

B.E.Met.& Mat. Engg. 3rd Year 2nd Semester Examination 2017Subject : **STEEL MAKING**

Time: 3 Hours

Instructions **Q-1 is compulsory and attempts any two from the rest**Section (if any) Part-I

Marks 50

Use separate answer-scripts for each part

Q. No.	Question	Marks
1. a)	Give the relation between dissolved oxygen content of liquid iron as a function of bath carbon at 1600 ^o C. Is there any effect of lowering p_{CO} on carbon removal reaction? Explain.	5
b)	If vacuum is created to 10 ⁻⁵ atm. during C refining, Calculate wt % O in 0.2 wt % C –steel? Given: K = 500.	3
c)	What is the effect of increasing Si on dissolved oxygen in liquid Fe melt at 1600 ^o C?	2
2. a)	Explain the Flood's slag theory with reference to Mn reaction between slag-metal interfaces.	7
b)	Explain the role of emulsion-foam formation on P removal in LD process. Will bottom blown help in refining extra low phosphorus steel? Explain.	8
c)	What is the effect of temperature on de-phosphorization reaction?	5
3. a)	What type of pretreatment do you suggest for Si level control in hot metal?	6
b)	What are the essential conditions for Mn reversion? Explain.	7
c)	Explain the role of furnace atmosphere and slag composition on desulphurization.	7
4. a)	Justify the need of bath agitate process for quality steel production.	7
b)	How can you control temperature and slag-metal composition in Ladle Metallurgy practice? Discuss.	8
c)	Estimate the activity of S in hot metal of a smelting furnace containing 0.04%S, 4% C, 2% Si & 1% Mn at 1600 ^o C in 1 wt. % std. state. Given: $e^C_S=0.24, e^{Si}_S=0.066, e^S_S=-0.028, e^{Mn}_S=-0.025$	5

[Turn over

3rd Year Met. Engg 2nd Semester 2017	
Subject : Steel Making	
Ref No. : Ex/Met/T/321/2017	Part - II
Answer Question No. 1 & any three from the rest	

	Marks
<p>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 founace (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.</p> <p>Calculate :</p> <ul style="list-style-type: none"> - 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. <p>Data Given :</p> <p>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. 4/kwh Cost of DRI is Rs. 21,500/ton & that of steel scrap is Rs. 25,000/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%</p>	5+5+4
2 Answer to the followings	
<p>a) Differentiate between</p> <ul style="list-style-type: none"> - Greenfield Expansion & Brownfield Expansion of Steelplant - AC Electric Arc Furnace & DC Electric Arc Furnace - LD & LDAC Process 	3 X 3
<p>b) State the role of mould powder in continuous casting process with one example.</p>	3
3 Answer to the followings :	
<p>a) Explain the importance of Secondary Steelmaking</p>	4
<p>b) Describe briefly about the Injection Ladle Metallurgy for desulphurisation</p>	3
<p>c) State & describe the common quality criteria for lime (to be used in steelmaking)</p>	3
<p>d) What is Ingotism</p>	2
<p>4 Describe the Induction Furnace (IF) process in details covering the following items :</p> <p>Furnace Description & Special Feature Charging, Melting & Refining State the advantages & disadvantages of IF over AC EAF Describe Depth of Penetration for IF process</p>	4+2+4+2
<p>5 Briefly describe the solidification mechanism of Killed, Semi-killed & Rimmed steel ingot. Describe the Oxygen Lancing System and Waste Gas treatment in LD steelmaking</p>	6+4+2