

Code No: RT21031

R13**SET - 1**

II B. Tech I Semester Supplementary Examinations, June - 2015
METALLURGY AND MATERIAL SCIENCE
(Com. to ME, AME)

Time: 3 hours

Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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**PART -A**

- 1 a) Explain metallic bond in detail. [3]
- b) What is an alloy? What is the need for alloying? [3]
- c) What is an eutectic temperature? [4]
- d) What are cast Irons? Why are they named so? [4]
- e) Give reasons why there exist many types of ceramics. [4]
- f) What are the properties that are to be considered for good bonding between fibres and matrix. [4]

**PART -B**

- 2 a) Explain the cooling history of 4.3% C in Fe-Fe<sub>3</sub>C system by drawing cooling curve? [8]
- b) Calculate proportionate of different phases for 2.8%C in Fe-Fe<sub>3</sub>C diagram at 1200<sup>0</sup>C, 1173<sup>0</sup>C, and 600<sup>0</sup>C. Also draw the microstructures at room temperature? [8]
- 3 a) What are cast Irons? Why are they named so? Give the importance of cast irons in the metallurgical curriculum with suitable example [8]
- b) Explain the microstructure, properties and applications of [8]
  - i. White Cast Iron
  - ii. S.G. Cast Iron.
- 4 a) What are the requirements of an age-hardenable alloy. [4]
- b) Give a typical heat treatment schedule for duralumin and explain the relevant microstructural changes. [12]

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**R13****SET - 2**

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PART -A

- 1 a) What is the importance of grain size in steel? [3]
b) Justify the statement “ Alloy is a material which is expected of a metal, but it is not a pure metallic element”. [3]
c) Name possible types of Cementite in Fe-Fe₃C diagram? [4]
d) Discuss in detail the effect of alloying elements in steels. [4]
e) Distinguish between hardness and hardenability. [4]
f) Discuss briefly about whisker reinforced composites? [4]

PART -B

- 2 a) Define and explain the structural phases. [9]
i. Ferrite
ii. Austenite
iii. Cementite.
b) Describe the construction of the phase diagram for 2 metals completely soluble in liquid state and insoluble in solid state. [7]
- 3 What are four basic types of cast Irons? Explain them with respect to properties, microstructure with a diagram and applications? [16]
- 4 a) Define the term heat treatment and explain why are the steels heat treated [8]
b) Define and explain hardness and Hardenability. [8]

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R13**SET - 3**

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2. Answer **ALL** the question in **Part-A**
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**PART -A**

- 1 a) Define grain and grain boundary? [3]
- b) Discuss various types of intermediate phases? [3]
- c) What is the effect of carbon on Mechanical properties [4]
- d) What is the difference between Iron-Cementite and Iron-graphite phase diagram? [4]
- e) Give the heat treatment and applications for the following steels [4]
  - i. Austenitic stainless steels
  - ii. Martensitic stainless steels
- f) What are laminates? Indicate their characteristics. [4]

**PART -B**

- 2 a) Define crystallization of metal? How is that commercial alloy invariably solidify with heterogeneous nucleation? [8]
- b) What factor favours the formation of fine grained material? How is a large single crystal being produced? [8]
- 3 a) What is the disadvantage of too high a first stage annealing temperature for Malleable Cast Iron? Explain. [8]
- b) Why are alloying elements added to steels? Give some examples of common alloying elements and their effect on the properties of steel. [8]
- 4 a) Discuss the characteristics of quenchants for effective removal of heat from a work piece. [8]
- b) Explain the effect of current on the depth of hardness during the induction hardening process. [8]

SET - 3

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**R13****SET - 4**

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2. Answer **ALL** the question in **Part-A**  
3. Answer any **THREE** Questions from **Part-B**

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PART -A

- 1 a) Write a short note on Directional solidification. [3]
- b) What do you mean by intermediate alloy phase? [3]
- c) Give the classification of stainless steels? [4]
- d) Discuss briefly Nitriding of steels. [4]
- e) Explain the effects of quenching media on the hardness of steels. [4]
- f) What is the role of matrix in a composite material? Discuss various types of matrix materials. [4]

PART-B

- 2 a) Explain chemical compounds, metallic compounds and interstitial compounds with suitable examples. [9]
- b) Explain the effect of alloying elements on the properties of steel as substitutional and interstitial alloying elements. [7]
- 3 a) Draw a neat sketch of Fe-Fe₃C diagram and label all important points, lines and phases in it. [10]
- b) Explain the solidification of hypo eutectic cast Iron. [6]
- 4 a) Explain the following: [16]
 - (i) Natural aging
 - (ii) Artificial aging
 - (iii) Delayed aging
 - (iv) Solution treatment in Age hardening process
- 5 a) Explain about Alpha and Alpha-Beta Alloys of Titanium . [8]
- b) Which Aluminium casting alloy develops the highest mechanical properties?. Why? [8]

SET - 4