

**OBJECTIVE**

To enable the students to know the basic concepts of ceramic materials used for electronic applications and their applications in various fields.

**OUTCOME**

On completion of the course the students are expected to Have studied the use of ceramic materials as insulators and capacitors and their properties.

- Have learnt the processing, properties and various applications of ceramic materials in ferroelectric applications.
- Have learnt the manufacture, characteristics and properties of magnetic ceramics.
- Have a basic knowledge about superconductivity.
- Have a basic knowledge about the manufacture, characteristics and properties of varistors and fuel cells.

**UNIT I CERAMIC INSULATORS**

Porcelain insulators – triaxial, steatite, non feldspathic types – composition, properties and uses – dielectric strength – dielectric breakdown mechanisms – factors affecting dielectric strength – dielectric constant and loss-polarization- different types of polarization – effect of frequency and temperature.

**UNIT II CERAMIC CAPACITORS**

Capacitance-ferroelectric behavior – barium titanate – effect of solid solutions – additives – film capacitors, single layer discrete capacitors – multilayer capacitors – basic principles and fabrication processes.

**UNIT III FERROELECTRIC CERAMICS**

Piezo-electricity – barium titanate, relaxor ferroelectrics, multiferroics, ferroelectricity, manufacture of barium titanate based ceramics – properties of ferroelectric ceramics – hysteresis loop – PZT – PLZT materials, compositional systems, processing and fabrication – mixed oxide and chemical precipitation processes.

**UNIT IV MAGNETIC CERAMICS**

Classification of magnetic materials – domain theory – Ferromagnetism – Spinel ferrites – structure, types of ferrites – manganese, zinc ferrites – hexagonal ferrites – garnets – standard ceramic processing and fabrication techniques-GMR.

**UNIT V VARISTORS AND FUEL CELLS**

Introduction- ZnO varistors – PN junction diode– electrical characteristics, fabrication of ZnO varistor behavior- microstructure – gas sensors fuel cells – types, principle, working, solid oxide fuel cells – applications- structure and operation principle of oxygen sensors, NOx sensors.

**TEXT BOOKS**

1. Hench L.L and J.K.West, Principles of Electronic Ceramics, John Wiley, NewYork, 1990.
2. Moulson AJ and HM Herbert, Electroceramics, Chapman and Hall, London, 1990.

**REFERENCES**

1. Setter N and Colla SL, Ferroelectric Ceramics, Birkhauser Ver Lag, 1993.
2. S.Somiya, F.Aldinger, N.Clausen, RM Sprigs, K.Uchino, K.Koumoto, M.Kaneno, Handbook of Advanced Ceramics : Vol.II, Processing and their applications, Academic Press, 2003.
3. Buchanan RC, Ceramic Materials for Electronics, Marcel Dekker Inc., NY, 1991.