Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/CT(N)/SEM-3/CT-301/2012-13

2012

EARTH SCIENCES & 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 from the following : 10 × 1 = 10

i) Which of the following is measured by XRD techniques ?

a) Particle size b) Grain size

c) Crystallite size d) None of these.

ii) Which form of alumina is spinel like structure

a) Alpha Alumina b) Beta Alumina

c) Gamma alumina d) None of these.

iii) PSZ contain

a) tetragonal and cubic phase with less monoclinic ZrO_2

b) cubic and monoclinic ZrO_2

c) Only cubic ZrO_2

d) None of these.

iv) Crystallite size of Al_2O_3 solely depends on

a) Calcinations temperature of $AI(OH)_3$

b) Impurity present

c) Grain size

d) None of these.

v) Hard agglomeration forms through

a) Particle-particle solid bridging

b) Particle-particle liquid bridging

c) Particle-particle overlapping

d) None of these.

vi) Conrad discontinuity separates

a) Mantle from core

b) Crust from core

c) Sial from Sima

d) Crust from mantle.

vii) The disaster sequence of the seismic waves is

a) Body wave > Love wave

b) Love wave > Body wave

c) Love wave = Body wave

d) None of these.

viii) In the Plate Tectonics concept of the 'Plates' are made up of

a) Continental crust only

b) Oceanic crust only

c) Both continental crust and oceanic crust

d) Continental curst, oceanic crust and upper part of the upper mantle.

ix) In a three dimensional network

a) One oxygen is shared between two tetrahedral

b) Two oxygens of each tetrahedron are shared

c) Three oxygens of each tetrahedron are shared

d) All oxygen atoms of each tetrahedron are shared

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

a) 32 b) 42

c) 6 d) 30.

GROUP – B

(Short Answer Type Questions)

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

2. With the help of suitable diagram, describe the different silicate structures. Give one example of each silicate structure. 5

3. Discuss the advantages of synthetic ceramic raw materials over natural ceramic raw materials with suitable example.

4. Write short note on Lustre and Cleavage of a mineral.

5. Discuss about the sediment grade classification. State the classification of igneous rocks based on silica percentage.

6. How multiphase PLZT powder is prepared. Discuss briefly hydrothermal synthesis with example. 3 + 2

GROUP – C

(Long Answer Type Questions)

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

7. a) Discuss briefly the basic principle of Sol-Gel Process.

   b) Discuss briefly the different method of preparation of sol.

   c) How ultra pure quality silica glass is prepared from TEOS by Sol-Gel route.

   d) Discuss the effect of pH on the rate of reaction, gelation behavior and particle size of gel. 2 + 3 + 4 + 6

8. a) How Y_2O_3 doped ZrO_2 powder is prepared by solution route.

   b) How this powder is characterized. What is the role of Y_2O_3 for such synthesis.

   c) Discuss the effect of calcinations temperatures of hydrous phase on crystallite size and C/T phase ratio.

   d) Discuss briefly the application of ultra fine ZrO_2 Powder in different area. 4 + 4 + 2 + 3 + 2

9. a) How $BaTiO_3$ is prepared by Pachini process. Discuss its structural stability.

b) How nano size nickel ferrite is prepared by sol-gel process.

c) Discuss the precipitation and co-precipitation of Aluminum and magnesium hydroxide in relation with their solubility product. (K_{sp} of $Al(OH)_3$ and $Mg(OH)_2$ is 1×10^{-33} and 6×10^{-12} respectively.

d) Discuss different organic and inorganic precursors used for co-precipitation of Aluminium and magnesium hydroxide. 3 + 2 + 4 + 4 + 2

10. a) Discuss the different polymorphic transformation of silica.

b) Why such transformation important in ceramic technology.

c) What is the role of mineralizers in such transformation.

d) Give an account of the structural compositional features of clays and suggest a classification of clay minerals.

e) Discuss the role of cation exchange capacity influencing the usefulness of the clays as ceramic raw materials.

4 + 2 + 2 + 4 + 3

11. a) Define mineral. Write short note on 'porphyroblastic texture'.

b) How did you differentiate between a conglomerate and a breccia.

c) Define polymorophism.

d) Explain 'Pyrophillite' structure with diagram.