LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – CHEMISTRY

THIRD SEMESTER – NOVEMBER 2023

PCH3ID01 – MATERIAL SCIENCE

Date: 09-11-2023   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.	**State True or False**	
a)	A unit cell is primitive if it contains lattice points only at its corners.	
b)	The pyroelectric effect depends on frequency.	
c)	Hardness of nanoparticles is hundred times more than bulk materials.	
d)	The phenomenon of electrical resistance reduced to zero level is called Super electrons.	
e)	Semiconductors with band gap close to 1.8 eV are ideal materials for solar cell fabrication.	

SECTION A – K2 (CO1)

	Answer ALL the questions	**(5 x 1 = 5)**
2.	**Define the following**	
a)	Crystal structure	
b)	Polarization	
c)	Exfoliate	
d)	Magnetic levitation	
e)	Exciton	

SECTION B – K3 (CO2)

	Answer any THREE of the following in 300 words	**(3 x 10 = 30)**
3.	Explain the Powder X-ray diffractometer analysis for crystals.	
4.	Explain the different types of polarization in dielectric materials.	
5.	Outline the applications of polymer matrix nanocomposites.	
6.	Describe the properties of Ferro, Piezo, and pyro electric materials in detail.	
7.	Discuss the construction and working function of DSSCs with neat diagram.	

SECTION C – K4 (CO3)

	Answer any TWO of the following in 500 words	**(2 x 12.5 = 25)**
8.	Describe Czochralski method of crystal growth.	
9.	Discuss the working principle and instrumentation of AFM with neat diagram.	
10.	(i) Discuss the various types of dielectric breakdown. (ii) How does superconductivity work?	(6.5+6)
11.	Illustrate the mechanism of water splitting reaction in DSSCs.	

SECTION D – K5 (CO4)

	Answer any ONE of the following in 750 words	**(1 x 15 = 15)**
12.	What are the differences between soft magnets and hard magnets in terms of their characteristics, applications and magnetic properties? Explain the Hysteresis curve on the basis of Domain Theory.	

13.	Explain the construction and working principle of CO_2 laser with suitable energy level diagram.
	SECTION E – K6 (CO5)
	Answer any ONE of the following in 1000 words **(1 x 20 = 20)**
14.	(i) Describe the neutron diffraction method in crystal structure analysis. (ii) Explain how the Laue equation can be used to verify Bragg's law for X-ray diffraction in crystalline materials. **(10+10)**
15.	**(a)** What are Core-Shell nanoparticles? Explain the classification based on shell property. (b) What do you mean by anchoring groups? Mention its role with examples. **(8+12)**

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