Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CT)/SEM-4/CT-401/2011

2011

CERAMIC RAW MATERIALS

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. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) Which of the following can be measured by XRD techniques ?

   a) Particle size b) Crystallite size

   c) Grain size d) None of these.

   ii) Which of the following is the purest and stable form of Al_2O_3 ?

   a) α - Al_2O_3 b) β - Al_2O_3

   c) γ - Al_2O_3 d) None of these.

   iii) Which of the following transformations of ZrO_2 is not desirable ?

   a) Tetragonal to monoclinic

   b) Monoclinic to tetragonal

   c) Tetragonal to cubic

   d) None of these.

iv) Materials can be distinguished from amorphous materials by

a) surface area measurement

b) XRD techniques

c) density measurement

d) none of these.

v) Transparent SiO_2 gel is obtained through sol-gel technique by using

a) HCl b) HNO_3

c) CH_3CO_2H d) None of these.

vi) Why is ball clay more plastic than China clay ?

a) Because the former is denser than the latter

b) Because the former has greater water retention capacity than the latter

c) Because the former is more fine-grained than the latter

d) Because the former has more feldspar in it than the latter.

vii) Why is flint preferred to quartz in whiteware body production ?

a) Because of smaller crystal size

b) Because of white colour

c) Because of low specific gravity

d) Because of greater hardness.

viii) Which one is brittle mica ?

a) Muscovite b) Biotite

c) Chlorite d) Margarite.

ix) Montmorillonite belongs to the Kandite group, while kaolinite to the smectite group of clay minerals. It is

a) True

b) False.

x) The calcic end-member of the plagioclase feldspar solid solution series is

a) Anthophyllite b) Anorthite

c) Anthracite d) Anatase.

GROUP – B

(Short Answer Type Questions)

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

2. Discuss the role for mineralizer to reduce soda content in Bayer- Al_2O_3.

3. Why are synthetic ceramic raw materials becoming essential for the production of advance ceramics ?

4. How gamma alumina is prepared by urea hydrolysis reaction of aluminium sulphate ?

5. Mention the applications of bauxite and chromite in ceramic industry.

6. Distinguish between nepheline-syenite and wollastonite. Write their respective uses in ceramic industry.

7. Why is K-feldspar suitable for whiteware industries, while Na-feldspar for glass industries ?

GROUP – C

(Long Answer Type Questions)

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

8. Discuss the different applications of sol-gel process. How silica bulk glass is prepared from TEOS ? Explain the role of acid catalyst for this process. How do gelation time and gel structure depend on the nature of acid ? 4 + 5 + 4 + 2

9. a) How is Y_2O_3 stabilized ZrO_2 powder prepared by co-precipitation techniques ? How would you characterized this powder ? Discuss the effect of calcination temperature of hydrous phase on c/t phase ratio. 3 + 3 + 2

   b) Discuss the different precursors used for preparation of MAH powder by solution precipitation technique. Discuss the effect of calcination temperature on spinelization. 4 + 3

10. a) Discuss the Pechini Process for manufacture of $BaTiO_3$. Discuss structural stability and application of $BaTiO_3$. 5 + 4

    b) The solubility product of $Al(OH)_3$ and $Mg(OH)_2$ are 1×10^{-33} and 6×10^{-12} respectively. Explain the feasibility of co-precipitation from 0·1 (M) of both $AlCl_3$ and $MgCl_2$ solutions. 6

11. Discuss critically the polymorphic transformations of silica, highlighting the role of mineralisers in such transformations.

12. Name the different Al_2SiO_5 phases. Mention about their uses in ceramic industry and give a detailed account of their phase transitions.

13. Differentiate between micas and clay minerals from mineralogical and ceramic points of view.