

**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 read 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:**

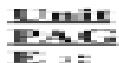
- 1 What are hypo eutectoid and hypereutectoid steels, explain.
- 2 What is 0.8% C, steel, what are its special properties?
- 3 What is a Eutectic system? Explain copper/silver eutectic
- 4 What is tempered martensite?
- 5 What is the driving force in the formation of Spheroidite?
- 6 What is nodular 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.
- 2 Describe the micro constituents of Iron carbon system?
- 3 Derive an expression for critical resolved shear stress in a material subjected to uniaxial tensile loading.
- 4 How 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:**

- 1 Draw Iron-carbon diagram and level the various fields and temperature. Discuss in brief different reaction take place in system.
- 2 Describe following reaction: - 1. Eutectic system 2. Eutectoid system 3 Peritectic system
- 3 Write short note: i) Gibb's Phase rule      ii) Hume Rothery rule iii) 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.



**Short  
Answers:**

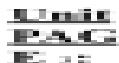
- 1 Explain how annealing and normalizing are diffusion-controlled processes?
- 2 What is the difference between martempering and austempering?
- 3 What is the difference between nitriding and carbo-nitriding processes?
- 4 Explain Jominy hardness test?
- 5 Define flame hardening and Induction hardening?
- 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.
- 4 Explain why steel is heat treatable and discuss :i) the different method of hardening steel ii) Changes occurring at different stages of tempering.



## 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 and Ti in steel?
- 2 Write short note on: - i) HSLA steel ii) Stainless steel
- 3 Explain substitutional and interstitial solid solution?
- 4 Explain bearing material and 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?



**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
- 3 Describe 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  $\text{Al}_2\text{O}_3$ ,  $\text{Si}_3\text{N}_4$  and  $\text{SiC}$ .
- 4 Write short note on: -
  - i) Nano materials
  - ii) Classification of steel
  - iii) BIS5 What is a composite? What are the properties of composites materials depend upon?