LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

FIFTH SEMESTER – **NOVEMBER 2024**

UPH 5602 – MATERIALS SCIENCE

Date: 21-11-2024   Dept. No.   Max. : 100 Marks
Time: 09:00 am-12:00 pm

	SECTION A - K1 (CO1)	
	Answer ALL the Questions -	**(10 x 1 = 10)**
1.	**Fill in the blanks**	
a)	When the bond length is decreased, the bond energy…………….	
b)	Secondary bonds have energy in the range of ………….. in kJ / mol	
c)	…………….. is the most widely used metal in the present world.	
d)	The wavelength range corresponding to UV-visible region is …………………..	
e)	NDT stands for…………………………….	
2.	**MCQ**	
a)	Materials that lack permanent magnetic dipoles are called………….. (a)Diamagnetic (b) ferromagnetic (c) semi magnetic (d) none of the above.	
b)	Electron Microscope can give a magnification up to ……………. (a) 400,000X (b) 100,000X (c) 15000X (d) 100X	
c)	What are the two main techniques for thermal analysis? (a) FTG and DGG (b) MSP and FCT (c) TGA and DTA (d) TSA and DGF	
d)	Polarisation is defined as……………… (a)dipole moment per unit area (b)dipole moment per unit ampere (c) dipole moment per unit volume (d)dipole moment	
e)	Pick out the odd statement about ceramics in the following (a) Good insulators of heat and electricity (b) Usually less denser than metals (c) Ductile in nature (d) Contains both metallic and nonmetallic elements	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Answer the following**	
a)	Give two examples for organic polymers.	
b)	What is thermal conductivity? Give its SI unit.	
c)	Give an example for ferroelectric material.	
d)	Mention two medical applications of shape memory alloys (SMA).	
e)	Write any two methods used for NDT?	
4.	**Definitions**	
a)	Lattice energy	
b)	Elastomer	
c)	Poisson's ratio	
d)	Dielectric breakdown	
e)	Smart catalysts	
	SECTION B - K3 (CO2)	
	Answer any TWO of the following	**(2 x 10 = 20)**
5.	Explain the different kinds of stability using the analogy of a tilting rectangular block.	
6.	Differentiate between hard magnetic materials and soft magnetic materials.	
7.	Draw the Stress – Strain curve and explain the variations in the elastic and plastic behaviour of the material.	
8.	Explain the principle, instrumentation and characterization of materials by UV spectroscopy method.	

SECTION C – K4 (CO3)	
Answer any TWO of the following	**(2 x 10 = 20)**
9.	Explain Born-Haber cycle for the formation of NaCl. Calculate the lattice energy of NaCl from the following data.(7 + 3) Heat of formation of NaCl = -411.3 kJ/mol Heat of sublimation = 108.4 kJ/mol Heat of dissociation = 244 kJ/mol Electron affinity = -349 kJ/mol Ionisation energy = 495 kJ/mol
10.	Classify the magnetic materials based on their properties.
11.	Discuss ferrofluids in detail. Write their uses.
12.	Explain the method to detect flaws using ultrasonic method with a neat diagram.
SECTION D – K5 (CO4)	
Answer any ONE of the following	**(1 x 20 = 20)**
13.	(a) Draw the plot for interatomic forces and potential energy, as a function of distance of separation, between two atoms and explain the concepts of bond energy, bond type and bond length. (8 marks) (b) Discuss in detail, the three important steps involved in the formation of ionic bond with reference to the NaCl crystal. (12 marks)
14.	(a) With a neat diagram, discuss the formation of "domain structure". (b) Highlight the essential features of NEMS and MEMS and discuss the materials employed in their fabrication. (10 + 10)
SECTION E – K6 (CO5)	
Answer any ONE of the following	**(1 x 20 = 20)**
15.	(a)Draw the block diagram of an Electron Microscope and explain its principle, construction and working. (10) (b) Determine the mechanical hardness of the material using Vicker's microhardness tester. (10)
16.	(a) Explain the different types of polarization and derive the expression for the total polarization of a material. Discuss the effects of temperature and frequency on polarization with a diagram (8+4) (b) Write a note on the applications of (i) surface acoustic wave materials and (ii) piezoelectric materials (4+4)

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