## BIOENGINEERING (BE)

Subject-area course lists indicate courses currently active for offering at the University of Louisville. Not all courses are scheduled in any given academic term. For class offerings in a specific semester, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm).

500-level courses generally are included in both the undergraduate- and graduate-level course listings; however, specific course/section offerings may vary between semesters. Students are responsible for ensuring that they enroll in courses that are applicable to their particular academic programs.

### Course Fees

Some courses may carry fees beyond the standard tuition costs to cover additional support or materials. Program-, subject- and course-specific fee information can be found on the Office of the Bursar website (http://louisville.edu/bursar/tuitionfee).

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
<th>Term Typically Offered</th>
<th>Prerequisite(s)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 101</td>
<td>Introduction to Bioengineering</td>
<td>1</td>
<td>Spring Only</td>
<td></td>
<td>Survey of the field of bioengineering and introduction to art/practice of bioengineering, through a series of creative, hands-on design and reverse engineering activities. Includes problem definition/solving, decision making and team skill building. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</td>
</tr>
<tr>
<td>BE 288</td>
<td>Bioengineering Co-op Education Seminar</td>
<td>0</td>
<td>Fall, Spring, Summer</td>
<td>ENGR 201, BE 310 (or concurrent) and BE 360 (or concurrent)</td>
<td>Discussion of rules and regulations governing cooperative internship experience and instruction in job interviewing techniques, resume preparation and in preparation of co-op report. Required prerequisite for the first cooperative internship. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</td>
</tr>
<tr>
<td>BE 289</td>
<td>Bioengineering Co-op Education I</td>
<td>1</td>
<td>Fall, Spring, Summer</td>
<td>BE 288</td>
<td>First cooperative education work term in an area directly related to the field of specialization of their degree program. Required for Professional School of Engineering students. Course Attribute(s): CBL - This course includes Community-Based Learning (CBL). Students will engage in a community experience or project with an external partner in order to enhance understanding and application of academic content. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</td>
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<tr>
<td>BE 310</td>
<td>Biotransport Phenomena</td>
<td>3</td>
<td>Spring Only</td>
<td>ENGR 205, ME 206, and ME 251</td>
<td>Introduction to fundamental concepts of momentum, heat, and mass transport with applications to biological and medical engineering science and design. Properties of biofluids. Conservation equations in integral and differential forms. For class offerings for a specific term, refer to the Schedule of Classes (<a href="http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm">http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm</a>)</td>
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<tr>
<td>BE 340</td>
<td>Computational Methodologies in Bioengineering</td>
<td>3</td>
<td>Summer Only</td>
<td>ENGR 205</td>
<td>Summer Only</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Name</td>
<td>Credits</td>
<td>Term Typically Offered</td>
<td>Grading Basis</td>
<td>Prerequisite(s)</td>
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<tr>
<td>BE 389</td>
<td>Bioengineering Co-op Education II</td>
<td>1 Unit</td>
<td>Fall, Spring, Summer</td>
<td>Pass/Fail</td>
<td>BE 289</td>
</tr>
<tr>
<td>BE 405</td>
<td>Practicum in Bioengineering Education</td>
<td>1 Unit</td>
<td>Spring Only</td>
<td></td>
<td>BE 310 and BE 360 and consent of instructor</td>
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<tr>
<td>BE 420</td>
<td>Biosystems &amp; Signals</td>
<td>3 Units</td>
<td>Spring Only</td>
<td></td>
<td>BE 340</td>
</tr>
<tr>
<td>BE 423</td>
<td>Bioengineering Measurements Laboratory</td>
<td>2 Units</td>
<td>Spring Only</td>
<td></td>
<td>BE 322</td>
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<tr>
<td>BE 430</td>
<td>Biosystems Controls</td>
<td>3 Units</td>
<td>Fall Only</td>
<td></td>
<td>BE 322, ENGR 330 and BE 420</td>
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<tr>
<td>BE 450</td>
<td>Biomaterials &amp; Biocompatibility</td>
<td>3 Units</td>
<td>Summer Only</td>
<td></td>
<td>CHEM 341, ME 251 and BE 360</td>
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<tr>
<td>BE 453</td>
<td>Introduction to Molecular Bioengineering</td>
<td>3 Units</td>
<td>Fall Only</td>
<td></td>
<td>CHEM 341 and BE 359</td>
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<tr>
<td>BE 460</td>
<td>Biomechanics of Tissues and Organs</td>
<td>3 Units</td>
<td>Fall Only</td>
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<tr>
<td>BE 480</td>
<td>Biomedical Device Design</td>
<td>3 Units</td>
<td>Spring Only</td>
<td></td>
<td>BE 423 (or concurrent) and BE 450 (or concurrent)</td>
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<tr>
<td>BE 489</td>
<td>Bioengineering Co-op Education III</td>
<td>1 Unit</td>
<td>Fall, Spring, Summer</td>
<td>Pass/Fail</td>
<td>BE 389</td>
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</tbody>
</table>

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BE 491. Economics, Ethics & FDA Regulations 3 Units
Term Typically Offered: Fall Only
Prerequisite(s): BE 423 and BE 450; Senior standing in Bio-engineering.
Corequisite(s): BE 497.
Description: Applies methods of engineering economic analysis, ethics, and FDA regulation processes. Methods to identify, articulate and resolve ethical dilemmas intrinsic to bioengineering. Practical "hands-on" experiences in the application of economic concepts and FDA regulations.

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BE 497. Bioengineering Design Project - CUE 3 Units
Term Typically Offered: Fall Only
Prerequisite(s): BE 354 and Senior standing in bio-engineering.
Corequisite(s): BE 491.
Description: Team-oriented design of a biomedical/biological mechanism, system or process satisfying a set of open-ended requirements. Written reports and oral presentations are required.
Course Attribute(s): CUE - This course fulfills the Culminating Undergraduate Experience (CUE) requirement for certain degree programs. CUE courses are advanced-level courses intended for majors with at least 90 earned credits/senior-level status.

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BE 500. Special Topics in Bioengineering 3 Units
Term Typically Offered: Fall, Spring, Summer
Description: This course will be devoted to topics that usually are not treated in detail in the general curriculum. For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

BE 522. Biomedical Acoustics 3 Units
Term Typically Offered: Spring Only
Prerequisite(s): BE 420.
Description: An introduction to the fundamental principles of physical acoustics with an emphasis on biomedical applications. Major concepts covered include acoustic wave physics, transducers, and ultrasound imaging.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

BE 524. LabVIEW for Bioengineers 3 Units
Term Typically Offered: Fall Only
Prerequisite(s): BE 340 or equivalent.
Description: This course will introduce students to an intermediate level of LabVIEW (Laboratory Virtual Instrument Engineering Workbench) available from National Instruments (Austin, TX). LabVIEW is the worldwide industry standard graphical programming environment for developing data acquisition, instrument control, and industrial automation software. Students will explore core programming fundamentals common to all programming languages by using LabVIEW software to develop independent programs and data acquisition solutions using a combination of LabVIEW, data acquisition hardware, and standard test instrumentation hardware.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

BE 540. Machine Learning in Medicine 3 Units
Term Typically Offered: Spring Only
Prerequisite(s): BE 420.
Description: Topics: 1) fundamentals of medical data, 2) application of machine learning models & algorithms to medicine, 3) learning from data & classification of disorders, and 4) overview of health data, collection with sensors, body area networks, brain image data and other publicly available medical applications data. Students will learn about machine learning applications to real world medical data through examples and reading papers. Students are expected to work on a team project and write technical reports.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

BE 551. Gene and Drug Delivery 3 Units
Term Typically Offered: Fall Only
Prerequisite(s): BE 354 and BE 450, or graduate standing.
Description: This course covers advanced topics of gene and drug delivery, including the physiological barriers and challenges to delivery, biomaterials used in delivery, considerations for specificity of drug/gene targeting, nanoscale delivery vehicles, the delivery of biologies and vaccines, and intracellular delivery. In addition, this course integrates literature and discussion regarding specific platform design and delivery considerations against cancer, viral, and bacterial applications.
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BE 552. Introduction to Tissue Engineering 3 Units
Term Typically Offered: Spring Only
Prerequisite(s): CHEM 341, BE 354, BE 359, and BE 450.
Description: Design, development and clinical application of tissue engineered components, including blood vessels, bone, cartilage, pancreas, liver and skin, for use in the human body.
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)
BE 553. Nanoscale Bioengineering: Application and Methodology of Nanobiomaterials in Bioengineering  
3 Units  
Prerequisite(s): BE 450 or BE 453 or permission of department chair.  
Description: An introduction to the fundamental principles of nanoengineering with a focus on 1) synthetic methodologies of tailored nanobiomaterials (physical, chemical and electrochemical); 2) nanobiomaterial characterization using advanced analytical, microscopic and spectroscopic techniques; and 3) therapeutic and diagnostic applications.  
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

BE 581. Advanced Computer Aided Design and Manufacturing for Bioengineers  
3 Units  
Term Typically Offered: Fall, Spring, Summer  
Prerequisite(s): BE 340 or by permission of Department Chair.  
Description: An introduction to the engineering design and manufacturing processes for bioengineering applications with an emphasis on the use of modern computer-based analysis, design and presentation tools as well as manufacturing techniques such as casting, machining, forming and assembly for polymer and metal-based materials.  
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)

BE 593. Independent Study in Bioengineering  
1-4 Units  
Term Typically Offered: Fall, Spring, Summer  
Prerequisite(s): Faculty consent.  
Description: A theoretical or experimental investigation of a problem area related to Bioengineering.  
For class offerings for a specific term, refer to the Schedule of Classes (http://htmlaccess.louisville.edu/classSchedule/setupSearchClassSchedule.cfm)