Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(CT)/SEM-5/CT-505/2010-11

2010-11

METALLURGY

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Objective Type Questions)

1. Answer the following questions : 10 × 1 = 10

A) Fill in the blanks :

i) Most of the structural items and merchant products are rolled from ..... ingots, where- as flat products are rolled from ..... ingots.

ii) In Electric Furnance refining process, Carbon Boil facilitates ..... & ..... .

iii) Production of steel through the conventional blast furnance route requires ..... of which India has limited reserves.

iv) Sponge Iron is a substitute of ..... for steel making through the secondary route *i.e.* DR/EF route.

v) The Aluminium oxide is electrolysed in solution in molten ..... .

vi) Shrinkage in foundry casting depends upon ..... and ..... .

B) Select the correct alternatives :

vii) Which of the following does not have an F.C.C. structure ?

a) Copper b) Gold

c) Aluminium d) α-iron.

viii) In which of the following alloy systems the two elements are completely insoluble in the solid state ?

a) Nickel-Copper

b) Lead-Tin

c) Bismuth-Cadmium

d) Magnesium–Tin.

ix) Main alloying constituents of Duralumin are

a) Ni, Cu, Mg b) Cu, Mn, Mg

c) Ni, Mn, Mg d) Cu, Mn, Cr.

x) Chemical formula of chalcopyrite is

a) $CuFeS_2$ b) CuS

c) $Cu\ FeS_2\ .2H_2\ O$ d) $CuO.Fe_2\ O_3$.

GROUP – B

(Short Answer Type Questions)

Write short note on any *three* of the following. 3 × 5 = 15

2. Continuous Casting of Steel.
3. DC Electric Arc Furnace.
4. Allotropic Changes of Iron.
5. Time-Temperature Transformation Diagram.
6. Advantages & Limitations of Powder Metallurgy.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. Distinguish between Killed Steel & Semi-killed Steel. In which case is Shrinkage more & why ? Wheel and Axles are made from fully killed steel & not from rimming steel. Why ? What are the common Ingot defects ? Describe them in short. 3 + 2 + 2 + 2 + 6

8. How does a slag metal emulsion form in Basic Oxygen Steel making ? How does it account for the fast rate of decarburization in a basic oxygen converter ? Discuss the merits of using magnesia-carbon refractory lining in LD process. What is Slag Splashing ? How is it practised ? What are the merits ? 4 + 2 + 4 + 1 + 2 + 2

9. a) Draw the Fe-Fe3C phase diagram, label the various phase fields and discuss in brief the various reactions taking place in the system.

   b) Discuss classification of Steel on the basis of

      i) Application

      ii) Structure

      iii) Composition and

      iv) Amount of alloying elements. 9 + 6

10. a) Write what you know about 'Ferrite Stabilisers' and 'Austenite Stabilisers'. Discuss Cast Iron briefly.

    b) Compute the relative amount of austenite and liquid in cast iron containing 3.5% carbon. (6 + 6) + 3

11. What is foaming slag ? How is it formed during Electric Furnace Steel making ? What are its advantages ? Discuss the design consideration of Hearth, Side Wall & Roof of EAF specially mentioning about Refractories. 2 + 3 + 2 + 8

12. Describe with a neat sketch the process flow diagram of Powder Metallurgy. What are the different methods of Powder preparation ? Describe them in short. What are the design considerations for Powder Metallurgy ? 4 + 2 + 7 + 2

13. What are the advantages of using sponge iron in Electric Arc Furnace / Induction Furnace ? How is DRI used for producing Pig Iron ? Describe the process with sketch. How is Sulphur removed from iron ? 4 + 2 + 7 + 2