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**Question Paper Code : 50863**

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017  
Third/Fourth Semester  
Mechanical Engineering  
ME 6403 – ENGINEERING MATERIALS AND METALLURGY  
(Common to Automobile Engineering/Manufacturing Engineering/Mechanical and  
Automation Engineering)  
(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Draw a typical isomorphous phase diagram.
2. Why carbon content in austenite is higher than ferrite ?
3. What is difference between stress relief and recrystallization heat treatment process ?
4. Which has higher critical cooling rate: eutectoid steel or hypereutectoid steel ?  
Justify.
5. Which type of stainless steel is non magnetic ?
6. What is the role of boron in steel alloying ?
7. What are outstanding properties of PTFE ?
8. List the typical applications of SiC.
9. What are the characteristic features of brittle fracture ?
10. State hardness whether corresponds to ultimate tensile strength or yield strength ?  
Justify ?

50863

-2-



PART – B

(5×13=65 Marks)

11. a) i) Draw Iron-Iron carbide phase diagram, name the various field, line and reactions. (10)
- ii) Find the wt. fraction of ferrite and cementite of eutectoid steel. (3)
- (OR)
- b) Compare the microstructure and properties of various cast iron.
12. a) Brief on hardening and tempering of steel. (7)
- (OR)
- b) Compare different types of case hardening process.
13. a) Brief on the influence of alloying elements in steel under classification of  $\alpha$  and  $\gamma$  stabilisers. (7)
- (OR)
- b) i) What are the classification of aluminium alloys and state the applications of any THREE alloy. (7)
- ii) Brief on the mechanism of ageing treatment of Al-Cu alloy. (6)
14. a) i) Classify composite materials based on the type of reinforcement and state an example of each. (7)
- ii) State the properties and applications of two ceramics from the list : PSZ,  $\text{Si}_3\text{N}_4$ ,  $\text{Al}_2\text{O}_3$  and SIALON. (6)
- (OR)
- b) i) List properties and applications of any three type of ceramics. (7)
- ii) Brief on properties and applications of any two polymers from the list. PP, PC, PEEK, ABS and PS. (6)
15. a) i) Compare slip and twinning. (4)
- ii) Draw a typical creep curve and brief on the mechanism. (9)
- (OR)
- b) i) Draw a typical tensile test curve of metallic sample, mark the different points/ regions that represent different mechanical properties. (4)
- ii) Draw a typical S-N curve of fatigue testing and brief on the mechanism. (9)



PART - C

(1×15=15 Marks)

16. a) i) Explain why certain alloys are heat treatable, some are castable and other wrought? (8)
- ii) Suggest an material of choice for application as orthopaedic implant (or) brake drum of automobile. Justify your choice, based on the properties of materials and method of production. (7)

(OR)

- b) Compare and contrast Brinell, Vickers and Rockwell hardness test technique, advantages and disadvantages. 15