



# Mechanical Engineering Dept. Department

## Syllabus

### ME 410: Introduction to Ceramics (3-0-3)

#### Course Catalog Description:

Fundamentals of ceramic materials including: atomic bonding, crystal structure, defects, physical properties, phase diagrams, and ceramic microstructure. Classification of ceramic materials including oxides, silicates, carbides, nitrides, glasses, cements, clays, refractories, and glass-ceramics. Ceramic synthesis and processing. Ceramic properties including mechanical, thermal, dielectric, magnetic, and optical. Application of ceramics and glasses

#### Course Pre-requisites:

- ME 205: Materials Science
- ME 216: Materials Science and Engg.
- ME 217: Materials Lab

#### Course Objectives:

1. To provide students with basic knowledge of ceramics structure, properties, processing and applications.
2. To provide students with basic knowledge of glass structure, properties, processing and applications .

#### Course Learning Outcomes:

- CLO1. An ability to demonstrate basic understanding of chemical and crystal structure of ceramics along with the structure-property relationship in ceramics
- CLO2. An ability to gain basic knowledge in glasses and glass-ceramics materials.
- CLO3. An ability to identify, formulate, and solve complex engineering problems related to ceramics and glasses by applying principles of ceramics engineering, science, and mathematics.
- CLO4. An ability to communicate effectively with a range of audiences via conduct independent library research on chosen ceramic materials topic and report their investigation in oral presentation
- CLO5. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions in ceramics field.
- CLO6. An ability to acquire and apply new knowledge in ceramics as needed in applications of ceramic materials in structural, biological and electrical components using appropriate learning strategies

## Learning Resources:

- C. Barry Carter and M. Grant Norton, Ceramic Materials: Science and Engineering, Springer, 2nd Ed., 2013

## Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Homework (4-5 )	1-10	5.0%
Quizzes (5)	1-10	10.0%
Project	14	10.0%
Presentation	14	5.0%
Final	15	40.0%
Midterm	7	30.0%

## Lecture Weekly Schedule:

Week#	Topics
1	1. Introduction, classification of ceramics (1 week)
2	2. Fundamentals of structure of atoms and bonding in ceramics (1 week)
3	3. Introduction to crystal structure and crystallography (1 week)
4	4. Binary and ternary phase diagrams (2 weeks)
5	4. Binary and ternary phase diagrams (2 weeks) (Continue)
6	5. Structure of ceramics and glasses and its influence on properties (2 weeks)
7	5. Structure of ceramics and glasses and its influence on properties (2 weeks) (Continue)
8	6. Defects, non-stoichiometry, diffusion and conductivity in ceramics (1 week)
9	7. Non-crystalline solids, glass and glass-ceramic composites (2 weeks)
10	7. Non-crystalline solids, glass and glass-ceramic composites (2 weeks) (Continue)
11	8. Processing & sintering of ceramics: traditional & advanced methods (2 weeks)
12	8. Processing & sintering of ceramics: traditional & advanced methods (2 weeks) (Continue)
13	9. Properties and applications of ceramics (2 weeks)
14	9. Properties and applications of ceramics (2 weeks) (Continue)
15	10. Students presentations (1 week)