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B.Tech
PCMT4303

6th Semester Regular / Back Examination 2016-17
IRON MAKING
BRANCH(S):METTA, MME
Time: 3 Hours
Max Marks: 70
Q.CODE: Z124
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**
  a) Hematite is more reducible than magnetite-why?
  b) What is the working principle of Dust Catcher?
  c) Explain the effect of Naumann's reversion reaction on bed permeability of blast f/c stack.
  d) What are the effects of temperature and pressure on Si reaction in b/f?
  e) A flux having 80% $CaCO_3$ with 17% $MgCO_3$ and 3% SiO_2 is used in a blast furnace to achieve the slag basicity of 1.5 then find out the available base of the flux.
  f) What are the conditions for topochemical reduction & Topochemical reduction with diffused interface w.r.t. Diffusion rate=D, Chem reaction rate=R.
  g) Slag is tapped more frequently than metal. State TRUE/FALSE and justify your answer.
  h) Define the following terms w.r.t B/F:
      i>   Available base
      ii>   Zero stock line
  i) What is DRI? Why is it called sponge iron?
  j) Direct Reduced Iron (DRI) produced from a gas based process contains Fe, FeO, C and remainder being gangue. The chemical composition of DRI is: Total Fe= 92 wt. % and Metallic Fe= 84 wt. %. Find out the weight percent of FeO in DRI.

Q2 **a)** Heat capacity of combustion=2300 KCal/Kg C. **(5)**
    Heat content of C= 540 KCal.
    Heat capacity of air=0.333 KCal /Nm^3 °C.
    Heat capacity of gas= 0.338Kcal/Nm^{3}°C at 1000°C.
    Calculate the RAFT when 1000°C preheated and 22% O_2 enriched air is used.
  b) Describe the six internal zones of B/F with suitable sketches. **(5)**

Q3 **a)** Briefly describe the three stage gas cleaning system in blast furnace plant with suitable sketches. **(5)**

b) Find out whether FeO can be reduced by H_2/H_2O mixture containing 60% H_2 and 40% H_2O at 727°C. Given: **(5)**
Fe + ½ O_2 = FeO $\Delta G° = -259600 + 62.55T$ J
H_2 + ½ O_2 = H_2O $\Delta G° = -246000 + 54.8T$ J

Q4 Calculate weight of ore used and weight of slag produced for production of 1 ton Pig iron in a B/F with the help of 0.5 ton limestone and 0.9 ton coke. Composition of the materials are as follows: **(10)**
Iron Ore: 9% SiO_2, 3% Al_2O_3, 4% moisture and rest is Fe_2O_3.
Coke: 10% SiO_2, 3% Al_2O_3, 3% moisture and rest is Carbon.
Hot Metal: 2.2%Si, 3.8%C and rest is Iron.(There is no Fe loss in slag phase).

Q5 **a)** Describe the two bell charging system with suitable sketches. Mention the advantages of bell less charging over bell charging system. **(5)**

b) A blast furnace produces hot metal with 3.5%C and 95%Fe from ore containing 80% Fe_2O_3 and 850kg coke (80%FC) per ton hot metal. If the B/F gas contains CO/CO_2 ratio=24/16 then find out the volume of B/F gas per ton hot metal. **(5)**

Q6 **a)** Explain the steps to start a newly lined blast furnace. **(5)**
b) Find out the % CO_2 in CO-CO_2 mixture in equilibrium with Fe_2O_3-Fe_3O_4 at 727°C. Given: **(5)**
$3Fe_2O_3+CO=2Fe_3O_4+CO_2$ $\Delta G°=-32969.92-53.85T$ J

Q7 **a)** With a neat sketch describe the function of a B/F stove. **(5)**
b) Explain the causes, effects and remedies of accretion formation in rotary kiln. **(5)**

Q8 **Write short notes on any two:** **(5 x 2)**
a) Water particle systems in pelletization
b) The Rist diagram
c) Channeling
d) HyL process