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

TEXT AND SOFTWARE

Textbook: **Pro/ENGINEER** WILDFIRE 2.0 **Mechanica Tutorial**

Reference Materials:
Pro/ENGINEER Tutorial and MultiMedia CD, A Click-by-Click Primer WILDFIRE 2.0
Journal of Bone and Joint Surgery AM BR
Clinical Orthopaedics
Spine
Journal of Orthopaedic Research

COURSE OBJECTIVE

- 3D MODELING: Develop 3D models of Hip, Knee, Spine devises. Use Pro Engineer software and modeling techniques. Use anatomic guidelines to establish the design envelop and design input.
- FEA ANALYSIS: Perform FEA using Pro Mechanica. 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: Regulatory Controls, Design Protocols and Procedures	General Introduction – review of syllabus and reference materials Lab: ProE introduction, operating system, Modeler, FEA modules, Design Layout 2D, 3D operations
2.		Survey: Commercially available Hip Systems 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 tapered Hip Stem, Femoral head
3.		Design Project: Femoral hip Component	Lecture: CAD modeling techniques components, assemblies. Lab: Lecture: CAD modeling techniques free forms/ bone structures / Proximal Femour (bone)

4.		CLASS PRESENTATION 1	Project Presentations HIP MODEL Lecture: Clinical correlations to presentations
5.		Design Project: Distal Femour and Proximal Tibia bone models	Lecture: Kinematics of the Knee, typical surgical protocols /Design input for Implants Lab: Modeling of Femoral /Tibial components
6.		Design Project: Femoral Component Tibial Component	Lecture: Additional modeling tools Lab: Modeling of Femoral /Tibial components
7.		CLASS PRESENTATION 2	Project Presentations PROXIMAL TIBIA MODEL Lecture: Clinical correlations to presentations
8.		Survey: Lumbar disc systems relevant materials	Lecture: Kinematics of the lumbar jount, typical surgical protocols /Design input for Implants Lab: Modeling of an elastomeric lumbar disc
9.		Design Project: Elastomeric Lumbar Disc	Lecture: Additional modeling tools Lab: Modeling of Lumbar Disc
10.		CLASS PRESENTATION 3	Project Presentations LUMBAR DISC MODEL Lecture: Clinical correlations to presentations
11.		Design Project: FEA Of proximal Femour and stem assembly	Lecture: FEA / Assembly, Loads, constraints, materials Lab: FEA Analysis of Femoral stem assembly.
12.		Design Project: FEA Of proximal tibial assembly	Lecture: FEA / Assembly, Loads, constraints, materials Lab: FEA Analysis of Tibial component.
13.		Design Project: FEA Of lumbar disc	Lecture: FEA / Assembly, Loads, constraints, materials Lab: FEA Analysis of Tibial component
14.		Design Project: FEA Fatique, 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 Hip stem component / Tibial Knee component/ Lambar Disc Component

GRADING:

Project Presentations HIP MODEL	20%
Project Presentations PROXIMAL TIBIA MODEL	20 %
Project Presentations LUMBAR DISC MODEL	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