**College of Engineering, Design, and Computing: PhD Bioengineering Program Sheet**

The PhD in bioengineering requires 30 credit hours of coursework and at least 30 credit hours of dissertation work. Note graduate credits must receive a B- or better. Below contains general recommendations for a timeline of events (see Handbook for requirements). Meet with your research mentor, academic advisor, committee, and the director of student services (DSS) for specific advice, changes, etc. Students with a master’s degree or other graduate course credits should meet with the DSS to evaluate courses that can count for required courses.

Fall Semester Year 1:

* Meet with academic advisor (Note: You must meet with your advisor every Fall semester in order to register for your spring classes, it is recommended meet once a semester to make sure you are on track)
* Meet with dissertation mentor (or mentors if in rotations)
* Define general dissertation project scope with dissertation mentor
* Take BIOE 5020, plus a life science and technical elective (9 credits total) per mentor advice

Spring Semester Year 1:

* Take BIOE 5040, BIOE 5041, a life sciences elective and a quantitative elective (9 credits total)
* Establish a Preliminary Exam Committee of at least 3 faculty – the research mentor, a core faculty member of BIOE per list on website to serve as chair, and at least 1 other faculty.

Summer Semesters:

* Register for 1 credit of PhD Dissertation Research (BIOE 8990)

Fall Semester Year 2:

* Meet with academic advisor
* Take 3-9 credits of elective courses (technical and general electives)
* Submit a Preliminary Examination Committee Proposal form to the DSS for approval (Note: Preliminary Exams can be taken earlier, for example, at end of first year or summer)
* Schedule Preliminary Exam date with committee
* Schedule a room for the Preliminary Exam (Note: typically takes 2 hours but should book room for 3 hrs)
* Complete a Preliminary Exam Request prior to 2 weeks before the exam
* Send a Preliminary Exam document (see handbook for details) to the committee 2 weeks before the exam

Spring Semester Year 2:

* Take remaining credits of elective courses by end of Year 2 or beginning Year 3
* Establish a Thesis Advisory Committee of at least 4 faculty – the research mentor, a core faculty member of BIOE per list on website to serve as chair, and at least 2 other faculty

During Year 2:

* Successfully pass the BIOE Preliminary Exam

Fall Semester Year 3:

* Meet with academic advisor
* Take 4 credits of BIOE 8990 if you have completed your course work requirements
* Schedule Comprehensive Exam date with committee
* Schedule a room for the Comprehensive Exam (typically 2 hours but should book room for 3 hours)
* Complete a Comprehensive Exam Request prior to 2 weeks before the exam
* Send a Comprehensive Exam document (see handbook for details) to the committee prior to 2 weeks

Spring Semester Year 3:

* Take 4 credits of BIOE 8990

During Year 3:

* Successfully pass the BIOE Comprehensive Exam

Subsequent Semesters:

* Meet with thesis advisory committee (TAC) – minimum once per year
* Take 1-10 credits of BIOE 8990 per consultation with TAC (must have 30 total to graduate)

Semester Before Defense:

* Meet with full dissertation committee – needs one additional member (5 total)

Final Semester – See email from DSS each semester for deadlines

* Apply to graduate through UCD Access Portal
* Complete and Submit the Application for Candidacy to DSS
* Schedule defense date with committee
* Schedule a room for the defense (book room for 3 hours)
* Complete and sign the Declaration of Original Work
* Complete and Submit the Request for Examination to DSS
* Send copy of dissertation to all committee members at least 2 weeks before the defense
* Send copy of dissertation to thesisdissertationsupport@ucdenver.edu for format review
* Defend Dissertation (45 min presentation, 15 min questions, 90 min closed exam)
* Make corrections to dissertation
* Get approvals on Thesis Approval Form and submit to Defense Chair
* Submit final dissertation to ProQuest
* Complete Exit Survey

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| **Bioengineering Core (5 to 6 credits)** |
| Course ID and Title | Semester  | Grade | Credits  |
| BIOE 5040 - Research Methods for Bioengineers (S) 2 credits |  |  |  |
| BIOE 5041 - Clinical Experiences for Bioengineers (S) 1 credit |  |  |  |
| BIOE 5000 - Department Seminar (F, S) min 2 credits, max 3 credits |  |  |  |
| Bioengineering Core Earned Credit Subtotal: |  |

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| **Quantitative Methods Core (3 credits)** |
| Course ID and Title | Semester  | Grade | Credits  |
| BIOE 5020 - Analytic Methods for Engineering Analysis (F) |  |  |  |
| Quantitative Methods Core Earned Credit Subtotal: |  |

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| **Quantitative Methods Electives (3 credits): Choose from among the following** |
| Course ID and Title | Semester  | Grade | Credits  |
| BIOE 5021 - Numerical Methods for Engineering Analysis (S) |  |  |  |
| BIOE 5064 - Advanced MatLab for Bioengineers (F) |  |  |  |
| BIOE 5420 - Image Processing for Bioengineers (S) |  |  |  |
| BIOE 5420 - Data Science Methods (F) |  |  |  |
| BIOL 6764 - Biological Data Analysis (S) |  |  |  |
| BIOS 6601 - Applied Biostatistics |  |  |  |
| MECH 5175 - Finite Element Analysis (F) |  |  |  |
| MECH 5143 - Theory of Elasticity (S) |  |  |  |
| MCEN 5023 - Solid Mechanics I (Boulder) (F) |  |  |  |
| CSCI 5625 - Computer Vision (F) |  |  |  |
| CSCI 5931 - Deep Learning (S) |  |  |  |
| Quantitative Methods Electives Earned Credit Subtotal: |  |

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| **Technology Electives (6 credits required, 3 must be BIOE): Choose from among the following** |
| Course ID and Title | Semester  | Grade | Credits  |
| BIOE 5039 - Mechatronics and Embedded Systems (F) |  |  |  |
| BIOE 5053 - Optics and Microscopy in Biomed Research (F) |  |  |  |
| BIOE 5054 - Regulatory Affairs (F) |  |  |  |
| BIOE 5057 - Rehabilitation and Assistive Technology (F) |  |  |  |
| BIOE 5063 - 3D Modeling for Bioengineers (F) |  |  |  |
| BIOE 5067 - Human Factors and Usability Testing for Bioengineers (SP) |  |  |  |
| BIOE 5073 - Neural Interfaces & Bionic Limbs (S) |  |  |  |
| BIOE 5068 - Introduction to Medical Imaging (F) |  |  |  |
| BIOE 5069 - Advanced Biomechanics (S) |  |  |  |
| BIOE 5083 - Polymers in Biomedical Applications (SP) |  |  |  |
| BIOE 5300 - Medical Device Design and Entrepreneurship (F) |  |  |  |
| BIOE 5420 - Special Topics in Bioengineering (for the following topics):Introduction to Design, Disability, and Aging (S)Engineering the ECM (F)MedTech Commercialization (F) |  |  |  |
| CSCI 5211 - Mobile Computing and Programming  |  |  |  |
| MECH5030 – Exp and Comp Methods in Human Movement (S) |  |  |  |
| MECH 5020 - Biomechanics (F) |  |  |  |
| MCEN 5115 - Mechatronics & Robotics I (Boulder) (F) |  |  |  |
| Technology Earned Credit Subtotal: |  |

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| **Life Sciences Electives (6 credits required, 3 must be BIOE): Choose from among the following** |
| Course ID and Title | Semester  | Grade | Credits  |
| BIOE 5010 - Cell and Molecular Biology for Bioengineers (F) |  |  |  |
| BIOE 5011 - Systems Physiology for Bioengineers (S) |  |  |  |
| BIOE 5200 - Stem Cells and Regenerative Medicine (F) |  |  |  |
| BIOE 5420 - Special Topics in Bioengineering: Engineering the ECM (F) |  |  |  |
| BIOE 5420 - Special Topics in Bioengineering: Anatomy, Physiology and Medical Terminology for Bioengineers (S) |  |  |  |
| BIOE 5073 - Neural Interfaces & Bionic Limbs (S) |  |  |  |
| BIOE 5074 - Introduction to Laboratory Animal Research (S) |  |  |  |
| CANB 7600 - Cancer Biology (S) |  |  |  |
| NRSC 7600 - Cellular and Molecular Biology (S) |  |  |  |
| NRSC 7610 - Fundamentals of Neuroscience (S) |  |  |  |
| NRSC 7615 - Developmental Neurobiology (F) |  |  |  |
| Life Sciences Earned Credit Subtotal: |  |

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| **General Electives (Remainder of credits) – In sciences, engineering, business related to the thesis or project.**  |
| Course ID and Title | Semester  | Grade | Credits  |
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| Electives Earned Credit Subtotal: |  |

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| **Research (30 credits)** |
| Course ID and Title | Semester  | Grade | Credits  |
| BIOE 8990 – Doctoral Dissertation  |  |  |  |
| Research Earned Credit Subtotal: |  |

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| **Total Credits Earned (60 minimum):** |  |

Suggested Courses for Specializations (\*Required courses for certificate are in red)

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|  | Neural Engineering\* | Biomaterials, Tissue Engineering, and Regenerative Medicine | Assistive and Inclusive Technologies\* | Medical Device Design, Entrepreneurship, and Regulatory Affairs\* | Orthopedics and Prosthetics | Computational Biomechanics and Bioinformatics |
| BIOE Core (5-6 credits) | BIOE5040 Res Methods (2)BIOE5041 Clin Exp (1)BIOE5000 Seminar (2-3) | BIOE5040 Res Methods (2)BIOE5041 Clin Exp (1)BIOE5000 Seminar (2-3) | BIOE5040 Res Methods (2)BIOE5041 Clin Exp (1)BIOE5000 Seminar (2-3) | BIOE5040 Res Methods (2)BIOE5041 Clin Exp (1)BIOE5000 Seminar (2-3) | BIOE5040 Res Methods (2)BIOE5041 Clin Exp (1)BIOE5000 Seminar (2-3) | BIOE5040 Res Methods (2)BIOE5041 Clin Exp (1)BIOE5000 Seminar (2-3) |
| Quantitative Methods Core (3 credits) | BIOE5020 Analytic Methods  | BIOE5020 Analytic Methods  | BIOE5020 Analytic Methods  | BIOE5020 Analytic Methods  | BIOE5020 Analytic Methods  | BIOE5020 Analytic Methods  |
| Suggested Quantitative Elective (3 credits) | **Choose 1 from among**:BIOE5021 Num MethodsBIOE5420 Special Topics (Image Processing)BIOE5420 Data Science MethodsBIOE5064 Adv. MatlabCSCI5931 Deep LearningCSCI5625 Computer Vision | BIOS6601 Appl Biostat  | BIOS6601 Appl Biostat  | BIOS6601 Appl Biostat | BIOE5021 Num Methods | BIOE5021 Num Methods |
| Suggested Technology Electives (6 credits) | **Choose 2 from among**:BIOE5073 Bionic LimbsBIOE5053 Optics & MicroscopyBIOE 5039 MechatronicsBIOE 5063 3D Modeling | BIOE5083 Polymers BIOE5420 Eng ECM  | BIOE5057 Rehab / Ass TechBIOE5420 Design Dis Age | BIOE5054 Reg AffairsBIOE5300 BioMed Device Design | BIOE 5039 Mechatronics MECH5030 Exp and Comp Methods in Human Move  | BIOE5063 3D BiodesignBIOE5069 Adv Biomech |
| Suggested Life Sci Electives (6 credits) | BIOE5010 Cell BioNRSC7610 Fundamentals of Neurobiology | BIOE5010 Cell Bio BIOE5011 Sys Phys  | BIOE5420 Anat Med Term BIOE5011 Sys Phys  | BIOE5010 Cell Bio BIOE5011 Sys Phys  | BIOE5010 Cell Bio BIOE5073 Bionic Limbs  | BIOE5010 Cell Bio BIOE5011 Sys Phys  |
| Other Possible Electives | NRSC7600 Cell and Molec Neurobiology | BIOE5420 Stem Cells CSDV7670 Organoids  | BIOE5067 Human Fact BIOE 5420 - Rehabilitation Engineering Fieldwork BIOE5063 3D Biodesign | BIOE5420 MedTech CommENTP6020 Bus Model Dev | NRSC7610 Fundamentals of NeurobiologyBIOE5420 Stem CellsBIOE5420 Eng ECMBIOE5063 3D Biodesign | BIOE5064 MATLABBIOE5063 3D Biodesign |
| Research(30 credits) | BIOE 8990 – Doctoral Dissertation | BIOE 8990 – Doctoral Dissertation | BIOE 8990 – Doctoral Dissertation | BIOE 8990 – Doctoral Dissertation | BIOE 8990 – Doctoral Dissertation | BIOE 8990 – Doctoral Dissertation |