1. Course number and name: BMED 2310 Intro Biomed Engr Design
2. Credits and contact hours: (1-4-0-3)
3. Prepared by: Martin Jacobson
4. Textbook: none, online readings and videos are distributed via Canvas
5. Specific course information
    a. Catalog description: Students work in teams to analyze existing medical devices and their functions. Teams use problem-based learning and human-centered design methodologies to create a concept which would solve the same problem, but for a new user who currently would not have access to the device. Students build prototypes and test them to refine them to the point that they would have demonstrable value for the new user.
    b. Prerequisites or co-requisites: BMED 2110, BMED 2250 and PHYS 2211
    c. Required
6. Specific goals for the course
    a. Explain the "big picture" of engineering design (Student Outcome 2)
        i. Differentiate engineering analysis and design
        ii. Characterize design problems and the process used to solve them
        iii. Explain the relationship between form and function of a product
    b. Define, formulate, and solve design problems (Student Outcomes 2 and 5)
        i. Characterize the different types of design problems, decompose and diagram a product's components, and select and apply design problem solution strategies
        ii. Describe the overall process of formulating a design problem determine customer and company requirements, and prepare an engineering design specification
        iii. Establish a consensus among members of a design team
    c. Create concept designs, build and test prototypes (Student Outcomes 2 and 6)
        i. Describe and apply function decomposition diagrams
        ii. Distinguish alternative design concepts as different, generate alternative design concepts, and evaluate concepts using weighted rating methods
        iii. Describe why companies build and test parts and products, and describe tests to validate form, fit, and function
        iv. Characterize traditional and rapid prototyping processes
    d. Select appropriate materials, and design for failure, safety, tolerances and environment (Student Outcome 2)
        i. Explain the interdependency of product function, material, process, and geometry
        ii. Describe fundamental material classes and properties, establish criteria for screening materials, and explain the differences between dimensions and tolerances

iii. Identify product failure modes, establish failure mode causes, likelihood, detectability, and describe and apply safety hierarchy fundamentals

e. Consider human factors/ ergonomics (Student Outcome 2)
    i. Describe the human machine system model, specify human limitations for applying forces and torques, and specify the size and range of motion limitations
    ii. Describe and apply strategies for design for fit
f. Understand the standards for professional conduct within the biomedical engineering community (Student Outcomes 3 and 4)
    i. Generate effective written reports
    ii. Construct and present effective oral presentations
    iii. Understand what constitutes ethical conduct within the engineering profession

7. Brief list of topics to be covered
    a. Real world design problems in biomedical engineering
    b. Engineering Design concepts, tools, and methodologies
    c. Usability & Human Factors
    d. Computer Aided Design (CAD)
    e. Introduction to Regulatory Considerations & Strategies in the US (FDA)
    f. Ethics in the engineering profession
    g. Visual communication tools (sketching, CAD, modeling, prototyping)
    h. Business and market size considerations
    i. Principles of Design for Manufacturing and Assembly