

## MSE 333: Ceramic Materials

<i>Course description:</i>	Processing, characteristics, microstructure and properties of ceramic materials.
<i>Number of credits:</i>	3. This course is required.
<i>Course Coordinator:</i>	Susmita Bose
<i>Prerequisites by course:</i>	MSE 201
<i>Prerequisites by topic:</i>	<ol style="list-style-type: none"><li>1. Basic knowledge of thermodynamics.</li><li>2. Elementary crystallography and crystal structure.</li><li>3. Mechanical behavior of materials.</li></ol>
<i>Postrequisites:</i>	None
<i>Textbooks/other required materials:</i>	None Reference books: <ol style="list-style-type: none"><li>1. Carter, C.B. and Norton, M.G. <i>Ceramic Materials Science and Engineering</i>, Springer.</li><li>2. Barsoum, M. W. <i>Fundamentals of Ceramics</i>, CRC Press.</li></ol>
<i>Course objectives:</i>	<ol style="list-style-type: none"><li>1. Review of crystallography and crystal structure.</li><li>2. Review of structure of atoms, molecules and bonding in ceramics.</li><li>3. Discussion on structure of ceramics.</li><li>4. Effects of structure on physical properties.</li><li>5. Ceramic Phase diagrams.</li><li>6. Discussion on defects in ceramics.</li><li>7. Introduction to glass.</li><li>8. Discussion on processing of ceramics.</li><li>9. Introduction to sintering and grain growth.</li><li>10. Introduction to mechanical properties of ceramics.</li><li>11. Introduction to electrical properties of ceramics.</li><li>12. Introduction to bioceramics.</li><li>13. Introduction to magnetic ceramics.</li></ol>
<i>Topics covered:</i>	<ol style="list-style-type: none"><li>1. Introduction to crystal structure and crystallography.</li><li>2. Fundamentals of structure of atoms.</li><li>3. Structure of ceramics and its influence on properties.</li><li>4. Binary and ternary phase diagrams.</li><li>5. Point defects in ceramics.</li><li>6. Glass and glass-ceramic composites.</li><li>7. Ceramics processing and sintering.</li><li>8. Mechanical properties of ceramics.</li><li>9. Electrical properties of ceramics.</li><li>10. Bio-ceramics.</li><li>11. Ceramic magnets.</li></ol>
<i>Expected learning outcomes:</i>	<ol style="list-style-type: none"><li>1. Knowledge of bonding and crystal structure of ceramics.</li><li>2. Knowledge of structure-property relationship in ceramics.</li><li>3. Knowledge of the defects in ceramics (Point defects).</li></ol>

4. Knowledge of glass and glass-ceramic composite materials.
5. Introductory knowledge of processing ceramics, bulk, and coatings.
6. Applications of ceramic materials in structural, magnetic, biological, and electrical components.

*Class schedule:* Three 50-minute lecture sessions per week, for one semester.

*Laboratory schedule:* None

*Contribution to meeting the professional component:* Engineering Topics

*Relationship of course to student outcomes:* Meets ABET EC2019, Criterion 3 program outcomes: 1, 3, 4, 7

*Reviewed by:* Susmita Bose and T. Fuller      *Date:* Sept 24, 2024