INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Four Year B.Tech III Semester End Examinations (Supplementary) - July, 2018
Regulation: IARE – R16
METALLURGY AND MATERIAL SCIENCE

Time: 3 Hours   **(ME)**   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Draw a neat sketch of Hexagonal Close Packed(HCP) Structure. Also calculate its Atomic Packing Factor. **[7M]**

   (b) "Grains are stronger than grain boundaries at high temperature and grain boundaries are stronger than grains at room temperature". Validate this statement with detailed explanation. **[7M]**

2. (a) Write about Solid Solution? Discuss about various conditions for forming substitutional solid solutions? **[7M]**

   (b) Describe about intermediate alloy phase? Explain any one type of intermediate alloy phase with suitable example. **[7M]**

UNIT – II

3. (a) Discuss about invariant reaction. Write down the following invariant reactions with examples
   - i. Eutectic **[7M]**
   - ii. Eutectoid

   (b) Two metals A and B of melting points 1000^0C and 800^0C respectively have unlimited mutual liquid solubilities. The solubility of B in A is maximum of 20% at the eutectic temperature of 500^0C, which reduces to 10% at 0^0C.The solubility of A in B is a maximum of 10% at the eutectic temperature which reduces to 5% at 0^0C. No solid state reactions other than those due to solubility changes occur in the series. The eutectic composition is 70% B. Assume solidus, liquidus and solvus lines to be straight. **[7M]**
   - i. Draw the phase diagram of the series
   - ii. Describe the mode of solidification, solid state reactions and room temperature of an alloy containing 40%B.

4. (a) Explain in detail about eutectic phase diagram with the help of neat sketches. **[7M]**

   (b) Explain briefly about construction of phase diagram of solid solution. **[7M]**

UNIT – III

5. (a) Draw Fe-Fe_3C diagram and show all phases, fields and temperature. Write all invariant reactions. Also explain the solidification of steel containing 0.4%C. **[7M]**

    (b) Enumerate the difference between annealing and normalizing in detail. **[7M]**

6. (a) Describe about Austempering and Martempering process for plain carbon steel. Draw cooling curves for these processes. **[7M]**

    (b) Describe the principle of Flame hardening and Induction hardening with neat sketch. **[7M]**

UNIT – IV

7. (a) Explain the composition and properties of **[7M]**
       i. Malleable Cast iron
       ii. Spheroidal cast iron

    (b) Write about chilled cast iron? Describe its properties and application. **[7M]**

8. (a) State the difference between Wrought alloys and Cast alloys. **[7M]**

    (b) Write short note on the following **[7M]**
       i. Titanium alloys
       ii. Copper - nickel alloys

UNIT – V

9. (a) Mention different structures of crystalline ceramics. Describe briefly each of them. **[7M]**

    (b) Explain about cermets with its properties and applications. **[7M]**

10. (a) Wriet a short note on roles of the following in composites **[7M]**
       i. Matrix
       ii. Reinforcement
       iii. Interphase

    (b) Explain about pultrusion process with a neat sketch. **[7M]**

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