Metal

COLLEGE OF ENGINEERING, PUNE
(An autonomous institute of Government of Maharastra)
END-SEM EXAMINATION
Nanomaterials and Nanotechnology (PY-517/PM-517/MT-404-3 or DE 1 TH)

Programme: F.Y. M. Tech. / Final year B. Tech. Year: 2012 – 2013

Time Duration: 3 Hours Max. Marks: 50

Instructions
1. Answer all questions, 2. Neat diagrams must be drawn wherever necessary
3. Sharing/exchange of calculators is not allowed.

Marks

Q. 1	What are carbon nanotubes (CNTs)? Discuss any two methods which are widely used for their synthesis. Also discuss some important properties and applications of CNTs.	**10**
Q. 2	Draw and explain **self illustrative curves** between (i) melting temperature versus particle size, (ii) coercitivity verus particle size, (iii) sensor sensitivity versus particle size (iv) band gap energy versus particle size and (v) hardness versus grain size of the nanomaterials. Please consider particle size range from few nanometers to several microns.	**10**
Q. 3	**Answer any three questions from the following;** 3x5 =	**15**
A	Explain the percolation threshold phenomena in CNTs filled polymer matrix nanocomposites. Discuss at least three factors which affect the percolation threshold value.	5
B	Write in brief about principle of any four characterization instruments widely using in nanotechnology for the measurement of crystallite or particle size.	5
C	Compare and discuss the B-H loops for the larger, smaller (nanosized) and super paramagnetic sized (magnetic) particles. Discuss in brief two applications of magnetic nanoparticles.	5
D	Discuss in brief any two sample preparation methods for the TEM analysis of nanomaterials.	5
Q. 4	Answer **any five** from the following questions; 5x3 =	**15**
A	Why do you need purification of CNTs? How will you do it?	
B	If the self diffusion coefficient of a molecule in a solvent at 300 K is equal to 1.04×10^{-9} m^2/s and viscosity is equal to 0.501×10^{-3} **Pa/s**, what is the radius of the molecule? [Boltzmann constant = $1.38 \times 10-23$ J/K].	
C	What do you mean by specific surface area of a material? What is its value for nanomaterials? Why does discrepancy arise between the experimental and the calculated specific surface area?	
D	Magnetic nanoparticles are generally coated with biocompatible molecules. Why does this coating require? What are those biocompatible molecules? What are the purposes of this coating?	
E	Explain why titanium dioxide nanoparticles are used as important ingredient in self cleaning glasses. From where the concept of self cleaning came?	
F	Write short note on **any one** from the following; Nano-Dry **or** quantum confinement	
G	Write short note on **any one** from the following; Dip-Pen Nanolithography **or** Ferrofluids	