**MECH 420: Biomechanics (3 Credits)**

This course teaches students about the application of engineering methodologies for quantitative understanding of biological/physiological phenomena. Topics covered also include continuum mechanics principles, cardiovascular systems and components viewed from a mechanistic standpoint.

(Prerequisites: CIVL 301, MECH 240 and MECH 360)

**Course Learning Outcomes:**

By the end of the course, students will be able to:

* Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.
* Recognize ethical and professional responsibilities in engineering situations and make informed judgments, which consider the impact of engineering solutions in global, economic, environmental and societal contexts.
* Function effectively on a team, to provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
* Develop and conduct appropriate experimentation, analysis and data interpretation, and use engineering judgment to draw conclusions.
* Acquire and apply new knowledge, using appropriate learning strategies.
* Regularly evaluate own strengths and weaknesses and pursue opportunities to develop in necessary areas.
* Apply engineering analysis techniques to orthopedic biomechanics problems.
* Evaluate and assess the performance of total joint replacements.

**Course Materials:**

* Winter D.A.,Biomechanics and Motor Control of Human Movement, Wiley.
* Stone R., Stone J., Atlas of the Skeletal Muscles, McGraw-Hill Education.
* Tank P.W., Gest T.R., Atlas of Anatomy, Williams & Wilkins.
* Nordin M., Frankel V., Basic Biomechanics of the Musculoskeletal System, Williams & Wilkins.
* Palastanga N.F, Soames R., Anatomy and Human Movement: Structure and Function, Butterworth Heinemann.

**Course Content:**

1. Statics of the Musculoskeletal System
2. Overall Motion Analysis- Walking and Running
3. Linkage Systems Kinematics applied to the human body; link-segment models of the human body
4. Dynamics of the Musculoskeletal System
5. Synthesis of Movement Analysis
6. Stress Analysis, applied to long bones
7. Modes of failure of the replaced joint, and failure prevention based on clinical experience, materials selection and design
8. Material Behaviour of Soft Tissue (Introduction)
9. Fluid Mechanics of the Cardiovascular System (Introduction)