Hall Ticket No | | | | | | | | | | | Course Code: AMEC07

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

B.Tech III SEMESTER END EXAMINATIONS (REGULAR / SUPPLEMENTARY) - FEBRUARY 2023

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

MODULE – I

1. (a) Explain the primary and secondary atomic bonding with a neat sketch. Distinguish between edge and screw dislocations based on the Burgers vector. [BL: Understand| CO: 1|Marks: 7]

   (b) Magnesium (Mg) has an HCP crystal structure, a c/a ratio of 1.624, and a density and molecular weight 1.74 g/cm3, 24.3g/mol. Compute the atomic radius for Mg.[BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) What is phase rule? Mention the number of phases, components and degree of freedom at the peritectic temperature of a binary phase diagram. [BL: Understand| CO: 2|Marks: 7]

   (b) Two metals A and B have 100 % mutual solubility in the liquid and solid states are given in Table 1. The melting point of pure metals A and B are 800^0C and 600^0C respectively. Details of start and end of solidification of various alloys in the series are as follows.

Table 1

Alloy composition	Temperature at the start of solidification ($.^0C$)	Temperature at the end of solidification ($.^0C$)
90%A+10%B	798	750
70%A+30%B	785	705
50%A+50%B	757	675
30%A+70%B	715	645
10%A+90%B	650	615

   i) Draw the phase diagram of the series and label all the regions

   ii) Determine the number, relative amount and concentration of phases present in an alloy of 40% A and 60% B at 700^0C and 400^0C. [BL: Apply| CO: 2|Marks: 7]

MODULE – III

3. (a) Compare normalizing and hardening. With appropriate graphs, describe the following processes i) Full annealing ii) Tempering iii) Hardening [BL: Understand| CO: 3|Marks: 7]

(b) Interpret the solid phases, invariant reactions and transformation of phases in steel with reference to iron-iron carbide equilibrium phase diagram. [BL: Apply| CO: 3|Marks: 7]

4. (a) Classify steel based on carbon content. Provide the properties and related applications. [BL: Understand| CO: 4|Marks: 7]

(b) Describe isothermal transformation diagrams and discuss the cooling curves superimposed on Time temperature transformation (TTT). Explain the transformation of austenite with respect to time. [BL: Understand| CO: 4|Marks: 7]

MODULE – IV

5. (a) Classify various types of cast iron. Explain the nodular and spheroidal cast iron reference to composition, microstructure, properties and applications [BL: Understand| CO: 5|Marks: 7]

(b) Discuss in detail about alpha and beta stabilizer? Give at least two applications of alpha, alpha - beta and beta alloys. [BL: Apply| CO: 5|Marks: 7]

6. (a) Explain various aluminum based alloys. Mention their applications in aircraft applications. [BL: Understand| CO: 5|Marks: 7]

(b) Distinguish between white cast iron and malleable cast iron with respect to their composition, microstructure, properties and applications [BL: Understand| CO: 5|Marks: 7]

MODULE – V

7. (a) Outline the properties and applications of the polymers: PMMA and PVC with reference to chemical structures. [BL: Understand| CO: 6|Marks: 7]

(b) Summarize about glass ceramics. How are they formed? Discuss the desirable characteristics of glass ceramics. [BL: Apply| CO: 6|Marks: 7]

8. (a) List the advantages and limitations of composite materials. Identify the need for developing composite materials citing some practical situations. [BL: Understand| CO: 6|Marks: 7]

(b) List the different reinforcement materials used in metal matrix composites. Categorize various types and characteristics of reinforcement materials. [BL: Apply| CO: 6|Marks: 7]

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