

26.4.19

Roll No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

B.E/B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2019

Common to B.E. (Industrial Engg., Manufacturing Engg., Aeronautical Engg.,  
Automobile Engg., & Production Engg.)  
Semester II

PH 7251 Materials Science

(Regulations 2015)

Time : Three hours

Maximum : 100 marks

(Answer ALL questions)

PART – A (10 X 2 = 20 marks)

1. What is an isomorphous system? Give example.
2. In a binary phase diagram (pressure omitted) what is the maximum number of phases that can co-exist for at least one degree of freedom.
3. Cite two major differences between martensitic and pearlitic transformations.
4. What is the fraction of proeutectoid cementite in 1.2% carbon steel.
5. What is the role of dislocations in slip?
6. Define endurance limit in fatigue testing.
7. What are the requirements of good insulating materials.
8. What is magnetic levitation? State its use.
9. What are the roles of matrix and reinforcement in composites?
10. List a few applications of ceramic materials.



PART – B (5 X 13 = 65 marks)

11. (a) (i) What are invariant reactions? List any four invariant reactions and their phase boundaries (3)  
(ii) With a neat sketch explain Eutectic phase diagram and discuss the phase transformations in detail. (10)

(OR)

- (b) (i) State Hume Rothery's rules for the formation of substitutional solid solutions. (3)  
(ii) Draw Peritectic phase diagram for a binary alloy and discuss the phase transformations in detail. (10)

12. (a) With a neat sketch explain Iron- Carbon phase equilibrium diagram with its phases and its invariant reactions. (13)

(OR)

- (b) Why is case hardening done for steels? Explain any five case hardening techniques employed to steel. (13)

13. (a) (i) What is Creep? Explain in detail the various stages in the creep curve. (7)  
(ii) With theory, Explain the measurement of hardness using Brinell hardness tester. (6)

(OR)

- (b) Explain Griffith theory of brittle materials and derive suitable equation for the applied stress at which fracture occurs due to a pre-existing crack. (13)

14. (a) (i) Explain electronic polarization in atoms and obtain an expression for electronic Polarizability in terms of the radius of the atom. (9)  
(ii) If a NaCl crystal is subjected to an electric field of 1000 V/m and the resulting Polarization is  $4.3 \times 10^{-8} \text{ C/m}^2$ . Calculate the relative permittivity of NaCl. (4)  
(Given  $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$ )

(OR)

- (b) (i) Discuss in detail Domian theory of ferromagnetism and based on that explain hysteresis in ferromagnetic materials. (9)  
(ii) If the magnetization and flux density of a magnetic material are 3200 A/m and  $0.005 \text{ Wb/m}^2$ . Calculate the relative permeability of the material. (4)

15. (a) What are Metallic glasses? Explain the preparation, properties and applications of Metallic glasses.

(OR)

- (b) What are Shape memory alloys? Discuss in detail the characteristics and list the applications of Shape memory alloys.

PART – C (1 X 15 = 15 marks)

16. (a) (i) Explain in detail the various strengthening methods used for the improvement of mechanical properties of materials. (11)  
(ii) A piece of copper originally 305 mm long is pulled in tension with a stress of 276 MPa. If the deformation is entirely elastic, what will be the resultant elongation? Given Young's modulus for copper is 110 GPa. (4)

