What is the importance of these low-dimensional structures in science and technology? What are the criterion for semiconductor nanoparticles to be "quantum" particles?

(5+5)

2A. How the 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 nano-structures.

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

(5+5)

3A. How can the atoms be manipulated by STM/AFM? How 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. Describe preparation of graphene by CVD techniques 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. Indicate two each technological applications of both materials.

(6+4)