**PhD—Bioengineering**  
Major Code: BION (Bioengineering)  
Biocatalysis Track

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**Program Total**  
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**Additional Required Courses**
- BIOE 7001 Biomaterials 4.0 SH
- CHME 5630 Biochemical Engineering 4.0 SH
- EECE 5664 Biomedical Signal Processing 4.0 SH
- ME 5667 Solid Mech of Cells and Tissues 4.0 SH

**Mathematical Methods for Bioengineers**
- CHME 7320 Chemical Engineering Math 4.0 SH
- EECE 7220 Linear Systems Analysis 4.0 SH
- EECE 7203 Complex Variable and Diff Equat 4.0 SH
- ME 7205 Adv Math Methods for Mech Engr 4.0 SH

**Required Biochemical and Bioenvironmental Courses**
- BIOL 6300 Biochemistry 4.0 SH
- CHME 5630 Biochemical Engineering 4.0 SH
- CHME 7340 Chemical Engineering Kinetics 4.0 SH
- CHME 7350 Transport Phenomena 4.0 SH
- CIVE 7251 Environmental Biol Process 4.0 SH

**Suggested Track Electives**
- BIOL 5579 Biochem/Mol Bio Exp Approaches 5.0 SH
- BIOL 5581 Biomedical Imaging 4.0 SH
- BIOL 5587 Comparative Neurobiology 4.0 SH
- BIOL 5600 Computer Systems 4.0 SH
- BIOL 5613 Optical Methods of Analysis 3.0 SH
- BIOL 5620 Protein Chemistry 3.0 SH
- BIOL 5621 Chemical Biology For Chemists 3.0 SH
- BIOL 5660 Analytical Biochemistry 3.0 SH
- CHEM 5686 Fund of Mol Struct Electronics 3.0 SH
- CHEM 7317 Analytical Biotechnology 3.0 SH
- CHME 7330 Chem Engineering Thermodynamic 4.0 SH
- PHSC 5100 Concepts in Pharmaceutical Sci 2.0 SH
- PHSC 6210 Drug Design Eval and Developmnt 2.0 SH
- PHSC 6218 Biomedical Chemical Analysis 2.0 SH
- PHSC 6226 Imaging in Med andDrug Discovery 2.0 SH
- PHSC 6290 Biophys Methods Drug Discovery 2.0 SH
- PHYS 7731 Biological Physics 1 4.0 SH
- PMST 6250 Advanced Physical Pharmacy 2.0 SH
- PMST 6252 PharmKin and Drug Metabolism 3.0 SH
- PMST 6254 Advanced Drug Delivery System 3.0 SH
- PMST 6256 Advanced Pharmacokinetics 2.0 SH

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**PhD—Bioengineering**  
Major Code: BION (Bioengineering)  
Biocomputing Track

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**Program Total**  
48.0 SH

**Additional Required Courses**
- BIOE 7001 Biomaterials 4.0 SH
- CHME 5630 Biochemical Engineering 4.0 SH
- EECE 5664 Biomedical Signal Processing 4.0 SH
- ME 5667 Solid Mech of Cells and Tissues 4.0 SH

**Mathematical Methods for Bioengineers**
- CHME 7320 Chemical Engineering Math 4.0 SH
- EECE 7220 Linear Systems Analysis 4.0 SH
- EECE 7203 Complex Variable and Diff Equat 4.0 SH
- ME 7205 Adv Math Methods for Mech Engr 4.0 SH

**Suggested Track Electives**
- BIOL 5553 Bio of Muscle: Molec to Mvmt 4.0 SH
- BIOL 5581 Biological Imaging 4.0 SH
- BIOL 5587 Comparative Neurobiology 4.0 SH
- BIOL 6200 Bioinformatics Programming 4.0 SH
- BIOL 6302 Bioinfo Methods and Algorithms 5.0 SH
- BIOL 6308 Bioinformatics Methods 1 4.0 SH
- BIOL 6309 Bioinformatics Methods 2 4.0 SH
- CS 5100 Frndts Artificial Intelligene 4.0 SH
- CS 5200 Database Management Sys 4.0 SH
- CS 5310 Impl of Database Mgmt Systems 4.0 SH
- CS 5310 Computer Graphics 4.0 SH
- CS 5320 Digital Image Processing 4.0 SH
- CS 5330 Pattern Recognn and Comput Vision 4.0 SH
- CS 5400 Principles of Programming Lang 4.0 SH
- CS 5600 Computer Systems 4.0 SH
- CS 5600 Algorithms 4.0 SH
- CS 5710 Knowledge-Based Systems 4.0 SH
- CS 6140 Machine Learning 4.0 SH
- CS 6200 Information Retrieval 4.0 SH
- CS 6410 Compilers 4.0 SH
- CS 6610 Parallel Computing 4.0 SH
- CS 6810 Distributed Algorithms 4.0 SH
- EECE 7200 Linear Systems Analysis 4.0 SH
- EECE 7203 Complex Variable and Diff Equat 4.0 SH
- EECE 7204 Appl Prob and Stochasitic Proc 4.0 SH
- EECE 7313 Pattern Recognition 4.0 SH
- EECE 7339 Testing and Dsgn for Testability 4.0 SH
- EECE 7350 Software Engineering 1 4.0 SH
- EECE 7351 Software Engineering 2 4.0 SH
- EECE 7352 Computer Architecture 4.0 SH
- EECE 7353 VLSI Design 4.0 SH
- EECE 7354 VLSI Architecture 4.0 SH
- EECE 7357 Fault-Tolerant Computers 4.0 SH
- EECE 7358 Parallel Arch for Hi Perf Comp 4.0 SH
- EECE 7359 Multiprocessor Architectures 4.0 SH
- EECE 7361 Digital Hardware Synthesis 4.0 SH
- EECE 7364 Mobile and Wireless Networking 4.0 SH
EECE 7365 Distributed Systems 4.0 SH
EECE 7367 Robotics and Automation System 4.0 SH
EECE 7368 High-Level Des of Hw-Sw System 4.0 SH
EECE 7389 Robot Vision and Sensors 4.0 SH
OR 6205 Deterministics Ops Research 4.0 SH
OR 7230 Probabilistic Operat Research 4.0 SH

PhD—Bioengineering

Major Code: BION (Bioengineering)

Biomechanics and Mechanobiology Track

BIOL 734 Speci Topics in Bioengineering 4.0 SH
BIOL 5100 Medical Physiology 4.0 SH
BIOL 7390 Seminar 0.0 SH
BIOL 5553 Bio of Muscles: Molec to Mvmt 4.0 SH
ME 5665 Musculoskeletal Biomechanics 4.0 SH
ME 7210 Elasticity and Plasticity 4.0 SH
BIOL 9990 Dissertation 0.0 SH
Course Work from the list "Additional Required Courses" below
Course Work from the list "Mathematical Methods for Bioengineers" below
Course Work from the list "Suggested Track Elective Courses" below
Group Total ................................................................. 48.0 SH

Program Total 48.0 SH

Additional Required Courses

BIOL 7001 Biomaterials 4.0 SH
CHME 5630 Biochemical Engineering 4.0 SH
EECE 5664 Biomedical Signal Processing 4.0 SH
ME 5667 Solid Mech of Cells and Tissues 4.0 SH

Mathematical Methods for Bioengineers

CHME 7320 Chemical Engineering Math 4.0 SH
EECE 7200 Linear Systems Analysis 4.0 SH
EECE 7203 Complex Variable and Diff Equat 4.0 SH
ME 7205 Adv Math Methods for Mech Engr 4.0 SH

Suggested Track Elective Courses

EECE 7367 Robotics and Automation System 4.0 SH
ME 6650 Advanced Mechanics of Material 4.0 SH
ME 6655 Dynamics and Mechanical Vibration 4.0 SH
ME 6657 Finite Element Method 4.0 SH
ME 6659 Control and Mechatronics 4.0 SH
ME 6667 Solid Mech of Cells and Tissues 4.0 SH
ME 7238 Adv Finite Element Method 4.0 SH
ME 7240 Composite Materials 4.0 SH
ME 7245 Fracture Mech and Failure Anlys 4.0 SH
ME 7255 Continuum Mechanics 4.0 SH
ME 7275 Essentials of Fluid Dynamics 4.0 SH
ME 7280 Statistical Thermodynamics 4.0 SH
ME 7325 Two Phase Flow 4.0 SH
PT 5133 Kinesiology 3.0 SH
Coreq: PT 5134
PT 5170 Motor Control 3.0 SH
Coreq: PT 5171
PT 6215 Assistive Technology 3.0 SH
Coreq: PT 6216

PhD—Bioengineering

Major Code: BION (Bioengineering)

Biomechanics and Mechanobiology Track

BIOL 734 Speci Topics in Bioengineering 4.0 SH
BIOL 5100 Medical Physiology 4.0 SH
BIOL 7390 Seminar 0.0 SH
EECE 7200 Linear Systems Analysis 4.0 SH
EECE 7203 Complex Variable and Diff Equat 4.0 SH
EECE 7204 Appl Prob and Stochastic Proc 4.0 SH

BIOL 9990 Dissertation 0.0 SH
Course Work from the list "Additional Required Courses" below
Course Work from the list "Mathematical Methods for Bioengineers" below
Course Work from the list "Suggested Track Elective Courses" below
Group Total ................................................................. 48.0 SH

Program Total 48.0 SH

Additional Required Courses

BIOL 7001 Biomaterials 4.0 SH
CHME 5630 Biochemical Engineering 4.0 SH
EECE 5664 Biomedical Signal Processing 4.0 SH
ME 5667 Solid Mech of Cells and Tissues 4.0 SH

Suggested Track Elective Courses

BIOL 5553 Bio of Muscle: Molec to Mvmt 4.0 SH
BIOL 5581 Biological Imaging 4.0 SH
BIOL 5587 Comparative Neurobiology 4.0 SH
BIOL 5603 Computational Neuroscience 4.0 SH
BIOL 6200 Bioinformatics Programming 4.0 SH
BIOL 6302 Bioinfo Methods and Algorithms 5.0 SH
BIOL 6308 Bioinformatics Methods 1 4.0 SH
BIOL 6309 Bioinformatics Methods 2 4.0 SH
CHEM 5612 Principls of Mass Spectrometry 3.0 SH
CHEM 5613 Optical Methods of Analysis 3.0 SH
CHEM 5637 Foundations of Spectroscopy 3.0 SH
EECE 4512 Biomedical Electronics 4.0 SH
EECE 4692 Subsurface Sensing and Imaging 4.0 SH
EECE 5646 Optics for Engineers 4.0 SH
EECE 5648 Biomedical Optics 4.0 SH
EECE 7202 Electromagnetic Theory 1 4.0 SH
EECE 7271 Comp Mthds in Electromagnetics 4.0 SH
EECE 7280 Fourier and Binary Optics 4.0 SH
EECE 7281 Fourier Optics 4.0 SH
EECE 7284 Optical Properties of Matter 4.0 SH
EECE 7293 Modern Imaging 4.0 SH
EECE 7310 Modern Signal Processing 4.0 SH
EECE 7311 2D Signal and Image Processing 4.0 SH
EECE 7312 Stat and Adaptive Sig Processing 4.0 SH
EECE 7313 Pattern Recognition 4.0 SH
EECE 7314 Auditory Signal Processing 4.0 SH
EECE 7323 Numerical Optimization Methods 4.0 SH
EECE 7335 Detection and Estimation Theory 4.0 SH
EECE 7337 Information Theory 4.0 SH
EXSC 6200 Cardiopulm Physio 3.0 SH
PHSC 6226 Imaging in Med andDrug Discovery 2.0 SH
PHYS 7741 Biological Physics 2 4.0 SH
PSYC 5120 Proseminar in Perception 3.0 SH
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PSYC 7220 Seminar in Sensation 3.0 SH
PSYC 7300 Advanced Quantitative Analysis 3.0 SH
PT 5138 Neuroscience 4.0 SH
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Coreq: PT 5138
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SLPA 5111 Anatomy and Physiology Aud Sys 3.0 SH
SLPA 6209 Psychoacoustics 2.0 SH
SLPA 6301 Speech Science 3.0 SH

PhD—Bioengineering

Major Code: BION (Bioengineering)

BioMEMs/BioNANO Track

BIOL 734 Speci Topics in Bioengineering 4.0 SH
BIOL 5100 Medical Physiology 4.0 SH
BIOL 7390 Seminar 0.0 SH
ME 6280 Microelectromechanical Sys 4.0 SH
ME 7262 Nanomanufacturing 1 4.0 SH

Biomechanics and Mechanobiology Track

BIOL 734 Speci Topics in Bioengineering 4.0 SH
BIOL 5100 Medical Physiology 4.0 SH
BIOL 7390 Seminar 0.0 SH
ME 6280 Microelectromechanical Sys 4.0 SH
ME 7262 Nanomanufacturing 1 4.0 SH

Program Total 48.0 SH

Additional Required Courses

BIOL 7001 Biomaterials 4.0 SH
CHME 5630 Biochemical Engineering 4.0 SH
EECE 5664 Biomedical Signal Processing 4.0 SH
ME 5667 Solid Mech of Cells and Tissues 4.0 SH

Suggested Track Elective Courses

BIOL 5553 Bio of Muscle: Molec to Mvmt 4.0 SH
BIOL 5581 Biological Imaging 4.0 SH
BIOL 5587 Comparative Neurobiology 4.0 SH
BIOL 5603 Computational Neuroscience 4.0 SH
BIOL 6200 Bioinformatics Programming 4.0 SH
BIOL 6302 Bioinfo Methods and Algorithms 5.0 SH
BIOL 6308 Bioinformatics Methods 1 4.0 SH
BIOL 6309 Bioinformatics Methods 2 4.0 SH
CHEM 5612 Principls of Mass Spectrometry 3.0 SH
CHEM 5613 Optical Methods of Analysis 3.0 SH
CHEM 5637 Foundations of Spectroscopy 3.0 SH
EECE 4512 Biomedical Electronics 4.0 SH
EECE 4692 Subsurface Sensing and Imaging 4.0 SH
EECE 5646 Optics for Engineers 4.0 SH
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EECE 7271 Comp Mthds in Electromagnetics 4.0 SH
EECE 7280 Fourier and Binary Optics 4.0 SH
EECE 7281 Fourier Optics 4.0 SH
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EECE 7323 Numerical Optimization Methods 4.0 SH
EECE 7335 Detection and Estimation Theory 4.0 SH
EECE 7337 Information Theory 4.0 SH
EXSC 6200 Cardiopulm Physio 3.0 SH
PHSC 6226 Imaging in Med andDrug Discovery 2.0 SH
PHYS 7741 Biological Physics 2 4.0 SH
PSYC 5120 Proseminar in Perception 3.0 SH
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SLPA 5111 Anatomy and Physiology Aud Sys 3.0 SH
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**PhD—Bioengineering**

**Major Code:** BION (Bioengineering)

**Cell and Tissue Engineering Track**

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**Program Total** 48.0 SH

**Suggested Track Elective Courses**

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**Program Total** 48.0 SH

**Additional Required Courses**

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**PhD—Bioengineering**

**Major Code:** BION (Bioengineering)

**General Bioengineering Studies Track**

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**Program Total** 48.0 SH

**Suggested Track Electives**

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<td>BIOL 5581</td>
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**Program Total** 48.0 SH
PhD—Bioengineering
Major Code: BION (Bioengineering)
Motor Control Track

- BI0E 7374 SpeciTopics in Bioengineering 4.0 SH
- BI0E 5100 Medical Physiology 4.0 SH
- BI0E 7390 Seminar 0.0 SH
- BI0E 9990 Dissertation 0.0 SH

Course Work from the list "Additional Required Courses" below

- Course Work from the list "Mathematical Methods for Bioengineers" below

Course Work from the list "Required Motor Control Track Courses" below

Group Total ................................................................. 48.0 SH

Program Total .............................................................. 48.0 SP

Additional Required Courses

- BI0E 7001 Biomaterials 4.0 SH
- CHME 5630 Biochemical Engineering 4.0 SH
- EECE 5664 Biomedical Signal Processing 4.0 SH
- ME 5667 Solid Mech of Cells and Tissues 4.0 SH
Mathematical Methods for Bioengineers
CHME 7320 Chemical Engineering Math 4.0 SH
EECE 7200 Linear Systems Analysis 4.0 SH
EECE 7203 Complex Variable and Diff Equat 4.0 SH
ME 7205 Adv Math Methods for Mech Engr 4.0 SH

Required Motor Control Track Courses
BIOL 5601 Multidisc Apprch Motor Control 4.0 SH
BIOL 5553 Bio of Muscle: Molec to Mvmt 4.0 SH
ME 5665 Musculoskeletal Biomechanics 4.0 SH
ME 5659 Control and Mechatronics 4.0 SH

Suggested Motor Control Track Electives
BIOL 5587 Comparative Neurobiology 4.0 SH
EECE 7200 Linear Systems Analysis 4.0 SH
EECE 7204 Appl Prob and Stochasitic Proc 4.0 SH
EECE 7213 System ID and Adaptive Control 4.0 SH
EECE 7214 Optimal and Robust Control 4.0 SH
EECE 7310 Modern Signal Processing 4.0 SH
PSYC 5180 Quantitative Methods 1 3.0 SH
PSYC 5181 Quantitative Methods 2 3.0 SH
ME 5655 Dynamics and Mechanicl Vibration 4.0 SH
ME 6200 Math Methods for Mech Engineer 1 4.0 SH
ME 6201 Math Methods for Mech Eng 2 4.0 SH
ME 7350 Graduate Seminar in Robotics 1.0 SH
IE 7280 Stat Methods in Engineering 4.0 SH
IE 7315 Human Factors Engineering 4.0 SH
CS 5335 Robotic Science and Systems 4.0 SH
Coreq: CS 5336
CS 5336 Lab for CS 5335 0.0 SH
Coreq: CS 5335
CSYE 5250 Robot Mechanics and Control 4.0 SH
PHYS 7301 Classical Mech/Math Methods 4.0 SH
PHYS 7321 Computational Physics 4.0 SH
PHYS 7735 Nonlinear Dynamics 4.0 SH
PHYS 7741 Biological Physics 2 4.0 SH
PT 5138 Neuroscience 4.0 SH
Coreq: PT 5139
PT 5139 Lab for PT 5138 1.0 SH
Coreq: PT 5138
PT 5150 Motor Cntrl/Develpmnt/Learning 4.0 SH
Coreq: PT 5151
PT 5151 Lab for PT 5150 1.0 SH
Coreq: PT 5150