

BACHELOR OF METALLURGICAL AND MATERIAL ENGINEERING EXAMINATION, 2025

(3rd Year, 1st Semester)

IRONMAKING

Time : Three hours

Full Marks : 100

Answer to the followings

Marks

1

Two companies 'A' & 'B' are mini steel plants. Each of them comprise of Electric Arc Furnaces (EAF), two equisized Blast Furnaces (BF'ce), some no. of coal based sponge iron plants (DR), Sinter Plant (SP), Pig Casting machine (PCM) & one no. of Power Plant (CPP) utilising the waste heat of all the DR plants (for each plant). The production of liquid steel is 2 mtpy & 1.5 mtpy respectively for 'A' & 'B'

6+6+6+2 CO-6

Calculate Size of each BF'ce for both the plants
No. of DR plants for both 'A' & 'B'
Heat rate for both Power Plant (in plant 'A' & 'B')
Production of DRI fines per year

Given : Operating days per year of BF'ce, DR Plant & EAF are is 350, 300 & 320 respectively
Metallic yield of EAF is 90% & 88% for 'A' & 'B'
Hot metal charge in EAF is 50% & 40% for 'A' & 'B' respectively
Yield of PCM is 95% & all Pig Iron produced is charged into EAF
Only lump DRI is charged into EAF & lump production from DR plant is 75% for 'A' & 76.4% for 'B'
Waste gas generation from DR kilns is 105,000 ncum/hr & 77,000 ncum/hr for 'A' & 'B'
For both the plants density of the gas is 1.3 kg/ncum, specific heat of gas is 0.3 kcal/degree C/kg and the inlet & outlet temperatures of gas are 915 & 45 deg C
For 'A' each rotary kiln size is 500 tpd & for 'B' the same is 350 tpd
The size of CPP for 'A' is 75 MW & for 'B' is 85 MW
Productivity of BF'ce is 2 & 2.2 tons/cum/day respectively for 'A' & 'B'.

2

Write short notes on the followings

5X4 CO-5

- HyL Process
- Itmk3 Process
- Difference between Finmet and Finex Process
- Drawbacks of Rotary Kiln
- Degree of Metallization of Sponge Iron

Or

- a) Describe the Corex process along with a neat sketch
- b) State the effect of DRI morphology on reactivity
- c) Write True or False
 - Romelt is an oxidation process
 - Maximum amount of sponge iron is being produced through Midrex process
 - The two major sources of scrap used for steelmaking are prompt scrap and obsolete scrap
 - Dam Ring occurs in Rotary Hearth Furnace Process
 - Electrical enegy consumption in steelmaking is higher with Sponge Iron than Steel Scrap

10 CO-5
5 CO-5
5 CO-5

[Turn over

3	a)	Define Blast Furnace Productivity	2	CO-4
	b)	State three advantages of PCI usage in Blast Furnace.	3	CO-4
	c)	Write short notes on Blast Furnace Control	5	CO-4
		Or		
	a)	Write short notes on High Top Pressure	5	CO-4
	b)	State the process, importance, advantages and disadvantages of	5	CO-4
4	a)	What are different types of refractory used in Blast Furnace & Why?	4	CO-3
	b)	Describe the structure of Blast Furnace slag.	4	CO-3
	c)	How iron ore quality affects reducibility of it in Blast Furnace?	4	CO-3
	d)	State the possible causes of breakdown of iron ore inside a BF'ce	4	CO-3
	e)	State the role of checker bricks in Blast Furnace Stove	4	CO-3
	f)	Explain the Boudouard reaction	3	CO-3
		Or		
	a)	What are the essential characteristics of iron ore for charging in the Blast Furnace (BF'ce) and how they influence the operation?	4+9	CO-3
	b)	Differentiate between Slip and Flooding	3	CO-3
	c)	Write short note on Fine Cleaning of Blast Furnace off gas	3	CO-3
	d)	Write short note on Kinetics of Iron Oxide Reduction in Blast Furnace	4	CO-3
5	a)	Name three by-products from Coke Oven	3	CO-2
	b)	Describe why coke from coking coals are used in Blast Furnace ironmaking	3	CO-2
	c)	State the role of Limestone in Blast Furnace ironmaking	3	CO-2
	d)	Describe the Pelletisation process of iron ore in detail	11	CO-2
		Or		
	a)	Differentiate between the followings - Coke & Coal - Acid Pellet & Fluxed Pellet - Recovery Coke Oven & Non-Recovery Coke Oven	3 X 4	CO-2
	b)	Write short note on use of Magnetite ore in Blast Furnace ironmaking	5	CO-2
	c)	Describe why 100% sinter are not usually charged inside Blast Furnace	3	CO-2
6		Draw the flowsheet of an integrated steel plant showing all the major facilities	7	CO-1
		Or		
	a)	Differentiate between an integrated steel plant and mini steel plant with example.	4	CO-1
	b)	State three major differences between ironmaking and steelmaking	3	CO-1