# **INSTITUTE OF AERONAUTICAL ENGINEERING**

(Autonomous) Dundigal-500043, Hyderabad

B.Tech III SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024

Regulation: UG20 MATERIALS ENGINEERING

Time: 3 Hours

(MECHANICAL ENGINEERING)

Max Marks: 70

Answer ALL questions in Module I and II Answer ONE out of two questions in Modules III, IV and V All Questions Carry Equal Marks All parts of the question must be answered in one place only

## $\mathbf{MODULE}-\mathbf{I}$

1. (a) What do you mean by atomic packing factor? Derive APF for BCC and FCC structures.

[BL: Understand| CO: 1|Marks: 7]

(b) Crystalline a luminum has cubic structure. The unit edge length is 4.440 X  $10^8$ . The density of solid aluminum is 4.096 g/cm<sup>3</sup>. Calculate the number of a luminum atoms in one unit cell.

[BL: Apply| CO: 1|Marks: 7]

#### $\mathbf{MODULE}-\mathbf{II}$

- 2. (a) Write a short notes on the following terms:
  - i) Hardness
  - ii) Ductility
  - iii) Fatigue
  - iv) Creep
  - v) Toughness vi) Stiffness

- [BL: Understand] CO: 2|Marks: 7]
- (b) Draw neat and labeled iron cementite phase diagram. What are the various reactions taking place in iron cementite phase diagram? [BL: Understand] CO: 2|Marks: 7]

## $\mathbf{MODULE}-\mathbf{III}$

- 3. (a) Differentiate between normalizing and annealing. Explain why normalizing results in more uniform structure than annealing? [BL: Understand| CO: 3|Marks: 7]
  - (b) Explain the properties and developments of microstructures constituent in iron carbon phase diagram. [BL: Understand| CO: 3|Marks: 7]
- 4. (a) Compare different stages of tempering of plain carbon steel based on
  - i) Main transformation
  - ii) Change in volumeiii) Change in hardness.
- [BL: Understand| CO: 4|Marks: 7]
- (b) A cold chisel is made of plain carbon steel. Analyse the application for properties required, select the hardness range desired, select the carbon content and specify the heat treatment.

[BL: Apply] CO: 4|Marks: 7]

#### $\mathbf{MODULE}-\mathbf{IV}$

- 5. (a) What are important types of cast iron? Write composition and application of each. Why cast iron is desirable for engineering material? [BL: Understand| CO: 5|Marks: 7]
  - (b) Describe the composition, properties and uses of various aluminum alloys.

[BL: Understand] CO: 5|Marks: 7].

- 6. (a) Why nodular cast iron is ductile? Discuss in detail about non-heat treatable aluminium alloys. [BL: Understand] CO: 5|Marks: 7]
  - (b) With the help of aluminium-copper phase diagram, explain the precipitation strengthening mechanism with appropriate microstructures.
    [BL: Understand] CO: 5|Marks: 7]

#### $\mathbf{MODULE}-\mathbf{V}$

- 7. (a) Differentiate between thermosetting and thermoplastic polymer. Write down the application of these polymer. [BL: Understand| CO: 6|Marks: 7]
  - (b) List various factors for thermal shock resistance. Explain particle-reinforced and fiber-reinforced composites and their properties. [BL: Apply] CO: 6|Marks: 7]
- 8. (a) Summarize about polymerization process. Classify the polymerization process and explain anyone in details. [BL: Understand| CO: 6|Marks: 7]
  - (b) State the fiber-reinforced composites with their properties and applications. Compare tungsten carbide and silicon nitride. [BL: Apply] CO: 6|Marks: 7]

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