BIOMEDICAL ENGINEERING (4800)

4800:101 Tools for Biomedical Engineering (3 Credits)
Prerequisite or Corequisite: 3450:221 or appropriate AP score.
Introduction to Biomedical Engineering; basic operations using the Matlab environment; engineering graphics with Solidworks; and wet laboratory skills.

4800:111 Introduction to Biomedical Engineering Design (3 Credits)
Prerequisite: 4800:101. Prerequisite or Corequisite: 3450:222.
Introduction to the interdisciplinary nature of Biomedical Engineering research and design through the use of lectures, discussions, homework and design projects.

4800:201 Biomedical Engineering Sophomore Seminar (1 Credit)
Prerequisites: 4800:101 and sophomore or greater standing. A seminar format to allow students to learn about current research and careers in Biomedical Engineering. Topics in technical communications will also be covered.

4800:220 Biomedical Computing (3 Credits)
Prerequisites: 3450:223, 4800:101 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: 3450:335. Programming in Matlab environment to solve engineering problems using built-in and user-defined functions and various modules including signal processing and image processing. Concepts will be illustrated using relevant biomedical engineering examples.

4800:300 Biomaterials (3 Credits)
Prerequisites: 4300:202 and admission to an engineering major within the College of Engineering and Polymer Science. Properties of materials used in medicine and their interaction with biological materials will be discussed. Biocompatibility issues and materials properties and characterization will also be discussed.

4800:305 Introduction to Biophysical Measurements (4 Credits)
Prerequisites: 4800:101 and [4400:231 or 4400:307] and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: 3100:200. Biomedical Engineering involves measurement of Physiological processes in living organisms. An understanding of the variety of instruments used and the limitations are introduced.

4800:310 Modeling & Simulation of Biomedical Systems (3 Credits)
Prerequisites: 3450:335, 4800:220, and admission to an engineering major within the College of Engineering and Polymer Science. Modeling and simulation of physiological systems.

4800:325 Design of Medical Devices (3 Credits)
Prerequisites: Junior/senior standing in the College of Engineering and Polymer Science or the College of Arts and Sciences. Design of Medical Devices, design criteria, human factors, patient care and monitoring devices, surgical devices, bench testing and legal liability.

4800:360 Biofluid Mechanics (3 Credits)
Prerequisites: 3450:335, 3150:133, 3650:292, and 4600:203. Introduction to the fundamentals of fluid mechanics and their application to biological, cardiovascular, respiratory and other biofluid systems.

4800:362 Transport Fundamentals for Biomedical Engineering (3 Credits)
Prerequisite: 3450:335, 4600:203 and admission to an engineering major within the College of Engineering and Polymer Science. Introductory topics in fluid, heat, and mass transfer including both integral and differential analysis as it applies to biological and biomedical systems.

4800:365 Mechanics of Biological Tissues (3 Credits)
Prerequisites: 4300:202 and admission to an engineering major within the College of Engineering and Polymer Science. The mechanical properties of musculoskeletal tissues are presented along with modeling techniques and testing procedures. Tendons, ligaments, cartilage and bone will be addressed.

4800:370 Biomechanics of Human Movement (3 Credits)
Prerequisites: 3100:202 and 4600:203. The application of engineering mechanics and anatomy to study and analyze human movement. Lectures and in-class labs will introduce students to experimental and theoretical techniques.

4800:401 Introduction to Biomaterials Laboratory (2 Credits)
Prerequisites: Admission into the Biomedical Engineering - Biomaterials and Tissue Engineering or the Biomedical Engineering - Biomaterials and Tissue Engineering / Cooperative Education program and 4800:101. Pre/Corequisite: 4800:400. Laboratory to explore techniques in biomaterials and tissue engineering and evaluate experimental outcomes. Biomaterials and Tissue Engineering Track students only.

4800:420 Biomedical Signal & Image Processing (3 Credits)
Prerequisites: 4800:220 and admission to an engineering major within the College of Engineering and Polymer Science. Corequisite: 4800:305. Introduction to the basic problems associated with biological signal and image processing applications, and appropriate approaches to dealing with them.

4800:422 Physiological Control Systems (3 Credits)
Prerequisites: 3100:202, 3450:335. The basic techniques employed in control theory, systems analysis and model identification as they apply to physiological systems.

4800:430 Design of Medical Imaging Systems (3 Credits)
Prerequisites: 3100:200, 3650:292, 4400:340, 4400:353, 4800:305 and admission to an engineering major within the College of Engineering and Polymer Science or permission of instructor. Physical principles and engineering design of medical imaging systems, with emphasis on digital radiography, computed tomography, nuclear medicine, ultrasound and magnetic resonance.

4800:435 Image Science (3 Credits)
Prerequisites: 3100:200, 3650:292, 4400:343 or by permission of instructor. Principles of image science, image performance parameters and image assessment techniques of medical imaging systems, with emphasis on digital radiography, tomographic imaging, ultrasound and magnetic resonance.

4800:437 Physics of Medical Imaging (3 Credits)
Prerequisites: 3100:200, 3650:292, 4400:353, 4800:305. Physical principles of medical imaging modalities with emphasis on the properties, generation mechanisms and interaction of radiation with matter, physics of the image formation and optimization.

4800:440 Advanced Biomaterials (3 Credits)
Prerequisites: 4800:300 and admission to an engineering major within the College of Engineering and Polymer Science. The interactions between biomaterials and medical devices will be analyzed with respect to their potential fractionation of biological mechanisms.

4800:445 Experimental Techniques in Biomaterials Tissue Engineering (3 Credits)
Prerequisite: 4800:440. Laboratory experience that applies engineering concepts and practices to the analysis of biomaterials and tissue engineering.
4800:450 Tissue Engineering (3 Credits)
Prerequisites: 4800:300, 4800:365, 4800:362, and [4800:360 or 4200:321].
This course will explore topics to successfully design tissue engineered
deVICES. For advanced engineering students with a background in
materials, mechanics, and transport phenomena.

4800:455 Biotransport (3 Credits)
Prerequisites: 3100:202, 4800:220, and [4800:362 or 4200:321]. With the
foundations of fluid, heat and mass transfer established, this course
focuses on specific biological examples of transport phenomena.

4800:460 Experimental Techniques in Biomechanics (3 Credits)
Prerequisites: 4800:362, 4800:365 and admission to an engineering major
within the College of Engineering and Polymer Science. Principles of
testing and measuring devices commonly used for biomechanics studies.
Laboratories for demonstration and hands-on experience.

4800:464 Microfluidics for Biomedical Engineering (3 Credits)
Prerequisites: 4800:362 or 4200:321 or 4800:360. This course will
discuss fundamental principles of single and two phase flow of biofluids
in microfluidic devices, and present the applications of lab-on-a-chip
systems in BME.

4800:470 Human Factors Engineering (3 Credits)
Prerequisite: Admission to an engineering major within the College of
Engineering and Polymer Science. Reliability and human error, human
capabilities and limitations, crew protection, display systems, controls
and controlling actions, interface design principles, risk management,
Safety and accident prevention.

4800:485 Special Topics in Biomedical Engineering (1-3 Credits)
Prerequisite: Permission of advisor. Directed individual or group research
or study in the student’s field of interest. Topic subject to approval of
advisor.

4800:491 Biomedical Engineering Design I (2 Credits)
Prerequisites: 4800:111, 4800:220, and [4400:307 and 4800:300 and
4800:362 and 4800:365] or [4400:340 and 4400:360 and 4600:203 and
4800:310] and admission to an engineering major within the College of
Engineering and Polymer Science. Pre/Corequisite: 4800:305. The design
process will be presented utilizing case studies and detailed biomedical
engineering design projects.

Gen Ed: Tier 3 - Complex Systems

4800:492 Biomedical Engineering Design II (2 Credits)
Prerequisites: 4800:491 and admission to an engineering major within
the College of Engineering and Polymer Science. The design process will
be continued utilizing case studies and detailed biomedical engineering
design projects.

4800:498 Introduction to BME Research (2 Credits)
Prerequisites: Permission of instructor. Directed individual or group study
in research in biomedical engineering. Course is credit/no credit. May not
be repeated.

4800:499 BME Research Project (1-3 Credits)
Prerequisites: 4800:498, permission of instructor. Directed individual or
group study in research in biomedical engineering. May be repeated.