



# LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

## B.Sc. DEGREE EXAMINATION – PHYSICS

FIFTH SEMESTER – APRIL 2017

### PH 5408- MATERIALS SCIENCE

Date: 02-05-2017  
01:00-04:00

Dept. No.

Max. : 100 Marks

#### PART A

Answer **ALL** questions:

10 x 2 = 20 marks

1. Draw the diagrams to illustrate the  $\pi$  and  $\sigma$  bondings.
2. Mention a few useful ceramic materials.
3. Write the equation for Young's modulus of a composite material.
4. What is meant by work hardening?
5. Mention a few soft magnetic materials.
6. Explain the concept of "thermal break down" in a dielectric.
7. Highlight the applications of elastomers.
8. What are "smart gels"?
9. Explain the benefits of NDT.
10. Distinguish between gamma ray and X-ray radiographic techniques.

#### PART B

Answer any **FOUR** questions:

4 x 7.5 = 30 marks

11. Discuss the classification and applications of engineering materials with suitable flow charts.
12. Explain the role of modulus of a material as a vital parameter in design.
13. With neat diagram, discuss the formation of "Domain structure".
14. With block diagram, explain the methods to fabricate MEMS structure.
15. Discuss the various electrical methods used for conducting NDT.
16. With neat diagrams, explain the concept of stability and meta-stability of materials.

#### PART C

Answer any **FOUR** questions:

4 x 12.5 = 50 marks

17. Discuss the formation of ionic bonding in NaCl and derive the expression for potential energy.
18. Draw the tensile stress-strain curve and explain the different stages involved in the response of the material upon loading and derive the power relationship.
19. Discuss the fundamentals of ferroelectric materials by considering barium titanate crystal as an example.
20. With neat diagram, explain the Piezoelectric effect and highlight the applications of Piezoelectric materials.
21. With neat sketch, explain the principle, instrumentation and operation of a scanning electron microscope (SEM).
22. Write note on
  - (i) One way and two way shape memory alloys (6.5)
  - (ii) Metallic and covalent bonding (6)

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