Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 41113

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2021.

Second Semester

Aeronautical Engineering

PH 8251 — MATERIALS 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 are Solid solutions? Give examples.

2. Compare the tie-line rule and the lever rule.

3. Mention any four factors influencing diffusion in solids.

4. What are hypereutectoid steels?

5. Strain hardening mechanism is not generally used for improving creep resistance. Why?

6. What is Vickers Hardness Number (V.H.N.)?

7. Mention any two applications in each case of hard and soft ferrites.

8. What is meant by polarization of a dielectric material?

9. What are Ceramics? Mention any two applications of ceramics.

10. Mention any four properties of Ni-Ti alloy.

PART B — (5 × 16 = 80 marks)

11. (a) Explain in detail the eutectic phase diagram and the peritectic phase diagram each with a suitable example. Also explain the invariant reactions which takes place during these phases

Or

(b) (i) Draw pressure-temperature phase diagram for one component system of iron and explain existence of different phase regions based on phase rule. (12)

(ii) What are the degrees of freedom of a system of two components when the number of phases is one, two, three and four? (4)

12. (a) Draw iron-carbon (iron carbide) equilibrium diagram and explain the properties of various phases in the iron-carbon system. Also explain various invariant reactions which occur in the iron-carbon system.

Or

(b) Explain martensitic transformation of eutectoid steel. Also explain the process of tempering of martensite and draw hardness variation as a function of temperature for any type of carbon steel.

13. (a) (i) Discuss grain size reduction and precipitation hardening methods for enhancing yield strength of material. (12)

(ii) The yield strength of a polycrystalline material increases from 120 MN m^2 to 220 MN m^2, on decreasing the grain diameter from 0.04 mm to 0.01 mm. Find the yield stress for a grain size of ASTM 9. Given that rain diameter for ASTM 9 is 0.01 59 mm. (4)

Or

(b) (i) Explain the experimental determination of critical stress intensity factor (K_{IC}) and draw its variation as a function of specimen thickness. Mention K_{IC} value for any two alloys (8)

(ii) Discuss different factors affecting fatigue life and suggest any four methods for increasing fatigue life. (8)

14. (a) (i) Apply domain theory to explain hysteresis behavior of a ferromagnetic material. (10)

(ii) Explain how the ferromagnetic materials are classified as hard and soft magnetic materials based on its hysteresis behavior. (6)

Or

(b) (i) Compare the temperature variation of resistivity of superconductors with normal metals. Also discuss various properties associated with superconductors. (10)

(ii) Explain any three possible factors that cause a dielectric material to fail. (6)

15. (a) (i) Explain how metallic glasses are prepared using melt spinning technique. (8)

(ii) Explain the changes in chemical and mechanical properties of material when the particle size is reduced to nanoscale. (8)

Or

(b) Discuss the different types of composite materials based on the nature of reinforcement, with suitable examples.

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