LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **CHEMISTRY**

THIRD SEMESTER – **NOVEMBER 2024**

PCH3ID01 – MATERIAL SCIENCE

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	**MCQ**
a)	For Bragg's reflection by a crystal to occur, the x-ray wave length λ and interatomic distance d must be i) $\lambda > 2d$ ii) $\lambda = 2d$ iii) $\lambda < 2d$ iv) $\lambda \leq 2d$
b)	The principle of laser is_____. i) Spontaneous absorption ii)Spontaneous emission iii)Stimulated emission iv)Stimulated absorption
c)	Image formation in electron microscope is based on _____. i) specimen size ii) electron number iii) column length iv) differential scattering
d)	Superconducting and normal states are i) irreversible ii) reversible iii) irrelevant comparison iv) controlled by temperature
e)	Which type of solar cells has the highest efficiency? i) amorphous ii) polycrystalline iii) monocrystalline iv) OPV
	SECTION A – K2 (CO1)
	Answer ALL the questions **(5 x 1 = 5)**
2	**Fill in the blanks**
a)	The smallest portion of the crystal lattice is known as_____.
b)	_____ is a molecular laser.
c)	Typical precursor used in sol-gel is _____.
d)	The phenomenon of electrical resistance reduced to zero level is called _____
e)	Semiconductors with band gap close to _____eV are ideal materials for solar cell fabrication.
	SECTION B – K3 (CO2)
	Answer any THREE of the following **(3 x 10 = 30)**
3	(a) Explain the Powder x-ray diffractometer analysis for crystals. (5) (b) Determine the angle through which an X – ray of wavelength 0.440Å is reflected from the cube face of a rock salt crystal (d = 2.814 Å). (5)
4	How do shape memory alloys exhibit their unique properties? What are the most significant industrial and medical applications of these materials?
5	Explain the working principle and instrumentation of SEM with neat diagram.
6	What is the mechanism of superconductivity? Explain the difference between Type I and Type II superconductors.
7	(a) List the applications of polymer matrix nanocomposites. (5)

	(b) Outline the factors affecting the efficiency of solar cells.	(5)
	SECTION C – K4 (CO3)	
	Answer any TWO of the following	**(2 x 12.5 = 25)**
8	Explain the key distinctions between low-temperature and high-temperature solution growth techniques	
9	(a) Illustrate the working principle of inert gas condensation with neat diagram. (b) Explain the synthesis of gold nanoparticles by sol-gel method.	(6.5) (6)
10	(a) Discuss the various types of dielectric breakdown. (b) How are the dielectric constant and dielectric loss related in materials?	(6.5) (6)
11	(a) Describe the working principle of photovoltaic cell. (b) What is exciton? Explain its types.	(6) (6.5)
	SECTION D – K5 (CO4)	
	Answer any ONE of the following	**(1 x 15 = 15)**
12	(a) What are the differences between soft magnets and hard magnets in terms of their characteristics, applications and magnetic properties? (b) Explain the Hysteresis curve on the basis of Domain Theory.	(10 + 5)
13	Explain the significance of the following terms polarization, electronic, ionic orientation, and space charge in materials.	
	SECTION E – K6 (CO5)	
	Answer any ONE of the following	**(1 x 20 = 20)**
14	(a) Describe the neutron diffraction method in crystal structure analysis. (b) What is the relationship between the angle of incidence, the spacing between planes, and the wavelength of X-ray diffraction?	(10) (10)
15	(a) Describe briefly different types of organic photovoltaic cells. (b) Discuss the construction and working function of DSSCs with neat diagram.	(10) (10)
