Total No. of Questions : 8]

SEAT No. :

PA-1280

[Total No. of Pages : 4

[5925]-305

S.E. (Mechanical/Automation & Robotics Engg.)

ENGINEERING MATERIALS AND METALLURGY

(2019 Pattern) (202044) (Semester - III)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Logarithmic tables, slide rule, electronic pocket calculator is allowed.***
5) ***Assume suitable data if necessary.***

Q1) a) Define the following with the help of a neat sketch. **[5]**

i) Ordered Substitutional Solid Solution

ii) Disordered Substitutional Solid Solution

b) What is meant by a binary Solid Solution alloy, draw the cooling curve of a typical solid solution alloy. **[5]**

c) What is a peritectic transformation? Show the peritectic point on Fe-C phase diagram. Evaluate the percentage of constituent elements at the peritectic point. **[8]**

OR

Q2) a) Explain how the following factors affect the nucleation process and graph the effect as a function of temperature. **[5]**

i) Nucleation Rate.

ii) The Growth Rate

b) What is Gibb's phase rule? Explain the various terms involved in it. **[5]**

c) What is an Eutectoid transformation? Show the Eutectoid point on Fe-C phase diagram. Evaluate the percentage of constituent elements at the Eutectoid point. **[8]**

P.T.O.

Q3) a) State the difference between Martensite and Pearlite on the basis of the Following points. **[5]**

i) Mechanism of formation

ii) Microstructure

iii) Cooling rate

iv) Properties

v) Application

b) Give any two reasons why Hypereutectoid steels in an Iron-Carbon Alloy are annealed from above the lower critical temperature (A_1) but never from above the upper critical temperature (A_{cm}). **[5]**

c) Describe the induction hardening technique and its two advantages and two disadvantages over flame hardening. **[7]**

OR

Q4) a) What is retained austenite? Write any two advantages and one disadvantage of Retained austenite in hardened steel? **[5]**

b) State the difference between Annealing and Normalizing with reference to the following points ? **[5]**

i) Procedure

ii) Microstructure

iii) Mechanical properties imparted after the process

iv) Internal Stresses

v) Grain size distribution

c) Show the following heat treatment cycles on a common Isothermal Transformation diagram of a hypoeutectoid steel. **[7]**

i) Martempering

ii) Austempering

also state the reason why the Austempering processes is expensive?

Q5) a) What is the content of carbon in Low Carbon Steel? State two Properties and two applications of Low Carbon Steel. **[5]**

b) What type of stainless steel would you prefer for the following and Why? **[5]**

i) Razor Blades

ii) Wrist watches

c) Explain the manufacturing process of a Malleable Cast Iron with the help of a Time – Temperature plot. State any four applications of Malleable Cast Iron. **[8]**

OR

Q6) a) What is the content of carbon in High Carbon Steel? State two Properties and two applications of High Carbon Steel. **[5]**

b) State the composition of the following steels which are designated as per Indian standard Designation system. **[5]**

i) 25 C5

ii) 35 Mn 1 S 18

c) Explain the effect of the following factors on the microstructure and properties of Cast Iron. **[8]**

i) Amount of total phosphorous, silicon and the equivalent carbon due to the presence of them (phosphorous and silicon)

ii) Rapid cooling, Slow cooling

Q7) a) What is 85-5-5-5 bronze? State any three applications of it. **[5]**

b) What is the percentage of Zinc in Gilding metals? State any four uses of Gilding metals. **[5]**

c) What is Nickel's crystal structure? Give the composition, at least one property, and use of the Nickel Alloys listed below. **[7]**

i) Invar

ii) Inconel

OR

Q8) a) What are bearing materials? Give the composition of the following bearing material. **[5]**

i) White Metal Alloys

ii) Copper-Lead Alloys

b) List any two materials that are commonly used in additive manufacturing. Also, for each of them, mention two areas of Application. **[5]**

c) What is Aluminium's crystal structure? Give the composition, at least one property and use of the Aluminium Alloys listed below. [7]

i) Y-Alloy

ii) Hinduminium

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