Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/CT/SEM-8/CT-801(B)/2013

2013

NON-OXIDE CERAMICS

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
(Multiple Choice Type Questions)

1. Answer any *ten* of the following : 10 × 1 = 10

A) Choose the correct alternative for the following :

i) Bonding between elements in non-oxide material is predominantly

a) electrovalent

b) covalent

c) metallic.

ii) Material decomposes before melting (ambient pressure)

a) SiC b) Si_3N_4

c) both (a) and (b) d) none of these.

iii) Synthesis os Si_3N_4 is done in oxygen free atmosphere due to preferential reaction between

a) O + N

b) Si + N

c) Si + O.

iv) Nitride bonded SiC means bonded by
   a) AIN
   b) Si_3N_4
   c) any nitride.

v) Non-oxide ceramics are potential engineering material due to their
   a) hardness
   b) fracture toughness
   c) machinability.

vi) In reaction bonded silicon carbide unreacted element present in the product is
   a) carbon
   b) silicon
   c) none of these.

vii) Sintering of SiC by B & C aid facilitate
   a) surface transport
   b) vapour transport
   c) grain-boundary diffusion
   d) volume diffusion.

viii) Gas pressure sintering of non-oxide ceramics
   a) increases surface transport
   b) suppresses grain-boundary diffusion
   c) suppresses dissociation of compound e.g.SiC/Si_3N_4.

ix) In silicon nitride Si (+ 4) may be replaced by Al (+ 3) provided
   a) Si (+ 4) replaced by Al (+ 3)
   b) Si (+ 4) and Al (+ 3) are anions.

x) Microstructure of sintered products preferably should consists of

a) fine grain

b) coarse grain.

xi) Intricate and complex shapes difficult to achieve by

a) pressureless sintering

b) hot pressing.

B) Answer very briefly :

xii) Nitridation of silicon to produce silicon nitride is done in two stages-way ?

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. How many polymorphic forms of SiC are known ? State their crystal habits. Which of those forms have polytypes. What is the difference between polymorphism and polytypeism ?

3. State general method of preparation of Boron Nitride.

4. What is SiAlON ? How is it structurally different from normal silicate ceramics ?

5. Give reasons for preferring silicon carbide based kiln furniture over traditional.

6. Self bonded silicon carbide show higher tensile strength at higher temperature. Explain.

GROUP – C
(Long Answer Type Questions)

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

7. Discuss with a neat flow diagram manufacturing process of clay bonded silicon carbide ceramics. Mention applications of the product.

8. Briefly describe various methods of sintering of silicon nitride. Discuss mechanism of liquid phase sintering of Si_3N_4.

9. What are different methods of synthesis of boron nitride. State some of its applications.

10. What are the differences between self bonded and reaction bonded silicon carbide ? Explain how an essentially non-sinterable silicon carbide is made sinterable.

11. What are the general methods for preparing oxynitride glass ? What is the thermodynamic parameters to be considered for selecting oxide for preparing oxynitride glass ? Propose some of the application potential of the material.