Ex/Met/PC/B/T/314/2024

B.E. METALLURGICAL AND MATERIAL ENGINEERING THIRD YEAR FIRST SEMESTER – 2024

IRON MMAKING

Time: 3 hours **Full Marks: 100**

Answer Ques No. (1) and any four from the followings

			Marks	
1		In a steelplant in ironamaking & cokemaking division there are one Blast Furnace (BF'ce), four no. of equisized Sinter Plant (SP), one no. of Coke Oven & By Product Plant (COBP) and one no. of Pig Casting machine (PCM). For the COBP the purchased amount of gross coking coal is 4.7 mtpy and after handling & moisture losses dry & net coking coal are charged in COBP. Total Hot Metal produced are trasferred to SMS & the rest iron input of SMS are being being made through pig iron (produced) & other solid charge. Calculate Size of BF'ce & SP (each) Amount of Pig Iron charged to SMS Total purchase price of coking coal & iron ore fines. Given : Operating days per year of SP, BF'ce & SMS are 330, 350 & 320 respectively. Yield of PCM is 95% & all Pig Iron produced is charged into SMS The specific consumption of charge sinter in B'Fce is 1,350 kg/Ton of hot metal & ratio of charge to product sinter is 90% Productivity of BF'ce is 2.2 tons/cum/day & that of SP is 1.25 tons/sqm/hr Yield of Gross Coke from COBP is 75%. Ratio of Gross Coke : BF Coke is 1.25, BF Coke : Skip Coke is 1.15 Handling & moisture loss of gross coking coal is 90% Specific Consumption of Skip Coke in BF'ce is 750kg/Ton Specific consumption of iron ore fines in SP is 1,200 kg/T Cost of Iron Ore Fines is Rs. 4,200/Ton & that of Coking Coal is Rs. 8,500/Ton	5+5+5+5	CO-6
2	a)	State the differences between DRI & HBI	3	CO-5
	b)	Briefly describe sponge iron production by rotary kiln	8	CO-5
	c)	Explain 'dam ring' & 'degree of metallisation'.	3 + 2	CO-5
	d)	State the difference between Midrex & HyL process	4	CO-5
3	a)	Discuss how ironmaking processes are classified with example	6	CO-1
	b)	Briefly explain the Scaffolding in Blast Furnace	4	CO-3
	c)	Write short note on PCI	5	CO-3
	d)	Describe the structure of Blast Furnace Slag with two uses	3 + 2	CO-3
4	a)	Briefly describe the pelletisation process highlighting the mechanism of its each stage.	7	CO-2
	b)	Define blast furnace productivity & name six paramters on which it is dependant	2 + 6	CO-4
	c)	What are different types of refractory used in Blast Furnace & Why?	5	CO-3

[Turn over

5	a)	What are the essential characteristics of iron ore for charging in the Blast Furnace (BF'ce) and how they influence the operation?	4 + 8	CO-2
	b)	Describe why 100% sinter or 100% pellet are not usually charged inside Blast Furnace	2 + 2	CO-2
	c)	Write short note on Blast Furnace Control	4	CO-3
6	a)	Diffentiate between the followings	3 X 5	
		- Isothermal Test & Non-isothermal Test of Reducibility		CO-2
		- Integrated Steel Plant and Mini Steel Plant		CO-1
		- Aircooled Blast Furnace Slag & Granulated Blast Furnace Slag		CO-3
		- Finmet Process & Finex Process		CO-5
		- Boudouard Reaction & Carbon Deposition Reaction		CO-3
	b)	Answer 'True' or 'False'	5	
		- Briquetting is an agglomeration technique		CO-2
		- Magnetite is more reducible than hematite		CO-2
		- The sweeling of pellet can be avoided by presence of silica in large amount		CO-2
		- The main product of HiSmelt process is hot metal		CO-5
		- Coke with very high reactivity helps in smooth operation of BF'ce		CO-4
7		Write short notes on the followings (any four)	5 X 4	
		- Desulphurisation in Blast Furnace		CO-3
		- Dust Catcher		CO-3
		- Swelling of Pellets in Ironmaking		CO-2
		- HyL Process		CO-5
		- Handling Problem of DRI in Ships		CO-5
		- The C-O System with respect to BF'ce ironmaking		CO-3