Ex/Met/PC/B/T/411/2024

B. E. Metallurgical and Material Engineering, 4thYr. First Sem. Examination, 2024

ALLOY STEEL

Time : Three hours | Full Marks : 100

(50 Marks for each Part)

Use separate answer script for each Part

PART - 1 (50 Marks)

Answer any two from the followings

			Marks	
1	a)	Define Secondary Steelmaking with benefits of Ladle Furnace use.	5	CO-2
	b)	Describe process and benefits of the injection of desulphurisations agents	5	CO-2
	c)	Draw the flow diagram of RH degasser and write down its advantages	5	CO-2
	d)	Write short note on VOD process	5	CO-2
	e)	Explain three types of Shrouding for Argon injection.	5	CO-2
2	a)	Define alloy steel with classification	4	CO-1
	b)	State the importance of ferro alloys in alloy steel production	3	CO-1
	c)	Explain the process of ferro alloy addition in detail in primary and/or secondary steelmaking	7	CO-1
	d)	Describe in detail the production process of HSLA. Also state the properties of HSLA	4+3	CO-3
	e)	Name four different addition agents of Ni bearing materials to produce Ni steel	4	CO-3
3	a)	Discuss about the different types of stainless steel	5	CO-4
	b)	State how common Stainless Steel is being produced in general, highlighting types of Fe-Cr and Cr-C equilibrium	10	CO-4
	c)	Write short note on ESR process	5	CO-2
	d)	Briefly describe the production process of High Speed Steel	5	CO-4

[Turn over

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B.E Metallurgical Engineering
Final Year, First Semester Examination, 2024
Name of the Subject: Alloy Steel
PART – II (Marks carried: 50)

(Use separate Answer papers for each part)

Answer the following Questions (For every question there is one alternative question. Attempt Q1 or Q2, Q3 or Q4, Q5 or Q6 ...; Marks: CO3: 15, CO4:20, CO5: 15]

Q1. (a) With reference to the classification of alloying elements discuss their role on steel hardenability taking at least two examples of each class.

(b) After giving an example comment on the microstructure of a highly alloyed steel after hardening treatment. What subsequent treatment would you recommend for this hardened structure and why?

[CO3] 8 + 7 = 15

OR

Q2. What is meant by γ loop formation and when does it form? What is the importance of knowing about the formation of this loop? Justify the composition of a common austenitic stainless steel. What kind of heat treatment is given to austenitic stainless steel and why? How can austenitic stainless steel be strengthened? What is the microstructure of annealed austenitic stainless steel?

[CO3] 4+2+3+2+2+2 = 15

Q3. Write short notes on – **(i)** Duplex stainless steel; (ii) Hadfield manganese steel; (iii) Maraging steel; **(iv)** Embrittlement of austenitic stainless steel **[CO4] 5 x 4 = 20**

OR

Q4. (a) Mention the role of all alloying elements present in this high speed steel. Discuss the complete heat treatment schedule with justifications of each step for HSS and comment on the final microstructure. **[CO4] 4 + 10 = 14**

(b) Give an account for carbides present in alloy steel. **[CO4] 6**

Q5. (a) Give an account of TRIP steel including its importance, processing, microstructure and properties. **[CO5] 8**

(b) Discuss the strengthening mechanisms involved in TMCP low-carbon steel. **[CO5] 7**

OR

Q6. What is a dual-phase steel? Justify the applications of this steel. How this steel is commonly processed? Comment on the microstructure of dual-phase steel with reference to deformation and fracture characteristics of this steel. **[CO5] 2+3+5+5 = 15**