ARYA COLLEGE OF ENGINEERING (ACE) (B.Tech *IIND* YEAR. *IIIRD* Semester 2025- 2026)

3ME4-06 MSE (GUESS PAPER)

Unit 1:

Short Answers:

1. What are coordination number of BCC, FCC and HCP crystal structure?
2 What are packing factors of BCC, FCC and HCP crystal structure?
3 Why fine-grained structure is harder than coarse grain structure?
4 How many slip planes are there in BCC, FCC and HCP crystal structure? 5 Define Recovery, Recrystallization, and grain growth?
6 Explain Frank reed source, Bauschinger effect?
7 Define crystalline substance. How does it differ from an amorphous material? 8 Define allotropy, give some example?

Analytical Answers:

1. How are crystal planes identified by means of miller indices? Draw the following planes and direction in an FCC structure: -
   i) (010) ii) (111) iii) (011)
2. Discuss crystal symmetry, Co-ordination number, & Bravais space lattice.
3. What is deformation? Explain the type of deformation?
4. What are miller indices? How are they determined?
5. Assuming that the length of the side of a cube in the FCC lattice equals one what is the distance between closest atoms?

Descriptive Answers:

1. Differentiate elastic and plastic deformation.
2. Explain Frank read source, Bauschinger effect, and Work hardening?
3. Explain with the neat sketch various type of crystal Imperfection?

Unit 2:

Short Answers:

1 What are hypo eutectoid and hypereutectoid steels, explain.
2 What is 0.8% C, steel, what are its special properties?
3 What is a Eutectic system? Explain copper/silver eutectic
4 What is tempered martensite?
5 What is the driving force in the formation of Spheroidite?
6 What is nodular cast Iron? How it is made
7 What do you understand by phase diagram?

Analytical Answers:

1 Explain binary system when two metals are completely soluble in the liquid state but only partial soluble in solid state with example.

2Describe the micro constituents of Iron carbon system?

3Derive an expression for critical resolved shear stress in a material subjected to uniaxial tensile loading.
4How steel is classified? Discuss mechanism of crystallization
5 What are the changes that take place in iron and steels at the following critical points? A_1 ,A_2 ,A_4 and A_{CM} ?

Descriptive Answers:
1Draw Iron-carbon diagram and level the various fields and temperature. Discuss in brief different reaction take place in system.

2Describe following reaction: - 1. Eutectic system 2. Eutectoid system 3Peritectic system

3Write short note: i) Gibb's Phase rule ii) Hume Rothery ruleiii) Lever rule

4 What do you understand by critical point and critical range and how are they related to heating and cooling of steel? Discuss their importance in phase transformation.

Unit PAGE ..:

Short Answers:

1 Explain how annealing and normalizing are diffusion-controlled processes?

2 What is the difference between martempering and austempering?

3 What is the difference between nitriding and carbo-nitriding processes?

4 Explain Jominey hardness test?

5 Define flame hardening and Induction hardening?

6 Define Gas carburizing and solid carburizing process?

7 Discuss the general effect of tempering the steel?

Analytical Answers:

1 Write short note on heat treatment furnace?

2 What is the objective of heat treatment process? List the various heat treatment process

3 Write short note: -1. Nitriding and Cyaniding 2.Normalising and carburizing

4 Draw a neat sketch of TTT diagram for a eutectoid steel and label the region?

5 Differentiate hardness and harden ability.

6 Distinguish annealing and stress relief process.

7 Describe the Gibb's Phase rule. How this rule is applied to pure metal and binary alloys?

Descriptive Answers:

1 Describe the allotropic transformation in iron and discuss their importance in practical application?

2 What are the common defects observed during heat treatment? Describe a few precautions for their prevention?

3 State and explain the differences between case hardening and surface hardening. List the various case hardening and surface hardening processes.

4Explain why steel is heat treatable and discuss :i) the different method of hardening steel ii) Changes occurring at different stages of tempering.

Unit PAGE [illegible]:

Short Answers:

1 What are the high-strength low-alloy steel?

2 What is Superalloy? Give composition and use of Waspalloy, and Inconel? 3 What are PTFE, Nylon 6, Nylon 610, Perspex, where they are used?

4 Give composition and use of (a) Hadfield steel (b) Maraging steel (c) Spring Steel (d) Rail Steel (e) Invar Steel

5 What are conducting polymers? 6 Explain Degradation of polymer?

7 What is elastomer? How do they differ from plastics?

8 How would you achieve a good combination of strength and ductility in medium carbon steel?

Analytical Answers:

1 What are the effect of alloying element? Discuss effect of alloying Si, Cr, Ni, Al, Mo, Co andTi in steel?

2 Write short note on: - i) HSLA steel ii) Stainless steel

3 Explain substitutional and interstitial solid solution?

4 Explain bearing materialand tool steel?

5 What is the contribution of light metal and their alloys for solving the problems related to corrosion? Give a few examples.

Descriptive Answers:

1 Explain the different methods used to protect steel against corrosion?

2 Write short note on: - i) PTFE ii) PMMA iii) PE iv) PC

3 What are thermosetting and thermoplastic polymers? Explain addition and condensation polymerization. Give the suitable example illustrating the structure and properties of these materials.

4 What are the special properties of plastics that make them useful engineering materials?

Unit PAG E

Short Answers:

1 Give composition and uses of Permalloy and Cammalloy

2 Describe the following (a) Ceramic matrix composite (b) Metal matrix composite (c) Carbon CarbonComposite .

3 What are dispersion strengthened and particulate composites? Give two examples of each. 4 What are silicon carbide and silicon nitride, what are their strength and hardness?

5 Explain the various mechanical properties of material?

6 Explain Nano material, Nano structures?

7 Why is the family of ceramic material exceptionally large?

Analytical Answers:

1 What are the different type of fractures in metals?

2 Describe different kind of engineering properties? Write measurement process of any one property

3Describe Indian standard designation of plain and alloy steels?

4 Differentiate various kinds of hardness test.

5 What is significance of fatigue test?

6 Describe the nature of bonding if atoms in ceramics materials and discuss the main feature of the ceramic crystal structures.

Descriptive Answers:

1 Describe briefly the important mechanical tests which give valuable information about metals.

2 What is fracture? What is the effect of cracks on fracture strength?
Explain the characteristics of brittle fracture and ductile fracture?

3 Distinguish between fibre and particulate reinforced composite. Discuss the properties and application of Al_2O_3, Si_3N and SiC.

4 Write short note on: - i) Nano materials ii) Classification of steel iii) BIS 5 What is a composite? What are the properties of composites materials depend upon?