भारतीय प्रौद्योगिकी संस्थान पटना

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MID-SEMESTER EXAMINATION M.M. 30 DURATION: 2 HOURS
COURSE: INTRODUCTION TO NANOMATERIAL (PH-401) DATE: 22 – 09 – 2016
Attempt all Questions

Time: 2hours **Full Marks: 30**

1. Why, there is no engineering beyond nanometer scale? [1]
2. Define 0D, 1D, 2D and 3D materials? [2]
3. What is the technological development has taken place from the understanding of hydrophobicity nature of bird wings? [2]
4. What is the difference between crystallographic phase boundary and metallurgical grain boundary? Why nanomaterial is single domain particle? [2]
5. Refractive index of PMMA (polymer) and iron (95% PMMA + 5% Iron) nanocomposite is 1.4724. A researcher makes discs of (thickness = 200 nm and diameter= 3.05mm) from this nanocomposite. The discs are floating on water (η_w=1.33). What will be the colour of the discs if one is looking at 90^0? [3]
6. Define the confinement length in a semiconductor. Draw a schematic diagram for *CdS* semiconductor ($m_e^* = 0.2m_e$, $m_h^*=0.7m_e$, $V_e = V_h = 10^5$ m/s, Plank's constant(h) = $6.62*10^{-34}$ Js, Mass of electron (m_e) = $9.1*10^{-31}$Kg.). What is the electron confinement in the metal? [3]
7. Write a short note on mechanical methods for preparing nanomaterials (top-down method). [3]
8. Write a short note on TEM and its applications for nanomaterial characterization. [3]
9. Give an example of microscope, which does not have an electromagnetic source for imaging. Explain the working principle of the microscope. [3]
10. Define the magic number for nanomaterials. Derive up to 8 magic numbers for Cubo-octahedral structure. Find the surface to volume ratio and discuss the result. [4]
11. Explain the process of photo-lithography method with block diagram, which one is the best method out of contact, proximity and projection printing method and, why? [4]

----------BEST OF LUCK----------