

B. E. METALLURGICAL AND MATERIAL ENGINEERING EXAMINATION, 2019

(3rd Year, 1st Semester)

IRON MAKING

Time : Three hours

Full Marks : 100

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

		Marks
1	<p>In a steelplant in ironmaking & 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.</p> <p>Calculate : Size of BF'ce & SP (each) Amount of Pig Iron charged to SMS Total purchase price of coking coal & iron ore fines.</p> <p>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 1.3 tons/sqm/day Yield of Gross Coke from COBP is 75%. Ratio of Gross Coke : BF Coke is 20:17, BF Coke : Skip Coke is 10:9 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</p>	5+5+5+5
2	<p>a) Briefly describe the Rotary Kiln based sponge iron process.</p> <p>b) State the advantages of Rotary Hearth Furnace over Rotary Kiln.</p> <p>c) Name two Rotary Kiln based sponge iron process (other vthan SL/RN)</p> <p>d) Explain the probability of Catalyst Poisoning in HyL III amd HyL with self reforming Process</p>	10 4 2 4
3	<p>a) Describe the use of Magnetite ore in Blast Furnace ironmaking</p> <p>b) State the possible causes of breakdown of iron ore inside a BF'ce</p> <p>c) Define Productivity of Blast Furnace</p> <p>d) State the role of Coke size & strength on productivity of Blast Furnace</p> <p>e) Describe the Midrex Process with its advantages & limitations (one each)</p>	4 3 2 4 5 + 2
4	<p>a) Describe probable Causes & Remedies of Scaffolding in Blast Furnace ironmaking.</p> <p>b) Why 100% sinter is not usually charged in Blast Furnace.</p> <p>c) Describe how sinter property changes with basicity.</p> <p>d) Why gas cleaning is important in Blast Furnace operation ?</p> <p>e) Explain the role of coke in Blast Furnace ironmaking</p>	2 + 2 3 7 2 4

[Turn over

- 5 a) Describe the Fe-O-C equilibrium diagram including the Boudouard curve for the Blast Furnace (BF) Ironmaking. Find the equations of complete reduction of 1 mole FeO, Fe₃O₄ and Fe₂O₃ by CO at 900 deg C 5 + 5
- b) Describe the three temperature zones inside the Blast Furnace for ironmaking. State all the reactions which take place inside Blast Furnace 3 + 5
- c) What is SRV in connection with HiSmelt Process. 2
- 6 a) Differentiate between the followings 3 X 5
- Recovery Coke Oven & Non-recovery Coke Oven
 - Coal based Sponge Iron & Gas based Sponge Iron
 - Coarse Cleaning & Semi-fine Cleaning of Blast Furnace Gas
 - Oxygenated Blast & Humidified Blast
 - Finmet Process & Finex Process
- b) Answer 'True' or 'False' 5
- Siderite is basically Iron Carbonate
 - Maximum amount of sponge iron is being produced through Midrex process
 - Total Pressure of the gas has no influence on Diffusivity
 - High Top Pressure increases the Boudouard reaction
 - If we increase the flame temperature, blast furnace productivity will constantly increase
- 7 Write short notes on the followings (any four) 5 X 4
- Kinetics of Iron Oxide Reduction inside Blast Furnace
 - ITMK3 Process
 - Advantages & Disadvantages of High Top Pressure in Blast Furnace
 - Blast Furnace Control
 - Role of Alkali in Blast Furnace Ironmaking Process
 - Bosh Slag & Bosh Shape