

B.Sc. 5th Semester (Honours) Examination, 2023 (CBCS)**Subject : Physics****Course : DSE-1 (OR)****(Nanomaterials and Applications)****Time: 2 Hours****Full Marks: 40***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words
as far as practicable.*

1. Answer *any five* of the following questions: 2×5=10
 - (a) Bulk gold is yellow but nano gold is never yellow. — Why is it so?
 - (b) Write down the advantages of electrodeposition method.
 - (c) Can X-ray diffraction distinguish between C and N atoms? Explain.
 - (d) What are the primary differences between SEM and TEM?
 - (e) Distinguish between electrical band gap and optical band gap.
 - (f) What is a quantum dot? Why are quantum dots referred to as artificial atoms?
 - (g) What is an exciton? In which way it is different from polaron?
 - (h) What are the important applications of carbon nanotubes?

2. Answer *any two* of the following questions: 5×2=10
 - (a) What are the conditions of quantum confinement? An electron of energy 342 eV is confined in a one-dimensional box of length 1Å. Calculate (i) the quantum number 'n' of the energy state of the electron and (ii) the energy required to take the electron to the next higher state. 2+3
 - (b) What is Chemical Vapour Deposition (CVD) technique for thin film preparation? What are the different CVD techniques? State some uses of CVD. 1+2+2
 - (c) What is meant by the point defects in crystals? State the difference between Schottky and Frenkel defects. Which of these two changes the density of the solids? 2+2+1
 - (d) What are the basic differences between NEMS and MEMS? Write some of the applications of MEMS in medical science. 3+2

3. Answer *any two* of the following questions: 10×2=20
 - (a) (i) Distinguish between top down and bottom up approach for nanomaterial synthesis. Give examples in each case.
 - (ii) Describe sol-gel process for deposition of thin films. What are advantages and disadvantages of sol-gel process? 3+(5+2)

- (b) Describe, in detail, about the principle and process of X-ray diffraction technique with neat sketch. X-rays of wavelength 0.71\AA are reflected from the (111) plane of a NaCl crystal of lattice constant $a = 2.82\text{\AA}$. Calculate the corresponding glancing angle for 2nd order reflection. 7+3
- (c) What is a transmission electron microscope (TEM)? Describe briefly different modes of operation of TEM. What type of information a TEM can provide about the sample? 2+6+2
- (d) (i) Discuss briefly the major applications of quantum dots in solar cells. What are advantages and disadvantages of quantum dot solar cell?
- (ii) Describe briefly the applications of nanoparticle in medical science. What are advantages of using nanoparticles in drug delivery? 5+5
-