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**Question Paper Code : 80283**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

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 Engineering)

(Regulation 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Hume Rothery rule.
2. Define isomorphous system.
3. State Fick's first law of diffusion.
4. Sketch the temperature – time diagram during the heating cycle of a 0.8% C steel. Use standard Fe-Fe<sub>3</sub>C phase diagram.
5. Define creep resistance.
6. Name four factors that affect hardening process of steel.
7. Calculate the critical current flow through a lead superconducting wire of 1 mm diameter. The critical field is  $7.9 \times 10^3$  amp/metre.
8. Differentiate between dielectric materials and insulators.
9. What are composites? Give an example for natural and manmade composites.
10. List out any four medical applications of nanomaterials.

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PART B — (5 × 16 = 80 marks)

11. (a) What is a eutectic phase diagram? Draw a typical equilibrium diagram for a eutectic type of system with limited solid solubility and explain its important.

Or

- (b) What is binary phase diagram? Explain in detail about binary isomorphous system and the region present in it.

12. (a) Draw TTT diagram for eutectoid steel and explain bainitic and martensitic transformation.

Or

- (b) (i) Calculate the amounts and compositions of phases and microconstituents in a Fe-0.60% C alloy at 726°C.  
(ii) What are the general properties of tool steels?

13. (a) What is fracture? Discuss the different types of fracture.

Or

- (b) (i) Discuss the strain hardening mechanism in detail.  
(ii) What is solid solution strengthening? Discuss in detail the various variables affecting it.

14. (a) What are ferrites? Explain the structure of ferrites, properties and its applications.

Or

- (b) What is ferroelectricity? Explain the structure and properties of ferroelectric materials.

15. (a) Classify the composites based on the matrix phase. Compare them based on their properties and applications.

Or

- (b) What are nanomaterials? Explain the properties and applications of nanomaterials.