



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/B.Tech (CT)/SUPPLE/SEM-7/CT-701/2010**

**2010**

**PHYSICAL CERAMICS**

Time Allotted : 3 Hours

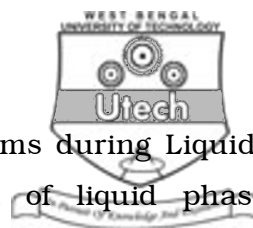
Full Marks : 70

*The figures in the margin indicate full marks.*

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

Answer any *five* questions.  $5 \times 14 = 70$

1. Derive Fick's laws of diffusion. What do you understand by uphill diffusion ?  $(5 + 6) + 3$
2.
  - a) Describe the mechanism of solid state sintering. 6
  - b) What do you understand by primary recrystallisation ? 4
  - c) What is the driving force for grain growth ? State the factors enhancing the grain growth. 4
3.
  - a) Discuss briefly, the basis of development of crystal structure of ceramic oxides with some detailed references to structure of corundum and periclase. 10
  - b) The atomic weights of Si and Al are very similar ( 28.09 and 26.98 respectively ), yet the densities of  $\text{SiO}_2$  and  $\text{Al}_2\text{O}_3$  are quite different ( 2.65 and 3.96 respectively). Explain this difference in terms of crystal structure. 4



4. Discuss briefly, mass transport mechanisms during Liquid-phase sintering. How can the concept of liquid phase sintering be used to develop conventional high alumina refractories ? Discuss why these bricks have inferior high temperature properties than bricks matured through solid state sintering.

6 + 5 + 3

5. State the main factors contributing to opacity of a two phase system. Compare sheet steel porcelain enamel, cast iron enamel and porcelain body glaze in respect of casting thickness, degree of opacification and opacifier to be used in each case. State the important optical characteristics of an opal glass. Explain how light scattering particles are formed in enamel with example.

3 + 6 + 2 + 3

6. a) Discuss the influence of an applied magnetic field on the motion of electrons in their orbits and hence define 'diamagnetism' and 'diamagnetic susceptibility.'
- b) What is magnetic domain wall energy ? Schematically illustrate the relationship among magnetic exchange energy, magnetocrystalline anisotropy energy and domain wall width. What is equilibrium wall width ?

1 + 3 + 1

- c) Why is a high electrical resistivity necessary for a magnetic material which is to be used for a transformer core operating at high frequency ? What are some industrial applications of soft ferrites and hard ferrites ?

1 + 3



7. a) Describe how thermal stresses originate from temperature gradients. 5
- b) Explain thermal tempering. 5
- c) What governs the upper limit of permissible quench rate in thermal tempering ? 4
8. What do you understand by phonon conductivity ? Discuss the various factors which influence the phonon conductivity of single phase crystalline ceramics. 3 + 11
9. Write notes on any *two* of the following : 7 + 7
- a) Influence of temperature on photon conductivity in dielectric solids
- b) Secondary recrystallisation and resultant properties of ceramic
- c) Spinodal decomposition.
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