



**VIT**

Vellore Institute of Technology

## Final Assessment Test – November 2019

Course: ECE1006 - Introduction to Nanoscience and Nanotechnology

Class NBR(s): 1488 / 1492 / 1496

Slot: A1

Time: Three Hours

Max. Marks: 100

**KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE**

General Instructions :

i) Calculators are allowed

ii) Answer should be specific to the questions

iii) Point by point answer is highly recommended instead of writing paragraphs

Answer ALL Questions

(100 Marks)

SEARCH VIT QUESTION PAPERS

ON TELEGRAM TO JOIN

1. Classify particles and their distribution functions in detail with relevant diagrams. [15]
2. Estimate the energy level for an electron trapped in deep potential well of  $2\text{\AA}$  width for  $n=2$  and  $n=3$  and  $2\text{ cm}$  width for  $n=2$  and  $n=3$ . Compare the differences and motivate your answer. [10]  
Assume  $h = 6.626 \times 10^{-34} \text{ m}^2 \text{ kg/s}$
3. Why nanomaterials exhibit unusual properties? What is the salient features of nanomaterials electronics and optical properties? [15]
4. Calculate the chiral angle and the diameter of CNTs for the following chiral vectors (i) (3, 0) (ii) (5, 5) (iii) (5, 3). Assume the lattice constant ( $a$ ) as  $14.4 \text{ nm}$ . Match the chiral vectors with the figure 1 images (a, b, c) and identify their electronic properties. Which CNT structure would you prefer to make CNT Field effect transistor? [10]

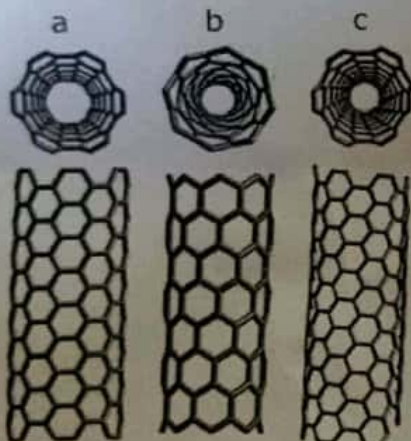


Figure 1



5. [10]

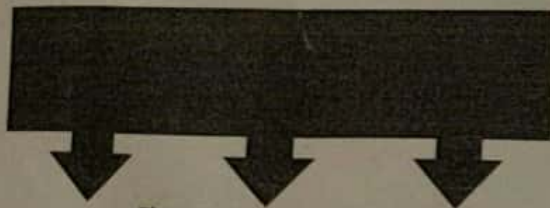
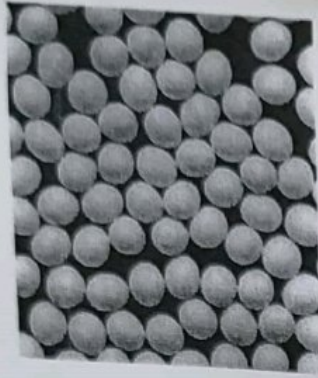


Figure 2

The image in figure 2 shows a patterned substrate onto which a thin film of gold needs to be deposited conformably and uniformly along the edges of the projected arrows as well as on the flat side in between arrows. Suggest a suitable technique and justify it with proper explanations.

6. Propose a suitable patterning technique to make nanostructures without mask. Explain the various steps involved in the proposed technique. [10]

7. The figure shows  $\text{SiO}_2$  nano-beads on a glass substrate. A morphology image of beads should be done with a suitable probe technique. Identify a suitable technique and explain its operation in detail. [10]



8. Electron and specimen interaction produces different signals. Explain the three important signals generated from specimen when electrons impinge and their roles in image formation. [10]
9. Discuss the operation of optical absorption and photoluminescence spectroscopy and compare their differences. [10]

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