Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

PCMT 4303

Sixth Semester Regular / Back Examination – 2015

IRON MAKING

BRANCH(S) : MM, MME

QUESTION CODE : J 143

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) How can you evaluate a flux containing 97% $CaCO_3$ and rest SiO_2 to be used in a blast furnace with basicity 1.5 ?

   (b) Find out the theoretical Fe content of hematite and magnetite. Which one is preferred in blast furnace and why ?

   (c) What are the effects of top charging of ore fines on blast furnace operation ?

   (d) Basicity of bosh slag is higher than final slag in B/F – Justify.

   (e) What is shortness of slag ? State its importance in blast furnace.

   (f) Dolomite is a good replacement of lime in fluxed sinter – Justify.

   (g) What is the effect of oxygen enrichment of blast and high top pressure on Silicon reaction in blast furnace ?

   (h) Why carbon blocks are used as refractory material in hearth ?

   (i) What are the effects of temperature and pressure on Boudouard equilibrium reaction ?

   (j) Why "slag off " is necessary in LDAC process ?

2. Consider a blast furnace with the following input data (in wt%) with 99.5% reduction and 0.5% slagging off. Find out 10

   i. Weight of iron ore required

   ii. Weight and composition of slag

P.T.O.

Iron Ore	Fe_2O_3	SiO_2	MnO	Al_2O_3	MgO	P_2O_5	H_2O
	78	8.4	0.6	5	1.2	1.7	5.1
Coke	C	SiO_2		Al_2O_3			H_2O
(900kg/t)	88	9	*	1	*	*	2
Flux	$CaCO_3$	SiO_2	$MgCO_3$				
(500kg/t)	96	2	2				
Pig Iron	Fe	C	Si	P	Mn		
	92.7	4	2	0.9	0.4		

3. Consider a blast furnace producing pig iron with 95% Fe and 3.6% C consuming 800kg of coke per ton hot metal. If the coke has 85%C and 15% ash, find out the air blast required and blast furnace gas produced with $CO:CO_2$ ratio 28 :12. 10

4. (a) What is the role of burden distribution inside the B/F on its productivity ? 5

   (b) Construct and comment the plot between RAFT and oxygen enrichment of blast (for 21 to 25% oxygen) at input blast temperature 1000°C from the following data : 5

   Heat capacity of combustion=2300 K Cal/kg C.
   Heat content of C= 540 K Cal.
   Heat capacity of air=0.333 K Cal /Nm^3 °C.
   Heat capacity of gas= 0.338Kcal/Nm^3 °C at 1000°C.

5. (a) Describe the two bell charging system in B/F. Mention the advantages of bell less charging over bell charging system. 5

   (b) Draw a neat sketch for simplified material flow in and out a of modern B/F. Mention functions of coke in B/F. Give the composition of a typical Indian pig iron. 5

6. (a) Describe the physico-chemical reactions taking place in DR processes. Differentiate between Coal based and Gas based DR process 5

   (b) With a neat sketch describe the SL/RN process in brief. 5

7. (a) Describe the processes of starting and shutting down a B/F for relining. 5

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

8. Write short notes on any **two** of the following : 5×2

   (a) Molecular theory of slag
   (b) Alumina problem
   (c) Accretion formation in rotary kiln
   (d) Alternative fuels in B/F.