BMEG 340 – Biomechanics

Student Outcome e: an ability to identify, formulate, and solve engineering problems.

Performance Criterion #1: *Students can apply the physical laws and mechanical aspects governing human movement.*

Scoring Rubric:

Aspect	1: Not proficient	2: Progressing to proficiency	3: Proficient	4: Superior proficiency
Student can draw and solve a free body diagram with respect to a specific body motion	cannot develop a free-body diagram	free body diagram is drawn but incorrectly	free body diagram is drawn correctly, but solution has errors	free body diagram is correctly drawn and solved
Student can apply Newton's laws for human body under equilibrium conditions	cannot identify Newton's laws	Equations describing Newton's laws were derived incorrectly	Reaction forces, moments of forces, and internals loads were calculated with minor arithmetic errors	Equations were derived and solutions for reaction forces, moments of forces, and internal loading were calculated correctly
Student can apply Newton's laws for human body motion under dynamic conditions	cannot identify Newton's laws	Equations describing Newton's laws were derived incorrectly	Reaction forces, moments of forces, and internals loads were calculated with minor arithmetic errors	Equations were derived and solutions for reaction forces, moments of forces, and internal loading were calculated correctly

Performance Criterion #2: *Students apply the principles of mechanics to model the time-dependent behavior of fibres.*

Scoring Rubric:

Aspect	1: Not proficient	2: Progressing to proficiency	3: Proficient	4: Superior proficiency
Student can describe/identify/model time-dependent mechanical behavior using Kelvin, Maxwell, Voight, and Hill models for constant load and constant displacement	Student cannot describe/identify/model time-dependent mechanical behavior	Students can identify time-dependent models but cannot derive their mathematical models	Students can identify time-dependent models and derive equations without imposing initial boundaries	Student can successfully model time-dependent mechanical behavior for constant load and constant displacement

Performance Criterion #3: *Students analyze the biomechanics of human skeletal muscle function.*

Scoring Rubric:

Aspect	1: Not proficient	2: Progressing to proficiency	3: Proficient	4: Superior proficiency
Student can apply force-length and force-velocity properties of muscles for modeling human skeletal muscle function	Students cannot describe force-length and force-velocity properties of muscles	Students can describe force-length and force-velocity properties of muscles but cannot differentiate different modes (active vs passive or eccentric vs. concentric)	Students can describe force-length and force-velocity properties of muscles but can differentiate different modes	Student can apply force-length and force-velocity properties of muscles for different activation levels

Performance Criterion #4: *Students apply biomechanics principles on musculotendinous units and joints.*

Scoring Rubric:

Aspect	1: Not proficient	2: Progressing to proficiency	3: Proficient	4: Superior proficiency
Student can describe modified Hill's muscle model with added tendon	Student cannot identify biomechanics principles using modified Hill's muscle model	Student can identify modified Hill's model with one or more missed components	Student can identify lumped mechanical components, i.e. springs, dashpots and force-generators, for describing musculotendinous units	Student can identify/solve lumped mechanical components of modified Hill's model for describing musculotendinous mechanics and human movement