**ST.ANNE’S**

**COLLEGE OF ENGINEERING AND TECHNOLOGY**

(Approved by AICTE, New Delhi. Affiliated to Anna University, Chennai)

(An ISO 9001: 2015 Certified Institution)

ANGUCHETTYPALAYAM, PANRUTI – 607 106.

**DEPARTMENT OF MECHANICAL ENGINEERIN**

**ME 8491 -ENGINEERING METALLURGY**

**QUESTION BANK**

**UNIT- I: ALLOYS AND PHASE DIAGRAMS**

**PART-A**

1. State peritectic and peritectoid reactions. (APR/May 2010&MAY2018)

2. Distinguish between steel and cast iron. Also classify steel with respect to carbon percentage.

3. What are interstitial solid solutions and interstitial compounds? (APR/May 2010)

4. Differentiate between eutectic and eutectoid phase reactions.(APR/May 2010,2018)

5. Define Solid Solution. (NOV/DEC 2009)

6. How are steels classified? (NOV/DEC 2009.2016,MAY2018)

7. What do you mean by substitutional solid solution? Briefly explain the rules governing the formation of substitutional solid solution. (May/June 2009)

8. Name and explain any one type of binary solid to solid state transformation reaction with ideal phase diagram? (May/June 2009)

9. Why carbon solubility is more in an austenite? APR/May 2008)

10. List the advantages of alloy steels as compared to plain carbon steels. APR/May 2008)

11. Distinguish between hypo-eutectoid steels and hyper-eutectoid steels. (May/June 2007)

12.Define the terms “ferrite” and “austenite” in iron-carbon alloy systems. (Nov/Dec 2006,2016)

13. What are the effects of crystal structure and atomic radii on formation of solid solution between two metallic elements Hume Rothery’s Rules? (May/June 2006)

14. State Hume Rothery’s rules for formation of substitutional solid solutions. (May/June2005)

15. What are intermediate phases? (Apr/May 2011)

16. What is an equilibrium phase diagram? (Apr/May 2018)

17. State Gibb’s phase rule? (Apr/May 2016)

18. Define Cementite and Pearlite. (Nov/Dec 2008&MAY2018).

19. How does cast iron differ from steels in terms of carbon content? (Nov’08)

20. Define polymorphism. (Nov/Dec 2009)

21. Write the constitution of austenite and its crystal structure.(May/June 2013&NOV16)

22.Define isomorphous?(May 2018)

23.Define invariant reaction. (NOV16)

**PART-B**

1.How are solid solution classified? Give two examples for each? (Apr’08,May’13)

2. Draw iron –carbon equilibrium diagram and label all the phases. Also enumerate the properties of the following phase. (May/June 2012, 2010, 2008, 2009)

3. Draw a typical isomorphism phase diagram and explain the structural change of an alloy. [May-2009]

4. Explain the Hume-Rothery rules of solid solubility.(May/June 2012

5. (i) Elements A & B melt at 700° C and 1000° C respectively. Draw a typical isomorphous phase diagram between the elements A & B.

 (ii) Elements A & B melt at 700° C & 1000° C respectively. They form a eutectic at 35%A at temperature 500° C. Draw a typical phase diagram between A & B. [May/June-2006]

6.Metal A has melting point at 1000° C. Metal B has melting point of 500° C. Draw one phase diagram (between the elements A & B) for each of the following conditions.

(i)The two elements exhibit unlimited solid solubility.

(ii)The alloy systems show formation of two terminal solid solution **and a** eutectic point at 50%Aand at 700° C. [Nov/Dec-2006]

7. Two metal A and B have melting points 800°C and 600°C respectively.

 (i) Draw a phase diagram between A and B if they exhibit unlimited solid solubility.

 (ii) Draw a phase diagram between A and B if a eutectic reactions occurs at composition 40%B and at temperature 400°C. Assume that the maximum solid solubility in either case is 5% and the room temperature solubility in either case is 1%.[May/June-2007]

**PART-C**

1..Explain the following invariant reactions with reference to a phase diagram.

(a) Eutectic reaction

(b) Eutectoid reaction

(c) Peritectic reaction

(d) Peritectoid reaction [Nov’09,Nov’12] (NOV 2013,17)

2.What is cooling curve? How does the time temperature cooling curve of an alloy of eutectic composition different from that of a pure metal?[MAY11]

3. What are the micro-constituents of iron-carbon alloys? Explain the general characteristics of each. [ Nov-’07, Apr’08, Nov’09 ] .(NOV 2013)

4. What are the different types of cast irons? Explain with neat sketch of the microstructure of any four types of cast irons. Give application for each. [MAY18]

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**UNIT – 2: HEAT TREATMENT**

**PART-A**

1. What are the purposes of the processing heat treatment ?[MAY17]

2. Difference between normalizing and full annealing. [MAY’15]

3. What are the different processes of surface hardening? [N/D’15,16]

4.What does the term hardening refer ?what are the factors affecting the hardness?

5. Distinguish the work hardening with the age hardening process.MAY18

6. What is the significance of TTT diagram in the heat treatment of steel?[MAY14]

7. Define the term critical cooling rate. What are the factors affecting it?(MAY2016)

8. What is martempering and austempering?(NOV2016,MAY12)

9. A low carbon steel in the normalized condition is stronger than the same steel in the annealed condition. Why?(May/June 2006)

10. Case carburizing heat treatment is not generally carried out for medium carbon steels. Why?(May/June 2006)

11. What is “critical cooling rate” in hardening of steels?(Nov/Dec2006)

12. What is the microstructure of an austempered steel? What is the advantage of austempering heat treatment?(Nov/Dec 2006)

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13. Define critical cooling rate.(Nov/Dec 2007)

14.Can mild steel be induction hardened?Substantiate.(Nov/Dec 2007)

.15.What are the principal advantage of austempering over conventional quench and tempermethod? (April /May 2008)

16. Mention few applications of induction hardening.(April /May 2008)

17. Name and explain any one subcritical case hardening treatment.(May/June 2009)

18. With heat treatment cycle, explain the conventional normalizing treatment for hyper eutectoid steel? (May/June 2009)

19. When is annealing process is preferred? (May/June 2013,2018DEC2016)

20. What is the purposes of tempering?(DEC2017)

21.What is the use of the isothermal transformation diagram?( DEC2016)

**PART- B**

1. Draw Time-Temperature-Transformation (T-T-T) diagram and label all the phases. Also enumerate any four objectives of heat treatment of steel.
(NOV 2013)

2.Write short notes on the following surface heat treatment operations

 a) Carburising b) Nitriduing

 c) Cyuniding d)Carbonitriding.(NOV 2013MAY18)

3. Write short notes on selective heating techniques employed for surface hardening. a)Flame hardening b) Induction hardening[ NOV 2013 MAY17]

4) Define Annealing. Explain the type of annealing process.(NOV 2013 MAY17)

5.Determining Hardenability (Jominey End – Quench Test): [MAY17,16,NOV15]

**PART-C**

1. Explain in detail Martempering of Austempring process of heat treatment.[NOV17,15]

2. Explain continuous- cooling transformation?

3.Describe the following process.(a).Normalizing b) Hardening C)Quenching d) Tempering [MAY15]

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**UNIT- III FERROUS AND NON-FERROUS METALS**

**PART-A**

1. Compare the martensite that is formed in maraging steels with the martensite that is formed in carbon steels.[may/june2006]

2. What is the main strengthening mechanism in high strength aluminium alloys?[may/june2006]

4. What is the purpose of magnesium treatment in producing S.G iron? [Nov/dec2006]

5. Distinguish between grey cast irons and spheoridal graphite cast irons in terms of microstructures and mechanical properties. [May/june2007]

6. What is the composition of 18/4/1 type high speed steel?[may/june2007]

7. List different types of tools steels. [Nov/dec2007]

8. Mention any two aluminium base alloys and their applications. [Nov/dec2007]

9. How does silicon addition influence the properties of steel? [Apr/may2008, 17,NOV16]

10. Write short notes on the types of stainless steels. [May/june2009]

11. With composition, property and application explain? [May/june2009]

12) What will be the effects, if the following elements alloyed with steels?

13) Write down the composition and any one application of the following alloys: (April / May 2010)

14) What is inoculation?

16) Name the typical properties and applications of high-strength low-alloy steels.[NOV17]

17) Specify the % of carbon content in (a) gray CI and (b) white CI.

18) Name some of the common uses of brass alloy.

19) What is the structure difference between white cast iron and grey cast iron?

20) Name any two precipitation hardenable alloys.

21) Write the effect of “Cr” as alloying element on steel. [may/june2013]

22) Give the composition of the following non-ferrous alloys.

23) What is the alloying nickel and chromium in steels? Effect of alloying nickel:

24) What are bronze? List some uses of bronze. [may/june2013,17]

 **PART-B**

1. Discuss the Characteristics of copper and also mention its alloys their properties and uses. (Nov/Dec 2006, 2007) (Nov/Dec 2010) (May/June 2013)

2. Using the A1-Cu alloy system as example, explain the concept of Precipitation heat treatment. Explain the steps involved in precipitation hardening treatment. (May/June 2009) (April / May 2008) (Nov/Dec 2010) (April / May 2012)

3. What is bearing metal? Give its classification, composition, properties and uses. (Nov/Dec 2010) (April / May 2012) (May/June 2013)

4.Discuss the Characteristics of aluminium and also mention its alloys their properties and uses. (April / May 2008) (April / May 2011)

5. Write a short note on compositions, properties and Applications of the following steel: [may/june2013]

a. Austenitic stainless steel (April / May 2010,2007) (Nov/Dec 2006, 2007)

b. HSLA Steel. (Nov/Dec 2010) (April / May 2011) [may/june2006]

c. Martensitic stainless steel.

d. Maraging steel.

6.Discuss the effects of various alloying elements on the properties of steel. (Nov/Dec 2009) (Nov/Dec 2010) (April / May 2011, 2012) (Nov 2013)

**PART-C**

1.Explain the various types of cast iron. (May/June 2007) (Nov/Dec 2009)

2. Name non ferrous materials for the following articles. (May/June 2013,Nov/Dec 2016)

(1) Bush (2) Furnace Heating element (3) Type writer parts (4) Coins(5) Girders for Airship (6) Big end bearing(7) Filament of electrical lamp (8) Turbine blades]

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**UNIT-IV NON-METALLIC MATERIALS**

**PART-A**

1. Name the ethnic polymers (polymers that have the basic monomer structure of ethylene).(MAY 2006,DEC2016)

2. What are the important uses of alumina and silicon nitride?(MAY 2006)

4. Give one example each for metal-matrix composites and ceramic-matrix composites.(nova/Dec 2006)

5. Write the molecular structure of either phenol-formaldehyde (PF) polymer or urea-formaldehyde (UF) polymer.(MAY 2007)

6. Give any example of participate reinforced metal matrix composites.(MAY 2007)

7. Name any four common engineering polymers.( Dec 2007,16)

8. Define degree of polymerization (MAY 2009,2016)

9. State any two properties of ceramics.(MAY 2009)

10. With property and application, explain the following polymers (a) PVC (b)PMMA.

(MAY 2009)

11. Write the general mechanical properties of ceramics.(MAY 2009) 12. What will be the effects, if the following elements alloyed with teel (a) Phosphorous (b) Sulphur?(apr/may 2010)

13. Write down the composition and any one application of the following alloy (a)Duralumin (b)Brass(MAY 2010)

14. Write the effect of “Cr” as alloying element on steel.(NOV/DEC 2010)

15. Draw a typical hardenability plot as a functional of distance from the quenched end.(NOV/DEC 2010)

16. Give the composition of the following non-ferrous alloys.(NOV/DEC 2010)

 (a) Gunmetal (b) Babbit metal

17. What is the effect of alloying Nickel and Chromium in steels?( MAY 2011)

18. Differentiate between precipitation hardening and dispersion strengthening.( MAY 2011).

19. What are the applications of aluminium oxide (Al2O3)?(NOV/DEC 2011)

20. Discuss fibre-reinforced composites.(NOV 2011, May 2016)

21. Define plastics. (May 2013 (May 2016))

22. What is PA? (May 2013)

.23. What are the applications of Polystyrenes? (Nov 2013,2016)

24. What is polymerisation? [M/J’16]

**PART-B**

1. How do thermoplastics differ from thermosetting materials? [A.U. June’09]
2. What are the special properties of plastics that make them useful for engineering materials? [A.U. June’09,Apr’10 ,May-2013]

3. Describe the molecular structures, properties and applications of thermoplastics.[Anna Univ.Apr’08,10, June’06,07, Dec’06,07.09]

4. Describe the molecular structures, properties and applications of thermosetting plastics. [A.U. June’09, Nov’09,Apr’10]

5. What are the different types of engineering ceramics? Give any four ceramics , their properties and applications[A.U. Nov’09,June’07,09,April’08,10,17,18] (nov 2013)

6. Describe the different types of reinforcement used in polymer composite. [A.U. Nov/Dec ’07 ,09,15 , Apr/May 2008 , May/June 2009,2017]

7. Write a short note on Glass. (May/June 2013)

PART-C

8. Describe the mechanical behavior of polymers. (AU April/May 2008)

9. Explain the different types of matrix materials and reinforcement materials used to make polymer matrix composites. [A.U. May/ June 2007,15]

10. How are polymers classified?[MAY,17,18, Nov/Dec ’17]

**UNIT-V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS**

**PART-A**

1. Define endurence limit in fatigue test.(MAY.2006)
2. What properties are determined from tension testing of metallic products?( June2006)
3. In general, HCP metals are hard and brittle while FCC metals are soft and ductile.Why?(.Nov.2006)

4. Distinguish between slip and twinning(May 20072009,2013,2018)

5. How will you express the deformation characteristics of a material through tension test?(A.U.june.2007)

6. How many one distinguish between slip and twinning if the width of the twin band is of the same

7Why are impact specimens noteched?(A.U.Nov.2007)

8What are slip bands?( May2008)

9. What are different types of loadings available for fatigue testing?(A.U.May.2007)

10. What is creep? Draw a typical creep curve and show different creep stages on it. (A.U.May 2009)(May/June 2013)

11. List the tesing methods of metals.(AU.2009)

12. Define fatigue (MAY2009,DEC16)

13. What is twinning in metal?(AU.2010)

 14. What is the difference between HRB and HRC?(MAY 2010,2017)

15. Differentiate between ductility and malleability.

 16. What do you mean by toughness and stiffness? May/June 2016)

 17. State the Schmid’s law?

 18. What is meant by fracture? May/June 2016)

19. What is brittle fracture?

20. Define plastic deformation? (May/June 2013)

21. Differentiate Between Fatigue And Creep (NOV 2013**)**

 **PART-B**

1. Explain the procedure for performing the Rockwell test AND Vickers hardness testing? .[MAY14,15]

2. Write an engineering brief about the creep tests in detail.[NOV15]

3.explain the two modes of plastic deformation in metals with neat sketches.[MAY16]

4 .write in detail about destructive tests? .[MAY18]

5. Write short notes on hardness test? .[MAY16,18] Vickers hardness testing

6. Write short notes on impact tests? .[MAY17]

7. Critically compares the deformation by slip and twinning? .[MAY17]

**PART-C**

1. What are the different types of fractures in metallic materials? Give the important features of these fractured surfaces. What is the use of this study? [NOV07,MAY10]
2. Describe fatigue testing and methods for improving fatigue strength of the components. Draw the S-N curve for aluminium and titanium. [NOV15,MAY14]

3.Draw creep curve and explain the different stages of creep damage[NOV15,MAY14]

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