Ex/Met/PC/B/T/323/2022

B. E. Metallurgical and Material Engineering Examination, 2022

(3rd Year, 2nd Semester)

Steel Making

Time : Three hours | Full Marks : 100

Answer ***Question No. 1*** and any ***four*** from the rest

1	'A' & 'B' are two steelmaking companies, with the following data. Production of billets for company 'A' & 'B' are 3 mtpy & 1.5 mtpy respectively. Company 'A' has 8 equisized electric arc furnace (EAF), 4 equisized ladle furnace (LF) & 2 no.of billet casters with multiple strands. Company 'B' has a no. of 20 ton coreless induction fournace (IF), 4 equisized LF & 2 no. of billet casters with multiple strands. The charge mix of EAF is 80% DRI & rest steel scrap & that of IF is 100% steel scrap. The specific electrical energy consumption of EAF & IF for the above charge mix are 590 & 740 kwh/ton respectively. The specific electrical energy consumption of LF & billet caster are 35 & 12 kwh for both cases. Calculate : - Size of each EAF & no. of IF for two companies. - Ratio of sum of electrical energy cost & raw material cost of the two companies - No. of casting strand in both the cases. Data Given : The yield of billet caster is 98% & that of LF is 99.5% for both cases No. of days of operation for steel melt shop (SMS) is 320 for both cases Tap to tap time for EAF & IF are 72 min & 90 min respectively Casting speed is 2.815 m/min & casting time is 72 min. The billet size is 130 mm X 130 mm for Plant 'A' Electrical energy charge Rs. 7/kwh Cost of DRI is Rs. 32,000/ton & that of steel scrap is Rs. 37,000/ton Metallic yield of EAF is 92% & that of IF is 90% The billet size is 100 mm X 100 mm for Plant 'B' The line loss is 3%	6+5+5
	Name some factors on which quality of a steel plant lay-out is dependant on.	4
2	Answer to the followings	
a)	Differentiate between - Dry Slag & Wet Slag in Conventional Steelmaking Practice - Pneumatic Process & Slag Transfer Process - Greenfield Expansion & Brownfield Expansion of Steelplant - Narrow End Up (NEU) mould & Wide End Up (WEU) mould	4 X 4
b)	State the probable causes of segregation in ingot casting of steel and the remedy	4
3	Answer to the followings :	
a)	Write short notes on Ladle Furnace with a diagram	6
b)	Name solid, liquid & gaseous source of heat (one each) as external source in steelmaking	3
c)	Describe how heat is generated in coreless induction furnace.	3
d)	What are the favouarable conditions of dephosphorisation & dephosphorisation	4
e)	Write short note about importance of secondary steelmaking	4

Subject : Steel Making (cont'd)

4	Describe a conventional Electric Arc Furnace covering the following items : Furnace Description Charging, Melting & Arcing Refining Desulphurisation Comparison with Indusction Furnace	5+5+3+3+4
5	Write short note on oxygen jet & oxygen lancing in LD process How the metal-slag-gas emulsion is formed in LD convertor State the advantages & disadvantages of OBM process over LD Process Describe briefly about the Injection Ladle Metallurgy for desulphurisation	6+5+6+3
6	Answer & describe to the followings in detail	5 X 4
a)	Raw Materials for Steelmaking	
b)	Solidification mechanism of Killed Steel	
c)	Vertical & S-type Continuous Casting machine	
d)	Deoxidation in Steelmaking	