

Reg. No. :

Question Paper Code : 21139

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Second Semester

Aeronautical Engineering

PH 8251 – MATERIAL SCIENCE

(Common to : Aerospace Engineering / Automobile Engineering /
Industrial Engineering / Industrial Engineering and Management /
Manufacturing Engineering / Marine Engineering / Mechanical Engineering /
Mechanical Engineering (Sandwich) / Mechanical and Automation Engineering /
Mechatronics Engineering / Production Engineering / Robotics and Automation)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is Phase Equilibrium? In a three components system, what is the maximum number of phases that can coexist in equilibrium?
2. State lever rule.
3. Calculate the fractions of proeutectoid ferrite, eutectoid and total ferrite in a 0.2 % C steel?
4. State Fick's laws.
5. What are the essential requirements for a creep resistant material?
6. Give the Griffith's condition for fracture strength.
7. Distinguish between hard and soft magnetic materials.
8. Calculate the critical field required to destroy superconductivity at 5 K in lead whose transition temperature is 7.19 K and the critical field at 0 K is 0.0803 Tesla?
9. List any four applications of ceramics.
10. What are carbon nanotubes? Mention its types.

PART B — (5 × 16 = 80 marks)

11. (a) (i) What is an isomorphous system? (2)
(ii) Explain with an example, how the composition of phases can be determined using the tie-line rule. (14)

Or

- (b) Compare the features of eutectic phase diagram and peritectic phase diagram with suitable examples. (8+8)

12. (a) (i) Draw the Fe- Fe₃C equilibrium diagram. (4)
(ii) Explain the various phases in the Fe-C system and invariant reactions. (12)

Or

- (b) (i) Explain how T-T-T diagram is determined experimentally for a steel specimen. (12)
(ii) Draw T-T-T diagram for a eutectoid steel. (4)

13. (a) (i) Discuss in detail the role of dislocation in Slip. (8)
(ii) Explain any one strengthening method, used in metals and alloys. (8)

Or

- (b) Explain the Brinell hardness and Vickers hardness testing methods. State the advantages and disadvantages. (8+8)

14. (a) Explain the domain theory of ferromagnetism. Briefly discuss the various types of energy involved in domain formation. (16)

Or

- (b) What are superconductors? Discuss in detail the various properties of super conductors. (16)

15. (a) What are Metallic glasses? Explain a synthesizing method, properties and applications of Metallic glasses. (16)

Or

- (b) (i) What are Top-Down and Bottom-Up Approaches? (4)
(ii) Write a note on the properties of nanomaterials. (12)