

## ESM 353 Biomaterials: Manufacture, Properties, and Applications (Elective)

### Course Catalog description:

The engineering characteristics of materials, including metals, ceramics, polymers, composites, coatings, and adhesives, that are used in the human body. Emphasizes the need of materials that are considered for implants to meet the materials requirements specified for the device application (e.g. strength, modulus, fatigue, and corrosion resistance, conductivity, etc.) and to be compatible with the biological environment (e.g., nontoxic, noncarcinogenic, resistant to blood clotting if in the cardiovascular system).

*3 credits*

**Pre- or Corequisite(s):** ESG 332 Materials Science I: Structure and Properties of Materials

**Text(s):** Buddy D. Ratner, Introduction to Materials in Medicine: Biomaterials Science, 1997, Harcourt Brace and Company, ISBN: 0125824610

### Course Outcomes

#### Topics Covered:

- Week 1. Introduction. Scope of course (i.e., not biotechnology). Start dental materials.
- Week 2. Dental materials, Alloy compositions, Techniques of making restorations, Amalgams. Gold alloys, Polymeric dentures.
- Week 3. Orthopedics, arthroprotheses, Artificial hips and knees, Use of plates and screws, Metallic ceramic and composite materials, Engineering design of components.
- Week 4. Component failures. Example of hip screw, hip stem, plates and screws. Problems of corrosion, notches, poor design and wear.
- Week 5. Electrodes for neurosurgery. Electrode wear.
- Week 6. Use of ceramics. The three major classifications. Use of alumina in hips and in dental restorations.
- Week 7. Use of Polymers. Specialized production techniques. Bio-compatibility of polymers. Distinguish between in vivo and in vitro types of applications. Suture materials and adhesives.
- Week 8. Coatings. Carbon coatings, thermal spraying, ion beam modification and wear resistant applications.
- Week 9. Invited talk from medico.
- Week 10. Video of a specialized technique which illustrates the problems encountered in practice by medicos and engineers.
- Week 11. Applications - dental areas, orthopedics, e. g . hips
- Week 12. Artificial arteries, artificial ligaments, ceramic coatings.

### Class/ Laboratory Schedule:

ESM	353	Biomaterials	LEC	1	TH	6:50 PM	9:40 PM
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Contribution of Course to **meet requirement of Criterion 5:**

Outcomes met:

- ability to apply science/engineering knowledge
- critically read scientific articles and analyze/interpret data
- awareness of issues including economic, environmental, ethical, health & safety, manufacturability and quality
- effective communication (verbal and written) via presentations and group discussions.

**Relationship of course to program outcomes:**

(Refer to the sequence above)

- 10%
- 20%
- 60%
- 10%

**Person(s) who prepared this description and date of preparation:**

William J. Calvo, Ph.D.- Jan. 2009