

# **Department of Biomedical Engineering Undergraduate Handbook**

## **2013-2014**

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**Department of Biomedical Engineering  
University of Arkansas  
4188 Bell Engineering Center  
Fayetteville, Arkansas 72701**

\*This document is intended to be a guide to students in the biomedical engineering program. Students should refer to the University Catalog of Studies for official degree requirements.

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## Introduction

**Biomedical engineering** encompasses the creation, design, and operation, of processes / technology related to the broad field of human healthcare. The profession traditionally has focused on applications related to the development of instrumentation and diagnostic equipment, discovery of novel treatment options, production of new therapeutics, and the elucidation of underlying biophysical phenomena. Newer applications of biomedical engineering take advantage of the ever deepening understanding of human physiology and molecular genetics, as related to prevention, detection, and treatment of medical conditions.

The **program objectives** of the Biomedical Engineering undergraduate program are to produce graduates who are capable of:

- succeeding in the practice of engineering or other professional activities, and
- succeeding in post baccalaureate studies.

Completion of the degree requirements provides for the following **educational outcomes**:

- an ability to apply knowledge of mathematics, science, and engineering
- an ability to design and conduct experiments, as well as to analyze and interpret data
- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- an ability to function on multidisciplinary teams
- an ability to identify, formulate, and solve engineering problems
- an understanding of professional and ethical responsibility
- an ability to communicate effectively
- the broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal contexts
- a recognition of the need for, and an ability to engage in life-long learning
- a knowledge of contemporary issues
- an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

These educational outcomes are experienced within the context of biology and physiology appropriate to solving problems at the interface of engineering and biology.

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## Facilities

### **Engineering Research Center (ENRC)**

State-of-the art research facilities of our faculty are located in **the Engineering Research Center (ENRC)** at 535 W Research Center Blvd, approximately 2 miles south from the main campus. Shuttles are available for travel back and forth from BELL to ENRC. Please refer to the [shuttle schedule](#) for more information.

### **BMEG Teaching Laboratory**

*(To be completed in Fall 2013)* BMEG Teaching Laboratory is located at **ENGR 120**, and is used for BMEG laboratory courses such as Bioinstrumentation, Biomaterials, Biomolecular Engineering, Tissue Engineering and Biomedical Microscopy.

### **BMEG Design Laboratory**

*(To be completed in Fall 2013)* BMEG Design Laboratory is located at **ENGR 113**, and is used by students enrolled in Biomedical Design Courses. The laboratory is fully equipped with the resources needed to design, fabricate and test biomedical prototypes.

### **Computer Lab**

BMEG/BENG Computer Lab at **ENGR 205-206** are available for use by BMEG students outside of times when the lab is reserved.

### **vLab**

Students can access latest versions of several computer lab software (e.g. MATLAB) virtually from any computer through [vLab](#), a virtual Windows desktop provided by the IT services. Please refer to the website (<http://vlab.uark.edu/>) for instructions and a list of available software.

# Biomedical Engineering Curriculum

## Catalog Required Biomedical Engineering Curriculum

### Freshman Year

Fall Semester		Spring Semester	
GENG 1111 Introduction to Engineering I	1	GENG 1121 Introduction to Engineering II	1
MATH 2554 Calculus I	4	MATH 2564 Calculus II	4
CHEM 1103 University Chemistry I	3	Freshman Science Elective*	4
PHYS 2054 University Physics I	4	HIST 2003 or HSIT 2013 or PLSC 2003	3
ENGL 1013 English Composition I	3	ENGL 1023 English Composition II	3
	<b>15</b>		<b>15</b>

### Sophomore Year

Fall Semester		Spring Semester	
BMEG 2613 Introduction to BME	3	BMEG 2813 Biomechanics	3
Sophomore Science Lab Elective**	4	BMEG 2903/01L Biomedical Instrumentation	4
MATH 2574 Calculus III	4	MATH 3404 Differential Equations	4
BIOL 1543/41L Principles of Biology	4	BIOL 2533 Cell Biology	3
	<b>15</b>	Humanities/Social Science Elective	3
			<b>17</b>

### Junior Year

Fall Semester		Spring Semester	
BMEG 3634 Biomaterials	3	BMEG 3653 Biomed. Model. & Num. Methods	3
ELEG 3124 Systems & Signal Analysis	4	BMEG 3823/21L Biomolecular Engineering	4
CHEM 3603/01L Organic Chemistry I	4	CHEG2133/MEEG 3503 Fluid Mechanics	3
BIOL 2213/1L Human Physiology	4	CHEM 3613/11L Organic Chemistry II	4
CHEG 2313 Thermodynamics	3	Humanities/Social Science Elective	3
	<b>18</b>		<b>17</b>

### Senior Year

Fall Semester		Spring Semester	
BMEG 4813 Biomedical Engineering Design I	3	BMEG 4923 Biomedical Engineering Design II	3
BMEG 4623 Biomedical Transport Phenomena	3	BMEG Elective	3
BMEG Elective	3	Humanities/Social Science Elective	3
Science Elective	3	BMEG or Science Elective	3
Humanities/Social Science Elective	3		
	<b>15</b>		<b>15</b>

\*The Freshman Engineering Science Elective must be chosen from either CHEM 1123/1121L or PHYS 2074

\*\*The Sophomore Science Elective must be PHYS 2074 (if CHEM 1123/1121L was chosen as the Freshman Engineering Science Elective) or CHEM 1123/1121L (if PHYS 2074 was chosen as the Freshman Engineering Science Elective. That is, both courses are required for the degree)

## Pre-Med/Recommended Biomedical Engineering Curriculum

### Freshman Year

#### Fall Semester

GENG 1111 Introduction to Engineering I	1
MATH 2554 Calculus I	4
CHEM 1103 University Chemistry I	3
PHYS 2054 University Physics I	4
ENGL 1013 English Composition I	3
	<b>15</b>

#### Spring Semester

GENG 1121 Introduction to Engineering II	1
MATH 2564 Calculus II	4
CHEM 1123/21L University Chemistry II	4
BIOL 1543/41L Principles of Biology	4
ENGL 1023 English Composition II	3
	<b>16</b>

### Sophomore Year

#### Fall Semester

BMEG 2613 Introduction to BME	3
PHYS 2074 University Physics II	4
MATH 2574 Calculus III	4
CHEM 3603/01L Organic Chemistry I	4
BIOL 2533 Cell Biology	3
	<b>18</b>

#### Spring Semester

BMEG 2813 Biomechanics	3
BMEG 2903/01L Biomedical Instrumentation	4
MATH 3404 Differential Equations	4
CHEM 3613/11L Organic Chemistry II	4
	<b>15</b>

### Junior Year

#### Fall Semester

BMEG 3634 Biomaterials	3
ELEG 3124 Systems & Signal Analysis	4
CHEG 2313 Thermodynamics	3
BIOL 2213/1L Human Physiology	4
Humanities/Social Science Elective	3
	<b>17</b>

#### Spring Semester

BMEG 3653 Biomed. Model. & Num. Methods	3
BMEG 3823/21L Biomolecular Engineering	4
CHEG2133/MEEG 3503 Fluid Mechanics	3
Science Elective	3
Humanities/Social Science Elective	3
	<b>16</b>

### Senior Year

#### Fall Semester

BMEG 4813 Biomedical Engineering Design I	3
BMEG 4623 Biomedical Transport Phenomena	3
BMEG Elective	3
Humanities/Social Science Elective	3
BMEG or Science Elective	3
	<b>15</b>

#### Spring Semester

BMEG 4923 Biomedical Engineering Design II	3
BMEG Elective	3
Humanities/Social Science Elective	6
HIST 2003 or HSIT 2013 or PLSC 2003	3
	<b>15</b>



## **Science Electives**

- BIOL 2323 General Genetics
- BIOL 2443/2441L Human Anatomy
- BIOL 4263 Cell Physiology
- BIOL 4653 Cancer Biology
- BIOL 4713 Basic Immunology
- CHEM 3813 Introduction to Biochemistry

## **BMEG Electives**

- BMEG 4243 Advanced Biomaterials and Biocompatibility
- BMEG 4413 Tissue Engineering
- BMEG 4743 Drug and Gene Delivery
- BMEG 4973 Regenerative Medicine
- BMEG 470V Cell and Tissue Mechanics
- BMEG 470V Biomedical Microscopy

## Fine Arts, Humanities Requirement (6 hours)

Select 3 hours each from categories “a” and “b”

### a. *Fine Arts:*

ARCH 1003 Basic Course in the Arts:  
Architecture Lecture  
ARHS 1003 Basic Course in the Arts: Art  
Lecture  
COMM 1003 Basic Course in the Arts: Film  
Lecture  
DANC 1003 Basic Course in the Arts:  
Movement and Dance  
DRAM 1003 Theater Appreciation  
LARC 1003 Basic Course in the Arts: The  
American Landscape  
MLIT 1003 Basic Course in the Arts: Music  
Lecture  
MLIT 1013 Music Lecture for Music Majors

### b. *Humanities*

Any intermediate I foreign language\*  
ARCH 1013 Diversity and Design  
CLST 1003 Intro to Classical Studies: Greece  
CLST 1013 Intro to Classical Studies: Rome  
COMM 1233 Media, Community and  
Citizenship  
HUMN 1124H Honors Equilibrium of Cultures,  
500-1600  
HUMN 2003 Intro to Gender Studies  
HUMN 2124H Honors Twentieth Century  
Global Culture  
PHIL 2003 Intro to Philosophy  
PHIL 2103 Intro to Ethics  
PHIL 2203 Logic  
PHIL 3103 Ethics and the Professions  
WLIT 1113 World Literature I  
WLIT 1123 World Literature I

\*Typically numbered 2003. See Department of World Languages, Literatures and Cultures in the J. William Fulbright College of Arts and Sciences chapter in the Undergraduate Catalog.

## Social Sciences Requirement (9 hours)

Select from at least two different fields of study

AGEC 1103 Principles of Agricultural Microeconomics  
AGEC 2103 Principles of Agricultural Macroeconomics  
ANTH 1023 Intro to Cultural Anthropology  
COMM 1023 Communication in a Diverse World  
ECON 2013 Principles of Macroeconomics  
ECON 2023 Principles of Microeconomics  
ECON 2143 Basic Economics: Theory and Practice  
GEOG 1123 Human Geography  
GEOG 2003 World Regional Geography  
HESC 1403 Life Span Development  
HESC 2413 Family Relations  
HIST 1113 Institutions and Ideas of World Civilizations I  
HIST 1123 Institutions and Ideas of World Civilizations II  
HIST 2003 History of the American People to 1877\*\*

HIST 2013 History of the American People 1877 to  
Present\*\*  
HUMN 1114H Honors Roots of Culture to 500 C.E.  
HUMN 2114H Honors Birth of Modern  
Culture, 1600-1900  
PLSC 2003 American National Government\*\*  
PLSC 2013 Intro to Comparative Politics  
PLSC 2203 State and Local Government  
PSYC 2003 General Psychology  
RESM 2853 Leisure and Society  
RSOC 2603 Rural Sociology  
SOCI 2013 General Sociology  
SOCI 2033 Social Problems

\*\* If not selected to meet the three hours of U.S. History requirement

Please refer to the [Undergraduate Course Catalog](#) for more complete information on degree requirements and academic policy.

## Biomedical Engineering Curriculum Flowchart

Please refer to the [BMEG departmental website](#) for the most up-to-date curriculum flowchart.

### Advising Procedures

At the beginning of the sophomore year, each student is assigned an adviser to help select courses that fit within the required program of study and to assure that courses are taken in the appropriate sequence. **Prior to registering for the next semester, each student must meet with his/her adviser to go over the progress and to select courses.** Students will not be able to register unless their adviser removes the advising hold in ISIS.

Procedures to complete before seeing your adviser:

1. Fill out/update your [Biomedical Engineering Undergraduate Advising Sheet](#) with all course credits you have earned. This sheet will be submitted to the adviser at advising.
2. Refer to the [Biomedical Engineering Undergraduate Flow Chart](#) and select courses for next semester and enter these into the Advising Sheet.
3. Using [ISIS](#), access the Schedule of Classes and prepare a trial schedule. Make sure required course **pre-requisites** are complete and that you sign up for course **co-requisites**.
4. In ISIS, check your assigned advisor before your advising session.
5. Check the **group advising** schedule provided by the Program Coordinator by email and plan on attending one of the sessions. It is strongly suggested that students attend a group advising session to ensure that their advising holds are removed in time for registration.
6. If you are unable to attend the group advising sessions, **contact your assigned adviser** to schedule an individual appointment **ASAP**. Do not wait until the last minute to contact your adviser.
7. Remember that all **registration holds (negative service indicators) must be removed** before you can register. Such holds include advising holds but can also be financial holds from Parking and Transit, Student Health Center, or the Treasurer's Office. Once all holds are removed, you may register in ISIS during your assigned registration period.

Academic advising is a service provided by the University to assist students in making thoughtful decisions related to their academic experiences, and maximizing their educational and career opportunities. Our faculty advisers do their best to work with you, but remember that the student possesses the final responsibility for successful completion of a degree.

# Registration

## ISIS

The University requires students to use [ISIS](#) to view the schedule of classes and to register for classes. For assistance with ISIS for registration, contact the [Registrar's Office](#) (575-5451) or [ISIS help](#).

## Registration periods

Students must register during one of the formal registration periods. Visit [ISIS](#) to view your available registration dates.

## Schedule Changes and Add/Drop

Students can make changes to their schedules (add and/or drop courses) using [ISIS](#) during the first five class days of the semester. A student may drop a full-semester course during the first 10 class days without having the drop shown on the official academic record. After the first 10 class days, and before the drop deadline of the semester, a student may drop a course, but a mark of "W" (withdrawal) will be recorded. For fee refund schedules and add/drop deadlines for specific semesters, refer to the [Academic Semester Calendar](#) at the Registrar's Office.

## Registration Overrides

Students unable to register for Engineering courses due to **pending transfer credits** causing **pre- and co-requisite conflicts**, **time conflicts** or **class full** may be placed in a course upon case-by-case approval from the **course instructor(s)** and the **undergraduate coordinator**. In these cases, the student should:

1. Fill out the [College of Engineering Override Form](#). Obtain course information directly from ISIS and specifically indicate reason for override in "Comments" section in addition to checking all reasons that apply.
2. Contact the **course instructor** and obtain his/her approval and signature on the form.
3. Contact the **undergraduate coordinator** and obtain his/her approval and signature on the form in the section for Department Head's Approval.
4. Submit the completed override form to the **Student Records Office, BELL 3189**.

Students that require override for courses outside the College of Engineering should contact the home department of the course for which they are enrolling and follow appropriate procedures required by the department.

## Transfer/Study Abroad

- If you are transferring into BMEG from a different department/college/institution, please consult the **undergraduate coordinator** regarding your course transfers.
- If you wish to obtain credit for a class taken at another institution or by tests, you may look up course equivalencies on the [Registrar's website](#). Please discuss further questions with your adviser and/or the undergraduate coordinator.

## Honors Program

The Honors Program in the Department of Biomedical Engineering is designed for high-ability students who are interested in more vigorous and in-depth academic challenges. In order to graduate from the Honors Program, students must take **a minimum of 12 hours of honors courses**, with **at least 6 of the 12 hours in BMEG** including BMEG 450VH Honors Thesis as an honors student in the Department of Biomedical Engineering. Below are the honors courses offered in the BMEG department of which one is required:

- BMEG 3653H Biomedical Modeling and Numerical Methods
- BMEG 3824H Biomolecular Engineering
- BMEG 4623H Biomedical Transport Phenomena

In addition to the honors coursework, honors students are required to complete an **honors thesis research project** under the direction of a faculty mentor. Please refer to the [Biomedical Engineering Honors Program Handbook](#) for more details regarding the requirements and benefits of the Honors Program.

## **Undergraduate Research**

Opportunities are available for undergraduate BMEG students to participate in research. Students can participate through the **Honors Program**, as well as just by working with an individual faculty member. Refer to the [BMEG departmental website](#) for descriptions of research activities within the department. A student may get involved in research by contacting individual faculty members about their research program. Research funding and/or student stipends are available through resources such as [SURF \(Statewide Undergraduate Research Fellowships\)](#) and [Honors College Undergraduate Research Grants](#) through the Honors College. Refer to the [Honors College website](#) for more information.

## **Student Organizations**

### **Biomedical Engineering Society (BMES)**

Faculty Advisor: Dr. David Zaharoff (Zaharoff@uark.edu)

The Biomedical Engineering Society at the University of Arkansas promotes the education and advancement of biomedical engineering by engaging members in insightful discussions and organized events. Its goals are to:

1. Introduce current research being conducted by UA professors as well as those from other institutions.
2. Explore professional opportunities in industry, medicine and academia.
3. Provide a networking platform for members to gain experience in biomedical engineering through internships.

Refer to <http://www.uark.edu/rso/bmes/> or email at [bmes@uark.edu](mailto:bmes@uark.edu) for more information.