Biomedical Engineering Graduate Concentration – Fall 2015

Bioelectrical
Advisor: Cynthia Chestek, Ph.D.

BIOELECTRICAL (select one course):
BIOMEDE 417 Electrical Biophysics (4) (II)
BIOMEDE 599.003 Neural Engineering (3) (II)

NOTE: Students who have previously taken an undergraduate bioelectricity course are advised to take BIOMEDE 599.003 instead of BIOMEDE 417.

GENERAL (both courses are required):
BIOMEDE 500 Biomedical Engineering Seminar (1) (I,II)
BIOMEDE 550 Ethics and Enterprise (1) (I)

BIOMEDICAL RESEARCH AND DESIGN (select one – BIOMEDE 590 or BIOMEDE 599.002 and BIOMEDE 599.004):
BIOMEDE 590 Directed Research (2-3) (I,II,III)
BIOMEDE 599.002 Graduate BME Innovative Design Team (3) (I)
BIOMEDE 599.004 Graduate BME Innovative Design Team (4) (II)

NOTE: In order for BIOMEDE 599.002 and BIOMEDE 599.004 to count toward their degree in BME, students must register for these courses in both the fall and winter terms, and they must adhere to the following rules:

a) this course can be counted as a SUGS, terminal MS, or MS/PhD student's 2 credit hour technical elective (fall term) and Biomedical Research and Design requirement (winter term),
b) this course, taken in both terms, can be counted as a technical elective for a student that has already taken BIOMEDE 590,
c) this course can be counted as PhD coursework providing that it has not already been counted as the student's Biomedical Research and Design requirement or technical elective in their MS program, and the student's advisor approves.

MATHEMATICS (select one course):
MATH 450 Advanced Mathematics for Engineers I (4) (I,II,IIIb)
MATH 454 Boundary Value Problems for Partial Differential Equations (3) (I,II,IIIa)
MATH 462 Mathematical Models (3) (II)
MATH 463 Mathematical Modeling in Biology (3) (I)
MATH 471 Introduction to Numerical Methods (3) (I,II,IIIb)
MATH 550 Introduction to Adaptive Systems (3) (I)
MATH 555 Introduction to Functions of a Complex Variable with Applications (3) (I,II)
MATH 556 Applied Functional Analysis (3) (I)
MATH 557 Applied Asymptotic Analysis (3) (II)
MATH 558 Applied Nonlinear Dynamics (3) (I)
MATH 559 Topics in Applied Mathematics (3)
MATH 561 Linear Programming I (3) (I,II)
MATH 562 Continuous Optimization Methods (3) (II)
MATH 563 Advanced Mathematical Methods for the Biological Sciences (3) (II)
MATH 564 Topics Math Biology (3)
MATH 571 Numerical Linear Algebra (3) (I,II)
MATH 572 Numerical Methods for Differential Equations (3) (II)
MATH 651 Topics in Applied Mathematics I (3) (I,II)
MATH 656 Introduction to Partial and Differential Equations (3) (I)
MATH 657 Nonlinear Partial Differential Equations (3) (II)
MATH 756 Advanced Topics in Partial Differential Equations (3)
MECHENG 501  Math Methods in Mechanics (3) (II)
MECHENG 564  Linear Systems Theory (4) (I)

**BIOINSTRUMENTATION (select one course):**
- BIOLCHEM 516  Intro Biochemistry Lab (3) (I)
- BIOMEDE 458  Biomedical Instrumentation and Design (4) (I, II)
- BIOMEDE 510  Medical Imaging Laboratory (3) (II)
- IOE 432  Industrial Engineering Instrumentation Methods (3) (I)
- MCDB 429  Cellular & Molecular Biology Lab (3) (II)

**STATISTICS (select one course):**
- BIOMEDE 503  Statistical Methods for Biomedical Engineering (3) (II)
- BIOSTAT 602  Biostatistical Inference (4) (II)
- BIOSTAT 650  Applied Statistics I: Linear Regression (4) (I)
- BIOSTAT 651  Applied Statistics II: Extensions for Linear Regression (3) (II)
- EECS 501  Probability and Random Processes (4) (I, II)
- IOE 461  Quality Engineering Principles and Analysis (3) (I)
- STATS 470  Introduction to the Design of Experiments (4) (I)
- STATS 500  Applied Statistics I (3) (I)
- STATS 525  Probability Theory (3) (I)

NOTE: BME graduate students can only take EECS 501 in the winter term.

**LIFE SCIENCE (two courses are required – at least one course must be outside of the College of Engineering):**

*Required:*
- BIOMEDE 519  Quantitative Physiology (4) (I)

*Select one course:*
- ANAT 403  Human Anatomy (5) (I, II)
- ANAT 541  Mammal Reprod (4) (II)
- BIOLCHEM 451  Introductory Biochemistry I (4) (I)
- BIOLCHEM 515  Introductory Biochemistry (3) (I, II)
- BIOLCHEM 550  Macromol Struc & Func (3) (I)
- BIOPHYS 520  Biophys Chem I (3) (I)
- CANCBIO 553  Cancer Biol (2) (I)
- CDB 530  Cell Biology (3) (I)
- CDB 550  Histology (4) (II)
- CDB 581  Developmental Genetics (3) (I)
- CDB 583  Stem Cells Regen Bio (3) (II)
- KINESLGY 522  Clin Neurophys Image (3) (II)
- KINESLGY 545  Metab Respon to Exer (3) (II)
- MCDB 422  Cellular and Molecular Neurobiology (3) (I)
- MCDB 423  Neurology Lab (3) (I)
- MCDB 427  Molecular Biology (4) (I)
- MCDB 428  Cell Biology (4) (II)
- MCDB 429  Laboratory in Cell and Molecular Biology (3) (II)
- MCDB 435  Intracellular Trafficking (3) (I)
- MCDB 530  Cell Biology (3) (I)
- MICROBIOL 440  Immunology (3) (II)
- NEUROSCI 570  Human Neuroanatomy (3) (I)
- NEUROSCI 601  Principles Neuro I (4) (I)
- NEUROSCI 602  Principles Neuro II (4) (II)
- PATH 581  Tissue, Cellular and Molecular Basis of Disease (4) (II)
- PHYSIOL 592  Integrative Neuroscience (3) (II)
**TECHNICAL ELECTIVES:**
The student must select the remaining credit hours needed to fulfill the minimum MS degree requirement of 30 credit hours from graduate level engineering courses. No more than 2 credit hours of seminar courses may be applied to the 30 credit hours needed to fulfill the MS degree requirement.

Sample Course Sequence:
- **Fall**: BIOMEDE 458 (4), BIOMEDE 500 (1), Statistics, Life Science
- **Winter**: BIOMEDE 599.003 (3), BIOMEDE 418 (4), BIOMEDE 590 (2), Mathematics
- **Fall**: BIOMEDE 519 (4), BIOMEDE 550 (1), Technical Elective

**Recommended Technical Electives:**
- BIOMEDE 418 Quantitative Cell Biology (4) (I,II)
- BIOMEDE 510 Medical Imaging Laboratory (3) (II)
- BIOMEDE 516 Medical Imaging Systems (3) (I)
- EECS 414 Introduction to MEMS (4) (I)
- EECS 425 Integrated Microsystems Laboratory (4) (II)
- EECS 559 Advanced Signal Processing (3) (I)

**KEY AND ADDITIONAL NOTES:**
Course Department and Number Course Name (# of credits) (term offered)

Terms: I- fall, II - winter, III - spring-summer, IIIa - spring half, IIIb summer half

Every effort is made to make sure that the course offering is correct, but students should refer to the Schedule of Classes or the department’s website for the current offering.