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**Question Paper Code : 90497**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Second Semester

Mechanical Engineering

PH 8251 – MATERIALS SCIENCE

(Common to Aeronautical Engineering/Aerospace Engineering/Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/ Manufacturing Engineering/Marine Engineering/Mechanical Engineering (Sandwich)/Mechanical and Automation Engineering/Mechatronics Engineering/ Production Engineering/Robotics and Automation Engineering)  
(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. What is a solid solution ? Give example.
2. Define isomorphous system.
3. State Fick's first law of diffusion.
4. Give the composition of low, medium and high carbon steel.
5. Define proof stress and ultimate tensile strength.
6. What is Hall-Petch equation and explain the terms involved in it ?
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. Give any four applications of shape memory alloys.



## PART – B

(5×16=80 Marks)

11. a) What is a peritectic phase diagram ? Draw a typical equilibrium diagram for a eutectic type of system with limited solid solubility and explain its important features.
- (OR)
- b) What is binary phase diagram ? Explain in detail about binary isomorphous system and the region present in it.
12. a) i) Compare pearlitic and martenstic transformation. (8)  
ii) List the alloying of Si and Cr on properties and structure of steel. (8)
- (OR)
- b) i) Calculate the amounts and compositions of phases and microconstituents in a Fe-0.60%C alloy at 726°C. (10)  
ii) What are the general properties of tool steels ? (6)
13. a) What is fracture ? Discuss the different types of fracture. (16)
- (OR)
- b) i) Discuss the strain hardening mechanism in detail. (8)  
ii) What is solid solution strengthening ? Discuss in detail the various variables affecting it. (8)
14. a) Explain the hysteresis phenomenon in a ferromagnetic material using domain theory and draw the B-H curve for soft and hard magnetic materials. (16)
- (OR)
- b) Explain the phenomenon of super conductivity and the properties exhibited by superconductors. (16)
15. a) Classify the composites based on the matrix phase. Compare them based on their properties and applications. (16)
- (OR)
- b) What are nanomaterials ? Explain the properties and applications of Nanomaterials. (16)
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