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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech III Semester End Examinations (Supplementary) - February, 2018

Regulation: IARE – R16

MATALLURGY AND MATERIAL SCIENCE

(Mechanical Engineering)

Time: 3 Hours

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) Write the difference between crystalline solids and amorphous solids. [7M]
- (b) Describe the following types of bonds [7M]
 - i. Ionic
 - ii. Covalent
 - iii. Metallic

Discuss how strength, ductility and electrical conductivity are influenced by these bonds.
2. (a) What is a solid solution? What are the conditions for forming substitutional solid solutions? [7M]
- (b) What do you mean by intermediate alloy phase? Explain any one type of intermediate alloy phase with suitable example. [7M]

UNIT – II

3. (a) State and discuss Gibb's Phase rule. [7M]
- (b) Two metals A and B are used to form an alloy containing 75% A and 25% B. A melts at 600°C and B at 400°C. When alloyed together these metals form no compounds or solid solutions, but form an eutectic at 40%A and 60%B. Assume that the liquidus lines are straight and the eutectic solidifies at 250°C. [7M]
 - i. Construct the phase diagram and label each region
 - ii. Determine the % Eutectic at room temperature and % of solid in the alloy at 300°C.
 - iii. Find the temperature at which the alloy will begin solidification and completes the solidification.
4. (a) Explain the following with neat diagrams (i) Peritectic system (ii) Eutectoid system. [7M]
- (b) Explain Aluminium rich portion of Al-Cu phase diagram with neat sketch and label the various points, lines and areas. [7M]

UNIT – III

5. (a) Draw Fe-Fe₃C diagram and show all phases, fields and temperature. Write all invariant reaction and explain the solidification of steel containing 0.4%C. [7M]
- (b) Enumerate the difference between annealing and normalizing. [7M]
6. (a) Draw TTT diagram for eutectoid steel and explain the different microstructures obtained at various cooling rates. [7M]
- (b) What is Martempering? What are its advantages over conventional hardening process. [7M]

UNIT – IV

7. (a) Explain various heat treatment process given to cast iron? Explain them in brief. [7M]
- (b) Write short note on the following [7M]
- i. Ni-Resist Cast Iron
 - ii. Ni-Hard cast iron
8. (a) Write short note on the following [7M]
- i. Gun metal
 - ii. Cartridge Brass
- (b) Why alpha brass is more ductile than 60 - 40 brass? [7M]

UNIT – V

9. (a) Discuss types of glasses. Explain properties and applications of various glasses. [7M]
- (b) Discuss properties and applications of crystalline ceramics. [7M]
- i. Grain size and shape
 - ii. Purity
 - iii. Porosity
10. (a) Write short note on the following [7M]
- i) Metal matrix composite
 - ii) Ceramic-matrix composite
- (b) Differentiate between thermoplastics and thermosetting plastic. [7M]

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