Biomechanics

1. **Course number and name:** 020BIMES3 Biomechanics

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours per week

3. **Name(s) of instructor(s) or course coordinator(s):** Ali AL Shaer

4. **Instructional Materials:** PowerPoint slides

    - Textbooks/References:
        - Biomechanics: Mechanical Properties of Living Tissues, Y.C. Fung, 2nd edition, Springer, ISBN 978-1-4419-3104-7.
        - Introduction to Continuum Biomechanics, K. A. Athanasious and R. M. Natoli, Springer, ISBN: 978-3-031-00498-8.

5. **Specific course information**
    a. **Catalog description:**
    This course deals with the biomechanical principles underlying the kinetics and kinematics of normal and abnormal human motion with emphasis on the interaction between biomechanical and physiological factors (bones, joints, connective tissues, and muscle physiology and structure) in skeleto-motor function and their applications in testing and in rehabilitation practice. It includes introduction to constitutive equations and stress-strain relationships for biomaterials, rheological properties of blood, and biomechanics of vessels and heart.

    a. **Prerequisites:** Mechanical Systems (020SMEES1) and Introduction to Materials Science (020ISMNI2 or 020ISMCI2).

    b. **Selected Elective** for ME students.

6. **Educational objectives for the course**
    a. **Specific outcomes of instruction:**
    A student who successfully fulfills the course requirements will have demonstrated an ability to:
        - Demonstrate an appropriate and consistent use of tensors.
        - Describe the relationship between mechanical properties and structure of biomaterials using constitutive equations and rheological models.
        - Identify the different rheometers used to determine the rheological properties of blood.
        - Analyze the biomechanics of bones, skeletal muscles and biological cells.

b. PI addressed by the course:

PI	1.1	1.2	1.3
Covered	x	x	x
Assessed			

7. Brief list of topics to be covered

- Introduction to continuum mechanics (2 Lectures).
- Stress tensor and operations on tensors (5 Lectures).
- Strain tensor (2 Lectures).
- Stress-strain material laws (3 Lectures).
- Rheological models (4 Lectures).
- Muscle mechanics (2 Lectures).
- Bone mechanics (2 Lectures).
- Blood rheology (2 Lectures).
- Cell mechanics (2 Lectures).
- Human motion mechanics (2 Lectures).