

Name :

Roll No. :

Invigilator's Signature :

**CS/B.TECH (CT-N)/SEM-3/CT-301/2011-12
2011**

EARTH SCIENCE AND 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 × 1 = 10

- i) Age of the solar system is
 - a) 4500 m.y.
 - b) < 4500 m.y.
 - c) > 4500 m.y.
 - d) None of these.
- ii) The inner solid core of the earth is separated from the outer liquid core by the
 - a) Mohorovicic discontinuity
 - b) Conrad discontinuity
 - c) Lehmann discontinuity
 - d) Gutenberg discontinuity.



iii) Stratigraphy is the

- a) study of fossils
- b) study of rocks
- c) study of the relative age of the rock sequences
- d) study of economic minerals.

iv) Albite is a/an of Anorthite.

- a) Pseudomorph
- b) Polymorph
- c) Isomorph
- d) Enantiomorph.

v) External symmetry-wise altogether how many crystal classes are there ?

- a) 48
- b) 42
- c) 32
- d) 38.



vi) Which of the following form of alumina is spinel-like structure ?

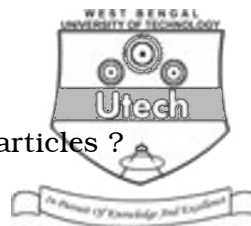
- a) Alpha alumina
- b) Beta alumina
- c) Gamma alumina
- d) None of these.

vii) Crystallite size of a material can be measured by

- a) BET-method
- b) Microscopic method
- c) XRD method
- d) None of these.

viii) Which of the following transformation of ZrO_2 is not desirable ?

- a) Monoclinic to tetragonal
- b) Tetragonal to cubic
- c) Tetragonal to monoclinic
- d) None of these.



- ix) Which milling operation gives finest particles ?
- a) Ball mill
 - b) Vibratory mill
 - c) Attrition mill
 - d) None of these.
- x) The particle size of $\text{Al}(\text{OH})_3$ hydro sol increases with
- a) decreasing of concentration of aluminium nitrate
 - b) at a fixed concentration of aluminium nitrate
 - c) increasing of concentration of aluminium nitrate
 - d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer the following. $3 \times 5 = 15$

2. a) How is PLZT powder prepared by solvent vaporization technique ? Give two examples of hydrothermal synthesis. $3 + 2$

OR

- b) Discuss the role of mineralizers to reduce the soda content in Bayer Al_2O_3 . Why the quality and cost of Al_2O_3 depend on the soda content. $3 + 2$



3. a) How does the knowledge of Geology help in the proper grasping of Ceramic Science and Technology ?

OR

- b) With the help of neat diagram(s), describe the layered structure of the earth and its atmosphere.
4. a) Give the definitions of 'Plastic material', 'Refractory material' and 'Fluxing material' and cite two natural examples of each. 3 + 2

OR

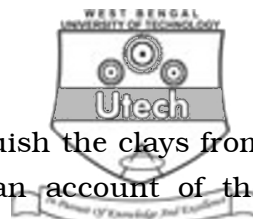
- b) Discuss the structural stability of BaTiO_3 . Show a descriptive flow chart for manufacture of BaTiO_3 by Pechini Process. 2 + 3

GROUP – C

(Long Answer Type Questions)

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

5. a) Write down the Geological Time Scale. Phanerozoic time is subdivided more finely than the Precambrian time. Why ? 5 + 3
- b) Show a descriptive flow chart for manufacture of SiO_2 glass film coating from TEOS by Sol-Gel process. Discuss the process variable of such synthesis. 3 + 4



6. a) Mention the properties which distinguish the clays from other ceramic raw materials. Give an account of the structural compositional features of clays and suggest a classification of clay minerals. $2\frac{1}{2} + 3 + 2\frac{1}{2}$
- b) What are the precursors used for the preparation of MAH powder by solution precipitation techniques. Discuss the manufacture of MAH Gel by coprecipitation technique. How do calcinations temperature affect on spinelization. $2 + 3 + 2$
7. a) Narrate a well-accepted scheme of classification each for the igneous rocks and the sedimentary rocks. $4 + 3$
- b) Discuss with a descriptive flow chart for preparation of Y_2O_3 doped ZrO_2 powder by solution precipitation techniques. How would you characterized this powder? What is the role of Y_2O_3 for such synthesis? $3 + 3 + 2$
8. a) Write short notes on any *two* of the following : $4 + 4$
- In the light of the theory of Plate Tectonics, the types and significance of lithospheric plate margins
 - Mineral hardness
 - Comparison between sintering and calcination
 - Role of cation exchange capacity (CEC) influencing the usefulness of the clays as ceramic raw materials.
- b) How is pure mullite powder obtained from silica sol and fume alumina. Describe the role of particle size and morphology of powder obtained. $5 + 2$



9. a) Discuss the different polymorphic transformations of Silica. Why are such transformations important in ceramic technology ? What is the role of mineralisers in such transformations ? 4 + 1 + 2
- b) What are the advantages of Synthetic Ceramic Raw materials ? Discuss the different applications of Synthetic Raw materials in ceramic field. 3 + 5
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