



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.*

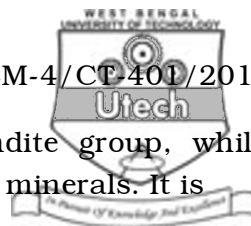
*Candidates are required to give their answers in their own words  
as far as practicable.*

**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  $\text{Al}_2\text{O}_3$  ?
    - a)  $\alpha - \text{Al}_2\text{O}_3$
    - b)  $\beta - \text{Al}_2\text{O}_3$
    - c)  $\gamma - \text{Al}_2\text{O}_3$
    - d) None of these.
  - iii) Which of the following transformations of  $\text{ZrO}_2$  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
- surface area measurement
  - XRD techniques
  - density measurement
  - none of these.
- v) Transparent  $\text{SiO}_2$  gel is obtained through sol-gel technique by using
- HCl
  - $\text{HNO}_3$
  - $\text{CH}_3\text{CO}_2\text{H}$
  - None of these.
- vi) Why is ball clay more plastic than China clay ?
- Because the former is denser than the latter
  - Because the former has greater water retention capacity than the latter
  - Because the former is more fine-grained than the latter
  - Because the former has more feldspar in it than the latter.
- vii) Why is flint preferred to quartz in whiteware body production ?
- Because of smaller crystal size
  - Because of white colour
  - Because of low specific gravity
  - Because of greater hardness.
- viii) Which one is brittle mica ?
- Muscovite
  - Biotite
  - Chlorite
  - 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.  $3 \times 5 = 15$

2. Discuss the role for mineralizer to reduce soda content in Bayer-  $\text{Al}_2\text{O}_3$ .
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.  $3 \times 15 = 45$

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 characterize 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  $1 \times 10^{-33}$  and  $6 \times 10^{-12}$  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.