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Code No. : 13504 S

**VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**  
**B.E. (Mech. Engg.: CBCS) III-Semester Supplementary Examinations, May/June-2018**

**Metallurgy & Material Science**

Time: 3 hours

Max. Marks: 70

*Note: Answer ALL questions in Part-A and any FIVE from Part-B*

**Part-A (10 × 2 = 20 Marks)**

1. The grain sizes of two steels are 200 μm and 200 nm respectively. Which one do you expect to have high strength? Provide your reason.
2. List the conditions under which ductile to brittle transition takes place.
3. State Fick's I law of diffusion and indicate its formula.
4. Sketch the S-N curve for a ferrous material and show the endurance limit.
5. Show the cooling curve of pure iron and discuss.
6. Determine the number of phases that can co-exist in equilibrium at the eutectoid point in the iron – iron carbide binary phase diagram.
7. Draw transformation diagram for eutectoid steel (0.8%C) and show on it the time – temperature path that will produce 100% bainite.
8. Outline the heat-treatment necessary to produce martensite.
9. Discuss briefly the steps involved in the extraction of aluminium.
10. Identify a method by which you can keep the sulphur content in steel to be minimal.

**Part-B (5 × 10 = 50 Marks)**

11. a) Explain the phenomenon of slip and twinning with appropriate sketches. [5]  
b) Develop an expression to determine the critical resolved shear stress. [5]
12. a) With the help of neat sketch, discuss on the variation of creep strain with time. [4]  
b) Discuss an experimental method for the determination of fatigue strength of a material. [6]
13. a) Describe qualitatively the microstructural evaluation upon slow cooling of eutectoid steel. [5]  
b) Determine amount of phases for a steel of 0.6%C composition at a temperature just below the eutectoid temperature. [5]
14. a) Differentiate between annealing and normalizing. [5]  
b) A flywheel shaft is made from Low Carbon steel and is to be surface hardened. Suggest suitable techniques and elaborate any two of them. [5]
15. a) Describe the method of production of copper from its ore. [5]  
b) Discuss the composition, properties and applications of different types of brasses. [5]
16. a) Differentiate between Cold working and Hot working processes. [5]  
b) Sketch the fatigue fractured specimen. Discuss the cumulative fatigue damage theory. [5]
17. Answer any *two* of the following:
  - a) Discuss the microstructure, properties and applications of Gray Cast iron. [5]
  - b) Al-Cu alloy is widely being used in aerospace industry due to its age hardening properties. Explain the heat treatment procedure typically followed for attaining the age hardening. [5]
  - c) Define composite materials and discuss their applications. [5]