

B.E Metallurgical Engineering, 4th Year 1st Semester
Examination 2025
Subject: Alloy Steel

Full Marks: 100**Time: Three hours**

(50 Marks for each Part)

Use separate answer scripts for each Part

PART I (50 Marks)

Answer any two from the followings

Marks

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|---|----|--|-----|------|
| 1 | a) | Write down different objectives of Secondary Steelmaking | 5 | CO-2 |
| | b) | Describe process types and benefits of the deoxidation | 5 | CO-2 |
| | c) | Write short note on Wire Feeding | 5 | CO-2 |
| | d) | Write short note on Tank degassing process | 5 | CO-2 |
| | e) | Compare Top Lancing of Ar, Basal lancing of Ar & EMS | 5 | CO-2 |
| 2 | a) | Define alloy steel with classification | 5 | CO-1 |
| | b) | State the role of ferro alloys in alloy steel production along with the addition process | 3+5 | CO-1 |
| | c) | For the production process of low carbon silico manganese (LCSM) one company has installed two submerged EAF of 9 MVA each. The total power cost per year is 60 crores out of which 10% is demand charge. The electrical energy consumption for the plant is 6,200 kwh/ton of LCSM. The charge of electrical energy is Rs 4.5/kwh. Find the line & distribution loss in %
Given :
The load factor & the power factor for the furnace are 0.92 & 0.86
The operating days per year is 330 for furnace | 8 | CO-1 |
| | d) | State the role of Vanadium and Chromium in alloy steel. | 4 | CO-1 |
| 3 | a) | State the uses of different types of stainless steel (one each). | 5 | CO-3 |
| | b) | Describe the difficulties of Stainless Steel Production using High Carbon Ferrochrome. Write in detail about the process of solving these difficulties. | 3+7 | CO-3 |
| | c) | Name four different addition agents of Ni bearing materials to produce Ni steel. State one application of this steel. | 4+1 | CO-3 |
| | d) | Briefly describe the production process of HSLA Steel | 5 | CO-3 |

[Turn over

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PART – II (Marks: 50)

(Answer the following questions)

Q1. Draw and discuss separately the effect of increasing amount of chromium and manganese in Fe-C system in relation to relevant portion of phase diagram. [CO3] 5+5 = 10

OR

Q2. (a) Give an account for carbides present in alloy steel. [CO3] 6

(b) Whether can ferrite stabilisers increase the hardenability of steel? Give reason in support of your answer. [CO3] 4

Q3. Discuss the complete heat-treatment schedule of a common variety High Speed Steel with justification of each step of the heat-treatment schedule. What is the microstructure of the steel after complete heat treatment? What is known as austenite stabilization and how can the degree of stabilization be determined? [CO4] 12+3+5 = 20

OR

Q4. (a) Give an account of different types of stainless steel along with their composition, microstructure, characteristics and applications. [CO4] 10

(b) What is 'Maraging Steel?' Give an account of processing, microstructure and properties of this steel. [CO4] 3+7 = 10

Q5. What is the background for development of "low-carbon HSLA steel?" [CO5] 4

Discuss the processing schedule after explaining the physical metallurgy principles involved in every step of processing low-carbon HSLA steel. [CO5] 12

What are the sources of strength in such HSLA steel? [CO5] 4

OR

Q6. (a) What is known as "dual-phase" steel? What are its special features? [CO5] 3+3 = 6

(b) Discuss the batch annealing process for developing dual-phase steel and explain the deformation and fracture behaviour of the steel under tensile loading in relation to microstructure of the steel. [CO5] 9+5 = 14