

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Marks Scored:

Level : B.Sc.
Year : IV

Course : PHYS 403
Semester: I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date

MAR 12 2018

SECTION "A"

[20 Q. \times 1 =20 marks]

Choose and tick the most appropriate answer.

- The diameter of human hair is about
[a] 1mm [b] 0.1mm [c] 1nm [d] 5mm
- Which of the following is non-periodic crystal?
[a] quantum dot [b] nanotube [c] nanodisc [d] nanoribbon
- Most of the electronic structure are neglected in ionic motion mainly due to
[a] charge [b] angular momentum
[c] mass [d] spin
- Void defect is of nature
[a] 0D [b] extrinsic [c] 1D [d] 2D
- If there are even numbers of electrons in the basis the crystal will be in general _____.
[a] insulator [b] metal [c] semiconductor [d] superconductor
- Non-lithographic method will be most suitable for fabrication of _____.
[a] multilayered film [b] integrated circuit [c] fullerene [d] MBE
- In V-I curve of gas discharge, the current in the abnormal glow is of the order of _____.
[a] 1A [b] 10mA [c] $1\mu\text{A}$ [d] 50A
- If a single atom scatters a photon in 30° angle then the change in wavelength of photon in terms of Compton wavelength will be
[a] 0.5 [b] 2 [c] 1 [d] 0
- In FCC crystal, if all the Miller indices are even the atomic form factor will be _____.
[a] $16f$ [b] $0f$ [c] $2f$ [d] $4f$
- _____ in monoatomic metals most commonly proceeds by lattice vacancies.
[a] self-diffusion [b] dispersion [c] conductivity [d] transparency

Fill in the blanks with appropriate word(s).

11. Originally, the term nanotechnology was restricted to _____, which had no immediate practical use.
12. Although nanoscience and nanotechnology are new to us, but in nature there are many objects that function in _____ and _____ scale.
13. The _____ indices (m,n) in single walled nanotube are used to describe its _____.
14. In _____ semiconductors the minimum unoccupied level and maximum occupied levels are at different _____.
15. The Drude's model of electrical conduction is in the application of _____ to electrons in metals.
16. Transmission probability from a rectangular finite barrier depends on _____ and _____ of the barrier.
17. 2D electron gas can be realized at the _____ of two superlattices.
18. From X-ray diffraction Miller indices for the first three peaks in NaCl crystal are _____, _____, and _____.
19. The new volume of a cubic crystal of unit side is _____ if it is deformed by $1+\epsilon$ in each direction of Cartesian axes.
20. The characteristic lengths on the magnetic properties is the case of magnetic particles that have dimensions smaller than the critical magnetic _____ diameter.

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F. M. : 55

SECTION "B"

[5 Q × 4 = 20 marks]

1. "There is plenty of room at the bottom", explain this statement with background and context.
2. Write some unique properties of nanomaterials that are distinct from its bulk counterpart
OR
Calculate the total surface area (one sided) in m^2 if a cube of 1mm length is broken to make cubes of 1nm length.
3. Describe electro deposition process of nano fabrication.
4. How is X-ray diffraction method utilized for the characterization of nanomaterials?
5. Describe different carbon topologies with suitable examples.

SECTION "C"

[5 Q × 7 = 35 marks]

6. Differentiate between top-down vs bottom-up as well as lithographic vs non-lithographic techniques for film deposition.
OR
Calculate the distance between [111] consecutive planes of SC crystal in terms of lattice constant.
7. What is the significance of nanopores? Give one example of its use in nanofabrication.
8. Relate the source-target distance with film thickness in thermal evaporation process.
9. Define crystal structure with primitive lattice vectors and atomic positions for ZnO, TiO₂ and GaN. Write a POSCAR file for each of them.
10. Explain the use of nanotechnology in four different sectors of your choice.
OR
Describe the working principle of AFM in detail.

