

## MSE 406: Biomaterials

<i>Course description:</i>	Overview of the different types of materials used in biomedical applications such as implants and medical devices.
<i>Number of credits:</i>	3
<i>Course Coordinator:</i>	S. Bose
<i>Prerequisites by course:</i>	MSE 201
<i>Prerequisites by topic:</i>	<ol style="list-style-type: none"><li>1. Introductory material science.</li><li>2. Basic knowledge of bonding and properties of metal, ceramic, polymer and composite, organic and inorganic chemical structures.</li><li>3. Basic knowledge of biology.</li></ol>
<i>Postrequisites:</i>	None.
<i>Textbooks/other required materials:</i>	<p><u>Reference Books</u></p> <ol style="list-style-type: none"><li>1. <i>Biomaterials Science: An introduction to Materials in Medicine</i>, edited by B.D. Rutner, A.S. Hoffman, F.J. Schoen and J.E. Lemons, Academic Press.</li><li>2. <i>An Introduction to Bioceramics</i>, edited by L. L. Hench and J. Wilson, World Scientific.</li><li>3. <i>Structural Biomaterials</i>, by J. Vincent, Princeton University Press.</li><li>4. Recent articles will be cited as reference materials during some of the classes.</li></ol>
<i>Course objectives:</i>	<ol style="list-style-type: none"><li>1. Provide an introduction and issues related to different types of biomaterials.</li><li>2. Overview of basic biology: proteins/cells/tissues, tissue material interactions in vivo.</li><li>3. Overview of different types metallic, ceramic, polymeric and composite bio materials in biomedical, pharmaceutical applications in medicine and in artificial organs, orthopedics and dentistry. A brief overview of FDA regulations.</li></ol>
<i>Topics covered:</i>	<ol style="list-style-type: none"><li>1. Introduction to Biomaterials</li><li>2. Properties of Materials</li><li>3. Backgrounds in Biology: Proteins/Cells/Tissues</li><li>4. Biomaterials: Metals</li><li>5. Biomaterials: Ceramics</li><li>6. Biomaterials: Polymers and Composites</li><li>7. Tissue – material interactions and testing biomaterial</li><li>8. Applications of Biomaterials in Medicine</li><li>9. Biomaterials in Artificial Organs</li></ol>

- 10. Cardiovascular-artificial heart, heart valve, dialysis, etc.
- 11. Regulatory environment: FDA rules and regulations

*Expected learning outcomes:*

- 1. Knowledge of types of biomaterials, metals, ceramics, polymers and composites, based on application types and sites.
- 2. Knowledge of material properties required for different applications.
- 3. Knowledge of basic biology.
- 4. Knowledge of different types of tissue material interactions.
- 5. Knowledge of biomaterials in artificial organs, orthopedics and dentistry, and medicine.
- 6. FDA rules and regulations.

*Class schedule:*

Two 75-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:*

3 strongly supported; 2 supported; 1 minimally supported

Student Outcomes Pre-Fall 2018  
(ABET EC2000)

Student Outcomes Fall 2018 forward  
(ABET EC2019)

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	1	2	3	4	5	6	7	8	9	10	11
		3					3		3		3	3	3			3	3	3	3		3				

*Prepared by:* Andrea Butcherite and Dr. Susmita Bose

*Date:* May 30, 2018