Course Description
The objective of this course is to provide students a fundamental understanding of biomaterials, implant applications, and their design consideration. This course covers the fundamentals of the synthesis, properties, and biocompatibility of metallic, ceramic, polymeric, composite, and biological materials, and their applications for both hard and soft tissue replacement, and controlled drug delivery. This course will also provide students a broad understanding of cutting edge development in nanomaterials and their potential applications in tissue engineering. The course is intended for undergraduate senior/graduate students.

Course outline
1. Introduction : (1.5 week)
   - Introduction to biomaterials
   - The structures of materials
   - Characterization of materials
2. Classes of biomaterials (1.5 weeks)
   - Metals
   - Ceramics
   - Polymers
   - Composites
   - Biological materials
3. Tissue response to materials (1 week)
   - Host response to biomaterials
   - Material response to host
   - Biocompatibility of materials
4. Biomaterials (2 weeks)
   - Soft tissue replacement I: sutures, skin, maxillofacial implants
   - Soft tissue replacement II: Blood interfacing implants
   - Hard tissue replacement I: long bone repair
   - Hard tissue replacement II: joints and teeth
   - Transplants
   - Biomaterials in Tissue Engineering
5. Nanomaterials in tissue engineering (4 weeks)
   Nanomaterial-cell interactions
   Electrospinning technology for nanofibrous scaffolds
   Nanomaterials for skeletal, muscle, nerve, and heart tissue engineering
   Nanomaterials for stem cell tissue engineering
   Nanomaterials for drug delivery
   Magnetic nanoparticles for tissue engineering
   Nanoparticles/nanotubes/nanowires for cellular engineering

Textbooks

Reference books and materials
- Materials Science and Engineering an Introduction, William D Callister, Jr., 6th, or 7th or 8th Edition
- Review articles

Homework and exams
Homework assignments
Term paper
Take-home final

Grading
Homework 40%
Abstract and outline of a term paper 20%
Final (Term paper) 40%

Schedule
First day of class: Tues, Jan 3
Abstract and outline of the term paper: Thurs, Feb 2
Final draft of the term paper by email: Thurs, March 8