**MIEG 6216: Bio Mechanics**

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| **Module Number :** MIEG 6216**Module Title:** Bio Mechanics  | **Credit Hours: 3****ESTC: 7****Contact Hours**: 3 Lecture, 1 seminar  |
| **Module objectives:** After active participation in this course and an effort to learn the material, students will be able to: 1. Identify a given bone, ligament or muscle by name, anatomic location, or function. 2. Recall the general characteristics, material properties, appropriate constitutive model, and adaptation potential for tissue and organs studied. 3. Identify relationships between structure and function in tissues and the implications/importance of these relationships. 4. Analyze the forces at a skeletal joint for various static and dynamic human activities. 5. Calculate the energy expenditure and power required to perform an activity. 6. Analyze the stresses and strains in biological tissues, given the loading conditions and material properties. 7. Identify the appropriate viscoelasticity model for the mechanical behavior of a given biological tissue. 8. Predict the overall creep and stress relaxation behavior for a basic viscoelastic material model. |
| **Module description:** The course provides an overview of musculoskeletal anatomy, the mechanical properties and structural behavior of biological tissues, and bio dynamics. Specific course topics will include * Structure and function relationships in tissues and organs; application of stress and strain analysis to biological tissues;
* Analysis of forces in human function and movement;
* Energy and power in human activity;
* Introduction to modeling viscoelasticity of tissues (including an ADAMS modeling laboratory).
* Finally, the course will include the beginning stages of a biomechanical design project.

Course format will include readings, lectures, active learning exercises, discussion, group activities, in-class quizzes, two mid-term exams, and a final exam. |
| **Module Outline:**1. Musculoskeletal Anatomy, Basic Statics and Joint Mechanics (elbow, shoulder, spine, hip, knee, ankle)
2. Basic Dynamics to Human Motion: Review of linear and angular kinematics; Kinetic equations of motion; Work & energy methods; Momentum methods; Examples in biomechanics; Modern kinematic measurement techniques; Applications of human motion analysis
3. Structure, Function, and Adaptation of Major Tissues and Organs: Bones, Cartilage, Ligaments, Tendons, Muscles, Skin, Heart, Artery, Vein, Lung, Liver, Kidney, Intestine Week
4. Fundamental Strength of Materials in Biological Tissues:
5. Introduction to Viscoelasticity and Comprehensive Review
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| **Pre-requisites:**  |
| **Textbook:**1. Fundamentals of Biomechanics: Equilibrium, Motion, and Deformation, by Ozkaya and Nordin
2. Basic Biomechanics of the Musculoskeletal System, by Nordin & Franke
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| **References:**1. McGinnis, Peter M.: Biomechanics of Sport and Exercise-2nd Edition.
2. Robertson, D.Gordon E.: Research Methods in Biomechanics.
3. Zatsiorsky, Vladimir: Kinetics of Human Motion.
4. Zatsiorsky, Vladimir: Kinematics of Human Motion. Whiting, William C.: Biomechanics of Musculoskeletal Injury
5. Basic Orthopaedic Biomechanics, by Mow and Hayes
6. Fundamentals of Orthopaedic Biomechanics, by Burstein and Wright
7. Orthopaedic Basic Science, Ed. by Simon
8. Cardiovascular Biomechanics, by Chandran
9. Biomechanics: Mechanical Properties of Living Tissues, by Fung
10. Melloni’s Illustrated Medical Dictionary, by Dox, Melloni, and Eisner
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| **Teaching methods:** Assignments, Project , and seminars are part of teaching learning process in addition to class room lecture.  |
| **Minimum attendance required to be permitted to examination:**75% lecture attendance and tutorial |
| **Evaluation:**Assignment (10%), Seminar (20%), Project (25%), seminar (10%), Final Exam (35%) |
| **Hours per Semester: 64** |