# Question Paper

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

## MANIPAL ACADEMY OF HIGHER EDUCATION

**INTERNATIONAL CENTRE FOR APPLIED SCIENCES**
**III SEMESTER B.Sc. (Applied Sciences) IN ENGINEERING END SEMESTER EXAMINATION APRIL/MAY 2019**
**MATERIAL SCIENCE AND METALLURGY [IME 233]**

**Marks: 100** **Duration: 180 mins.**

**Answer 5 out of 8 questions.**

1) A) What are the various types of Crystal Imperfections? Explain with a neat sketch
Ionic Defects
Interstitial & Substitutional defects. (10)

B) What is co-ordination number? Explain the co-ordination number for BCC. FCC, HCP. Show that packing efficiency of both FCC and HCP are approximately same. (10)

2) A) What are dislocations? Explain with a neat sketch edge and screw dislocation with the help of Burger's Circuit. (10)

B) Explain the conditions favorable for the formation of solid solutions. (10)

3) A) Differentiate between homogeneous and heterogeneous nucleation. (10)

B) With any two cooling curves and phase diagram, explain the binary system where the components are completely soluble in liquid and insoluble in solid state. Name the system and give one example. (10)

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| 4) | | Melting temperatures of metal A and metal B are 800$^{o}$C and 1200$^{o}$C respectively. Metal A and B are mutually soluble in the liquid state and partly soluble in the solid state. A liquid phase alloy containing approximately 30% B completely transforms into a mixture of two solid solutions at 600$^{o}$C. Maximum solubility of A in B and B in A are approximately 15% and 10% respectively at 600$^{o}$C, 10% and 5% respectively at 300$^{o}$C. Assuming the solubility curves to be linear, draw phase diagram to scale and label the regions. For 60% B alloy determine the following:<br><br>Weight percentage of the Eutectic mixture formed.<br>Composition of the liquid phase for the reaction. | (10) |
| | A) | | |
| | B) | With heat treatment cycle, purposes and relevant sketches explain the following:<br>Hardening<br>Tampering | (10) |
| 5) | | With relevant sketches explain the standard hardenability test for eutectoid steel. | (10) |
| | A) | | |
| | B) | Neatly sketch the Fe-Carbon phase diagram and label the regions. On the diagram show any two alloys which solidifies like pure metal. | (10) |
| 6) | | Explain with part of phase diagram and any two cooling curve Peritectic Phase diagram. | (10) |
| | A) | | |
| | B) | With a part of phase diagram and cooling curves, explain the phase transformation of steel from austenite phase to room temperature phase. | (10) |
| 7) | | Write the procedural steps of TTT diagram and neatly sketch the diagram for eutectoid steel. | (10) |
| | A) | | |
| | B) | Why degree of super cooling is necessary during solidification process? | (10) |
| 8) | | Breifly explain general properties of cast iron. | (10) |

A)

B) Explain three carburizing methods. (10)

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