LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **PHYSICS**

THIRD SEMESTER – **NOVEMBER 2024**

PPH3ID01 – NANOSCIENCE

Date: 16-11-2024   Dept. No.   Max. : 100 Marks
Time: 01:00 pm-04:00 pm

SECTION A – K1 (CO1)

	Answer ALL the questions	**(5 x 1 = 5)**
1	**Definitions / MCQ / Match the following / True or False**	
a)	Define the surface plasmon resonance effect.	
b)	The steps involved in the top-down synthesis approach are a) Nano-particles → Powder → Bulk b) Powder → Bulk → Nano-particles c) Bulk → Powder → Nano-particles d) Nano-particle → Bulk → Powder	
c)	What is a Buckyball? (a) Carbon-60 (b) Carbon-111 (c) Carbon-4 (d) Carbon-20	
d)	Nanomaterials with the same dimensions but with different structures might have different physical properties. (True/False)	
e)	Which property of nanomaterials is often used in drug delivery systems? A) Electrical conductivity B) Biocompatibility C) Magnetic properties D) High density	

SECTION A – K2 (CO1)

	Answer ALL the questions	**(5 x 1 = 5)**
2	**MCQ**	
a)	Which of the following nanomaterials exhibits quantum confinement in a single direction? a) one-dimensional b) two-dimensional c) three-dimensional d) zero dimensional	
b)	_____can be viewed as a stack of graphene layers. a) Diamond b) SWCNT c) MWCNT d) Graphite	
c)	Typical precursors used in sol-gel are _____. a) metal oxides b) metal dioxides c) metal alkoxides d) metal fluorides	
d)	XPS is not routinely used to analyze. a) inorganic compounds b) metals c) ceramics d) organic chemicals	
e)	What advantages do nanosensors offer? a) high sensitivity b) detecting chemical vapours c) high selectivity d) all of the above	

SECTION B – K3 (CO2)

	Answer any THREE of the following	**(3 x 10 = 30)**
3	Enumerate any 5 applications of nanomaterials.	
4	Explain the electrical, optical, chemical, and thermal properties of nanostructured materials.	
5	Discuss the inter-and intramolecular interactions existing in various crystal compounds.	(5+5)
6	a) Explain the classification of core-shell nanoparticle semiconductors with suitable examples. b) How are nanomaterials synthesized using solvothermal methods?	(5+5)
7	a) Nitrogen (N_2) was employed to determine the surface area of a 1.0 g sample of silica gel. The slope and intercept obtained are 137486 m^{-3} and 943.5 m^{-3}. The sample was maintained at the normal boiling point of liquid N_2 at 77 K. Area of cross section of N_2 molecule is 16.2 x 10^{-20} m^2. Calculate the specific surface area of silica gel by the BET method. b) Explain the working principle of nanobiosensors.	(5+5)

SECTION C – K4 (CO3)

	Answer any TWO of the following	**(2 x 12.5 = 25)**
8	Write notes on different dimensions of nanomaterials.	
9	With neat diagrams, explain the essential components, principle, and operation of SEM.	
10	a) How do bonding force and energy vary against inter-atomic separation in a given material? b) Illustrate the classification of semiconductor nanocomposites with suitable examples.	(6.5+6)
11	a) How are metal oxide nanostructures synthesized using the sol-gel method? Write the advantages and drawbacks of this method. b) How is the specific surface area of solid adsorbents determined using the BET equation?	(6.5+6)

SECTION D – K5 (CO4)

	Answer any ONE of the following	**(1 x 15 = 15)**
12	Explain the different types of magnetic nanomaterials.	
13	a) Describe the electronic and optical properties of graphene. b) Illustrate the role of carbon nanotubes as field emitters in field emission displays.	(8+7)

SECTION E – K6 (CO5)

	Answer any ONE of the following	**(1 x 20 = 20)**
14	Draw the diagram of a Molecular Beam Epitaxy (MBE) thin film deposition apparatus, and explain its operation.	
15	a) Explain the nonbonding intermolecular forces with suitable equations. b) How is energy dispersive spectroscopy performed for elemental analysis of nanomaterials? 10+10)	

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