Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.Tech (CT)/SEM-7/CT-702/2011-12
2011
ADVANCED CERAMICS – II

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)   Which of the following natural material is used as a dielectric material ?

        a)   Vermicullite   b)   Bentonite

        c)   Halloysite   d)   Mica.

    ii) Which of the following single crystal is used as a Telecommunication filter ?

        a) ZrO_2 b) $LaTiO_3$

        c) Al_2O_3 d) $MgTiO_3$.

    iii) Which of the following material is not an electrooptic ceramic material ?

        a) $LiNbO_3$ b) $LiTaO_3$

        c)   PZT   d)   PLZT.

7325   [Turn over

iv) Which of the following material exhibits superconductivity ?

a) $SrTiO_3$

b) $La_{2-x}Sr_xCu_3O_7$

c) PLZT

d) Al_2O_3.

v) Which of the following size ranges are usually referred to as nano phase materials ?

a) 1-10 nm

b) 10-100 nm

c) 1-100 nm

d) 100-1000 nm.

vi) Which of the following is not a ferroelectirc material ?

a) αFe_2O_3

b) γFe_2O_3

c) $Co(\gamma Fe_2O_3)CrO_2$

d) Cr_2O_3.

vii) Which of the following in not a ferroelectric material ?

a) $BaTiO_3$

b) $KNbO_3$

c) KH_2PO_4

d) NaH_2PO_4.

viii) Which of the following material is used for magnetic bubble memories ?

a) SiO_2

b) $PbTiO_3$

c) $PbZrO_3$

d) Hexagonal Ferrite.

ix) Which of the following material is used as a Barrier Layer capacitor ?

a) Quartz

b) AIN

c) $CaZrO_3$

d) SiAlON.

x) Which of the following material is not piezoelectric ?

a) Quartz

b) $PbTiO_3$

c) Rochelle

d) Rutile.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Define direct and converse piezoelectric effect. Give examples. Define two types of piezoelectric coefficients with mathematical expression. Show how they are correlated ?

$$1 + 1 + \frac{1}{2} + \frac{1}{2} + 1 + 1$$

3. The magnetic field strength in a piece of Fe_2O_3 is 10^6 Am^{-1}. Given that the susceptibility of Fe_2O_3 at room temperature is $1 \cdot 4 \times 10^{-3}$, find the flux density and the magnetization in the material. $2 \times 2\frac{1}{2}$

4. "The addition of non-magnetic zinc ferrite to manganesse ferrite raises the saturation magnetizatiion". Explain. 5

5. "Reducing the grain size of the barium titanate ceramics below 1 μm in diameter has a flattening effect on capacitance versus temperature diagram." Explain. 5
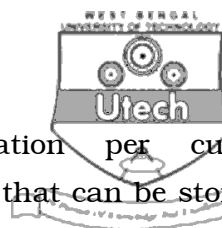
GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

6. a) With a flow sheet describe the manufacturing process of PLZT ceramics. 5

   b) Describe paraelectric and ferroelectric polymorphs of $BaTiO_3$ with neat schematic. Also show the direction of spontaneous polarization in each case. 5

c) Calculate the maximum polarization per cubic centimeter and the maximum charge that can be stored per square centimeter for $BaTiO_3$. 5

Given : Values of lattice constants [$a = b = 3.98$ Å, $c = 4.03$ Å]

7. a) What are the different parameters to assesses the performance of a ceramic capacitor ? 5

b) Explain with examples the mechanism of Relaxator Dielectrics. 5

c) Discuss the mechanism and advantages of Barrier Layer Ceramics. 5

8. a) Write short notes on any *one* of the following : 5

i) Magnetostrictive energy

ii) Kerr Effect

iii) Dielectric Breakdown

b) Describe structure and properties of different types of ferrites in details. 10

9. a) Explain Meissner effect of superconductivity. Prove that superconductors are perfect diamagnetic. 3 + 2

b) Explain Type-I and Type-II superconductors with examples. 5

c) Describe the system of Superconducting Quantum Interface Device. 5