

B. MET. ENGG. PART I EXAMINATION, 2006

(1st Semester)

IRON MAKING

Time : Three hours

Full Marks : 100

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

1. In a steel plant, one million ton of liquid steel has been produced in a year from electric arc furnace (EAF). The charge mix in EAF is 50% hot metal and 50% DRI. The metallic yield in EAF for this charge mix is 90%. The steel plant also consists of two blast furnaces (BF), one sinter plant (SP), one coke oven plant, and a number of coal based DRI plants (each of 500 tones per day of production capacity)

Calculate the folio wings :

20

- i) Size of each BF
- ii) Size of sinter plant (machine grate area)
- iii) Requirement of dry coking coal per year
- iv) Pig Iron production per year
- v) Excess DRI production per year (both lumps and fines)

Assumptios given

- i) Operating days per year for DRI plant, BF, sinter Plant, EAF are 300, 350, 330 and 320 respectively.
- ii) Specific consumptions of charge sinter and skip coke in BF are 1300 kg/ton and 500 kg/ton respectively.

[Turn over

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- iii) Productivity of BF is 2 ton/cum/day and that of sinter plant is 1.25 ton/sqm/hr.
 - iv) Yield of pig casting machine is 95%
 - v) Out of total DRI production, lump fraction is 75% and only lump DRI is charged in EAF
 - vi) Charge sinter : Product sinter = 90%
 - vii) Ratio of skipcoke : BF coke = 95%, BF coke : Gross coke = 85% and Gross coke : Dry coking coal = 76%
2. a) What is known as “Blast Furnace Productivity” ? Explain some methods of increasing coke throughput. 2+8
- b) Explain some factors affecting reducibility of iron ore in blast furnace iron making. 10
3. a) Why agglomeration of iron ore is useful in blast furnace iron making ? 2
- b) What happens in the reducibility degree of oxidation and strength of iron ore sinter, when $\frac{\text{CaO}}{\text{SiO}_2}$ ratio has been changed from ‘0’ to ‘2.8’ and explain the reasons. 9
- c) Write two advantages of fluxed sinter. Write two advantages and disadvantages of using pellets in iron making. 6
- d) What is green pellet and why induration of it is necessary ? 3

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4. a) What is DRI ? Why it is also called as sponge iron ? 2
- b) Discuss about main fuels and reductants of DRI production. 3
- c) Why production of H B I is important in the global scenario ? 3
- d) Why rotary hearth furnace based DRI production is getting importance now a days ? 2
- e) Describe rotary kiln based sponge iron process. 10
5. Write short notes on the followings (any *four*) 4×5
- i) Boudouard Reaction.
- ii) Blast Furnace temperature profile.
- iii) Swelling of pellets.
- iv) Slip and Flooding.
- v) Scaffolding.
- vi) Corex process.
6. a) Answer to the following questions : 6×2
- i) What is degree of metallisation for sponge iron ?
- ii) Name two gas based DRI production process.
- iii) State two advantages of DRI over steel scrap.
- iv) State two uses of coke in the blast furnace.

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- v) Name two tests for reducibility of iron ore.
 - vi) Name two factors which have influence on gaseous diffusivity in iron oxide reduction.
- b) State “True’ or ‘False’ 8
- i) Feeding of DRI in blast furnace increases coke consumption.
 - ii) Higher slag volume helps in desuphurisation inside the blast furnace.
 - iii) Use of higher blast temperature results in a decrease in coke rate.
 - iv) The reduction rate of iron ore always increases with increase in linear velocity of the reducing gas.
 - v) Channeling is a type of blast furnace irregularity.
 - vi) The approximate net calorific value of export gas of corex process is 8000kJ/m^3 .
 - vii) High pressure of hot blast through the tuyeres is necessary to push the reducing gases through the solid burden.
 - viii) Iron making is basically an oxidation process.