Dr. Nitesh Kumar 6/12/2022

NATIONAL INSTITUTE OF TECHNOLOGY HAMIRPUR

DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

End-Term Examination Nov/Dec 2022 (odd semester 2022-23)

Iron and Steel Making **Course Code: MS 313**

DURATION: 3 HOURS **MAX. MARKS: 50**

Note: Read the questions carefully and answer all questions. The answer of each question should be in one place. Marks for each question are mentioned in parenthesis.

Q.1 A blast furnace uses hematite ore with 80% Fe_2O_3 and 20% gangue materials. It uses 600 kg coke per ton of hot metal. The coke contains 85% C and 15% ash. The composition of hot metal is 95.5% Fe and 4.5% C. Find out the weight of iron ore used and slag produced per ton of hot metal. Given: Atomic weight: O = 16, C = 12, N = 14, Fe = 56; All the compositions are in wt.%. Assume that the gangue materials of the ore and ash content of coke form slag while Fe_2O_3 in the ore is consumed in making hot metal. (10 Marks)

Q.2 During the end blow period in LD steelmaking, the de-carburisation rate is expressed by the equation:

$dc/dt = -(c-c^*)$ where c and c*are the instantaneous and equilibrium concentration of carbon in steel respectively, in units of wt%. Given that c*= 0.04 wt % and c (t=0 min) =0.4 wt%. Find out the concentration of carbon in steel (in wt%) at t=1 min. (answer up to three decimal places). (5 Marks)

Q.3 In BOF steelmaking, 5 ton of lime containing 90 wt.% CaO is used to refine 100 ton of hot metal containing 93.2 wt.% Fe. The slag produced during refining contains 40 wt.% CaO and 22 wt.% FeO. Neglecting material losses, find out the yield of Fe (in wt%). (5 Marks)

Q4. $C(s) + CO_2(g) \Leftrightarrow 2CO(g)$ is an important reaction in iron making. Given ΔH_0 at 298K =172000 joules per mole of CO_2, which of the following conditions will favour the forward reaction and why? (5 Marks)

(A) Increasing both temperature and pressure

(B) Decreasing temperature and increasing pressure

(C) Decreasing both temperature and pressure

(D) Increasing temperature and decreasing pressure

PTO

142

Q5. Distinguish between killed and semi-killed steel ingot? In which case shrinkage is more and why? (5 Marks)

Q6. What is the mould material in continuous casting? What is the role of tundish in continuous casting of steel? (2+3 Marks)

Q7. Explain the difference between RH and DH degassing processes with help of suitable diagram? (10 Marks)

Q8. What is the importance of carbon boil in electric furnace steel making? How do you promote the boil? (5 Marks)

END OF PAPER

PTO