

## **MSE-351 Ceramics & Glasses**

**Credit Hours:** 3-0

**Pre-requisites:** MSE101-Fundamentals of Engineering Materials

### **Course Objectives**

The course is designed to study the unique properties of structural and functional ceramics and glasses including ferroelectric, piezoelectric and magnetic ceramics, clays, porcelains and refractories. The main objectives of the course are:

- To introduce the rudimentary concepts about ceramics and glass materials.
- To understand the structure and properties of ceramics and glasses
- To introduce the manufacturing and processing methods of ceramics and glasses.

### **Course Contents**

- Physical, Thermal, Electrical and Mechanical Properties of Ceramics
- Ceramic Crystal Structures
- Processing of Ceramic Powders
- Sintering Kinetics
- Hot pressing
- Hot Isostatic Pressing
- Over pressure sintering
- Phase Transformation in Ceramics
- Engineering Ceramics in Chemical Processes
- Filters, Machining of Ceramics and Near Net Shape Manufacture
- Kinetics of Glass Transition
- Fictive Temperature
- Factors influencing glass transition
- Viscous and Visco-elastic behavior
- Phase Transformation in Glasses
- Glass production Techniques and Heat Treatment of Glasses

## **Course Outcome**

At the conclusion of this course, the student should have develop knowledge of

- How a range of ceramic materials and glasses are made and what are the critical steps in these processes
- How ceramic and glass processing is used to control and modify microstructure.
- How ceramic microstructure controls the subsequent properties of a material.
- Understand materials design, materials selection and new developments in ceramic science.
- Understanding of different physical and chemical properties of ceramics
- Understanding of crystal structures of ceramic materials
- Process and Process parameters selection
- Learn about ceramics processing techniques and sintering mechanisms
- Controlling properties using heat treatment of glasses

## **Suggested Books**

- Michel Barsoum, Fundamentals of Ceramics, McGraw Hill Publications
- W. D. Kingery, H. K. Bowen, D. R, Uhlmann, Introduction to Ceramic, 2<sup>nd</sup> Edition John Wiley and Sons 1996.
- James, Reed, Principles of Ceramic Processing, 2nd Edition, 1995, John Wiley and Sons
- M. N. Rahaman, Ceramic Processing, Taylor & Francis, 2006.