

**Purdue School of Engineering and Technology
Indiana University-Purdue University Indianapolis (IUPUI)**

Department of Biomedical Engineering

IUPUI

**SCHOOL OF ENGINEERING
AND TECHNOLOGY**

A PURDUE UNIVERSITY SCHOOL

Indianapolis

BME Undergraduate Handbook Bachelor of Science Degree in Biomedical Engineering

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Application to BME Program

All engineering students, regardless of intended major, are advised during their freshman year by the New Student Academic Advising Center (NSAAC). Students who intend to major in Biomedical Engineering must submit a short application, available from the BME department (SL 220), in the semester in which they are finishing their prerequisite requirements (typically the second semester of the freshman year). This application should be submitted by **April 1** in the academic year prior to enrolling in BME 241. At the time of submitting the application, students should have successfully completed (or be in the process of completing during the spring and summer) the following prerequisite classes: ENGR 195, 196, and 197; MATH 165, 166, and 171; PHYS 152; CHEM-C 105 and 125; and either CHEM-C 106 or BIOL-K 101. Students accepted into the program will be notified by June 1.

The purpose of the application is to ensure that students entering the program are properly prepared: that they have satisfied the appropriate prerequisites with grades of at least C and an average GPA in those courses of at least 2.5, and have given some thought to their reasons for pursuing the major. It also provides important information on the background, interests, and career plans of entering students. So far, the program has had the resources to accommodate all qualified students who are interested in the program and have satisfied the above requirements. If the number of interested students begins to exceed available space, however, applications may become competitive.

Courses Required for Graduation

The BME Undergraduate Plan of Study is included below. BME students must complete a minimum of 130 credit hours of courses in three categories:

Required engineering, science, and BME courses

ENGR 195, 196, 197 and 297 BIOL-K 101, 324, 325 PHYS 152, 251
CHEM-C 105, 106, 125, 341, 343 MATH 165, 166, 171, 261, 266
BME 222, 241, 322, 331, 334, 352, 354, 381, 383, 402, 411, 442, 461, 491, 492

Required and elective General Education classes

ENG-W 131 COMM-R 110 TCM 360

Four General Education electives chosen from the approved list and meeting all requirements for Gen Ed electives (Appendix A for students who started at IUPUI prior to Fall 2013; Appendix B for students who entered IUPUI during Fall 2013 or later).

Depth Area electives

This sequence of four courses must be selected in consultation with a BME advisor to gain some depth in a sub-discipline of Biomedical Engineering. At least two of these four electives must be engineering courses (BME, ECE, ME); the other two may be engineering, science, or math electives as approved by an advisor. These are described in more detail below, under "Schedule Planning in the BME Program". The table of approved courses is available in Appendix C.

Grade Policy

Beginning with courses taken in Fall 2009, students must earn a minimum grade of C- in required BME and ENGR courses in order to count those courses for credit on the Plan of Study. REQUIRED BME and ENGR courses are those courses that are required of ALL students for the undergraduate BME degree. As of Fall 2013, these courses include:

ENGR 196, 197 and 297

BME 222, 241, 322, 331, 334, 352, 354, 381, 383, 402, 411, 442, 461, 491 and 492

Passing grades below C- earned in these courses PRIOR TO Fall 2009 will still count toward the plan of study.

Other Policies for the School of Engineering and Technology

In addition to BME-specific policies, BME students are subject to the policies and procedures of the School of Engineering and Technology. These policies are described in detail in the Bulletin:

<http://www.iupui.edu/~bulletin/iupui/2012-2014/schools/purdue-engineer-tech/policies/index.shtml>. In particular, students should be aware of the following:

Academic Warning, Probation, and Dismissal: A student whose semester GPA falls below 2.0, but whose cumulative GPA is 2.0 or higher, will be placed on academic warning. Students on academic warning will be required to meet with their academic advisor before being able to register for classes.

A student whose cumulative GPA falls below 2.0 will be placed on academic probation. Students on academic probation will be required to meet with their academic advisor before being able to register for classes. The student may continue studies provided the student achieves a semester GPA of at least 2.0 for each semester while on probation. A student on probation who has completed at least 12 credit hours at IUPUI is subject to dismissal from the School if the student fails to attain a GPA of at least 2.0 in any two consecutive IUPUI semesters, including the semester that the student was first placed on probation. A student can also be dismissed from the School when the student has ceased making progress in the degree program. Examples of lack of progress may include average GPA in major courses below 2.0, multiple semesters with semester GPA below 2.0, and repeated failures in core courses in the curriculum.

A student dismissed for the first time from the School of Engineering and Technology must remain out of school for at least one regular (fall or spring) semester. During that semester, the student may apply to the School of Engineering and Technology for readmission. A student dismissed a second time must sit out two regular semesters, and may submit an application for readmission during the second semester of sitting out. (Note, however, that readmission after a second dismissal is extremely rare.)

E&T Course Drop Policy: Undergraduate students admitted to the School of Engineering and Technology in Fall 2012 and beyond may not drop more than one course per semester (not including adjustments made during the 100% refund period, when students may drop and add courses without penalty). Furthermore, these students are limited to a total of eight withdrawals over the course of their academic career after admission to the School of Engineering and Technology.

For more details on these and other school policies, consult the Bulletin.

Biomedical Engineering BEGINNING FALL 2013

Freshman Year

<i>First Semester</i>	SCH	<i>Second Semester</i>	SCH
ENGR 19500 Engineering Seminar	1	Phys 15200 Mechanics	4
ENGR 19600 Engineering Problem Solving	3	ENGR 29700 Intro. to Computing (MATLAB)	1
ENGR 19700 Intro. to Computing (C prog.)	2	Math 16600 Integrated Calculus and Analytic Geometry II	4
Math 16500 Integrated Calculus and Analytic Geometry	4	Math 17100 Multidimensional Mathematics	3
Biol. K101 Concepts of Biology I	5	Chem. C105 Principles of Chemistry I	3
Eng W 131 Elementary Composition I	3	Chem. 125 Experimental Chem. I	2
TOTAL SCH	18		17

Sophomore Year

<i>First Semester</i>	SCH	<i>Second Semester</i>	SCH
Math 26100 Multivariate Calculus	4	Math 26600 Differential Eqns.	3
Phys 25100 Elec., Heat, Optics	5	Biol. K324 Cell Biology	3
BME 24100 Intro. Biomechanics	4	Biol. K325 Cell Biology Lab	2
Chem. C106 Principles of Chemistry II	3	BME 22200 Biomeasurements	4
		Comm. R110 Fundamentals of Speech Communication	3
		General Education Elective	3
TOTAL SCH	16		18

Junior Year

<i>First Semester</i>	SCH	<i>Second Semester</i>	SCH
Chem. C341 Organic Chemistry I	3	BME 32200 Probability & Applications for BME	3
Chem. C343 Organic Chemistry Lab I	2	BME 35200 Tissue Behavior and Properties	3
BME 38100 Implantable Materials & Biological Response	3	BME 35400 Problems in Tissue Behavior and Properties	1
BME 38300 Problems in Implantable Materials & Biological Response	1	Gateway Elective*	3
BME 33100 Biosignals and Systems	3	General Education Elective	3
BME 33400 Biomedical Computing	3	BME 40200 BME Seminar	1
General Education Elective	3	TCM 36000 Communications in Engineering Practice	2
TOTAL SCH	18		16

Senior Year

<i>First Semester</i>	SCH	<i>Second Semester</i>	SCH
BME 49100 Biomedical Engineering Design I	3	BME 49200 Biomedical Engineering Design II	3
BME 41100 Quantitative Physiology	3	BME 46100 Transport Processes in BME	3
BME 44200 Biofluid and Biosolid Mechanics	3	BME/Sci/Tech Elective*	3
BME/Tech Elective*	3	General Education Elective	3
BME/Sci/Tech Elective*	3		
TOTAL SCH	15		12

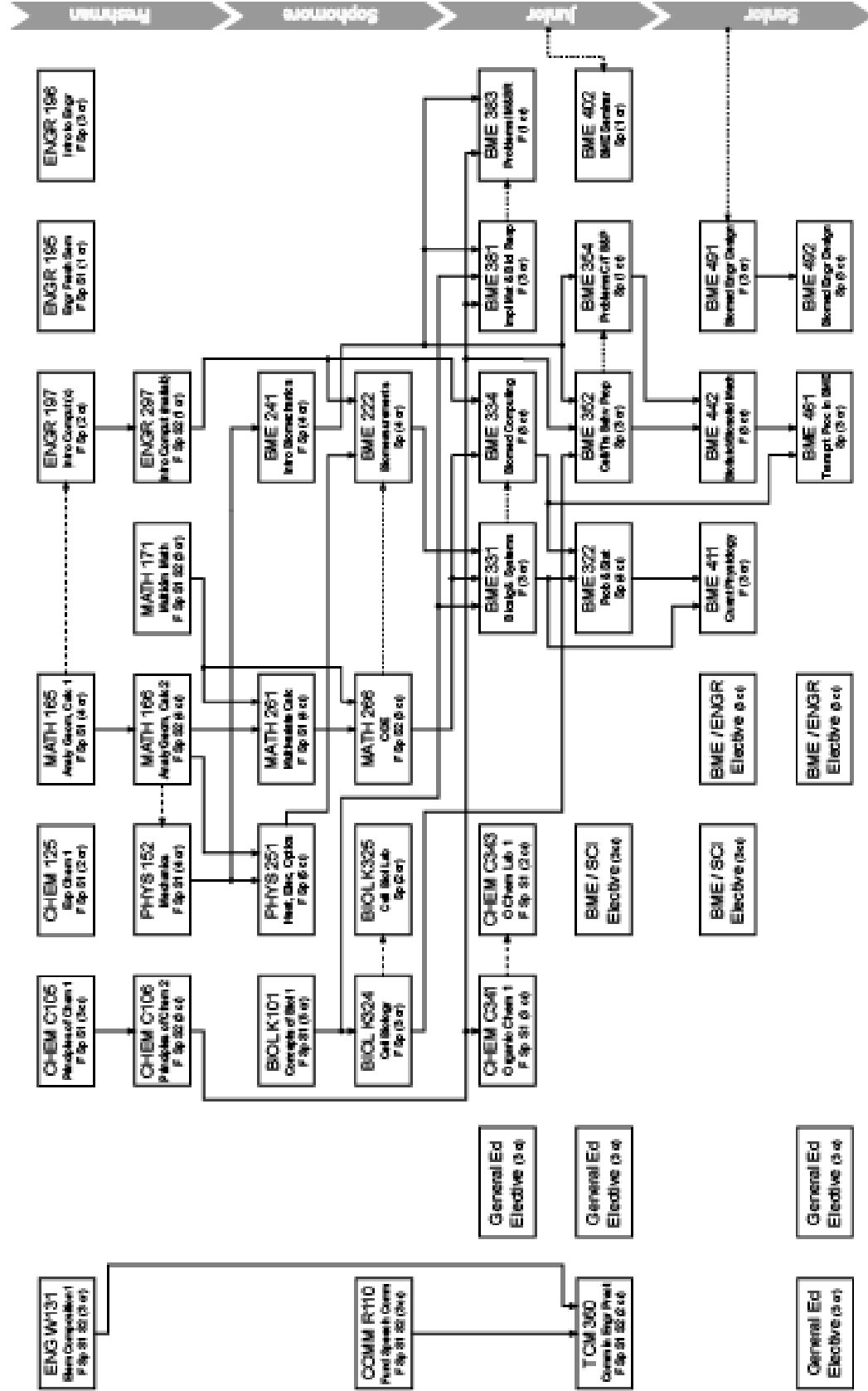
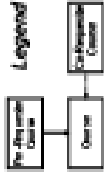
* The four BME/Sci/Tech electives must be selected in consultation with an advisor to form an appropriate Depth Area.

Rev. 05/21/13

TOTAL SCH = 130

BIOMEDICAL ENGINEERING UNDERGRADUATE CURRICULUM FLOWCHART

Rev. Aug 2013



Schedule Planning in the Biomedical Engineering Program

Because the Biomedical Engineering Program (1) offers most of its required BME courses only once per year, and (2) requires many courses with laboratory and/or recitation components, planning your schedule for the coming semester should take into account how the courses you choose may affect your schedule in future semesters.

The curriculum flowchart above shows the prerequisites (solid arrows) and corequisites (dotted arrows) for all the courses in the BME Plan of Study. The sections below provide scheduling information that will help ensure all BME requirements can be completed in four years. Please note, though, that students who feel that they may improve their chances of success in the program by taking fewer credit hours per term and spreading the requirements out over an extra semester or year can be easily accommodated. Such students, particularly those who have work or other outside commitments, are encouraged to speak to their BME advisor if they think such an option may be a good choice for them.

Biology Sequence

Cell Biology

BIOL-K 325, Cell Biology Lab, is currently ONLY offered in the Spring. BIOL-K 324, Cell Biology Lecture, has for the past few years been offered both in the Fall and Spring (but not Summer). It is recommended that students take these classes together during the spring semester of the sophomore year. Note that BIOL-K 324 is a prerequisite for BME 352, Cell/Tissue Behavior and Properties, normally taken during the spring of the junior year. Therefore, to stay on-track, **BIOL-K 324 should be taken no later than the fall of the junior year.** (The lecture and lab do not have to be taken together; so even if you are unable to get into a lab section during your sophomore year, you may go ahead and take the lecture course, and plan to pick up the lab the following year.)

BIOL-K 101 – The Prerequisite to Cell Biology

The official prerequisite for Cell Biology is BIOL-K 103. **However**, BME students have special permission from the Biology department to use BIOL-K 101 as the prerequisite instead of BIOL-K 103. Grade data from recent years indicates that on average BME students perform as well as or better than other students in the Cell Biology class; the missing prerequisite does not seem to be a hindrance to dedicated students.

If Cell Biology is to be taken in spring of the sophomore year, BIOL-K 101 must be completed no later than fall of the sophomore year. **It is recommended, however, that students take BIOL-K 101 either during the freshman year or over the summer before the sophomore year.** If the course is taken during fall of the sophomore year, students end up with three courses in the same semester with a lab component: BME 24100 (only offered in the fall, and a prerequisite to junior-year BME classes), PHYS 251 (a prerequisite for BME 22200), and BIOL-K 101. While do-able, this makes for a challenging semester, and is not recommended, especially for students who also work or

participate in research projects or extracurricular activities with more than a couple-hour-per-week time commitment.

Chemistry Sequence

The two freshman Chemistry lecture classes, CHEM-C 105 and CHEM-C 106, are closely linked – so much so that the final exam for C106 is cumulative for **both** classes (that is, it contains material from both C105 and C106). It is recommended, therefore, that students complete these two courses in back-to-back semesters if possible.

As with Cell Biology, the BME department has special permission to allow students to take CHEM-C 343, the Organic Chemistry I laboratory, with CHEM-C 125 rather than C126 as the prerequisite. The Chemistry department is aware of this exception and can grant permission for students needing to register for C343. Contact Marie Nguyen (mlnguyen@iupui.edu) or Lin Zhu (zhu2@iupui.edu) and let them know you are a BME student who needs permission to take C343 using C125 as a prerequisite.

Math Sequence

The required sequence of math courses on the BME Plan of Study is MATH 165, 166, 171 (freshman year), 261 and 266 (sophomore year). Note that 166 and 171 are the prerequisites for both 261 and 266, and 266 is the prerequisite for several BME courses in the junior year. Since MATH 261 is not a direct prerequisite for either MATH 266 or any 1st-semester junior year BME courses, if you are unable to fit all five math courses into your schedule during the first two years, MATH 261 is the best choice to delay to a later semester. It should, however, be completed prior to the spring of the junior year; both BME 322 Probability and Applications and BME 352 Cell/Tissue Behavior and Properties rely on familiarity with multivariate concepts.

Physics Sequence

Because MATH 166 is a co-requisite for PHYS 152, students who start the freshman year in MATH 165 can take PHYS 152 no earlier than their 2nd semester. If not taken in the spring of the freshman year, it should be taken over the summer: it is a prerequisite for PHYS 251, which is in turn is a prerequisite for BME 22200 in the spring semester of the sophomore year. Because BME 22200 is a prerequisite for many courses in the junior year, delaying Physics may delay your graduation by at least a semester.

BME Depth Areas

The four courses labeled “Gateway Elective”, “BME/Tech Elective”, “BME/Sci/Tech Elective” should be selected in consultation with your BME advisor to form a depth area: a sequence of courses exploring a subdiscipline of Biomedical Engineering. At least two of these courses must be from either the BME department or another engineering department; the other two may be math or science courses, if they are appropriate to the depth area.

The primary depth areas for Biomedical Engineering are Biomaterials/Tissue Engineering; Bioinstrumentation/Biosignal Processing/Neural Engineering; and

Biomechanics. Appendix C lays out the list of courses that have been approved for each depth area. The courses listed are the most common choices for these depth areas, along with the semester in which each course is typically offered. BME 59500 courses are typically taught every other year; pairs of BME 59500 courses listed with an “OR” mean that they are taught by the same instructor, and each year, only one of the two will be offered. Since undergraduates are not eligible to take 500-level (graduate) courses until they reach senior standing, this means most students will only take one of the two classes as part of their depth area. However, if a student does take both courses (by sticking around for an extra year, for example), both may be applied to the appropriate depth area. For other (non-BME) courses separated by “OR”, only one of the two courses may be applied to the depth area due to a significant overlap in course content. (So, for example, a student who takes MATH 351 would not be eligible to also use MATH 511 for the depth area, because they are both linear algebra courses with significant content overlap.) When appropriate, courses not included on the list may also be applied to the depth area if approved by your BME Advisor.

Applying Experiential Learning to the Plan of Study

With the approval of the Dept Chair, three credits of related internship or research work (for example, three semesters of industrial internship, or three related one-credit research projects under the same mentor), may be applied as a technical elective on the Plan of Study. Students who plan to take advantage of this option must fill out an Experiential Learning Agreement. Contact a BME advisor for more information.

Medical School Prerequisites and the BME Curriculum

Most of the prerequisites for medical school (including calculus, physics, and much of the biology and chemistry requirement) are automatically satisfied by the courses in the BME plan of study. However, students who plan to apply to medical school will need to take a few additional courses that are not part of the BME requirements (although some may be used to fulfill electives, when appropriate).

Biology Requirements

Most medical schools (including IU) require a full year of introductory biology, with lab; at IUPUI this requirement is typically satisfied with BIOL-K 101 and K103. For BME students, IU Medical School will accept the higher-level Cell Biology with lab (BIOL-K 324/325) as the second semester of biology in place of K103. Some students opt to take K103 anyway because the MCAT includes that material, or because they are applying to other schools besides IU that may not accept Cell Bio as an alternative to K103. Note, however, that K103 cannot be used to satisfy any requirements (including electives) on the BME plan of study.

Chemistry Requirements

Most medical schools require a full year of freshman chemistry, with lab; students planning to apply to medical school should therefore plan to take CHEM-C 126 in addition to their other freshman chemistry requirements. Like BIOL-K 103, this is an

extra course that does not apply to any BME requirements or electives. Medical schools also require a full year of Organic Chemistry with lab, and beginning next year will also require Biochemistry (which will begin to appear on the new version of the MCAT in 2014). Because the Organic Chemistry labs are 2-credit rather than 1-credit classes, some medical schools will accept the 8 credit hours of CHEM-C 341/343 plus CHEM-C 342 as a full year of Organic Chemistry with lab. Both Organic Chemistry II lecture and Biochemistry (BIOL-K 483) may be used as Science electives if appropriate to the student's depth area. (There is also a version of Biochemistry taught in the Chemistry department as a two-semester sequence, CHEM-C 484 Biomolecules & Catabolism and CHEM-C 485 Biosynthesis & Physiology. Because this sequence covers the same topics as BIOL-K 483 but in greater depth, students who opt for the Chemistry department version will need to take two courses instead of one to meet the pre-med requirement.)

General Education Requirements

The new version of the MCAT will also include questions covering introductory Psychology and Sociology, which will thus be considered premed requirements. Both of these courses (PSY-B 110 and SOC-R 100) can be used as General Education electives.

Scheduling Considerations

Medical school applications should be submitted approximately a year before the desired start date – thus, students who wish to enter medical school in the fall after graduation should be completing their applications (and submitting MCAT scores) no later than the summer before the senior year. Particularly with the addition of new subjects to the MCAT, completing all the premed requirements in time to take the MCAT during or just after the junior year will require most students to take summer classes. Many students opt to complete Organic Chemistry I and II during the summer before the junior year; this would allow for picking up Biochemistry during the junior year. The two general education classes are likewise good candidates for summer completion.

BME Advising Team

Academic Advising:

Karen Alfrey Senior Lecturer kalfrey@iupui.edu
Director of the Undergraduate Program in Biomedical Engineering

Steve Higbee Visiting Lecturer shigbee@iupui.edu
Area of expertise: Biomaterials and mechanics of materials

Julie Ji Associate Professor of BME jjj@iupui.edu
Area of expertise: Cellular biomechanics, chemical engineering

Joseph Wallace Assistant Professor of BME jmwalla@iupui.edu
Area of expertise: Bone biomechanics

Ken Yoshida Associate Professor of BME yoshidak@iupui.edu
Area of expertise: Bioinstrumentation, neural engineering

BME Careers:

Ed Berbari Professor of BME
Chair of the Department of Biomedical Engineering

eberbari@iupui.edu

ACADEMIC INTEGRITY

Discussing course material, assignments, and approaches to programming with your classmates is highly encouraged. Rote copying, or even paraphrasing, without contributing or fully understanding the material is prohibited.

The IUPUI Student Code of Conduct (<http://www.iupui.edu/code>) includes a section on Academic Responsibilities and Misconduct (Part II, Section G). Note in particular the university's definition of plagiarism:

3. Plagiarism

Plagiarism is defined as presenting someone else's work, including the work of other students, as one's own. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged, unless the information is common knowledge. What is considered "common knowledge" may differ from course to course.

- a. A student must not adopt or reproduce ideas, opinions, theories, formulas, graphics, or pictures of another person without acknowledgment.
- b. A student must give credit to the originality of others and acknowledge indebtedness whenever:
 - 1. Directly quoting another person's actual words, whether oral or written;
 - 2. Using another person's ideas, opinions, or theories;
 - 3. Paraphrasing the words, ideas, opinions, or theories of others, whether oral or written;
 - 4. Borrowing facts, statistics, or illustrative material; or
 - 5. Offering materials assembled or collected by others in the form of projects or collections without acknowledgment.

Students are expected to abide by the IUPUI Student Code of Conduct. Consistent with school and university procedures, instances of academic dishonesty will be documented by the instructor and discussed with the student. Depending on the severity of the offense, an academic penalty may be imposed (ranging from a deduction of points on an assignment for a minor infraction, to dismissal from the program for severe or repeated offences). A diagram summarizing these procedures can be viewed here:

http://www.iupui.edu/code/misconduct_diagram.pdf

APPENDIX A

GUIDE TO GENERAL EDUCATION ELECTIVES IN BIOMEDICAL ENGINEERING

For students who started at IUPUI prior to Fall 2013

INTRODUCTION

General education is an important part of the biomedical engineering (BME) program at the Purdue School of Engineering and Technology, IUPUI. Perhaps moreso than in any other engineering discipline, BME students must possess good communication and critical thinking skills in order to interface effectively with colleagues in medicine, biology and engineering. Because their work directly impacts human lives through medicine, they also must be aware of the many ethical issues that may arise during their careers. Furthermore, they must be prepared to serve as effective leaders in society and policy-making relative to the development and use of technology in medicine and biology.

The IUPUI Department of Biomedical Engineering (BME) curriculum includes strong general education components to provide students an integrated and well-rounded education in the humanities, social sciences, fine arts, and related areas. A total of 12 credit hours of courses are required in the general education category. These courses are in addition to the 9 credit hours of courses in written communication (ENG W131), oral communications (COMM R110), technical communications (TCM 360), and engineering ethics (BME 404).

With the assistance of an academic advisor in the department, each student must select the 12 credit hours of general education courses in accordance with the following requirement and rules:

REQUIREMENT

At least 6 credit hours of the 12 credits must be chosen from the approved list of courses that are indicated as having significant *contemporary*, *societal*, or *cultural* emphasis. Approved courses in this category are shown in **bold** on the Approved General Education Electives List below.

ADDITIONAL RULES

1. General education electives may be found in subjects such as philosophy, religion, history, literature, fine arts, classical studies, sociology, psychology, anthropology, economics, geology, geography, environment, public affairs, music, and modern languages. A list of currently approved courses follows this list of rules.
2. Students are encouraged to explore different areas of general education.
3. At least two of the courses must be at 200 or higher level (to assure *depth*). In the case of foreign languages, however, coursework beyond the first three hours of a particular language may be used in place of 200-level courses.
4. To further assure *depth* a minimum of 6 credit hours must be selected in at least one department.
5. Courses taken must be from at least two different departments. To assure that students experience a *breadth* of topics, no more than 9 credits taken from one department will be counted as general education credit, including credit by examination.

6. When used as electives, modern language courses must include at least one 5 credit hour course or two 3- or 4 credit hour courses in a single language. Grammar or vocabulary courses in a student's native language may not count as a general education elective.
7. Courses such as accounting, industrial management, personal finance, ROTC, and personnel administration do not fulfill the purpose of the general education program, regardless of their general value in total engineering education, since they basically teach personal skills.
8. Courses that build skills, such as keyboard/computer music courses, physical education, photography, drawing etc., cannot be used to satisfy these general education requirements.
9. The Pass/Fail option may not be used for ANY courses on an engineering Plan of Study including general education electives. Also courses completed by correspondence may not be used on an engineering Plan of Study.
10. The approved list of courses may vary from semester to semester. Courses on the approved list during the semester the student takes the course will be accepted even if they are subsequently removed from the list.
11. Students may petition their academic advisor and department chairperson for approval of courses not listed here.

APPROVED GENERAL EDUCATION ELECTIVES LIST

The approved general education courses are listed below. Those with strong *contemporary*, *societal*, or *cultural* emphasis are indicated with **bold** characters.

<i>Afro-American Studies:</i>	AFRO A150, A202 , A303, A352
<i>American Studies:</i>	AMST A301, A302, A303, A304
<i>Anthropology:</i>	ANTH A103, A104, A303, A304, A361, A454, B370, B371, E300, E310, E316, E320, E326, E335, E336, E356, E380, E384, E391, E402, E403, E411, E421, E445, E455, E457, E470, L300, L401, P220
<i>Arabic:</i>	NELC A117, A118, A119, A200, A250
<i>Art:</i>	HER H100, H101, H103, H300, H301, H302, H326, H333, H334, H341, H342, H344, H345, H347, H351, H352, H355, H361, H362, H402, H404, H413, H414, H418
<i>Chinese:</i>	EALC C117, C118, C119, C131, C132, C201, C202
<i>Classical Studies:</i>	CLAS C205, C310, C311, C351, C361, C491
<i>Communication Studies:</i>	COMM T130, T133, T205, R310, T337, T338
<i>Economics:</i>	ECON E201, E202, E303, E304, E305 , E307, E308, E321, E322, E323, E325, E363, E380, E385, E420, E430, E447, E485

<i>English:</i>	ENG G104, G205, G310, L105, L115, L200, L202, L203, L204, L205, L206, L207, L213, L214, L200 and all 300 or higher level ENG Lxx courses
<i>Film Studies:</i>	FILM C292, C390, C391, C392, C393, C394, C398, C491, C493
<i>Folklore:</i>	FOLK F101, F131, F354, F360, F363
<i>French:</i>	FREN F117, F118, F119, F131, F132, F203, F204, and all 300 or higher level FREN courses
<i>Geography:</i>	GEOG G107, G110, G130, G315, G331
<i>Geology:</i>	GEOL G107, G110, G115, G132
<i>German:</i>	GER G117, G118, G119, G131, G132, G225, G230, G265, and all 300 or higher level GER courses
<i>History:</i>	HIST H105, H106, H108, H109, H113, H114, H220, H221, and all 300 or higher level courses with prefix A, B, C, D, F, G, or H.
<i>Italian:</i>	ITAL M117, M118, M119, M200
<i>Japanese:</i>	EALC J117, J118, J119, J131, J132, J201, J202, J301, J302, J394, J401, and all Japanese culture courses taught in English EALC E231, E351, E472
<i>Latin:</i>	CLAS L131, L132, L200, L250
<i>Music:</i>	MUS M174, M393, M394, Z105, Z200, Z201, Z301, Z315, Z374, Z380, Z401
<i>Organizational Leadership and Supervision:</i>	OLS 263, 327 NOTE: Following review of the course content, which does not match the guidelines for a General Education elective, OLS 331 is no longer allowed as a General Education elective (effective Summer 2011).
<i>Philosophy:</i>	PHIL P110, P120, P237, P280, P281, P307, P314, P316, P317, P322, P323, P325, P326, P331, P358, P365, P367, P368, P369, P382, P383, P385, P393, P394, P414, P418, P448, P468 NOTE: Following review of the course content, which does not match the guidelines for a General Education elective, PHIL P162 and P265 are no longer allowed as General Education electives (effective Fall 2011).

<i>Political Science:</i>	POLS Y101, Y103, Y215, Y217, Y219 , Y300 and higher level courses
<i>Psychology:</i>	PSY B110 , B310 , B334, B344, B354, B356, B360, B366, B368, B370, B376 , B380, B424
<i>Public and Environmental Affairs:</i>	SPEA V170 , V264 , V362 , V366 , V372 , V376 , V443 , E162 , E272 , H120
<i>Religious Studies:</i>	REL R100, R111, R133 , R173, R200, R212, R223 , R283, R293, R300 , R303, R310, R312, R313 , R326, R339 , R343, R344, R352 , R360 , R361 , R383 , R393
<i>Spanish:</i>	SPAN S117 , S118 , S119 , S131 , S132 , S203 , S204 , S210 , and all S300 or higher level courses
<i>Sociology:</i>	SOC R100 , R121 , R220, R234, R305, R312 , R314 , R315, R317 , R320 , R321 , R325 , R329 , R330 , R338, R344, R345 , R346 , R356, R357, R381 , R382 , R410, R415 , R425 , R461, R463 , R467, R476 , R478 , R480

APPENDIX B

To meet state requirements for a transferrable 30 credit-hour common core, students are required to select their four General Education courses from the approved lists of courses in Cultural Understanding, Arts & Humanities, and Social Sciences. Students must select one course (at least 3 credit hours) from each of these three lists; the fourth course can come from either the Arts & Humanities or Social Sciences list. A list of approved courses in each category is below; however, because new courses may be added to these lists, consult the IUPUI General Education Core webpage (<http://uc.iupui.edu/UndergraduateEducation/GeneralEducationCurriculum/GeneralEducationCore.aspx>) for the most up-to-date information on approved courses. (Note that this page mentions three other categories of courses in the campus Gen Ed core: Core Communication, Analytical Reasoning, and Life and Physical Sciences. These IUPUI requirements are satisfied by required courses in the BME Plan of Study.)

Cultural Understanding: 3 credits

AFRO A-140	INTRODUCTION TO AFRICAN AMERICAN AND AFRICAN DISAPORA STUDIES
AFRO A-150	SURV CULTR OF BLACK AMERICANS
AFRO A-152	INTRODUCTION TO AFRICAN STUDIES
ANTH A-103	HUMAN ORIGINS & PREHISTORY
ANTH A-104	CULTURAL ANTHROPOLOGY
ASL-A131	INTENSIVE BEG AMER SIGN LANG I
CLAS L-131	BEGINNING LATIN 1
EALC C-117	BASIC CHINESE I
EALC J-131	BEGINNING JAPANESE 1
EDUC E-201	MULTICULT EDUC/GLOBAL AWARENS
FREN F-117	BEGINNING FRENCH I
FREN F-131	INTENSIVE BEGINNING FRENCH I
GER G-117	BEGINNING GERMAN I
GER G-131	INTENSIVE BEGINNING GERMAN I
HER H-221	ART PAST AND PRESENT
INTL I-100	INTRO TO INTERNATIONAL STUDIES
ITAL M-117	BASIC ITALIAN I
MUS M394	SURVEY OF AFRICAN AMERICAN MUSIC
NELC A-131	BEGINNING ARABIC 1
PSY B-203	ETHICS AND DIVERSITY IN PSY
SPAN S-117	BEGINNING SPANISH I
SPAN S-131	INTENSIVE BEGINNING SPANISH I
SWK S-102	UNDERSTANDING DIVERSITY IN A PLURALISTIC SOCIETY

Arts & Humanities: at least 3 credits of 9 credits total in Arts, Humanities, and Social Sciences

ART 21000	HIST OF ARCHITECTURE 1
COMM T-130	INTRODUCTION TO THEATRE
ENG L-105	APPRECIATION OF LITERATURE
ENG L-115	LITERATURE FOR TODAY
ENG L-202-IUPUC only	Literary Interpretation
ENG L-203-IUPUC only	Introduction to Drama
ENG L-204-IUPUC only	Introduction to Fiction
ENG L-205-IUPUC only	Introduction to Poetry
ENG L-207-IUPUC only	Women and Literature
ENG L-213-IUPUC only	Literary Masterpieces
ENG L-214-IUPUC only	Literary Masterpieces
ENG W-210-IUPUC only	Literacy and Public Life
HER E-101	BEGINNING DRAWING I
HER E-105	BEGINNING PAINTING I
HER E-109	COLOR AND DESIGN FOR NON-ART MAJORS
HER E-201	PHOTOGRAPHY I
HER E-209	DRAWING FOR INTERIOR DESIGN
HER E-214	VISUAL LEARNING: FROM THE SIMPSONS TO THE GUERRILLA GIRLS
HER H-100	ART APPRECIATION
HER H-101	HISTORY OF ART 1
HER H-102	HISTORY OF ART 2
HER H-210	THE ART OF ART HISTORY
HER H-221	ART PAST AND PRESENT
MUS E-241	INTRO TO MUSIC FUNDAMENTALS
MUS M174	MUSIC FOR THE LISTENER
MUS Z-201	HISTORY OF ROCK AND ROLL MUSIC
PHIL P-110	INTRODUCTION TO PHILOSOPHY
PHIL P-120	ETHICS
PHST P-105	GIVING & VOLUNTEERING IN AMER
REL R-133	INTRODUCTION TO RELIGION
REL R-212	COMPARATIVE RELIGIONS

Social Sciences: at least 3 credits of 9 credits total in Arts, Humanities, and Social Sciences

BUS F 260	PERSONAL FINANCE
BUS F-151 (1 cr.)	PERSONAL FINANCES OF THE COLLEGE STUDENT
BUS F-152 (1 cr.)	BASIC FINANCIAL PLANNING AND INVESTMENT
BUS F-251 (1 cr.)	MANAGING PERSONAL AND FINANCIAL RISK
BUS W-200	INTRO TO BUSINESS & MANAGEMENT
BUS X-100	BUS ADMINISTRATION: INTRO
COMM C-180	INTRO TO INTERPERSONAL COMM
COMM M-150	MASS MEDIA & CONTEMP SOCIETY
ECE 32700	ENGINEERING ECONOMICS
ECON E-101	SURVEY OF ECONOMIC ISS & PROB
ECON E-201	INTRO TO MICROECONOMICS
ECON E-202	INTRO TO MACROECONOMICS
EDUC P-251	EDUC PSY FOR ELEM TCHRS
EDUC P-254-IUPUC only	Ed Psy for Teachers-All Grades
ENG G-205-IUPUC only	Intro to the English Language
ENG Z-104	LANGUAGE IN OUR WORLD
FOLK F-101	INTRODUCTION TO FOLKLORE
GEOG G-110	Intro to Human Geography
GEOG G-130	WORLD GEOGRAPHY
HIST H-105	AMERICAN HISTORY I
HIST H-106	AMERICAN HISTORY II
HIST H-108	PERSPECTIVES: WORLD TO 1800
HIST H-109	PERSPECTIVES:WORLD 1800-PRES
HIST H-113	HISTORY OF WESTERN CIVILIZ 1
HIST H-114	HISTORY OF WESTERN CIVILIZ 2
INF I-202	SOCIAL INFORMATICS
POLS Y-101	INTRODUCTION TO POLITICAL SCIENCE
POLS Y-103	INTRO TO AMERICAN POLITICS
POLS Y-217	INTRO TO COMPARATIVE POLITICS
POLS Y-219	INTRO TO INTNL RELATIONS
PSY B-104-IUPUC only	Psychology as a Social Science
PSY B-110	INTRODUCTION TO PSYCHOLOGY
SOC R-100	INTRODUCTION TO SOCIOLOGY
SOC R-121	SOCIAL PROBLEMS
SPEA J-101	AMERICAN CRIMINAL JUSTICE SYS
SPEA V-170	INTRO TO PUBLIC AFFAIRS
SPEA V-221	NONPROFIT & VOLUNTARY SECTOR
SPEA V-222	PRINCIPLES OF SUSTAINABILITY
WOST W-105	INTRO TO WOMEN'S STUDIES

APPENDIX C

	Biomaterials		Tissue Engineering (Biomaterials Emphasis)		Tissue Engineering (Mechanics Emphasis)		Biomechanics		Bioinstrumentation		Bioinstrumentation (Implantable Systems)	
	F	S	F	S	F	S	F	S	F	S	F	S
BME Electives	F	S	F	S	F	S	F	S	F	S	F	S
BME 39500 Biomaterials (GATEWAY)		x		x								
BME 39500 Biomedical Instrumentation (GATEWAY)										x		x
BME 59500 Polymers for Biomedical Applications OR BME 59500 Advanced Biomedical Polymers	x		x									
BME 59500 Drug Delivery OR BME 59500 Engineering Principles of Biotechnology		x		x		x		x		x		x
BME 59500 Tissue Engineering OR BME 59500 Engineering Principles for Biomolecular Interaction		x		x		x						
BME 59500 Biomolecular Engineering OR BME 59500 Molecular and Cellular Mechanics	x		x		x		x					
BME 59500 Vascular Biomechanics BME 59500 Cellular Mechanotransduction							x					
BME 59500 Musculoskeletal Biology and Mechanics OR BME 59500 Engineering Analysis of Tissues				x		x		x				
BME 59500 Cardiac Electrophysiology OR BME 59500 Biosignal Processing Lab/ECE 53800 DSP									x		x	
BME 59500 Implantable Systems OR BME 59500 Cellular Electrophysiology OR BME 59500 Experimental Methods in BME	x		x		x		x		x		x	
BME 59500 Neural Engineering OR BME 59500 Embedded Bioinstrumentation										x		x
BME 59500 Nanosystem Principles	x		x		x		x		x		x	
BME 59500 Integrated Nanosystem Processes and Devices		x		x		x		x		x		x
Technical Electives	F	S	F	S	F	S	F	S	F	S	F	S
ME 20000 Thermodynamics	x	x	x	x	x	x	x	x				
ME 27400 Basic Mechanics II (GATEWAY)					x	x	x	x				
ME 54600 CAD/CAM Theory and Advanced Applications					x	x	x	x				
ME 55100 Finite Element Analysis					x		x					
ME 55200 Advanced Applications of Finite Element Method (P: ME 55100)						x		x				
ECE 25500 Introduction to Electronics Analysis & Design										x		x
ECE 27000 Introduction to Digital System Design									x	x	x	x
ECE 36200 Microprocessor Systems & Interfacing									x	x	x	x

Science Electives (limit 2)	F	S	F	S	F	S	F	S	F	S	F	S
ECE 26400 Advanced C Programming + ECE 28200 UNIX Programming for Engineers									X	X		
CHEM-C 342 Organic Chemistry II	X	X	X	X								X
CHEM-C 360 Elementary Physical Chemistry		X										
CHEM-C 361 Physical Chemistry of Bulk Matter		X										
CHEM-C 484 Biomolecules and Catabolism (P: CHEM-C342) OR	X		X									
BIOL-K 483 Biological Chemistry (P: CHEM-C342)	X	X	X	X								
BIOL-K 484 Cellular Biochemistry (P: CHEM-C342)		X		X								
BIOL-N 261 Human Anatomy OR	X	X	X	X	X	X	X	X	X	X	X	X
ANAT-D 501 Human Gross Anatomy		X		X		X		X		X		X
BIOL 568 Regenerative Biology and Medicine	X	X	X	X								
ANAT-D 527 Neuroanatomy										X		X
MATH 35100 Elementary Linear Algebra OR	X	X	X	X	X	X	X	X	X	X	X	X
MATH 51100 Linear Algebra with Applications	X	X	X	X	X	X	X	X	X	X	X	X
MATH 42600 Introduction to Applied Math & Modeling		X		X		X		X		X		X
Butler Science Electives (EDDP students; limit 2)												
CH 352 Organic Chemistry 2	X		X									
CH 361 Biochemistry	X		X									
MATH 361 Statistical Theory	X		X		X		X		X			X
MATH 330 Complex Analysis					X		X		X			X
PH 325 Thermodynamics/Statistical Physics	X		X		X		X		X			X
PH 321 Intermediate Classical Mechanics					X		X					
PH 461 Computational Physics					X		X		X			X
PX 311 Human Anatomy	X		X		X		X		X			X
PX 315 Human Physiology	X		X		X		X		X			X
	Biomaterials		Tissue Engineering (Biomaterials Emphasis)		Tissue Engineering (Mechanics Emphasis)		Biomechanics		Bioinstrumentation			Bioinstrumentation (Implantable Systems)

NOTES:

The BME electives separated by **OR** are taught in alternating years. Most students graduating in four years will therefore take only one of these two courses. Students who stay in the program longer may take both courses and apply them toward the depth area, if applicable.

However, the Science electives separated by **OR** are courses with significant overlapping content. Therefore, only one of these courses (e.g. only one Anatomy class, not both) can be taken for credit toward the BME degree requirements.

Last updated: 3/11/14