

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034
B.Sc. DEGREE EXAMINATION – PHYSICS
FIFTH SEMESTER – NOVEMBER 2003
PH 5402 / PHY 402 – MATERIALS SCIENCE

12.11.2003
1.00 – 4.00

Max. : 100 Marks

PART – A

Answer all the questions

(10 x 2 = 20 marks)

01. How will you classify the engineering materials on the basis of the major areas of applications?
02. Write a note on the structure-property relationships in materials.
03. Discuss the steps involved in the formation of Burger's circuit for dislocation.
04. Determine the Miller indices of a plane that makes intercepts of $4x$, y and $2z$.
05. Give the formula for measuring the Young's modulus of composite materials.
06. Explain the phenomenon of "work hardening" of engineering materials.
07. What is the principle of the NDT method based on photoelastic phenomenon.
08. How does the intrinsic break down of a dielectric material take place?
09. Calculate the relative dielectric constant of a barium titanate crystal, which, when inserted in a parallel plate condenser of area $8 \text{ mm} \times 8 \text{ mm}$ and distance of separation of 1.8 mm gives a capacitance of $0.05 \mu\text{F}$
10. List the advantages of scanning electron microscopy (SEM).

PART – B

Answer any FOUR questions

(4 x 7.5 = 30)

11. Discuss, how the physical properties of materials are influenced by the variation in bonding character.
12. What is meant by a symmetry operation? Explain the different types of symmetry elements of a crystalline solid.
13. What are true stress and true strain? Using the tensile stress-strain curve for a ductile material, obtain the power relationship connecting σ and e .
14. Explain (i) electrical resistance (ii) triboelectric effect and (iii) thermoelectric effect techniques adopted for NDT.
15. Give the theory of ferroelectrics as applied to Barium Titanate. Mention the applications of ferroelectric materials.

PART – C

Answer any FOUR questions

(4 x 12.5 = 50)

16. What is meant by polarization?

Discuss the various polarization processes with necessary diagrams and hence obtain the expression for the total polarization of a material.

17. Draw a schematic diagram of an Electron Microscope and explain its working.

18. a) Discuss the essential characteristics of covalent bonding with relevant examples.

(5 marks)

b) Explain the necessary steps involved in the formation of ionic bond and obtain the expression for the potential energy of the system of bond forming atoms. (7.5 marks)

19. a) State and explain Bragg's law of x-ray diffraction

(5 marks)

b) Describe with a neat sketch, the powder XRD method of determining crystal structure.

20. Discuss the atomic model of elastic behavior with necessary figure and derive the relations connecting y , γ , μ , and κ .

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