ME/BIOE C117 Structural Aspects of Biomaterials/ ME C215/ BIOE C222: Advanced Structural Aspects of Biomaterials
LECTURES: Tuesdays –Thursdays 11-12:30 pm, 150 GSPP
PROFESSOR LISA PRUITT: **lpruitt@berkeley.edu**; *OH: Tuesdays 10-11 AM (5134 EH) or by appointment*
GSI: Annie Labine; alabine@berkeley.edu *OH: TBA*

COURSE DESCRIPTION

This course covers the basic design, materials selection, stress analysis and clinical case studies for load-bearing medical devices. Implant applications include orthopedics, dentistry and cardiology reconstructive surgery. FDA regulatory requirements and intellectual property issues are discussed. Case studies of medical devices elucidating the trade-offs in structural function and clinical performance are presented. Ongoing challenges with personalized implantable devised are addressed. This is a project-based course.

Prerequisite: ***Basic understanding of mechanical behavior of materials and materials science***

TEXTBOOK: ***Mechanics of Biomaterials: Fundamental Principles for Implant Design,*** L. Pruitt and A. Chakravartula, Cambridge University Press, Cambridge, UK, 2011.

TOPICS COVERED

I: Overview of Biomaterials, Tissues and Biocompatibility Issues *(Ch. 1-5)*
Overview of biomaterials and basic design methodology used in medical devices
Biocompatibility and sterilization methods for implantable devices
Engineering biomaterials and bio-inspired materials
Structural tissues and relevant diseases requiring load-bearing devices

II: Basic stress analysis of load bearing devices *(Ch. 6-10)*
Elastic and plastic deformation for multi-axial loading
Yield criteria and permanent deformation
Fracture criteria and stress concentrations
Fatigue: Total life and defect-tolerant philosophies
Tribology: Wear, friction and Lubrication

III: Medical Devices and Clinical Issues *(Ch. 11-16)*
FDA regulatory requirements
Orthopaedics: total joint replacement, soft tissue repair, and spinal implants
Cardiovascular: heart valves, stents, grafts and vascular devices
Dental: restorative dentistry and implants, TMJ reconstruction
Soft Tissues: repair, reconstruction and augmentation
Intellectual property issues and ongoing challenges with personalized implants

COURSE ELEMENTS:

Team Projects: Project I: February 26 (20%), Project II: April 4 (20%); Project III: May 7 (25%)

Test of Understanding: Thursday April 18 (25%) - closed book/notes

Guest lectures -- Attendance required (10%)
Audrey Ford (PCU as a biosinspired polymer for medical implants – UCB): Thursday February 7
Dr. Michael Ries (Orthopedic surgery and total joint design - UCSF): Tuesday March 19
Dr. Nima Nia (Cardiovascular devices - Edwards): Thursday March 21
Dr. Louis Malito (Corrosion and failure in metal implants - Exponent): Thursday April 11
Professor Robert Ritchie (Heart valves: fatigue and fracture design - UCB): Thursday April 25