**ME 8491 ENGINEERING METALLURGY**

QUESTION BANK

**UNIT I-ALLOYS AND PHASE DIAGRAM**

**PART-A**

1. What do you mean by invariant reaction?
2. Define Eutectoid.
3. What is Peritectoid reaction?
4. State Gibb’s phase rule.
5. State Hume Rothery’s rules for formation of substitutional solid solution.
6. Define Eutectic Reaction.
7. How is steel classified?
8. Differentiate Isomorphous and Eutectic reactions.
9. Draw the microstructure eutectoid steel and white cast iron.
10. Define solid solution.
11. Differentiate between grey cast iron and malleable cast iron.
12. What are eutectic and peritectic reactions? Give equations.
13. Define ferrite and cementite in Fe-C alloys.
14. State peritectic and peritectoid reactions.
15. Distinguish between steel and cast iron. Also classify steel with respect to carbon percentage
16. Define substitutional and interstitial solid solution.
17. Distinguish between hypo eutectoid and hyper eutectoid steel.
18. What are substitutional and interstitial solid solutions? Give one example for each.

**PART-B**

1. (i)Draw Iron Carbide phase diagram, name the various field, line and reactions.

(ii)Draw the typical microstructure of 1.2% C steel at 920°C 780°Cand 200°C.

1. (i)Discuss on substitutional solid solution of isomorphous alloy system.

(ii)Brief on maximum percentage of carbon in ferrite and austenite based on the interstitial sites.

1. What is Interstitial and explain? Explain in detail about Eutectic reactions.
2. What are the properties and application of different types of cast Iron, Explain in Brief.
3. Explain with a phase diagram of Eutectoid & Peritectic reaction
4. (a) What is solid solution? And Explain their types with suitable sketch
5. Explain equilibrium cooling of a solid solution alloy and showing the microstructure at various points during solidification.
6. Discuss the classification, micro structure properties and application of CI.
7. (i) Explain Hume-Rothery rules of solid solubility. (ii) Discuss the composition, properties and application of the Malleable and Spheroidal cast Iron.
8. Explain the various micro constituents present in steel.

**UNIT-II HEAT TREATMENT**

**PART- A**

1. State the application of isothermal transformation diagram.
2. Which type of surface hardening process that does not involve composition change?
3. What is quenching? List some of the quenching medium generally used in industries.
4. What is the significance of TTT diagram in the heat treatment of steel?
5. Define the term stress relief annealing and spheroidizing.
6. Define critical cooling rate.
7. List any four principal methods of case hardening
8. Write the importance of spherodising annealing.
9. Define hardenability and case depth.
10. Define spheroidizing.
11. What changes in physical and mechanical properties occur due to annealing?
12. List any two factors that affect hardenability of steels.
13. Enumerate any two differences between full annealing and normalizing.
14. Define tempering
15. Differentiate carburizing and nitriding.
16. Why is it necessary to temper hardened steel?
17. Define hardenability.
18. Write down the reaction during nitriding of steels.

**PART-B**

1. (i) Brief on hardening and tempering of steel with respect to rate of cooling and tempering temperature respectively

(ii) Compare Austempering and Martempering

1. Distinguish between ‘Hardness and harenability’. With suitable sketches, explain the jominy hardness test for hardenability
2. Explain flame and induction hardening
3. Explain the isothermal transformation diagram for a Eutectoid Iron-Carbon alloy with superimposed cooling curves.
4. Write short notes on:
5. Hardenability
6. Nitriding
7. Flame hardening
8. Cyaniding
9. What is annealing? Discuss in details on different types of annealing and compare with normalizing.
10. Draw Time-Temperature-Transformation (T-T-T) diagram and label all the phases. Also enumerate any four objectives of heat treatment of steel.
11. What is Hardening? Discuss in detail on different hardening methods and mechanism. Compare hardening and annealing.
12. What is case hardening? Discuss nitriding process and its importance for industrial applications. Differentiate surface chemical treatment and surface thermal treatment.
13. How are steel surface hardened? Discuss the different method of case hardening processes.

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

**PART – A**

1. Which type of stainless steel is used for surgical instruments?
2. What is the typical constituent microstructure of bearing alloy?
3. What is HSLA? also properties.
4. Define Precipitation Hardening.
5. What is meant by the term unsaturated molecule? State its significance in plastics
6. What are SIALONs? State their applications.
7. What are the properties of steel?
8. Explain why copper is suitable for automobile radiators?
9. Define the term maraging.
10. What is the effect of alloying Nickel and chromium in steels?
11. Differentiate between precipitation hardening and dispersion strengthening.
12. Write the effect of ‘‘Cr’’ as alloying element on steel.
13. Give the composition of the following non ferrous alloys.
    1. Gunmetal, b. Babbit metal.
14. What is the structure difference between white cast iron and grey cast iron?
15. Name any two precipitation hardenable alloys.
16. What will be the effects, if the following elements alloyed with steel?
    1. Phosphorous, b. Sulphur.
17. Write down the composition and any one application of the following alloys.
    1. Duralumin, b. Brass, c. Bronze

**PART– B**

1. (i) Brief on the influencing of alloying elements in steel under classification of ferrite and austenite

stabilizer.

(ii) List the types and their typical applications of tool steel.

1. (i) What is Cupronickel? Explain its applications.  
   (ii) Discuss Effect of Si on steel.
2. Write short notes on the following:  
   (i) Tool steels (ii) White malleable Iron (iii) Bearing Alloys.
3. What are the influences of alloying Al, Cr, Ni, Mo, Si, Si, Mn and Cu in steel? Explain in brief.
4. What are the properties of aluminium? And what is the effect of different types of alloying elements such as Cu, Iron, Manganese, Magnesium used with aluminium and its application? Explain.
5. (i) Describe the stainless steels with respect to composition, properties and applications.

(ii) What is maraging steels? Discuss the strengthening method of maraging steels

1. (i) Discuss the different types of copper alloys and their properties and applications

(ii) Write short notes on bearing alloys

1. Write short notes on :

(i) Maraging steel (ii) Stainless steel (iii) Springs steel (iv) TRIP steel.

1. Discuss the steps and the mechanism of precipitation hardening.
2. (i) Enumerate the composition and applications of following alloys.

(1) Cupro nickel (2) Bronze (3) Bearing alloy

(ii) State the effects of the following alloying elements in steel

(1) Chromium (2) Molybdenum

**UNIT- IV NON METALLIC MATERIALS**

**PART - A**

1. What are PMMA and PTFE?
2. What are outstanding properties of Polycarbonate?
3. What is Polymer?
4. What is Fiber reinforced plastics?
5. What is the effect of grain size on the mechanical properties of the materials?
6. Brief about any two types of polymers.
7. What are the applications of polystyrenes?
8. List two important characteristics for polymers.
9. What is a hybrid composite?
10. Define degree of polymerization.
11. What are PEEK and PMMA?
12. Name the plastics used for the following applications (a) tooth brush (b) gears.(c) Bakelite
13. What is polymerization?
14. What is the structure of polyethylene? Suggest any two uses.

**PART B**

1. (i)Differentiate between thermoplastic and thermosetting polymers.

(ii)What are fibers reinforced plastics and state its applications?

(ii)State the properties and applications of polyurethane.

1. Write the properties and applications of the following polymers and discuss anyone fabrication methods of polymers.

(i) PMMA, (ii) PEEK, (iii) ABS and (iv) PS

1. Explain in detail the following:  
   (i) PET (ii) PC (iii) ABS.
2. Write short notes on  
   (i) Phenol Formaldehydes  
   (ii) Applications of PMMA and PP
3. Explain the different types of mechanical properties and mechanism of plastic deformation by slip and twinning.
4. (i) List the important engineering ceramic materials and discuss its general applications of ceramic

materials in various engineering fields.

(ii) What are the advantages and disadvantages of ceramics?

1. Write short notes on :
2. Ceramics
3. Urea Formaldehyde
4. Phenol Formaldehyde.
5. Discuss the structure and applications of any four thermoplastic and any four thermoset plastic

materials.

1. (i) Discuss the properties and applications of the following four Ceramics.

(1) Silica, (2) Zirconia, (3) SiC, (4) Cubic boron nitride.

(ii) What is fibre reinforced plastics? Name any four fibers and their matrix material.

1. Name the suitable alloys, polymer and ceramics for manufacturing the following items
2. Bush
3. Furnaces heating element
4. Lathe Bed
5. Coins
6. Girders for Airship
7. Big end bearing
8. Turbine blades
9. Conduit pipes
10. Knobs
11. Windshields
12. Touch Screens
13. Furnace linings
14. Grinding wheels
15. Coating on cutting inserts
16. Cutting inserts for ferrous alloys.

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

**PART - A**

1. What are the characteristic features of fracture surface of creep rupture component?
2. State advantage of Vickers hardness testing over other technique.
3. What is twinning?
4. What is Charpy?
5. Sketch slip and twinning types of deformation
6. Differentiate between Fatigue and Creep tests.
7. What is the difference between brittle fracture and ductile fracture?
8. What is meant by transition temperature?
9. Differentiate between Izod and Charpy impact testing
10. Draw the S-N curve for mild steel and aluminium
11. Define toughness.
12. What is creep?
13. With a simple sketch show the phenomenon of slip in metallic materials.
14. Define ‘Creep’ of metals.
15. List the parameters that can be determined from the tensile test.
16. Mention some of the disadvantages of Brinell hardness test.
17. Classify the different hardness testing methods.
18. Draw the testing sample diagram for impact testing.
19. List any four mechanical testing methods of metals.

**PART-B**

1. (i) Compare Charpy and Izod Impact test. List the applications of impact test.

(ii) Draw a typical S-N curve and brief on the influence of any TWO design parameters and

metallurgical properties.

1. Define Hardness. Explain Fatigue and Creep Tests.
2. Explain in brief the testing of materials to measure Tension and Compression with a graph and an example.
3. What is hardness test & impact test? Explain with a sketch and an Example.
4. Explain the mechanism of slip and deformation by twinning
5. Explain the types of impact tests and how ductile to brittle transition is occur with diagram
6. (i) Draw the engineering stress-strain curve for mild steel, aluminium and cast iron, discuss the tensile

test and different mechanical properties obtained in tensile testing.

(ii) Write short note on compression test

1. (i) List the various types of hardness testing. Write short notes on Brinell and Vickers hardness and

their significance

(ii) What do you mean by slip and twinning?

1. Explain the two mechanisms of plastic deformation with neat sketch.
2. 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?
3. (i) Discuss fatigue test for a metallic material. What is S-N diagram?

(ii) Why impact tests are important? Explain any one impact test.

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