ESM 353 BIOMATERIALS: MANUFACTURE, PROPERTIES, AND APPLICATIONS (ELECTIVE)
Credit: 3

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).

PRE- OR COREQUISITE(S): ESG 332 Materials Science I: Structure and Properties of Materials

TEXT(S) OR OTHER REQUIRED MATERIAL Buddy D. Ratner, Introduction to Materials in Medicine: Biomaterials Science, 1997, Harcourt Brace and Company, ISBN: 0125824610

COURSE LEARNING OUTCOMES	SOS	ASSESSMENT TOOLS
Ability to analyze and interpret data from tables, charts and diagrams.	a b g	Competency Problem(s) Homework Assignment(s)
Ability to understand failure mode analysis. .	a b g k	Competency Problem(s) Homework Assignment(s)
Ability to use Microsoft Office necessary for engineering practice (Word, Excel, PowerPoint).	a b g k	Competency Problem(s) Homework Assignment(s)
An ability to apply knowledge of engineering to understand contemporary issues in science/technology.	a b g j	Competency Problem(s) Homework Assignment(s)
Ability to understand impact of engineering solutions in a societal context.	a b g j k	Competency Problem(s) Homework Assignment(s)
Ability to engage in lifelong learning.	a b g j k	Project evaluation
Understand professional and ethical responsibilities.	f	Exam questions
Give oral/written presentation on research topic.	a b g j k	Evaluation of oral and written presentation
Ability to understand various manufacturing processes involving biomaterials.	a b g j k	Competency Problem(s) Homework Assignment(s)

COURSE TOPICS:

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 f or 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-compatability 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

CURRICULUM

This course contributes 3 credit hours toward meeting the required 48 hours of engineering topics.

STUDENT OUTCOMES (SCALE 1-3):

A	B	C	D	E	F	G	H	I	J	K
3	2				2	3			3	3

3 – Strongly supported 2 – Supported 1-Minimally supported

LEAD COORDINATOR(S) WHO PREPARED THIS DESCRIPTION AND DATE OF PREPARATION:

William J. Calvo, Ph.D.- June 7, 2010