

BME 698 -103**Advanced CAD for Orthopedic Devices****CLASS HOURS**

BME 698 –103 –lecture &lab M 06:00– 09:05 PM EAST 636
 Office Hours: By appointment: (973) 432-3660 or gmakris@njit.edu

Reference Materials:

Journal of Bone and Joint Surgery
 Clinical Orthopaedics
 Spine
 Journal of Orthopaedic Research

COURSE OBJECTIVE

- 3D MODELING: Develop 3D models of Hip, Knee, Spine devices. Use Pro Engineer software and modeling techniques. Use anatomic guidelines to establish the design envelop and design input.
- FEA ANALYSIS: Perform FEA using Pro Mechanical. Develop models of bone structures, use of material properties, loads, constraints, etc. Advanced modeling :Symmetry constraints, Contact /Bearing surfaces, Large deformations, Fatigue , Optimization. Review and analyze results.
- DESIGN PRESENTATION: Create design Output reports: presentations of design, animations etc.
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COURSE OUTLINE

Week	Date	Assignment	Topics
1.		Survey: Design Protocols and Procedures. HIP Systems	General Introduction – review of syllabus and reference materials Lab: ProE introduction, operating system, Modeler, FEA modules, Design Layout 2D, 3D operations
2.		Survey: Hip System Design Rational, Survey relevant material properties and characteristics of materials used in orthopedics	Lecture: Review mechanical properties of metallic, ceramic, and polymeric implant materials; corrosion, degradation, wear and failure modes. Lab: Lecture: Design Input, Design goals. Lab: ProE Tools, Modeling of a Straight Hip Stem, Modular Femoral head
3.		Design Project: Femoral hip Component	Lab: Lecture: CAD modeling
4.		CLASS PRESENTATION 1	Project Presentations HIP Project
5.		Design Project: Knee Femoral Component. Commercially available Systems	Lecture: Knee, typical surgical protocols /Design input for Implants Lab: Modeling of Femoral component.

6.		Design Project: Femoral Component	Lab: Modeling of Femoral components
7.		CLASS PRESENTATION 2	Project Presentations Femoral Knee Project
8.		Survey: Lumbar disc systems relevant materials	Lecture: Kinematics of the lumbar joint, typical surgical protocols /Design input for Implants Lab: Modeling of an elastomeric lumbar disc
9.		Design Project: Lumbar Disc	Lecture: Additional modeling tools Lab: Modeling of Lumbar Disc
10.		CLASS PRESENTATION 3	Project Presentations LUMBAR DISC Project Lecture: Clinical correlations to presentations
11.		Design Project: Lumbar Disc	Lab: Modeling of Lumbar Disc Design output: Drawings
12.		Design Project: Design Output: Drafig, SLA, CAM	Lecture: Drafing, SLA, CAM Lab: FEA Analysis of Lumbar disc component.
13.		Design Project: FEA Of lumbar disc	Lecture: FEA / Assembly, Loads, constraints, materials Lab: FEA Analysis of Tibial component
14.		Design Project: FEA Fatigue, deformation	Lecture: FEA analysis, Convergence, large deformations, Failure modes Lab: FEA Constraints as loads/ Simulation features
15.		CLASS PRESENTATION 4	Final Project Presentations FEA ANALYSIS Lambar Disc Component

GRADING:

Project Presentations HIP Project	20%
Project Presentations KNEE Project	20 %
Project Presentations LUMBAR DISC Project	20%
Final Project Presentations FEA ANALYSIS	35 %
Class and Lab Participation	5%

Note: Cannot pass course if you having failing grades on ANY of the Assignments