

BIOMED E BIOMEDICAL IMAGING CONCENTRATION - F07

MS: 30 total credit hours minimum

Advisor: Luis Hernandez-Garcia, Ph.D. (hernan@umich.edu)

Biomedical Imaging:

BIOMED E 516¹ Medical Imaging Systems
(3) (I)²

General:

BIOMED E 500 Biomedical Engineering
Seminar (1) (I,II)
BIOMED E 550 Ethics and Enterprise (1) (I)

Biomedical Research and Design (one course):

BIOMED E 450 Biomedical Design (4) (II)
– for MS only students
BIOMED E 590 Directed Research (2)
(I,II,III)
BIOMED E 599 - Section 001
Graduate BME Innovative
Design Team (2) (I) **AND**
BIOMED E 599 - Sections 004 and 005
Graduate BME Innovative
Design Team (4) (II)³

Mathematics (one course):

Math 419 Linear Spaces and Matrix
Theory (3) (I,II)
Math 462 Mathematical Models (3)⁴
Math 463 Math Modeling in Biology (3)
(I)
Math 513 Introduction to Linear
Algebra (3)⁵ (I,II)
Math 556 Methods of Applied Math I
(3) (I)
Math 557 Methods of Applied Math
II (3) (II)
Math 562/IOE 511/Aero 577
Continuous Optimization
Meth. (3) (I)
Math 571 Numerical Methods for
Scientific Computing I (3)
(I,II)
Math 572 Numerical Methods for
Scientific Computing II (3)
(II)
Math 651 Topics in Applied
Mathematics I (3)⁴
Math 652 Topics in Applied
Mathematics II (3)⁴
Math 656 Introduction to Partial
Differential Equations (3)⁴

Bioinstrumentation (one course):

BIOMED E 458 Biomedical Instrumentation
and Design (4) (I,II)
BIOMED E 510 Medical Imaging
Laboratory (3) (II)
Biophysics 608 Biophysical Principles of
Microscopy (3)⁶

Statistics (one course):

EECS 501/Aero 552
Probability and Random
Processes (4) (I,II)
Statistics 525/Math 525
Probability Theory (3) (I)

Life Science (two courses):

Required:
BIOMED E 519 Quantitative Physiology
(4) (I)

And one of the following:

BIOMED E 401 The Human Body (4) (I)
BIOMED E 418 Quantitative Cell Biology
(4) (II)
Neurosci 570 Hum Neuroanat I (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 level⁷ engineering. This may include EECS 451 for students needing DSP. 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 Sequences:

For a student that has not had DSP:

Fall BIOMED E 458, BIOMED
E 500, EECS 451, EECS
501
Winter BIOMED E 418, EECS
556, Math 513
Fall BIOMED E 516, BIOMED
E 519, BIOMED E 550,
BIOMED E 590

For a student that has had DSP:

Fall	BIOMED E 458, BIOMED E 500, BIOMED E 516, EECS 501
Winter	BIOMED E 418, BIOMED E 510, EECS 556, Math 513
Fall	BIOMED E 519, BIOMED E 550, BIOMED E 590

⁷ Please see Horace H. Rackham School of Graduate Studies guidelines.

Recommended Technical Electives:

BIOMED E 417	Electrical Biophysics (4) (I)
BIOMED E 482	Fundamentals of Ultrasonics (2) (II)
BIOMED E 599-section 127	Biomedical Optics (3) (I)
EECS 556	Image Processing (3) (II)
EECS 559	Advanced Signal Processing (3) (II)

For Doctoral Students the following courses are recommended:

BIOMED E 510	Medical Imaging Laboratory (3) (I,II)
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¹ Officially EECS 451 (Digital Signal Processing) is a prerequisite, but taken concurrently is adequate for students with a good background in linear systems and Fourier transforms (e.g. EECS 316). Students who consider concurrent enrollment should consult with the EECS 516 instructor.

² I - fall, II - winter, III - spring-summer, IIIa - spring half, IIIb - summer half.

³ In order for this course to count toward their degree in BME, students must register for this course in both the fall and winter terms, and they must adhere to the following rules:
 a) this course can be counted as a SGUS, 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 BIOMED E 450 or BIOMED E 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.

⁴ Refer to the Mathematics Department for current offering.

⁵ Prerequisites: Math 412 or Math 451.

⁶ Refer to the Biophysics Department for current offering.