Hall Ticket No | | | | | | | | | | | Question Paper Code: AME005

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER

B.Tech III Semester End Examinations, November – 2018

Regulations: IARE-R16

METALLURGY 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 about metallic bond? Explain about various type of bonding does influence the properties of crystals? Distinguish between a family of planes and family of directions.	**[7M]**
	b)	Discuss about Atomic packing factor (APF)? Find APF of a Body Centered Cube and a Face Centered Cube?	**[7M]**
2.	a)	Explain the effects of crystal structure and atomic radii on formation of solid solution between two metallic elements.	**[7M]**
	b)	Discuss about intermediate phases? Explain most common types of intermediate phases with examples.	**[7M]**

UNIT – II

3.	a)	Discuss about cooling curve? With the help of appropriate diagram explain the cooling curve for (i) Pure metal (ii) Binary solid solution (iii) Binary eutectic system.	**[7M]**
	b)	Elements A and B melt at 600˚C and 900˚C respectively. They form an eutectic at 40 % B and at temperature 400˚C. Draw a typical phase diagram between A and B. Find (i) Amount of free A and eutectic in 20 % B alloy (ii)Amount of free B and eutectic in 60 % B alloy	**[7M]**
4.	a)	Draw and explain the various areas of an isomorphous system (phase diagram) in which two metals are completely soluble in solid as well as liquid.	**[7M]**
	b)	Explain How is the cored structure formed and how can it be eliminated?	**[7M]**

UNIT – III

5.	a)	A1.0% hypereutectoid plain carbon steel is slowly cooled from 900˚C to a temperature just above 723˚C. Calculate the weight percentage of proeutectoid cementite and austenite present in steel.	**[7M]**

b) Explain the effect of small quantities of (i) Sulphur (ii) Manganese (iii) Phosphorus (iv) Silicon upon the properties of steel? **[7M]**

6. a) Describe the Austempering and Martempering process for Plain carbon steel. Draw the cooling curves for these processes. **[7M]**
   b) Recommend a heat treatment process to improve the machinability of high carbon steel. Explain the process and indicate the microstructure desired with a neat sketch. **[7M]**

UNIT – IV

7. a) Explain the composition and properties, uses of (i) SG Iron (ii) White Cast iron (iii) Malleable cast iron. [**7M]**
   b) Write a short note on (i) Ni-resist Cast iron (ii) Ni-hard Cast iron. **[7M]**

8. a) State composition and properties of any three bearing materials. **[7M]**
   b) Describe the tin bronzes based on composition, properties and applications. **[7M]**

UNIT – V

9. a) Describe the structure, properties and applications of the following engineering thermoplastic polymers (i) Nylons (ii) Polyethylene terephthalate (PET). **[7M]**
   b) Describe the properties and applications of following structural ceramics (i) Alumina (ii) Silicon carbide (iii) Silicon nitride. **[7M]**

10. a) Describe the following particulate reinforced composites (i) Cermets (ii) Cast metal particulate composites. **[7M]**
    b) Compare the advantages and limitations of Fibre reinforced polymer matrix and ceramic composites. **[7M]**

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COURSE OBJECTIVES:

I	Understanding of metallurgical engineering concepts and properties.
II	Analyze of microstructures of metals and alloys and relationship to heat treatment.
III	Compare the properties of ceramics, glasses, composites and polymers for industrial applications.

COURSE OUTCOMES:

S. No.	Description	Blooms Taxonomy Level
CAME005.01	Analyze the structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, Atomic packing factor, Coordinate number etc.	Understand
CAME005.02	Explain the necessity of alloying, types of solid solution and intermediate alloy phases.	Understand
CAME005.03	Explain the concept of phase and phase diagram and understand the basic terminologies associated with metallurgy.	Remember
CAME005.04	Construction of phase diagrams and identification of different phases and invariant reaction.	Remember
CAME005.05	Understand and suggest the heat treatment processes and types, and significance of mechanical and metallurgical properties with respect to microstructures.	Remember
CAME005.06	Explain the concept of Hardenability and demonstrate the test used to find the Hardenability of steels.	Remember
CAME005.07	Analyze the microstructure of metallic materials using phase diagram and modify the microstructure and properties using different heat treatment processes.	Remember
CAME005.08	Define and differentiate engineering materials on the basis of structure and properties for engineering applications.	Understand
CAME005.09	Explain features, classification, and application of materials like polymers like thermosetting, thermoplastics.	Understand
CAME005.10	Explain features, classification, and application of materials like ceramics.	Understand
CAME005.11	Explain features, classification, and application of materials like composites.	Understand
CAME005.12	Differentiate the properties and application of various materials like ceramics, composites and polymers.	Understand

CAME005.13	To make the students conversant with ISO and IS standards of the material composition and mechanical properties.	Understand
CAME005.14	To design and develop materials for high temperature applications and understand mechanical properties at elevated temperatures.	Understand
CAME005.15	To familiarize on different international standards for composite materials and its applications	Remember
CAME005.16	To design materials for strength to weight ratio applications.	Remember

MAPPING OF MODEL QUESTION PAPER QUESTIONS TO THE ACHIEVEMENT OF COURSE OUTCOMES

SEE Question No.		Course Outcomes		Blooms Taxonomy
1	a	CAME005.01	Analyze the crystal structure of materials	Understand
	b	CAME005.01	Analyze the crystal structure of materials	Understand
2	a	CAME005.02	Relate properties of metals to micro structure	Remember
	b	CAME005.03	Explain the concept of phase and phase diagram.	Remember
3	a	CAME005.04	Construction of phase diagrams and identification of reactions.	Remember
	b	CAME005.04	Construction of phase diagrams and identification of reactions.	Remember
4	a	CAME005.04	Construction of phase diagrams and identification of reactions.	Remember
	b	CAME005.04	Construction of phase diagrams and identification of reactions.	Understand
5	a	CAME005.05	Understand the heat treatment processes and its types.	Understand
	b	CAME005.05	Understand the heat treatment processes and its types.	Understand
6	a	CAME005.06	Apply the principles of heat treatment for improving properties.	Understand
	b	CAME005.06	Apply the principles of heat treatment for improving properties.	Understand
7	a	CAME005.07	Select metals and alloys for engineering applications	Understand
	b	CAME005.07	Select metals and alloys for engineering applications	Understand
8	a	CAME005.08	Identify suitable metals, non-metals for various industrial products	Remember
	b	CAME005.08	Identify suitable metals, non-metals for various industrial products	Remember
9	a	CAME005.09	Understand various advantages and limitations of polymers.	Remember
	b	CAME005.10	Understand various advantages and limitations of Ceramics.	Remember
10	a	CAME005.11	Understand various advantages and limitations of composites.	Remember
	b	CAME005.12	Compare properties of ceramics and composites.	Understand

Signature of Course Coordinator

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HOD, Mechanical Engineering