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QUESTION BANK

ENGINEERING MATERIALS AND METALLURGY

UNIT I

CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

PART – A

1. What are the effects of crystal structure and atomic radii on formation of solid solution between two metallic elements?
2. Define peritectic reactions?
3. Define eutectoid reactions?
4. State the conditions under which two metallic elements will exhibit unlimited solid solubility.
5. Define the terms "ferrite" and "austenite" in iron carbon alloy system
6. Distinguish between hypo- eutectoid steels and hyper-eutectoid steels
7. What is substitutional solid solution? Give two examples
8. Give an example of eutectoid reaction.
9. Why carbon solubility is more in an austenite?
10. List advantages of alloy steels as compared to plain carbon steels.
11. Name and explain any one type of binary solid to solid state transformations reaction with ideal phase diagram
12. Define solid solutions
13. How are steels classified?
14. Distinguish between eutectic and eutectoid transformations.
15. State peritectic and peritectoid reactions.
16. What are interstitial solid solutions and interstitial compounds?
17. Distinguish between steel and cast iron. Also classify steel with respect to carbon percentage.

PART – B

Iron carbon diagram

1. Show the different steel and cast iron region in the iron carbon diagram with its microstructure and write down its composition, mechanical properties and application. (AU: May 2012, Dec 2009, May 2008)

2. Draw Iron carbon diagram and label all fields? (AU: May 2012, Dec 2009, May 2008)

3.Using the iron carbon diagram predict the micros true at room temperature of a carbon steel that contain 0.4% carbon when cooled in furnace. (AU: May 2012, Dec 2009, May 2008)

4. Elements A and B melt at 700^0C and 1000^0C respectively. Draw a typical isomorphous phase diagram between the elements A and B (8) (AU: May 2012, Dec 2009, May 2008)

5. Elements A and B melt at 700^0C and 1000^0C respectively. They form a eutectic at 35% A at temperature 500^0C.draw a typical phase diagram between A and B (8) (AU: May 2012, Dec 2009, May 2008)

6. Metal A has melting point of 1000^0C. Metal B has melting point of 500^0C. Draw on phase diagram for each of the following conditions

i) The two elements exhibit unlimited solid solubility

ii) The alloy system shows formation of two terminal solid solutions and a eutectic point, at 50% A and at 700^0C

iii) The alloy system shows formation of an intermetallic phase with the chemical formula"A_2B" (AU: May 2012, Dec 2009)

7. i)Draw the schematic isothermal transformation diagram corresponding to 0.8% carbon steel.(8)
ii) What will be the microstructure of a 0.25% C steel at room temperature (5) (AU: May 2012)

8. Draw a typical equilibrium diagram for an isomorphous system and explain the equilibrium cooling of any one alloy from the above diagram. (AU: May 2012, Dec 2009, May 2008)

9. Draw a typical equilibrium diagram for a eutectic type of system with limited solid solubility and explain its important features. (AU: May 2012, Dec 2009, May 2008)

10. Explain the Peritectic temperature using a binary equilibrium peritectic phase diagram (AU: May 2012)

11. Explain the method of plotting an equilibrium diagram and derive the lever rule as applied to equilibrium diagram. (AU: May 2011, May 2010)

12. Discuss the effect of Silicon, Manganese elements in cast iron. (AU: May 2012)

13. What is the effect of small quantities of (a) Sulphur (b) manganese (c) phosphorus (d) Silicon upon the properties of steel? (AU: May 2011, May 2010)

14. Describe the composition, microstructure, properties and applications of grey cast iron. (AU: May 2011, May 2010)

PART - C

(If Applicable, Either or Choice)

For Case Study/Comprehensive type Questions, there will be no choice.

UNIT II

HEAT TREATMENT

PART - A

1. Name various methods of heat treatment of steel.

2. When the annealing process is preferred?

3. Define full annealing.

4. Define heat treatment.

5. What is martensite and for eutectoid steel in what temperature range it is generally formed?

6. What is the purpose of spheroidising annealing?

7. Define normalizing.

8. What is the purpose of normalizing?

9. What are the factors affecting the hardening process?

10. What is austempering process and what is the microstructure produced after austempering?

11. What is martempering process and what is the purpose of this treatment?

12. Distinguish between hardness and hardenability.

13. Define carburizing.

14. What are the three methods of carburizing commonly employed?

15. What is the purpose of flame hardening and induction hardening of steel?

16. Name the four different methods used for flame hardening.

17. What steels are commonly used for nitriding?

18. What is the process of nitriding?

19. Define cyaniding.

20. What is the process of carbonitriding?

PART – B

TIME TEMPERATURE TRANSFORMATION (TTT) DIAGRAM

1. Describe the method of plotting isothermal transformation or TTT diagram? (AU: May 2011, May 2010)

2. Draw an IT diagram or TTT diagram for an eutectoid steel .Indicate the various decomposition products on it and explain? (AU: May 2011, May 2010)

Continuous Cooling Transformation (CCT) diagrams

3. Draw a schematic CCT diagram for a carbon steel containing 0.8% C .Using this diagram explain how different cooling curves lead to the (a)Annealing heat treatment (b) Normalizing heat treatment (c) Hardening heat treatment (AU: May 2012, Dec 2009, May 2008)

Quenching test

4. Explain how Jominy end quench test is used for determining the harden ability of steels. (AU: May 2012)

Carburizing.

5. Describe the heat treatment cycle following carburizing. (AU: May 2011, May 2010)

6. Describe the process of carbonitriding. Differentiate between carburizing and carbonitriding. (AU: May 2011, May 2010, May 2009 Dec 2008)

Hardening.

7. i)Explain flame hardening.

ii) What is speroidize annealing process? State its applications (AU: May 2011, May 2010)

8. Explain Induction hardening. (AU: May 2012, Dec 2009, May 2008)

9. Give a detailed account on (a) Annealing (b) Normalizing (c) Aus tempering (d) Case hardening e) Mar tempering (AU: May 2011, May 2010, May 2009 Dec 2008)

10. Explain how surface hardening is achieved using flame hardening. (AU: May 2012)

11. Explain the hardening and tempering process with respect to heat treatment procedure, microstructure and mechanical properties.

12. i) What is meant by harden ability? Describe a method of measuring harden ability of alloy steel

ii) Distinguish between diffusion and thermal surface hardening treatments. (AU: May 2010)

13. i)The normalized steel is found to be superior to that of annealed steel. Why? Explain

ii) Distinguish between aus tempering and mar tempering. (AU: May 2004)

PART - C

(If Applicable, Either or Choice)

For Case Study/Comprehensive type Questions, there will be no choice.

UNIT – III
FERROUS AND NON FERROUS METALS

PART - A

1. What is the effect of chromium alloying element on the properties of steel?

2. What is cast iron?

3. What is HSLA?

4. What are advantages of alloy steels over plain carbon steels?

5. Discuss the general effects of alloying elements in steel.

6. Specify the effect of nickel on the properties of steel.

7. What advantages are derived by using a combination of nickel and chromium in steel?

8. What are the principal alloying elements in triple alloy steel?

9. How is silicon useful as an alloying element in steel?

10. What is the purpose of tungsten used in steel?

11. What are stainless steels? Why are these steels stainless?

12. What type of stainless steels is referred to as ferritic stainless steels?

13. What are tool steels? Classify them.

14. List the bearing materials that are commonly used?

15. What is meant by precipitation hardening?

16. What is duralumin?

17. Give composition and applications of duralumin?

18. List at least four types of brasses used.

19. List some bronze alloys.

20. How can you classify tool steels?

PART – B

Stainless steels,

1. Write short note on compositions and properties of the following stainless steels, (a) Ferritic stainless steel (b) Austenitic stainless steel (c) Martensitic stainless steel (d) Precipitation hardening stainless steel (AU: May 2010, May 2008)

2. State the types, compositions and properties of high speed steel. (AU: May 2011, May 2010)

3. Discuss Hadfield and Mar aging steels on the following lines (a) Chemical composition (b) Heat treatment (c) Mechanical properties (d) Applications (AU: May 2012, Dec 2009, May 2008)

4. Explain the various methods to achieve high strength in HSLA steels. (AU: May 2011, May 2010, May 2009 Dec 2008)

Bearing alloys.

5. Explain Bearing alloys. (AU: May 2011, May 2010)

6. Explain Tool steels. (AU: May 2012)

7. Name different alloys of copper. Give its composition, properties and uses. (AU: May 2011, May 2010, May 2009 Dec 2008)

8. Explain Mar aging steels. (AU: May 2011, May 2010)

9. Explain Stainless steels, High speed steels. (AU: May 2011, May 2010, May 2009 Dec 2008)

10. Explain, bearing metals, Explain (AU: May 2012)

PART - C

(If Applicable, Either or Choice)

For Case Study/Comprehensive type Questions, there will be no choice.

UNIT-IV

NON METALLIC MATERILS

PART-A

1. What is PTFE?

2. What is PE?

3. What is PS?

4. Define the degree of polymerization.

5. What is PVC?

6. What is copolymerization?

7. What is PMMA?

8. What is PET?

9. What is ABS?

10. What is PI?

11. What is PAI?

12. What is PPO?

13. What is PPS?

14. What is PEEK?

15. What is PTFE?

16. What is PA?

17. What is PP?

18. What are acrylics? Mention their application.

19. Distinguish between hard and soft glasses.

20. How is alumina ceramics produced?

PART-B

Polymers

1. Explain the properties and application of the PVC, PE, PTFE, and ABS (AU: May 2011, May 2010, May 2009 Dec 2008)

2. Give the detailed account on: (a) Urea formaldehydes (b) Fibre reinforced plastics (c) Cellulose nitrate. (AU: May 2010, May 2008)

3. Explain PMMA. (AU: May 2011, May 2010)

4. What is polymerization? Describe addition polymerization and condensation polymerization. (AU: May 2011, May 2010)

5. How plastic materials are classified? Explain each classification. (AU: May 2012)

6. Write brief notes on following traditional ceramics (a) Clay products (b) Glasses (c) Cements (d) Refractory's (AU: May 2012, Dec 2009, May 2008)

7. Describe the properties and applications of following structural ceramics (a) Alumina (b) Partially stabilized zirconia (c) Silicon carbide (d) Silicon nitride (e) Sialon (AU: May 2012)

8. Describe the structures, properties and applications of following commodity thermoplastic polymers (a) Polyethylene (b) Polyvinylchloride (c) Polystyrene (AU: May 2011, May 2010)

9. Describe the strictures, properties and applications of the following commodity thermoplastic polymers (a) Acrylonitrile Butadiene Styrene (b) Polytetrafluoroethylene (c) Nylons (d) Polycarbonates (e) Polyethylene terephthalate (AU: May 2012, Dec 2009, May 2008)

10. Describe the structures, properties and applications of the following thermoset polymers (a) Phenol formaldehyde (b) Urea formaldehyde (c) Epoxies (d) Unsaturated polyesters (AU: May 2012)

PART - C

(If Applicable, Either or Choice)

For Case Study/Comprehensive type Questions, there will be no choice.

UNIT-V

MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

PART-A

1. Name the slip plane and slip direction for FCC crystal.

2. What is creep?

3. Define slip.

4. Name different types of facture.

5. What properties are determined from tensile testing of metallic products?

6. Distinguish between resilience and toughness.

7. Draw typical engineering stress strain curves for the following materials: (a) Aluminum (b) Mild steel (c) Cast iron (d) Polymer

8. What do you mean by ‘double shear’ test?

9. Define the hardness of a material.

10. State the advantage and limitation of Rockwell hardness test over the Brinell and Vickers hardness test.

11. Differentiate between Charpy and Izod test results not useful in design?

12. What is fatigue test S-N curve?

13. Define endurance limit in fatigue test.

14. Define fatigue strength in fatigue test.

15. Differentiate between elasticity and plasticity.

16. Differentiate between ductility and malleability.

17. Define the terms brittleness and hardness.

18. How can you prevent the brittle fracture?

19. What is meant by creep fracture?

20. Sketch a creep curve explaining different stages of it.

PART-B

Fatigue Test

1. Describe with neat sketch fatigue test. (AU: May 2012)

2. Describe with neat sketch creep test. (AU: May 2011, May 2010)

3. Explain the mechanism of plastic deformation by slip and twinning with neat sketch. (AU: May 2011, May 2010, May 2009 Dec 2008)

4. Describe how the torsion test is conducted and what are the properties deter from this test? (AU: May 2010, May 2008)

Hardness Test

5. Explain the testing procedure for Vickers hardness test and mention the advantages and limitations. (AU: May 2011, May 2010, May 2009 Dec 2008)

Impact Test

6. Describe the procedure of Charpy impact testing and the properties obtained from it. (AU: May 2012)

7. Explain the method of testing the materials for fatigue and how is the fatigue data presented. (AU: May 2011, May 2010)

8. Draw a typical creep curve and explain the various stages of creep. (AU: May 2012, Dec 2009, May 2008)

9. What is meant by ductile fracture? Explain the mechanism of it. (AU: May 2011, May 2010, May 2009 Dec 2008)

10. Compare and contrast the Brinell, Vickers and Rockwell hardness tests. (AU: May 2012)

PART - C

(If Applicable, Either or Choice)

For Case Study/Comprehensive type Questions, there will be no choice.

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