Question Paper

Exam Date & Time: 30-Dec-2019 (09:30 AM - 12:30 PM)



MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTER FOR APPLIED SCIENCES END SEMESTER THEORY EXAMINATIONS NOVEMBER 2019 III SEMESTER B.sc. (Applied Sciences) in Engg. MATERIAL SCIENCE AND METALLURGY [IME 233 - S2]

Marks: 100

Answer 5 out of 8 questions. Missing data, if any, may be suitably assumed (8) 1) What is atomic packing factor? Find the Atomic packing factor for HCP structure. A) B) (6) Explain the procedure of obtaining miller indices for planes and sketch the following planes of miller indices: (201), (212), (100) C) Write the differences: i)Edge and Screw dislocation ii) Schottky and Frankel ⁽⁶⁾ defects (8) 2) Differentiate the following with necessary diagrams i)Homogeneous and Heterogeneous nucleation A) ii) Cooling curves for pure metals and alloys B) (6) What is the importance of super cooling in solidification of liquid metals. C) (6) Explain interstitial and substitutional solid solutions. 3) (10)Write short notes on: i) Gibb's phase rule ii) Hume Rothery rule A) B) (10)What do you mean by intermediate phase? Explain any two of them . (10)4) Explain the construction procedure of binary Isomorphous system. Give an example and sketch the diagram. A) B) (10)Write schematic phase diagram and reactions for the following eutectic systems and explain: i)Components are completely soluble in the liquid state and partly soluble in the solid state ii)Components are completely soluble in the liquid state and insoluble in the solid state 5) (10)An alloy pair forms a eutectic at 600°C of composition 60% Band 40%A. A and B have unlimited mutual liquid solubilities. Two metals A and B have A) their melting points at 900°C and 800°C respectively. Their solid solubilities are as follows: 10% B in A at 600°C and 5% B in A at 0°C ,8% A in B at

Duration: 180 mins.

600°C and 4% A in B at 0°C Assume the liquidus, solidus and solvus lines to be straight. No solid state reactions or any intermediate phase changes occur in the series. i)Draw the phase diagram for the series and label all salient temperatures, compositions and regions. ii) Find the freezing range and room temperature structure of an alloy of composition 60% A and 40% B, with respect to the number, type, extent and composition of the phases iii)Amount of eutectic and pro eutectic phases for 30%A alloy at room temperature iv) Temperature where equal proportions of liquid and solid phases exist for 20%B alloy.

- ^{B)} Neatly sketch the Fe-Fe3C phase diagram and label the regions and show ⁽¹⁰⁾ cooling diagram of pure iron
- With relevant sketches explain the construction of TTT diagram for 1080 (10) steel
 - ^{B)} What is heat treatment? What are its objectives? Classify the heat treatment ⁽¹⁰⁾ processes. Show cooling curves of possible heat treatments on IT diagram.
- ⁷⁾ Explain the theory of case hardening treatment. Also explain carburizing (10) and nitriding processes with chemical reactions during the process.
 - ^{B)} "Tempering follows hardening" justify. Explain low medium and high (10) temperature tempering processes.
- ⁸⁾ Explain the effects of following elements on steels: Nickel, Cobalt, Copper, ⁽¹⁰⁾ Molybdenum, Niobium.
 - ^{B)} List the various types of stainless steels and explain their characteristics. ⁽¹⁰⁾

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