

U.G. 6th Semester Examination-2022**PHYSICS****[HONOURS]****Discipline Specific Elective (DSE)****Course Code : PHY-H-DSE-T-03****(Nano Materials and Applications)**

Full Marks : 40

Time : 2½ Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

1. Answer any **five** questions : $2 \times 5 = 10$
- Define term nano. Give an example of zero dimensional nanomaterials.
 - Discuss classification of nanomaterials on the basis of dimension.
 - What are the magnetic nanoparticles? Explain with appropriate example.
 - Discuss the basic difference between nanosheet and nanowire with an example.
 - The golden colour of gold particle is lost in nano dimension.-Explain.
 - What do you mean by transmission coefficient?

- What do you mean by density of states (DOS)?
- What is an optical transistor? In which way it is different from conventional transistor?

2. Answer any **two** question: $5 \times 2 = 10$
- What do you mean by optical switches? In which ways are they advantageous compared to electrical switch? Which wave length regime is this switch suitable for single mode signal operation? $2+2+1$
 - Write a short note on Scanning Electron Microscopy. 5
 - What are the basic difference between MEMS and NEMS? Indicate some of the applications of MEMS. $2+3$
 - What are topological defects? Discuss its effects on two dimensional systems. $2+3$
3. Answer any **two** questions: $10 \times 2 = 20$
- What is the difference between electrical band gap and optical band gap? What is an exciton? In which ways it is different from phonon? Show that DOS of 1D system is proportional to $\frac{1}{\sqrt{E}}$, where E is the energy of the system. $2+1+2+5$

- ii) Discuss briefly the transport property of two dimensional nanomaterials. 10
- iii) What is a transmission electron microscope (TEM)? Describe its working principle. What type of information a TEM can provide about the sample? Mention some of the application of SEM. Why both SEM and TEM are operated in vacuum? 1+3+2+2+2
- iv) Briefly explain the meaning of quantum confinement. What are the important effects of quantum confinement on the properties of nanomaterial? How can you tune the band gap of two dimensional nanomaterials? How band gap is related with electron transmission for a two probe system? 2+4+2+2
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