DEPARTMENT OF BIOMEDICAL ENGINEERING

FACULTY, STAFF AND STUDENT HANDBOOK INFORMATION GUIDE

2016-2017

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INFORMATION GUIDE

HISTORICAL SKETCH

Biomedical Engineering at the University of Kentucky developed as part of the research programs of the Wenner-Gren Aeronautical Research Laboratory (WGARL). The Laboratory was a gift of the Viking Foundation (Axel Wenner-Gren, president) as a result of proposals and negotiations of Professor A. J. Meyer and Colonel James H. Graham, Dean of the College of Engineering. The laboratory was completed in 1941 and operated through the war years as a research and training facility for the design, operation and maintenance of aircraft engines and related equipment. The laboratory was under the administrative jurisdiction of the Office of the Dean of the College of Engineering with Professor Meyer serving as director of the laboratory.

During the final phase of World War II the WGARL, Prof. Meyer and Dean Graham were the subjects of investigations by the University and the U.S. State Department due to allegations that Wenner-Gren was a Nazi sympathizer. As a result, the State Attorney General's office ruled that the name of Wenner-Gren should be removed from the laboratory even though the conditions under which the University accepted the gift of the laboratory specified that the building carry the name of Wenner-Gren. Even though Wenner-Gren was cleared of the charges against him, these problems, coupled with the rather rapid shift to the use of jet engines by military and commercial aircraft, brought the activities of the laboratory to a low level in the late 1940's.

Professor A. J. Meyer left the University in 1951 and the administrative responsibility for the Aeronautical Research Laboratory was placed in the Department of Mechanical Engineering. Professor E. B. Penrod, head of the Mechanical Engineering Department, directed the activities of the laboratory until Dr. Karl O. Lange was appointed laboratory director in 1953. The laboratory, however, continued as a unit of the Mechanical Engineering Department. Dr. Lange obtained authority to restore the name of Wenner-Gren to the laboratory while developing new areas of research and development.

One of the new areas of activity was Biomedical Engineering which involved the development of the Massie Sliding Hip Nail and the Lange Skinfold Caliper in the period 1954 to 1957. A program to investigate whole body response to vibrations was initiated in 1957 and the first graduate degree based on biomedical engineering research was awarded in 1959. A USAF contract awarded in 1959 to train chimpanzees for the Mercury Space Flight program marked the major shift of activity in the laboratory to predominantly biomedical engineering research. This period also saw the establishment of the UK College of Medicine and research in the area of human response to vibrations was developed through collaborative efforts with the Department of Physiology and Biophysics. The research related to space flight continued under funding from NASA and studies of gravity effects on biological systems remained a significant part of the laboratory's research program. A UK biomedical engineering student was awarded first place honors in regional and national competition for the best technical paper presented by a graduate student to the Institute of Aerospace Sciences in 1962.

The NASA research program prompted the 1966 expansion of the laboratory to house a 50 foot diameter centrifuge for the investigation of gravitational effects on earth organisms. From 1967 to 1982, research programs in cardiovascular and musculoskeletal dynamics were developed and NASA-funded research expanded to include a series of rocket flights (Aerobee 250A rockets) dedicated to experiments conducted by University of Kentucky investigators from the Wenner-Gren Laboratory. During this period, an ad-hoc committee was formed to develop a Biomedical Engineering Program. This committee was later replaced by a Biomedical Engineering Council. By 1981, there were nine Ph.D. candidates, five M.S. candidates and two postdoctoral fellows

participating in the Biomedical Engineering graduate program. The participation of 20 undergraduates resulted in four award-winning papers including 1969 and 1989 Oswald Awards.

The continued growth of the program and its international recognition prompted the second expansion of the laboratory. This 1978 addition to the facility provided an excellent vivarium and surgical facilities as well as additional laboratory and office space. In 1980 the Colleges of Medicine and Engineering commissioned a review and evaluation of the operation and activities of the biomedical engineering program. This review was performed by Dr. Robert Rushmer, a noted physiologist and founder of the Bioengineering Center at the University of Washington. Dr. Rushmer recommended that a Center for Biomedical Engineering be created "for the purpose of providing opportunities for broader scope, better balance and greater probability of attaining the full potential of which the program is capable" and that the core faculty be increased to provide a "critical mass" of five to seven members.

In 1985, Dr. Rushmer's major recommendations were implemented with the creation of the Graduate Center for Biomedical Engineering under the jurisdiction of the Graduate School. The program, the Wenner-Gren facilities, the Wenner-Gren operating budget and three faculty positions, were transferred to the Center. Faculty appointments were established in the Graduate School. Later, University reorganization led to the placement of the Center under the newly created office of the Vice President for Research and Graduate Studies with the Center Director reporting to the Vice Chancellor for Research and Graduate Studies in the Medical Center. Graduate programs leading to the M.S. and Ph.D. degrees in Biomedical Engineering were approved by the Kentucky State Council on Higher Education in January 1988.

With reorganization in 1991, the Center Director reported to the Dean of the Graduate School. From 1991-1994, the Dean of the Graduate School reported to the Vice President for Research and Graduate Studies concerning matters related to the Biomedical Engineering Program. In 1994, further reorganization maintained the reporting relationship of the Center to the Dean of the Graduate School but placed the budget and faculty lines in the Medical Center and required the Dean of the Graduate School to report to the Chancellor of the Medical Center concerning Biomedical Engineering. When the University switched to a provost system in 2003, the Dean of the Graduate School began reporting to the Provost regarding Biomedical Engineering**.** In July 2010, the Center joined the College of Engineering. The unit was administratively reorganized into a Department of Biomedical Engineering in July 2013. Today, the department occupies the renovated 5th floor of the Robotics and Manufacturing Building.

MISSION

The mission of the Department of Biomedical Engineering is to provide quality programs of education, research and service in the area of biomedical engineering. The multidisciplinary character of biomedical engineering and operation of the program as a Department offer unique opportunities to fulfill this mission. The educational mission is served by bringing the expertise of faculty from diverse disciplines to bear upon the development of a curriculum focusing on the application of the principles of engineering and physics to medicine and biology.

The facilities and support services of the Department provide the opportunity for multidisciplinary research of varied and unique character. The research mission of the Department includes efforts to encourage and support collaborative research that involves faculty from the numerous disciplines that interact with biomedical engineering.

The Department recognizes the responsibility and the opportunity to provide service to other programs of the University as well as various groups and organizations of the state and nation. The Department maintains service units that traditionally have provided support for both internal and external activities.

FACULTY AND STAFF OF THE DEPARTMENT

The faculty and staff, with their primary areas of research and work, are listed below (addresses are listed in Appendix B).

FACULTY

1. *Primary Appointment*

Babak Bazrgari, Ph.D., Assistant Professor; Biomechanics, Sport Biomechanics and Rehabilitation Engineering.

Thomas P. Hedman, Ph.D., Adjunct Associate Professor; Biomechanics; Orthopaedic Biomechanics and Spinal Biomechanics

Abhijit R. Patwardhan, Ph.D., Professor, Interim Chair and Director of Graduate Studies; Cardiovascular Control and Signal Processing

David Pienkowski, Ph.D., M.B.A., Associate Professor, Departments of Biomedical Engineering and Orthopaedic Surgery; Orthopaedic Biomechanics

David A. Puleo, Ph.D., Professor and Associate Dean for Research and Graduate Studies in The College of Engineering; Biomaterials, Cell and Tissue-Biomaterial Interactions, Tissue Engineering

Hainsworth Shin, Ph.D., Adjunct Assistant Professor; Department of Biomedical Engineering; Cell Mechanotransduction

Sridhar Sunderam, Ph.D., Associate Professor; Computational Neural Engineering, Signal Analysis for Epilepsy, State-Space Models of Behavior.

Guoqiang Yu, Ph.D., Professor; Near-Infrared Diffuse Optical Spectroscopy/Tomography

2. *Joint Appointment*

Anders Andersen, Ph.D., Research Associate Professor, Department of Anatomy and Neurobiology; Analog and Digital Signal Processing

Kimberly Ward Anderson, Ph.D., Professor, Department of Chemical Engineering and Materials; Molecular Cell Bioengineering

Donald T. Frazier, Ph.D., Professor Emeritus, Department of Physiology; Pulmonary Function and Control

Peter A. Hardy, Ph.D., Assistant Professor, Department of Radiology; Magnetic Resonance Imaging in Aging and Arthritis

Lu-Yuan Lee, Ph.D., Professor, Department of Physiology; Chemosensitive Neurons in the Lung, Airway Inflammation, Bronchial Hyperreactivity

Ai-Ling Lin, Ph.D., Assistant Professor, Sanders-Brown Center on Aging, Graduate Faculty in Nutritional Sciences; Neuroimaging, Risks for Alzheimer's disease, Dietary effects on cognitive aging.

David Powell, Ph.D., Research Assistant Professor, Department of Anatomy and Neurobiology; Magnetic Resonance Imaging and Spectroscopy

David C. Randall, Ph.D., Professor, Department of Physiology; Neural Cardiovascular Control and Behavioral Conditioning

Keith Rouch, Ph.D., Professor, Department of Mechanical Engineering; Finite Element Analysis and Modeling

Sibu Saha, M.D., Professor, Cardiothoracic Surgery; Transmyocardial Revascularization, Cartotid Atherosclerosis, Device Therapy for Hypertension

Robert Shapiro, Ph.D., Professor, Department of Kinesiology and Health Promotion; Biomechanics and Motion Analysis

Charles Smith, M.D., Professor, Department of Neurology; Magnetic Resonance Imaging and Spectroscopy

Margaret M. Szabunio, Professor, M.D., Department of Medicine; Radiology and Surgery

Moriel Vandsburger, Ph.D., Assistant Professor, Department of Physiology and Saha Cardiovascular Research Center; Magnetic Resonance Imaging, Molecular Imaging

Janet Walker, M.D., Associate Professor, Department of Orthopaedic Surgery; Pediatrics and Orthopedics

Joseph Zwischenberger, M.D., Johnston Wright Professor, Chairman, Department of Surgery; Artificial Organs

3. *Adjunct Faculty*

Thomas P. Hedman, Ph.D., Adjunct Associate Professor; Biomechanics, Orthopaedic Biomechanics and Spinal Biomechanics

Hainsworth Shin, Ph.D., Adjunct Assistant Professor; Cell Mechanotransduction

4. *Emeritus Faculty*

Eugene N. Bruce, Ph.D., Professor Emeritus, Department of Biomedical Engineering; Computational Physiology, Signal Processing and Control of Breathing.

Charles F. Knapp, Ph.D., Professor Emeritus, Department of Biomedical Engineering; Biofluid Mechanics, Cardiovascular Regulation

Stephen J. Lai-Fook, Ph.D., Professor Emeritus, Department of Biomedical Engineering; Pulmonary Mechanics, Biomechanics

Betty F. Sisken, Ph.D., Research Professor Emeritus, Department of Biomedical Engineering and Department of Anatomy and Neurobiology; Tissue Regeneration, Wound Healing and Alzheimer Disease Studies

5. *Other*

Chong Huang, Post-Doctoral Scholar

Arawwawala Don Thinga Liyanage, Post-Doctoral Scholar
Aleksandra Kawala-Janik, Post-Doctoral Scholar
Yuvaraj Rajamanickam, Post-Doctoral Scholar

6. *Department Staff*

Joyce M. Evans, M.S., Biomedical Scientist

Jennifer Hart, Administrative Support Associate I

Sue Mills, Administrative Services Assistant Sr.

(A list of responsibilities for those staff members who provide general services to the Department can be found in Appendix A.)

7. *Students*

	Names	***Under/Grad Degree***	***Degree Sought***	***Enrollment Semester***	***Advisor***	***Area of Interest***
1.	Ajwad, Asma'a	BS	PhD	F13	SS	Signal Processing/Neural
2.	Al-Bakrei, Amir	BS	PhD	F13	SS	Signal Processing/Neural
3.	Asafo-Adjei, Theodora	BS	PhD	F10	DAP	Biomaterials
4.	Bahrani, Ahmed	BS	PhD	F13	GY	Biophotonics
5.	Biswal, Dibyajyoti	BS	PhD	F16	AB	
6.	Chen, Alexander	BS	MS	F14	DAP	Biomaterials
7.	Fuentes, Michelle	BS	MS	F10	DAP	Biomaterials
8.	Fugate, Earl	MS	PhD	F13	SS	Signal Processing/Neural
9.	Haddix, Chase	BS	PhD	F16	SS	
10.	Hameed, Wissam	MS	PhD	F15	MV	Quantitative Cardiac MRI
11.	Huffman, Dillon	BS	PhD	F14	SS	Signal Processing/Neural
12.	Irwin, Daniel	MS	PhD	F12	GY	Biophotonics
13.	Kohrs, Nicholas	BS	MS	F15	DAP	Biomaterials
14.	McKenty, Taylor	BS	MS	F14	HS	Biomechanics
15.	Mazdeyasna, Siavash	MS	PhD	F15	GY	Biophotonics
16.	Najarzadeh, Amir	BS	PhD	F12	DAP	Biomaterials
17.	Rudd, Matt	BS	MS	F10	DAP	Biomaterials
18.	Shojaei, Iman	MS	PhD	F13	BB	Biomechanics
19.	Slade, Cameron	BS	MS	F16	BB	
20.	Thalman, Scott	BS	PhD	F14	MV	Quantitative Cardiac MRI
21.	Thomas, Sarah	BS	MS	F15	SS	Signal Processing/Neural

22. Thyagarajan, Sridevi	BS	MS	F15	AP	Cardiovascular
23. Wasemiller, David	BS	MS	F14	AP	Cardiovascular
24. Wehner, Gregory	BS	PhD	F13	BF	Cardiology
25. Wieman, Kevin	BS	MS	F14	HS	Biomechanics
26. Zhao, Mingjun	BS	PhD	F12	GY	Biophotonics

***Major Advisors*:** BB: Dr. B. Bazrgari BF: Dr. B. Fornwalt TH: Dr. T. Hedman AP: Dr. A Patwardhan
DP: Dr. D Pienkowski DAP: Dr. D Puleo SS: Dr. S Sunderam
MV: Dr. M. Vandsburger GY: Dr. G. Yu HS: Dr. H Shin

BME Officers 2016-2017:

President…Ahmed Bahrani
Vice President...Dillon Huffman
Secretary…Sridevi Thyagarajan
Treasurer...Sarah Thomas

ACADEMIC PROGRAMS

The Department of Biomedical Engineering offers M.S. and Ph.D. degrees in Biomedical Engineering in addition to a minor in Biomedical Engineering for students pursuing undergraduate degrees in college of engineering. The program emphasizes the application of engineering principles to the areas of medicine and biology and covers the broad aspects of mechanics, fluids, mass transfer, instrumentation, signal processing, systems analysis, materials and laboratory experimentation. The course work also stresses the practical application of these techniques to specific areas such as rehabilitation engineering, sports medicine, orthopedic implant design, medical instrumentation, diagnosis and image processing. There are two M.S. programs offered: The research-oriented Master of Science degree in Biomedical Engineering and the Professional Master in Biomedical Engineering degree. At the Ph.D. level, the focus is primarily on research.

Students in the program are provided with educational and research opportunities through the facilities and faculty of the Department and its close ties with other units of the University including: Anatomy & Neurobiology, Biochemistry, Biology, Cardiology, Cardiothoracic Surgery, Center for Applied Energy Research, Chemical & Materials Engineering, Chemistry, Electrical & Computer Engineering, Kinesiology and Health Promotion, Markey Cancer Center, Magnetic Resonance Imaging and Spectroscopy Center, Mathematics, Mechanical Engineering, Neonatology, Nephrology, Neurosurgery, Oral & Maxillofacial Surgery, Orthopaedic Surgery, Otolaryngology, Pediatric Cardiology, Periodontology, Pharmacy, Physical Medicine and Rehabilitation, Physiology, Plastic Surgery, and Radiology.

General Program Requirements

Students enroll in the graduate program through the Department of Biomedical Engineering and establish a course of study with the Department primary faculty and others from engineering and the life sciences. Entering students are expected to have an ABET-accredited degree in engineering with some course work in the biological sciences. Applicants with degrees in physical or biological sciences may be required to complete basic course work in an undergraduate engineering curriculum before being admitted into the Program. The time required to complete the undergraduate courses, such as electrical circuits, solid and fluid dynamics, thermodynamics and controls, typically ranges from one to four semesters, depending upon the applicant's background.

Graduate School Information and Requirements for Advanced Degrees

Important Graduate School policies and regulations for advanced degrees can be found in Appendix C. The full Graduate Bulletin may be accessed at http://www.research.uky.edu/gs/bulletin/bullinfo.shtml.

Master of Science in Biomedical Engineering

The Master of Science degree provides students with a combination of experiences in basic research, design, development, and practical applications. The M.S. degree requires successful completion of 26 credit hours plus an acceptable thesis. In special cases, a non-thesis option consisting of 31 credit hours is available for students with significant previous research or design experience. Enrollment in the non-thesis option requires approval of the Director of Graduate Studies and must be requested within the student's first nine (9) credit hours of graduate course work.

First Semester		(Credit Hours)
BME 605	Biomedical Signal Processing I	3
or BME 661	Biomaterials Science and Engineering	
BME 6xx[1]	Biomechanics Elective	3
BME 772	Seminar	0
PGY 412G	Principles of Human Physiology	4
Second Semester		
BME 530	Biomedical Instrumentation	3
BME xxx[2]	BME Technical Elective	3
BME 772	Seminar	0
XXX xxx[2]	Math Elective	3
Third Semester		
BME 661	Biomaterials Science and Engineering	3
or BME 605	Biomedical Signal Processing I	
BME 640	Biomedical Engineering Ethics	1
BME 772	Seminar	0
XXX xxx[2]	Technical Elective	3
Fourth Semester		
BME 748	Master's Thesis Research	0
BME 772	Seminar	0
	Total Credit Hours	26

[1] BME 670, 672, or 685 can be taken to fulfill the biomechanics requirement.
[2] At least one elective must be at the 600 level or higher.

NOTE: You MUST have 26 credit hours with grades to be eligible for a degree. At least 13 credit hours of 600-700 level courses *MUST BE COMPLETED!!* See the checklist in Appendix C.

Professional Master Degree in Biomedical Engineering

The Professional Master of Biomedical Engineering degree seeks to develop a unique combination of managerial, technical and leadership skills for those who will direct the future course of biomedical technology. The P.B.M.E. degree requires successful completion of 42 credits, including the capstone Advanced Study Project, and a summer internship.

GENERIC CURRICULUM*

Prerequisites		(Credit Hours)
ACC 201	Accounting I	3
ECON 201	Micro Economics	3
BIO 515	Cell Biology	3
BME 501	Foundations of BME (or equiv)	3
BME 530	Biomedical Instrumentation (or equiv)	3
		15
First Semester		
BME 6XX	BME Technical Elective	3
PGY 412G	Principles of Human Physiology	4
BME 642	Navigational Guides for Biomedical Product Designs	2
HA 621	Quantitative Methods of Research	3
PA 642	Public Organization Theory & Behavior	3
BME 772	Seminar	0
		15
Second Semester		
BME 6XX	BME Technical Elective	3
PA 623	Decision Analysis	3
HA 601	Healthcare System Overview	3
HA 637	Health Finance	3
MKT 600	Marketing Management	3
BME 772	Seminar	0
		15
Summer Internship	(required)	
Third Semester		
BME 6XX	BME Technical Elective	3
BME 766	Management of Technology	3
HA 602	Strategic Planng & Mgmt of HC Orgs	3
BME 777	Advanced Study Project	3
BME 772	Seminar	0
		12
	Total Program Credits	42

*Electives can be taken from the tracks in: Biomedical Controls & Signal Processing; Biomechanics; Biomaterials or a faculty defined general track.

Doctor of Philosophy Degree in Biomedical Engineering

The Doctor of Philosophy degree is a research degree granted on the basis of broad knowledge of engineering applications in biology and medicine and an in-depth study in a specific area leading to a dissertation reflecting original and independent work by the candidate. Applicants to the Ph.D. program are generally expected to have a master's degree. Under special circumstances, exceptional students may bypass the M.S. or be admitted directly to the Ph.D. program upon approval of the biomedical engineering faculty. Courses for advanced study are determined in consultation with an advisory committee and will be selected from the areas of engineering, mathematics, life sciences, and chemistry. To earn a Ph.D. degree, students must:

1. Meet the general requirements of the Graduate School.
2. Pass the Qualifying Examination. This exam, consisting of written and oral components, is designed and administered by the student's Doctoral Advisory Committee.
3. Present and satisfactorily defend a dissertation documenting independent and comprehensive scholarship.

Coursework required for doctoral students in BME (starting Spring 2014 and thereafter)

1) For students who have an earned MS degree in Biomedical Engineering:
   a) Meet graduate school requirements of pre and post qualifying residencies and credits.
   b) PGY 502 and BME 640.
   c) Specific courses decided by the advisor, in consultation with a co-chair in case the advisor is an Associate Member of the Graduate Faculty, until a committee is formed, by the committee thereafter.
   d) In case the advisor is an Associate Member of the Graduate Faculty, a co-chair having Full Membership must be selected at the time of admission. The co-chair may be changed when the committee is formed.
   e) Advisory committee must be formed before the end of the first year (calendar) of enrollment of the student at UK if the advisor is a Full Member of the Graduate Faculty. Committee must be formed before the end of the first semester if the advisor is an Associate Faculty of the Graduate Faculty.
   f) If student's MS degree is not from UK BME, then at least 9 course credits must be with a BME prefix.

2) For students who have an earned MS degree in a field other than Biomedical Engineering:
   a) Meet graduate school requirements of pre and post qualifying residencies and credits.
   b) PGY 502 and BME 640.
   c) Specific courses decided by the advisor, in consultation with co-chair in case the advisor is an Associate Member of the Graduate Faculty, until a committee is formed, by the committee thereafter.
   d) In case the advisor is an Associate Member of the Graduate Faculty, a co-chair having Full Membership must be selected at the time of admission. The co-chair may be changed when the committee is formed.
   e) Advisory committee must be formed before the end of the first year (calendar) of enrollment of the student at UK if the advisor is a Full Member of the Graduate Faculty. Committee must be formed before the end of the first semester if the advisor is an Associate Member of the Graduate Faculty.
   f) One half of the total credits taken while the student is enrolled in BME at UK must be from courses with a BME prefix, or a minimum of 14 credits from courses with a BME prefix.

3) For students who do not have an earned MS degree and have an undergraduate degree in Biomedical Engineering:
    a) Meet graduate school requirements of pre and post qualifying residencies and credits.
    b) PGY 502 and BME 640.
    c) Specific courses decided by the advisor, in consultation with co-chair in case the advisor is an Associate Member of the Graduate Faculty, until a committee is formed, by the committee thereafter.
    d) In case the advisor is an Associate Member of the Graduate Faculty, a co-chair having Full Membership must be selected at the time of admission. The co-chair may be changed when the committee is formed.
    e) Advisory committee must be formed before the end of the first semester of the student's enrollment in BME at UK.
    f) One third of the total credits taken while the student is enrolled in BME at UK must be from courses with a BME prefix, or a minimum of 12 credits from courses with a BME prefix. Note that the current requirement that we have for our MS students is that they earn at least 14 credits using courses with BME prefix.

4) For students who do not have an earned MS degree and have an undergraduate degree in a field other than Biomedical Engineering:
    a) Meet graduate school requirements of pre and post qualifying residencies and credits.
    b) PGY 502 and BME 640.
    c) Specific courses decided by the advisor, in consultation with co-chair in case the advisor is an Associate Member of the Graduate Faculty, until a committee is formed, by the committee thereafter.
    d) In case the advisor is an Associate Member of the Graduate Faculty, a co-chair having changed when the committee is formed.
    e) Advisory committee must be formed before the end of the first semester of the student's enrollment in BME at UK.
    f) One half of the total credits taken while the student is enrolled in BME at UK must be from courses with a BME prefix, or a minimum of 14 credits from courses with a BME prefix. Note that the current requirement that we have for our MS students is that they earn at least 14 credits using courses with BME prefix

Minor in Biomedical Engineering

This minor is intended for undergraduate engineering students seeking to supplement their education by applying skills learned in their respective disciplines to the field of biomedical engineering (BME). The emphasis on upper level BME courses builds upon the foundation taught in core undergraduate engineering courses. Beyond the one required course, students will choose at least five elective courses in consultation with a Biomedical Engineering faculty advisor. Students and their advisor may select courses providing concentration in a particular subfield, or they may select courses providing breadth across the field of biomedical engineering. Examples of both types of curricula will be made available.

The minor in biomedical engineering requires: a) a minimum of 18 hours of coursework; b) a GPA of 2.5 in these courses; and c) no grade lower than a C in any BME course. At the discretion of the BME department chair (or designee), a limited number of equivalent course substitutions (i.e., 6 credit hours) may count toward the requirements for this minor. At least 12 credits must have the BME prefix.

Required course

BME 301 Fundamentals of Biomedical Engineering (3 credits)

Elective courses (select five from among the following#)

BME 395 Independent Research in Biomedical Engineering (1-6 credits)
BME 405 Introduction to Biomedical Signal Processing (3 credits)
BME 472 Human Biomechanics (3 credits)
BME 485 Fundamentals of Biofluid Mechanics (3 credits)
BME 488 Introduction to Biomaterials (3 credits)
BME 508 Cell Mechanics and Mechanobiology (3 credits)
BME 515 Modeling of Physiological Systems (3 credits)
BME 530 Biomedical Instrumentation (3 credits)
BME 540 Mechanical Modeling of Human Motion (3 credits)
BME 579 Neural Engineering (3 credits)
BME 580 Introduction to Biomedical Imaging (3 credits)
BME 481G Topics in Biomedical Engineering (Subtitle required) (3 credits)
BME 599 Topics in Biomedical Engineering (Subtitle required) (3 credits)

up to 6 credit hours of independent research (e.g., BME 395) or special topics courses (e.g., BME 481G or BME 599) may count as electives.

Class Schedule

The following BME courses are generally offered in the Fall and Spring semesters.

Fall

BME 301 Fundamentals of Biomedical Engineering
BME 395 Independent Research in Biomedical Engineering
BME 405 Introduction to Biomedical Signal Processing
BME 488 Introduction to Biomaterials
BME 501 Foundations of Biomedical Engineering
BME 508 Cell Mechanics and Mechanobiology
BME 515 Modeling of Physiological Systems
BME 580 Introduction to Biomedical Imaging
BME 605 Biomedical Signal Processing I
BME 640 Biomedical Engineering Ethics
BME 661 Biomaterials Science and Engineering
BME 772 Seminar
Various BME technical electives (see Courses)

Spring

BME 395 Independent Research in Biomedical Engineering
BME 472 Human Biomechanics
BME 485 Fundamentals of Biofluid Mechanics
BME 530 Biomedical Instrumentation
BME 540 Mechanical Modeling of Human Motion
BME 579 Neural Engineering
BME 662 Tissue-Implant Interface
BME 672 Musculoskeletal Biomechanics
BME 685 Biofluid Mechanics
BME 772 Seminar
Various BME technical electives (see Courses)

Check the UK Course Schedule web page for the most recent course offerings.

The following courses have specific applicability to students interested in Biomedical Engineering.

BME	301	Fundamentals of Biomedical Engineering	3
BME	395	Independent Research in Biomedical Engineering	1-6
BME	405	Introduction to Biomedical Signal Processing	3
BME	472	Human Biomechanics	3
BME	485	Fundamentals of Biofluid Mechanics	3
BME	481G	Topics in Biomedical Engineering (subtitle)	3
BME	488	Introduction to Biomaterials	3*
BME	501	Foundations of Biomedical Engineering	3
BME	579	Neural Engineering	3
BME	508	Cell Mechanics and Mechanobiology	3
BME	515	Modeling of Physiological Systems	3
BME	530	Biomedical Instrumentation	3
BME	540	Mechanical Modeling of Human Motion	3
BME	579	Neural Engineering	3
BME	580	Introduction to Biomedical Imaging	3
BME	599	Topics in Biomedical Engineering	3
BME	610	Biomedical Control Systems I	3
BME	615	Biomedical Signal Processing II	3
BME	620	Biomedical Control Systems II	3
BME	625	Analysis of Nonlinear Biomedical Systems	3
BME	630	Magnetic Resonance in Biomedicine	3
BME	635	Magnetic Resonance, Instrumentation & Measurements	3
BME	640	Biomedical Engineering Ethics	1
BME	641	Practices of Biomedical Engineering	3
BME	662	Tissue-Implant Interface	3
BME	672	Musculoskeletal Biomechanics	3
BME	680	Advanced Topics in Biomechanics	3
BME	682	Advanced Topics in Orthopaedic Biomechanics	3
BME	685	Biofluid Mechanics	3
BME	690	Research in Biomed Engr (subtitle)	1-3 **
BME	699	Special Topics in Biomedical Engineering (subtitle)	1-3 ***
BME	748	Master's Thesis Research	0
BME	766	Management of Technology	3
BME	767	Dissertation Residency Credit	2
BME	768	Residence Credit for the Master's Degree	1-6
BME	772	Seminar	0
BME	781	Special Problems in Biomedical Engineering	1-3 ***
BME	790	Research in Biomedical Engineering	1-9 ***
BCH	401G	Fundamentals of Biochemistry	3
BIO	515	General Cell Biology	3
CME	637	Biological Transport Phenomena	3
CME	680	Biochemical Engineering	3
EE	530	Robotics	3
EE	579	Neural Engineering	3
EE	583	Microprocessors	3
EE	613	Optimal Control Theory	3
EE	635	Image Processing	3
EE	640	Stochastic Systems	3
EE	688	Neural Networks	3
EGR	621	Finite Element Analysis in Engineering	3
EM	645	Advanced Dynamics I	3
KHP	615	Biomechanics of Fundamental Movements	3

KHP	620	Advanced Exercise Physiology	3
MA	522	Matrix Theory and Numerical Linear Algebra I	3
MA	532	Ordinary Differential Equations	3
MA	533	Partial Differential Equations	3
MA	616	Numerical Techniques for Nonlinear Optimization	3
MA	625	Numerical Methods for Differential Equations	3
MA	639	Research Projects in Biological Modeling	3
ME	501	Mechanical Design with Finite Element Methods	3
ME	529	Applied Fluid Mechanics	3
ME	531	Fluid Dynamics I	3
ME	599	Cryobiology Fundamentals	3
ME	631	Fluid Dynamics II	3
MSE	550	Corrosion	3
MSE	632	Advanced Materials Science	3
PGY	522	Quantitative Physiology	4
PGY	590	Cellular and Molecular Physiology	4
PGY	604	Advanced Cardiovascular Physiology	3
PGY	609	Advanced Respiratory Physiology	3
PHY	416G	Electricity and Magnetism	3
STA	503	Intro to Statistical Methods	4
STA	570	Basic Statistical Analysis	4
TOX	600	Ethics in Scientific Research	1

* Graduate credit for students with appropriate backgrounds from other programs.
** May be repeated to a maximum of 6 credit hours.
*** May be repeated to a maximum of 9 credit hours.
**** May be repeated to a maximum of 4 credit hours.

COURSE DESCRIPTIONS FOR BIOMEDICAL ENGINEERING (BME) CLASSES

BME 301 Fundamentals of Biomedical Engineering (3)
Overview of the application of engineering principles to problems in living systems and healthcare delivery. Fundamental anatomy and physiology for engineers. Quantitative measurement and analysis of the structure, function, and control of biological systems.

BME 395 Independent Research in Biomedical Engineering (1-6)
Individual research on selected problems of - 18 -urrent significance in biomedical engineering. Variable credit; may be repeated to a maximum of six credit hours. Prerequisite: Consent of instructor.

BME 405 Introduction to Biomedical Signal Processing (3)
Continuous and discrete signal concepts, sampling, signal transforms (Fourier, LaPlace, Z- Transforms), correlation and power spectrum, analog and digital filters, characteristics of biological signals and systems, introduction to non-linear systems, biomedical applications. Prerequisites: EE 305 or equivalent and MA 214; or consent of instructor.

BME 472 Human Biomechanics (3)
This course presents an engineering-based approach to the quantitative study of the human musculoskeletal system. Principles involving static and dynamic mechanical analyses will be applied to quantify the forces and moments in human posture and movement. Study of the material and biological properties of the musculoskeletal system is included because they are intimately coupled to the formulation and interpretation of problems in static and dynamic biomechanics. Prerequisites: EM 221, EM 313; or consent of instructor.

BME 481G Topics in Biomedical Engineering (Subtitle required)* (3) Detailed investigation of a topic of current significance in biomedical engineering such as: biomaterials, hard or soft tissue biomechanics, rehabilitation engineering, cardiopulmonary systems analysis, biomedical imaging. Prerequisite: Consent of instructor. Examples – BME 481G Topics in Biomedical Engineering: Biomaterials Surface Modification; Cardiovascular Biomechanics; Control Problems in Orthopaedics; Data Acquisition & Control for Neurophysiology, Mechanical Prosthetic Joints; Neural Engineering.

BME 485 Fundamentals of Biofluid Mechanics (3)
This course is taught concurrently with BME685 Biofluid Mechanics. This course provides the students with a review of basic fluid mechanics principles and a direct, practical application of these principles to biomedical and clinical problems associated with the human circulatory system. Prerequisites: Engineering standing or consent of instructor.

BME 488 Introduction to Biomaterials (3)
Study of biological and man-made materials that perform, improve, or restore natural functions. Structure and properties of connective tissues and commonly implanted metals, ceramics, and polymers; biocompatibility of materials used in orthopedic, soft tissue, and cardiovascular applications.
Prerequisites: Engineering standing, MSE 201, and MSE 301; or consent of instructor.

BME 501 Foundations of Biomedical Engineering (3) This course demonstrates the application of diverse engineering principles to analysis and understanding of the structure, function and control of biological systems. Quantitative measurements and analysis of homeostatic, regulatory, transport, biochemical and biomechanical processes of human body. Prerequisite: one semester of undergraduate biology or chemistry.

BME 508 Cell Mechanics and Mechanobiology (3)
This course will serve as an introduction to cell and tissue level mechanobiology with focus on human physiological and disease processes. The primary focus is to introduce principles of cell-level mechanics in the

context of the biology of living organisms, what we term mechanobiology. In effect, we treat biological processes and regulation as another variable(s) that must be accounted for when modeling the mechanical/physical behavior of human tissues. A large amount of the basic principles in this field of study arose as a result of the intense research in the cardiovascular field. We will draw many examples of mechanobiological principles as it relates to the circulatory system. Despite our cardiovascular focus, the basic principles can be applied to the whole range of mechanobiological research conducted in other applications (orthopedics, urological, pulmonary, etc.). Prerequisites: EM302 and/or CME/ME 330 (or equivalent fluid mechanics course); or consent of instructor.

BME 515 Modeling of Physiological Systems (3)
This introductory course in mathematical modeling will teach students how to construct simple and elegant models of biological and physiological processes — for instance the absorption and elimination of drugs in the human body or the kinetics of tumour growth in tissue — and to analyze or predict the dynamics of these events by solving the models. Prerequisites: Proficiency in calculus as demonstrated by completing a calculus sequence (MA 113, 114, 213,214), or consent of the instructor. Some familiarity with computer programming (MATLAB in particular), which is typically acquired in any undergraduate science or engineering curriculum, is desirable.

BME 530 Biomedical Instrumentation (3) Transducers, amplifiers for physiological measurements, biopotential measurements, and selected topics in biomedical instrumentation. Some of the topics include pressure, flow, ultrasonic and nuclear instrumentation and scanning and imaging devices. Lecture, two hours; laboratory, three hours per week. Prerequisite: EE 305 or equivalent.

BME 540 Mechanical Modeling of Human Motion (3)
An introduction to mechanical modeling of human motion (lectures) along with application of computational software to model and estimates internal tissues responses to physical demands of several different activities/tasks (lab activities). Prerequisites: EM 221, EM 313; or consent of instructor.

BME 579/EE 579 Neural Engineering (3) A multidisciplinary approach combining engineering principles for systems analysis and control, knowledge of biological control mechanisms, and computational properties of biological neural networks in the development of engineering neural networks for control applications. Topics include: equivalent circuit models for biological neurons and networks, non-linear differential equation representations, biological control strategies for rhythmic movements, design and development of controller for robot function, proposal development and presentation.

BME 580 Introduction to Biomedical Imaging (3)
A comprehensive introduction to bio-medical imaging systems used today, including xray imaging and computed tomography (CT), magnetic resonance imaging (MRI), ultrasound imaging (UI), and diffuse optical tomography (DOT). The course will review the fundamental mathematics underlying each imaging modality, the hardware needed to implement each system, and the image reconstruction and analysis. The class may involve homework, projects, and exams. Prerequisite: Engineering standing, or consent of instructor.

BME 599 Topics in Biomedical Engineering (Subtitle required) (3)
An interdisciplinary course devoted to detailed study of a topic of current significance in biomedical engineering, such as cellular mechanotransduction, systems biology, and tissue engineering. Prerequisite: Consent of instructor.

TOX 600 Ethics in Scientific Research (1) The course will commence with an overview of good laboratory practices and present them as the basis of good scientific research, along with an overview of quality assurance and appropriate practices in data analysis and data interpretation. The course will then move to the ethics of human and animal experimentation and discuss the concepts of data and intellectual property, their ownership and access to them. The problems of reviewing other workers' intellectual property such as grant applications,

research papers and other intellectual property will be addressed. Prereq: Research experiences; consent of instructor. (Same as VS 600.)

BME 605 Biomedical Signal Processing I (3) Continuous and discrete signals, sampling, Fourier transform, LaPlace transform, Z-transform, correlation and spectral analysis, digital filters. Prerequisite: EE 305 or equivalent.

BME 610 Biomedical Control Systems I (3) Homeostatic mechanisms, input-output analysis, steady state and transient response, feedback concepts, system identification and simulation from actual operating data. Prerequisites: PGY 502 and ME440 or equivalent.

BME 615 Biomedical Signal Processing II (3) Stochastic processes, Fourier-based spectral analysis and linear system identification, modern spectral estimation (AR, MA, ARMA), parametric transfer function estimation, time-frequency analysis of nonstationary signals. Prerequisites: BME 605, BME 610, EE 640 recommended.

BME 620 Biomedical Control Systems II (3) Biomedical systems models, dynamic programming, variational approach to optimal control problems, real-time parameter estimation, adaptive control methods and biomedical applications. Prerequisites: BME 605, BME 610.

BME 625 Analysis of Nonlinear Biomedical Systems (3) Basic concepts of nonlinear systems: iterated maps, dynamical flows, bifurcations, chaos. Modeling and analysis of nonlinear systems: Wiener kernels, white-noise identification, polyspectra, nonlinear time-series models. Extensive discussion of selected biomedical applications. Prerequisites: BME 610 required, BME 615 or EE 640 recommended.

BME 630 Magnetic Resonance in Biomedicine (3) Introductory course on the fundamental principles of magnetic resonance imaging and spectroscopy, and its uses in biomedical engineering. Topics include: quantum mechanical and classical descriptions of nuclear magnetic resonance, relaxation theory, signal generation, the Bloch equation and solutions, signal processing and encoding. Imaging and spectroscopy applications will be introduced. Several practical demonstrations will be given. Strong engineering/physics and mathematics background is necessary. Prerequisite: Undergraduate degree in engineering or physics.

BME 635 Magnetic Resonance Instrumentation and Measurement (3) Laboratory course on the fundamentals of magnetic resonance, instrumentation, measurement, and its biomedical applications. Begins with the nuclear induction experiment and ends with design and implementation of experiments to address engineering and physics problems that relate to the medical field. Instrumentation hardware and software will be taught. Strong engineering/ physics and mathematics background is necessary. Prerequisite: BME 630 or permission of instructor.

BME 640 Biomedical Engineering Ethics (1This course presents an engineering-based approach to study the system of ethics applicable to biomedical engineering. This course will describe and examine the responsibilities of biomedical engineers to stakeholders, e.g. patients, research subjects, and engineering clients as well as to the legal system (where applicable) and the profession as an entity. As a scholarly discipline, biomedical engineering ethics draws upon principles from subjects such as: the philosophy of science, the philosophy of engineering, and the ethics of technology. Materials from these principles will be used in this course with adaption to the special circumstances attending the practice of Biomedical Engineering.
MS students who joined the program before Fall 2013 will have an option of taking BME 774 or BME 640. MS students who started in the program in Fall 2013 and onwards must take BME 640. PhD students who started in the program in Spring 2014 and onwards must take BME 640.

BME 641 Practices of Biomedical Engineering (3) Survey of the regulatory, legal, managerial, financial and medical environment in which the biomedical engineering profession is practiced. This course attempts to provide the interface between the theoretical course material taught in the BME curriculum and the realities of the

diverse multidisciplinary world that is unique to the biomedical engineer. Outside guest speakers, in class lectures, and case history analyses will be used. Group term project is mandatory. Prerequisite: Engineering baccalaureates receive preference.

BME 642 Navigational Guides for Biomedical Product Designs (3) This course teaches how biomedical product designs are influenced by government regulations, economic issues, and ethical concerns. No prerequisites.

BME 661 Biomaterials Science and Engineering (3) Study of biological and man-made materials that perform, improve, or restore natural functions. Structure and properties of connective tissue and commonly implanted metals, ceramics, and polymers; biocompatibility of materials used in orthopedic, soft tissue, and cardiovascular applications. Prerequisite: Undergraduate engineering degree or consent of instructor.

BME 662 Tissue-Implant Interface (3) Study of the interface between implants and host tissues from both the materials and biological prospective. Structure of the tissue-implant interface; surface characterization of biomaterials; protein adsorption; mechanisms of cell responses; the methods for controlling the tissue-implant interface, with emphasis on orthopedic and cardiovascular applications. Prerequisite: BME 661.

BME 670 Biosolid Mechanics (3) Application of laws of mechanics to study the behavior of human organ systems. Stress-strain analysis of soft and hard body tissues and emphasis on pulmonary and musculoskeletal systems. Viscoelastic properties. Prerequisites: PGY 412G, EM 302 or consent of instructor.

BME 672 Musculoskeletal Biomechanics (3) Application of laws of mechanics to study the behavior of human organ systems. Whole body biodynamics: analysis of gait. Fluid mechanics of circulation. Steady and pulsatile flow in large blood vessels and microcirculation. Rheology of blood and other biological fluids. Prerequisites: PGY 412G, ME 330 or consent of instructor.

BME 680 Advanced Topics in Biomechanics (3) Flow limitation in compliant tubes. Impedance concepts in lung airways and vessels. Fluid mechanics of lung micro-circulation. Morphological analysis of bifurcating networks. Fractal analysis of blood flow. Stress wave in tissue. Structural analysis of body organs. Applications to the lungs, cardiovascular and skeletal systems. Prerequisites: BME 670 and BME 672 or consent of instructor.

BME 682 Advanced Topics in Orthopaedic Biomechanics (1) Seminars in orthopaedic biomechanics research exploring current clinical problems and engineering solutions. Prerequisites: BME 670 and BME 672.

BME 685 Biofluid Mechanics (3) Review of the rheology of circulatory processes in the body. Special emphasis on cardiovascular dynamics: pulsatile pressure and flow, vascular impedance, wave propagation/reflection, cardiac dynamics. Special topics. Lecture, three hours with periodic lab demonstrations. Prerequisites: PGY 502 or equivalent, BME 672, or consent of instructor.

BME 690 Research in Biomedical Engineering (Subtitle required)* (1-3) Individual study related to a special research project. Intended for M.S. candidates who want a research project independent of their M.S. thesis work. This course cannot be used to satisfy residency credit requirements. May be repeated to a maximum of six credits. Prerequisites: Consent of instructor and graduate standing in BME. Examples – BME 690 Research in BME: Cardiovascular Biomechanics; Cardiovascular Regulation; Hemodynamic Modeling; Respiratory Control; Mechanical of Prosthetic Joints; MIS Instrumentation. (All students need to sign up under their advisor's section when registering for this course.)

BME 699 Special Topics in Biomedical Engineering (Subtitle required)* (1-3) Special topics in biomedical engineering addressed primarily in a lecture/discussion format. Presentation of focused or specialized topics that is not available in standard courses. May be repeated to a maximum of nine credits. Prerequisites: Consent of instructor and graduate standing in BME. Examples – Special Topics in Biomedical Engineering: Advanced Biomedical Control; Biomedical Applications of Neural Networks; Hemodynamic Modeling; MRI Principles & Applications; Plasma Treatment of Biomaterials; Surface Modification of Orthopedic Biomaterials; Tissue Perfusion Simulation. (All students need to sign up under their advisor's section when registering for this course.)

BME 748 Master's Thesis Research (0) Half-time to full-time work on thesis. May be repeated to a maximum of six semesters. Prerequisite: All course work toward the degree must be completed. Most generally that would be the 3rd semester of your MS Curriculum.

BME 766 Management of Technology (3) Successfulness in developing new technologies relies upon knowing which technology advance, the ultimate scientific limits of that technology, and the forecasted rate technological change. This course presents curricula that explore the direction of technological change and how this affects the rate and extent of innovation. No prerequisites.

BME 767 Dissertation Residency Credit (2) Residency credit for dissertation research after the qualifying examination. If registered for 767, residency credit will be applied for a qualifying examination taken at any time during the first semester of enrollment in this course. However, you must schedule the qualifying examination through the Graduate School within the first 6 weeks of the semester. A minimum of two semesters are required as well as continuous enrollment (Fall and Spring) until the dissertation is completed and defended. (All students need to sign up under their advisor's section when registering for this course.)

BME 768 Residence Credit for the Master's Degree (1-6) May be repeated to a maximum of 12 hours. (All students need to sign up under their advisor's section when registering for this course.)

BME 772 Seminar (0) Review of current literature in the field of biomedical engineering, general discussion and presentation of papers on research in biomedical engineering. Lecture, one hour per week. Required for all graduate students in biomedical engineering. For other questions please review the syllabus for the class.

BME 777 Advanced Study Project (3) This is an independent study project, topic to be selected in consultation with the instructor. Purpose is to integrate all materials learned in the program and apply these principles to the solution of an actual problem in biomedical engineering technology. Prerequisites: Approval of instruction and completion of year 1 PBME studies. (All students need to sign up under their advisor's section when registering for this course.)

BME 781 Special Problems in Biomedical Engineering (Subtitle required)* (1-3) Discussion of advanced and current topics in biomedical engineering. Individual work on research problems of current interest. May be repeated to a maximum of nine credits. Lecture/laboratory hours, variable. Prerequisite: Approval of instructor. Examples – BME 781 Special Problems in Biomedical Engineering: Advanced Topics in Signal Processing; Analysis of Cardiac Arrhythmia; Biomedical Applications of Neural Networks; Cardiovascular Hemodynamics; Cell Biology and Orthopedics; Computational Neuroscience; Engineering Techniques for Assessment and Treatment of Adult Neurological Disorders; Growth Factors and Biomaterials; Neural Control of Physiological Systems; Neural Networks for Biomedical Engineering Controls; Pulmonary Mechanics; Respiratory Control. (All students need to sign up under their advisor's section when registering for this course.)

BME 790 Research in Biomedical Engineering (1-9) Graduate research in any area of biomedical engineering, subject to approval of the Director of Graduate Studies. May be repeated to a maximum of nine hours. Prereq: Consent of the Director of Graduate Studies. (All students need to sign up under their advisor's section when registering for this course.)

*See *Schedule of Classes* (https://myuk.uky.edu/zapps/slcm_coursecatalog/default.aspx) for current offerings.

PHYSICAL RESOURCES

The Department of Biomedical Engineering provides space, equipment and staff support for multidisciplinary research in the application of engineering principles to problems in medicine and the biological sciences. The Department occupies the entire fifth floor of the Robotics and Manufacturing Building. Special laboratories and capabilities include:

Bio-Photonics Laboratory (Dr. Yu) This laboratory develops near-infrared diffuse optical technologies for in-vivo measurements of tissue blood flow, oxygenation and oxygen metabolism. The research encompasses all aspects of optical imaging and spectroscopy ranging from small animals to large human tissue volumnes. The motivation is to explore the feasibility of optical instruments for diagnosis of various diseases (e.g., muscle vascular disease, cancers, brain injury and stroke) and longitudinal monitoring of therapies (e.g., photodynamic therapy, radiation therapy, chemotherapy). The goal is to create a strong bio-photonics research and teaching program, which vertically integrates optics, electronics, engineering and clinical translations.

Bone Quality Laboratory (Dr. Pienkowski) The Bone Quality Laboratory is dedicated to quantifying the structural and material properties of bone. This laboratory is the result of a joint effort between the Department of Medicine, Division of Nephrology, Bone and Mineral Metabolism and the Department of Biomedical Engineering. The Bone Quality Laboratory is the collective name for three separate functionally-linked facilities: 1) Bone Sample Preparation Laboratory, 2) Bone Diagnostic and Research Laboratory, and 3) FTIR Spectroscopy Laboratory. These laboratories occupy a total of 3,508 square feet in the Hospital of the University of Kentucky. They are equipped with a full range of hardware and software needed to process and analyze a wide variety of mineralized tissue specimens.

Cardiac Rhythm Laboratory (Dr. Patwardhan) The two facilities that comprise this laboratory are the rhythm dynamics laboratory and the arrhythmia laboratory. The focus of research conducted in the rhythm dynamics laboratory is on the use of linear and non-linear systems and signal analysis techniques to investigate the dynamics of cardiovascular function. Experiments are conducted to provide better understanding of the basic regulatory mechanisms in cardiovascular control and to develop tools for diagnosis of dysfunction. The research conducted in the arrhythmia laboratory focuses on the development of optimal therapies for termination of malignant arrhythmia such as ventricular fibrillation via timed electrical shocks. Both laboratories are equipped with instrumentation to measure cardiovascular function, computers for data analysis and acquisition, and platform for implementation of the developed algorithms on floating point DSP microprocessors

Cardiovascular Laboratory (Dr. Patwardhan/ J. Evans) This laboratory specializes in non invasive monitoring of cardiovascular parameters in healthy, fully reflexive human volunteers in response to environmental stresses. For that purpose, portable instrumentation packages including data acquisition computers and transducers for monitoring arterial pressure and flow, respiration, segmental impedance and peripheral flows can be transported to remote sites for “real world “monitoring. Equipment to apply controlled orthostatic stress includes: a treadmill housed inside a lower body positive pressure chamber (for looking at activities under partial weight conditions [simulating activities on the moon and Mars, for example]), lower body negative pressure chambers to produce time-dependent blood pooling; tilt tables; and a variety of software and statistical packages for off-line analysis of cardiovascular responses are available.

Extracellular Matrix Modification Research Laboratory (Dr. Hedman) This laboratory is focused on an injectable treatment approach for mechanically and nutritionally deficient tissues. The treatment strategy first discovered by Dr. Hedman involves chemical modification of the extracellular matrix of collagenous connective tissues to achieve improvements in mechanical properties. Our research team has shown that this approach has the potential to revolutionize the care, and the cost for care, for a wide variety of diseases. Current application areas for this novel technique include: spinal disc degeneration, spinal deformity, knee meniscus tears, flaccid soft palate in snoring and obstructive sleep apnea, and equine ligament and tendon tears.

Human Musculoskeletal Biomechanics Laboratory (Dr. Bazrgari) This laboratory focuses on the mechanical behaviors of the active neuromuscular and the passive musculoskeletal systems in the human body, and aims at controlling and managing musculoskeletal disorders. A primary area of current research in the lab is the biomechanics of the human trunk as it relates to low back pain. Using both in-vivo experiments and numerical simulations, we examine the effects of personal (e.g., age and physical fitness), physical (e.g., manual handling and vibration) and psychosocial (e.g., stress) risk factors for low back pain on the mechanical behaviors of the active and passive tissues in the human trunk. Also of interest are the effects of different treatment modalities (e.g., physical activity, exercise, manual therapies, and etc) for low back pain. Trunk kinematics and kinetics as well as muscle activities are collected during active (voluntarily and involuntarily) and passive trunk movements using both standard gait lab measuring instruments and custom-designed and fabricated experimental hardware. Obtained data are then input to several mathematical and/or mechanical models (e.g., finite element models, system identification models) to generate a comprehensive set of outcome measures describing the mechanical state of the human trunk. This information provides an estimate of mechanical risk of low back pain due to abnormal mechanics of the trunk; such abnormal mechanics can lead to excessive spinal loading and spinal instability, and we have particular interest in identifying and understand these injury mechanisms and pathways. What we learn has future application for controlling the level of exposure to low back pain risk factors in daily life and at work and potentially as biomarkers for assessing risk and developing/tracking treatment protocols.

Neural Systems Laboratory (Dr. Sunderam) Our research focuses on the diagnosis of brain states using physiological measurements, modeling and signal analysis, for applications in epilepsy therapy, sleep monitoring, neuroprosthetics, and cognitive science. For more information, please see our lab page (http://www.uky.edu/~ssu223/).

Regenerative Biomaterials Laboratory (Dr. Puleo) The objective of our research is to develop strategies for controlling cell and tissue interactions with biomaterials. Applications include promoting bone formation around orthopedic and dental implants, healing of bone defects, augmentation of alveolar bone, and regeneration of growth plate. Our approach is to modulate cell responses by delivering small molecule drugs and biomolecules (*e.g.*, growth factors and genes) in novel ways. The lab is equipped to: prepare biomaterial samples; modify biomaterials by immobilizing and releasing biomolecules from the surface; fabricate controlled release devices and tissue engineering scaffolds; isolate, culture, and characterize mesenchymal cells; conduct *in vitro* and *in vivo* assessment of cell and tissue interactions with biomaterials; and perform quantitative colorimetric and fluorometric biochemical assays. The lab maintains ties with collaborators in the Colleges of Arts and Sciences, Dentistry, Engineering, Medicine, and Pharmacy.

Cellular Mechanobiology and Engineering Laboratory (Dr. Shin) Our research addresses fundamental, but elusive, issues regarding the role of mechanical forces in controlling human biology, specifically identifying the cellular component(s) responsible for sensing and converting mechanical forces into a biological event (i.e., mechanotransduction). Current efforts focus on the involvement of fluid mechanics in regulating the functions of cardiovascular cells (e.g., endothelium, white blood cells) involved in physiological processes (e.g., inflammation, blood vessel remodeling). Our objective is to answer two basic questions: 1) how mechanical stresses serve as regulators of vascular cell activity and 2) how dysregulated vascular mechanotransduction contributes to the onset/progression of human diseases. For this purpose, we utilize cell biomechanics methodologies (e.g., micropipette apparatus, custom-fabricated flow and pressure chambers, computational modeling, etc.) in conjunction with current cell/molecular biology technology (fluorescence microscopy, recombinant DNA, biochemical analyses tools, etc.) to define the role of mechanics in the biology of cardiovascular cells and, from these efforts, develop novel research tools, therapeutic approaches, and tissue engineering strategies.

OPERATING POLICIES AND PROCEDURES

Student-Related:

- High school student (and those under 18 years) access to a BME lab.
  Professor provides copy of permission from EHS.
  Professor email staff and request a link blue ID to get access to complete required training before work in lab can be started. Information needed in email.
    Students full name--First, Middle and Last
    Birthdate
    Beginning work date
    Ending work date
    Access required
  Staff requests UKID # from IT person, IT will send students UKID# to staff and she/he will forward to student and professor.
  Professor email staff confirming training is complete.
  Once training is complete. Staff will forward professors email to Dr. Patwardan and request permission for High School student to access lab. High School students may not have card access to lab. They must be accompanied by a BME graduate student in lab at all times.

- UK Undergraduate student access to BME lab.
  Professor email staff and request access. Information needed.
    Students full name
    Copy of front and back of students UKID card
    Beginning work date
    Ending work date
    Access required
  Staff forwards professors email to Dr. Patwardan and requests permission for required access.

- Outside Undergraduate or Graduate Student access to BME lab.
  Professor email staff and request link blue UKID# if needed (see information above for HS students).
  Professor email staff and request access. Information needed.
    Students full name
    Copy of front and back of students UKID card
    Beginning work date
    Ending work date
    Access required
    Professor email staff confirming all required training is complete.

Staff forwards professors' email to the chair and requests permission for required access.

- Conference Support: (Student Support) All doctoral candidates are eligible to apply to the Graduate School for support if they have been accepted to present at a conference or professional meeting. Details are available at http://www.research.uky.edu/gs/fellowship/studentsupport.html. Students will not be reimbursed for their travel until all Graduate School funding is exhausted.

- Dropped Courses: In light of budget constraints and to maximize existing funds used for tuition assistance, the Graduate School will not pay drop charges for students who reduce hours below full-time status (usually 9 hours) or withdraw from the University on or after the first day of class. The policy includes funded students such as those on fellowships and assistantships. This means the student will be liable for any tuition charges for dropped courses after the first day of classes, if they fall below full-time status.

- Outside Employment: Stipends associated with research assistantships are provided to cover living expenses for students pursuing a graduate degree. Outside employment is strongly discouraged, as it interferes with the student's ability to obtain optimal training. However, provided that the graduate student continues to fulfill program requirements, limited outside employment may be permissible. Outside employment must be approved by the student's advisor and Director of Graduate Studies. Approval for outside employment will be re-evaluated on a yearly basis. By accepting an assistantship or fellowship, the student takes on the responsibility of devoting adequate time to completion of program requirements. Students should recognize that outside employment could impact satisfactory progress toward completion of the degree to the point that the research assistantship may be discontinued.

- Pay and Holidays: The pay rates are shown on page 33, and official university holidays are shown on Appendix E. Any work schedule changes require the approval of the student's major professor.

- Review of Student Progress: Assessment of progress towards completion of the University's degree requirements is an integral part of our program. In order for students to remain in good academic standing, it is essential that they continue to make satisfactory progress towards completion of their course work and research requirements irrespective of whether they have financial support from the program. Therefore, student performance will be evaluated at the end of each semester (or at other intervals, if deemed necessary by the Director of Graduate Studies). The reviews will be performed by the student's primary advisor, with input from the biomedical engineering faculty and the master's or doctoral advisory committee as appropriate. A copy of the written evaluation will be given to the student as well as a copy placed in the student's official file.

  Good progress consists of succeeding in course work with at least 3.0 GPA, presenting a seminar based on the student's research, passing the doctoral qualifying exam (as appropriate), and a combination of the following measures of research productivity: successfully completing experiments that lead to submission of student-authored abstracts, presentation of research findings at regional, national, and/or international meetings, preparation of manuscripts for publication in peer-reviewed journals, and passing the final exam (thesis or dissertation defense).

- Safety Training: The College of Engineering is serious about safety. In addition to lab-specific training (speak with your advisor about this), the College conducts its own training classes that are REQUIRED for ALL BME GRADUATE STUDENTS. UK Environmental Health and Safety requires that all graduate students working in chemical labs attend an annual Chemical Hygiene Refresher course. Dates of training and refresher courses will be distributed at the appropriate times.

  Level 1 – Fire Safety – All students must take this course.
  Level 2 – Shop Safety – Students working in a machine shop-type environment with power tools should take this course.
  Level 3 – Chemical Lab Safety/ Hazardous Waste Disposal – Students working in wet chemical labs
  Level 4 – Biohazard Safety – Students working in labs with biohazards

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- Seminar Programs and Meetings: The BME Program has both regularly and specially scheduled seminars. The topics for these seminars are chosen to provide information to enhance graduate education, and each graduate student **is required** to pre-register each semester and attend each seminar. Seminar announcements will be distributed by e-mail and posted on selected bulletin boards. All students enrolled in our PhD program are required to present at least one seminar in the Department seminar series per year starting their second year. A student may count an oral presentation made by the student at an International/National/Regional meeting affiliated with a recognized professional scientific or engineering society in lieu of a seminar. Oral presentations at these meetings may be used to meet the seminar requirement multiple times, but not in consecutive years. That is, if a student has given an oral presentation in any year and wishes to count that as

the seminar requirement, then the next year, he/she must give a seminar in our series irrespective of whether the student gives another oral presentation at a scientific meeting that year. Note that poster presentations and oral presentations made to group/lab meetings will not count as meeting the seminar requirement.

Student Health Insurance: The Graduate School enrolls all full-time research assistants in the Academic Health Plan. A card will be mailed to your student billing address within 30 days. Please email GSFH@email.uky.edu or phone at (859) 257-6608 if you have any questions. Be aware that AHP is a "hospitalization only" plan. If a student wishes to obtain a broader coverage plan, s/he is responsible for the additional premiums.

All full-time students pay a mandatory health fee ($175.00) and a recreation fee of $125.25 in the fall and spring semesters that entitles them to most services at University Health Service (Student Health) and Johnson Center at no cost. The health fee is voluntary for most students in the summer, as well as for all part-time students in the fall and spring semesters. Please see http://uky.myahpcare.com/ If you are a part-time student or a graduate student enrolled in a zero credit hour class or 767 (2), you may request a voluntary health fee and pay the charge at the Student Billing Office in Funkhouser Building. Please check the University Health Services website for deadlines on the health fee payment at http://www.ukhealthcare.uky.edu/uhs.

The student health insurance fee is covered by department if you are a full RA and is an injury and sickness plan that includes hospitalization benefits. Costs are $823 for the fall and $1,343 for the spring/summer for 2016-2017. The plan is a preferred provider organization (PPO) and UK Hospital and UK College of Medicine physicians are the preferred providers (in area). When receiving treatment away from UK, you may experience significantly higher out-of-pocket costs. The insurance plan is underwritten by United Healthcare Student Resources: http://uky.myahpcare.com/.

Since UK is the preferred provider for the student health insurance plan, University Health Service and student health insurance work well together. For example, students who receive treatment at University Health Service for medical services not covered by the health fee may file their claims with the insurance company.

Graduate students who are not registered in classes but are actively engaged in research leading to a degree are eligible to use the Health Service and pay the health fee. These students may be asked to obtain verification of their status from their department chairperson, dean or academic advisor each semester.

Student Registration and Add/Drop are your Responsibilities: It is imperative that you pay particular attention to pre-registration notices and announcements each semester. If you are **NOT** enrolled as a **full-time** student (9 cr hrs/sem, 4 cr hrs in 4 wk, 6 cr hrs in 8 wk), **FICA** and **taxes** will be deducted from your salary each pay period. Full-time status exempts you from this burden. Enrollment in BME 748 for 0 cr hrs is considered full-time, as is BME 767 for 2 cr hrs. Students who are working in the summer but not taking classes have to pay the FICA taxes.

- Telephones: You are reminded in the laboratory due to the level of activity, it is therefore necessary to keep personal calls to an absolute minimum in both number and time. If you are requested by your supervisor to make research-related calls, please use a phone in his/her office, so the proper research account can be charged.

General Information:

1. Absences: (travel, other), requires all students, to fill out an absence form on the departmental website. Staff, and faculty are required to enter on-line.
   (illness, vacation, other), requires faculty to fill out an absence form on the departmental website. http://www.bme.uky.edu/general/departmental-documents/or at
   http://www.uky.edu/eForms/Forms/absence.pdf). An absence sheet should be submitted even after the fact (if one cannot be filled out prior to the absence). If you will be arriving late or are unable to work because of illness, please inform your immediate supervisor/advisor as soon as possible.

2. Address and Phone Number Changes: Update home address and phone number in myUK and inform Staff and Sue Mills for completion of appropriate documents.

3. Building Maintenance: If you have a problem in your area, such as lights being burned out, the temperature being excessively hot or cold, water leaks, or any other repairs or maintenance needed in common areas, such as hallways, bathrooms, and lunchroom, that need attention, please report this to Becky along with the specific details of the problem and the room number. She will contact the Facilities Management to request that the problem(s) be resolved. If the problem occurs during non-business hours and is of an urgent nature, report the issue to the physical plant help desk at 257-3844.

4. Bulletin Board Information: Several bulletin boards are located in the Department. Please pay attention since information may apply to you. All posted notices must be dated and removed after the event has taken place. Help keep the boards clean, neat, and up-to-date.

5. Clean-up of Work Areas: To help maintain a collegial and safe working environment, please keep your student office desks and lab areas clean.

6. Computing Resources: In addition to the computers in your mentor's lab, you will have access to several shared-use computers within the Department. Each computer in the Department is registered with an IP address, and it is a **violation of University policy to change the IP address**. Network abuses will not be tolerated, and violations will result in the loss of network privileges. Please be aware of the UK Computing policy (http://www.uky.edu/UKIT/policies.htm). If you choose to bring a personal computer, wireless network access (SSID: uky.edu) is available throughout the department. Support for certain software and hardware is available from COE Engineering Computing Services You may call them at 257-3518, send e-mail to help@engr.uky.edu or drop by our office at 280 FPAT. If you send e-mail, please include a subject and a brief description of the problem in the body of the message.

7. Conference Room Scheduling: Please see Sue Mills or Jennifer Hart.

8. Copier, Scanner and Fax Machine: The department has a new copier/scanner/fax machine located in Room 522 RMB. You have access with your UK Linkblue ID (8 numbers) to copy/scan/fax. If you have any mechanical problems with the machine, please do not attempt to fix the problem; please see Staff or Sue Mills. Please keep Room 522 neat. **Do not** leave excess paper lying around or remove any supplies (i.e., stapler) from this room**.** Report any problems to either Staff or Sue Mills.

9. Emergency/Fire Exits: If an alarm sounds, all Department personnel will be notified immediately and will be required to exit the buildings (see maps in Appendix F). Know the closest route to an exit from both your office and lab. Be prepared before an emergency occurs!

10. Access to Fifth Floor BME: Bring your student ID and room #'s needed to Jennifer Hart and request access.

11. Student Desks/Locker Keys: You will receive a key to lock your desk. If lost, you will be responsible for the cost of a new key. Please see Staff for desk/key assignment. You must return the key upon graduation.

12. Laboratory Equipment: No equipment purchased by or assigned to the Department is to be removed from the building without the knowledge and approval of either the Principal Investigator (for research lab equipment) or the Chair of the Department (for other items). IN ALL CASES, A CHECKOUT SHEET MUST BE COMPLETELY FILLED OUT BEFORE ANY EQUIPMENT IS REMOVED FROM THE BUILDING. Acquisition of surplus equipment must be approved by the Principal Investigator of the project that will use the equipment or the Department Chair. All items (with property numbers) entering the Department must be inventoried.

13. Laboratory use after Regular Hours: As a research and academic facility, the laboratory is available for activities on a 24-hour basis. However, only departmental personnel are permitted access during off-duty hours unless: (1) permission has been obtained from a principal investigator or (2) non-employees are accompanied by department faculty, staff, or students.

14. Letterhead Stationery: BME letterhead stationery and envelopes are for official use *ONLY*. It is a violation of University policy to use official stationery for personal correspondence.

15. Kitchen Area: Room 324 is available for use by all department personnel. Please keep the areas clean, including the microwave ovens. Please identify your food and remove any **SPOILED** personal food stored in the refrigerator on a regular basis. If you use the refrigerator regularly, you may be asked to clean and/or defrost it.

16. Student Lounge: Room 322 is available for use by engineering students only. Please keep the area clean.

17. Machine Shop: The Mechanical Engineering machine shop, housed in the basement of the Ralph G. Anderson Building, provides a range of services for the College of Engineering. Contact Herb Mefford (7-6336 X80757) for more information.

18. Mail: Incoming mail will be delivered to your desk. Do not have personal mail sent to the office/lab. For sending out mail, please use the appropriately marked trays in RMB 522. Staff will deliver to post drop once daily.

Campus – free	Stamped – personal, USE CORRECT POSTAGE
USA Metered – BME official use ONLY	International Metered – BME official use ONLY

    NOTE: For USA and International METERED mail, be sure to use the appropriate postal code and account number for appropriate billing**.** See Staff or Sue for assistance.

    UPS and Federal Express services are available for official departmental use. A copy of **ALL** airbills must be given to Sue Mills for payment. **Otherwise, if a record is not on file, the sender (you) could be responsible for the payment.** Please see Staff for further details.

19. Map: A link to the campus is provided for your convenience: http://www.uky.edu/CampusGuide/

20. Parking Information: Applications for parking permits can be submitted online (http://www.uky.edu/Parking/) or call 257-5757. The parking tag should be returned to the UK Parking Department upon termination of your employment. Students must be registered for either part-time or full-time to be eligible for a parking pass. If conducting research during the summer, you will need to be enrolled in a research/thesis course.

21. Purchasing: Procurement Cards (Visa) are to be used for most small dollar purchases. Some restrictions apply. Please contact your supervisor about making research-related purchases. Submit Procard Order Forms, packing slips, and invoices for all purchases to Sue Mills. Procard Order Forms are located on the website at http://www.bme.uky.edu/general/departmental-documents/.

22. Security: Under **NO** circumstance should doors be propped open. If you are expecting a visitor before or after normal business hours, meet at the elevators and escort him/her into the department.

23. Severe Weather Safety: Look for signs showing Shelter areas at all exits. Please visit http://wwwagwx.ca.uky.edu/stormready/safeplaces.shtml?0108#safe to view severe weather information. Be prepared before an emergency occurs!

24. Smoking: A tobacco-free policy, which prohibits the use of all tobacco products on campus (cigarettes, chew, pipes, cigars, snuff, etc.), applies to all areas of the contiguous UK campus in Lexington, both indoors and out. Assistance to stop smoking is available through the UK Wellness Program. Anyone interested should contact the Wellness Program at 859/257-WELL.

25. Travel: The Travel Management Services program is available online at http://www.uky.edu/Travel/. Particular restrictions apply to purchase of airplane tickets and foreign hotel rates. **If you have questions, contact Staff or the Travel Department for assistance prior to buying the tickets**. A Pre-Travel form must be completed 30 days prior to departure or at the time of registration and submitted to Staff. Also, it is necessary that you submit an online travel request in MyUK or submit an Absence Form to Staff or Sue Mills before you leave on trips. Upon return, travel reimbursement is processed **ONLY** if documentation of airfare comparisons and all proper receipts, including all expenses paid by a procurement card, along with a completed Travel Request form (After Travel Form) are submitted. Sue Mills must receive the original copy of documentation for ALL procurement card purchases and Staff a COPY of the following procurement card purchases (airfare, registration, hotel, etc.) **If University guidelines are not followed, you may not be reimbursed**. Pre- and post-travel forms can be found under Departmental Documents on the BME web site. TRAVEL POLICY UPDATE Travel policy was updated in January. Changes included the following language: Failure to submit a valid cost comparison may result in your reimbursement being reduced to the historical lowest airfare in the market**. Therefore, there is no longer a need to submit an exception request when there is not a valid cost comparison**. Our Director of UK Travel Program has the ability to pull up historical fares and will make the determination on the amount to reimburse. This is for all instances where a cost comparison is needed and individual failed to secure a valid cost comparison as defined in policy:

    - ☐ When used an alternate vendor
    - ☐ Determining reimbursement limit when driving over 400 miles
    - ☐ Combining personal with business travel

26. Motor Vehicle Release (MVR): An MVR is required for any vehicle that you drive for UK business, regardless of whether you own the car or are renting the vehicle. Accounts Payable will not reimburse expenses without an MVR on file. This is a one-time document; once you have completed the MVR form, you will not need to fill out another. Please bring the form to Staff to keep on file. The form can be found at http://www.uky.edu/eForms/alphaindex.php?startswith=M.

27. Working hours for staff: Regular staff working hours are from 8:00 a.m. to 12 p.m. and from 1p.m. to 5:00 p.m., Monday through Friday. Full-time Department staff are expected to observe these hours. However, in accordance with University Regulations, exceptions to these hours can be made to accommodate special needs when justified. Approval from the Department Chair or your immediate supervisor is required for such exceptions.

GRADUATE STUDENT WORK SCHEDULE (2016-2017) AND CALENDAR

Fall Semester 2016:

Aug 03 – Dec 13	20 hrs/wk. or equiv. (as per P.I.) or NO PAY
Aug 24	Wednesday – Classes begin
Sept 5	Labor Day holiday
Sept 20	Thursday – Last day for filing an application for a December degree in college dean's office
Oct 17	Monday – Midterm
Oct – Nov 22	Priority Registration for the Spring Semester 2016
Nov 10	Thurs – Last day for candidates to schedule final exam for December degree.
Nov 23 – 26	Thanksgiving holidays (no classes on Wednesday but University still open)
Dec 1	Thursday – Last day for candidates for a December graduate degree to sit for a final exam
Dec 9	Friday – Last day of classes
Dec 12-16	Final Exams
Dec 16	Last day for candidates for a December degree to submit a thesis/dissertation to the Grad School
Dec 26 – 31	Christmas/special holidays
Jan 1, 2016	New Year's holiday
Jan 2, 2016	Special holiday

Spring Semester 2017:

Dec 14 – April 25	20 hrs/wk. or equiv. (as per P.I.) or NO PAY
Jan 11	Wednesday – Classes begin
Jan 16	Monday – Martin Luther King Jr. holiday
Feb 20	Thursday – Last day for doctoral candidates for a May degree to submit a Notification of Intent to schedule a final examination in The Graduate School
Feb 20	Last day to submit application for degree, to rec'v May (spring) 2017 degree
Mar 6	Monday – Midterm
Mar 27 – Apr 18	Priority Registration for the Summer Sessions & Fall Semester 2017
Apr 20	Friday Last day for candidates for a May graduate degree to sit for a final exam
Apr 28	Last day of classes
May 1 – May 5	Final Exams
May 5	Friday – Last day for candidates for a May degree to submit a thesis/dissertation to the Grad School
May 5	Friday – End of 2016 Spring Semester

Summer 2015:

April 26 – August 1	40 hrs/wk. or NO PAY
May 26	Monday, Memorial Day holiday
July 4	Friday, Independence Day holiday

Other holidays may be worked out with your immediate supervisor and/or the Chair.

Tuition and Fee Information Please update

(See http://www.uky.edu/Registrar/feesgen.htm)

Full-Time Students enrolled in The Graduate School (9 credit hours in the regular semester)

Tuition and Fees for 2015-2016	Semester Full-Time Fee	Part-time, 4 Week and 8 Week Intersession Fee Per Credit Hour
Resident	$6,118.00	$648.00
Nonresident	14,190.00	$1,544.00

Student Program Course and Administrative Fees -- $55.00 Per Credit Hour

Important Grant Information for Faculty

Fringe Benefits

Benefit	Faculty	Staff	Post Doc	Graduate/ Undergraduate Students
Retirement	10%	10%	N/A	N/A
Social Security	7.65%	7.65%	7.65%	7.65%
Other Fringe	3.6%	3.9%	1.2%	1.2%
Total	21.25%	21.55%	8.85%	8.85%
PLUS A Prorated Amount of Health and Life Insurance Multi-year projects should project a 3% increase in insurance per year				
Employee	$471/mo $5,652/yr	$471/mo $5,652/yr	$471/mo $5,652/yr	$2166/year
Employee + Children	$613/mo $7,356/yr	$613/mo $7,356/yr	$613/mo $7,356/yr	N/A
Employee + Spouse	$735/mo $8,820/yr	$735/mo $8,820/yr	$735/mo $8,820/yr	N/A
Employee + Family	$862/mo $10,344/yr	$862/mo $10,344/yr	$862/mo $10,344/yr	N/A
Life Insurance	$3/month	$3/month	$3/month	N/A
*Successive years should be increased by 10.5%.				

Graduate Student costs

Year	Tuition*	Health Premium
’15-‘16	$11,148 (est.)	$2,166(est.)
’16-’17	$12,000 (est.)	$2,500 (est.)
’17-‘18	$12,500 (est.)	$2,800 (est.)
’18-‘19	$13,000 (est)	$3,200 (est.)

* budgeted under “Other” direct costs

Summary of costs to be budgeted for a full-time research assistant

	2015-16		2016-17	
	M.S.	**Ph.D.**	**M.S.**	**Ph.D.**
Stipend/Salary	$18,000	$21,500	$18,000	$21,500
Other Fringe	$216	$258	$222	$266
Health	$2,166	$2,166	$2,200	$2,200
Tuition	$11,148	$11,148	$11,500	$11,500
FICA*	$1,377	$1,645	$1,418	$1,694
Total with FICA	$32,907	$36,717	$33,880	$37,805
Total without FICA	$31,530	$35,072	$32,462	$36,111

* Students who carry certain course loads are exempt from FICA. However, UKRF suggests FICA be included for all students because student loads are often below the required level.

Facilities and Administration Costs

Effective 7/1/2015 through 6/30/17:

Indirect Rates	**On Campus**	**Off Campus**
Research	50%	26%
Instruction	46%	26%
Other	31.5%	21.6%
Agricultural Research	40%	20%

Included in the base: all salaries and wages, fringe benefits, materials and supplies, services, travel and subgrants and subcontracts up to $25,000 of each subgrant or subcontract.

Excluded from the base: equipment, capital expenditures, charges for patient care and tuition remission, rental costs of off-site facilities, scholarships, and fellowships as well as the portion of each subgrant and subcontract in excess of $25,000.

Other useful information can be found at http://www.research.uky.edu/ospa/info.html

APPENDIX A

DEPARTMENT OF BIOMEDICAL ENGINEERING

DEPARTMENT CONCERNS AND QUESTIONS DIRECTORY

Concerns and questions should be directed to the following staff members:

SUE MILLS	**JENNIFER HART**	**COE IT Services (Phone #**(7-1346**)**
Administrative Concerns	***Office and Student Concerns***	***Computer/Electronic Concerns***
Accounts for Department & Faculty	Add/Drop/Handbook updates	Hardware problems*
Address/Phone Changes	Address/Phone Changes	Software problems*
Computing Center Accounts	BME Program Information	
Copier & Fax Maintenance	Building Maintenance/Repairs	
Credit Card Purchases	Class Rolls and course updates	
DAVs, PDR's	Copier & Fax Maintenance	
Faculty Meeting Minutes	Course(s) and Registration	
Holidays/Vacation/Sick Time	Alumni Information	
IDIVs	Grades/Transcripts/Student Files/Student desks	
Mail Services Info.	Mailing Services Info.	
Office Supplies	Office Supplies	
Parking Permits	Room Scheduling	
Payroll / Payroll Schedules	Seminar Announcements	
Personnel Issues	Equipment & Space Inventory	
Purchasing	Thesis/Dissertation Files	
UK Library Xerox Cards	Travel Procedures	
Building Maintenance/Repairs	Biorhythms Newsletter	
	Website Updates/Corrections	
	Access to building and rooms	

APPENDIX B
DEPARTMENT'S TELEPHONE DIRECTORY

Faculty/Staff/Postdocs	Phone	Office	E-Mail Address	Lab Phone	Lab Room
Bazrgari, Babak	7-1379	514E	babak.bazrgari@uky.edu	3-3976	513
Evans, Joyce	7-2685	514G	jevans1@uky.edu	8-5165	508B
Fax for BME	7-1856	522	---	---	---
Staff	7-8101	522		---	---
Huang, Chong	8-5164	514H	chu234@uky.edu	3-7330	509
Knapp, Charles			knapp@uky.edu	8-5165	508B
Mills, Sue	7-2783	522	bsmill01@uky.edu	---	---
Patwardhan, Abhijit	7-2728	514A	abhijit@uky.edu	7-2741	515
Pienkowski, David	3-1568	514F	pienkow@.uky.edu	8-5167	523
Puleo, David	7-2405	522A	puleo@uky.edu	8-5168	521
Sunderam, Sridhar	7-5796	514B	sridhar.sunderam@uky.edu	8-5166	511
Yu, Guoqiang	7-9110	514C	guoqiang.yu@uky.edu	3-7330	509
Conference Room	8-5172	512			
Instrumentation Lab	8-5171	508A			
Shared Lab	8-5169	519			

Graduate Students	Office	E-Mail Address	Lab Phone	Lab
Ajwad, Asma'a	510	asmaa.ajwad@uky.edu	8-5166	511
Al-Bakrei, Amir	510	amir.al-bakrei@uky.edu	8-5168	511
Asafo-Adjei, Theodora	510	taas222@email.uky.edu	8-5168	521
Bahrani, Ahmed	510	aaba228@l.uky.edu	3-7330	509
Biswal, Dibyajyoti	510	dibyajyoti.biswal12@uky.edu	7-2741	515
Chen, Alexander	510	alexander.chen@uky.edu	8-5168	521
Haddix, Chase	510	chase.haddix@uky.edu	8-5166	511
Hameed, Wissam	510	wissam.hameed@uky.edu		
Huffman, Dillon	510	dillion.huffman@uky.edu	8-5166	511
Irwin, Daniel	510	daniel.irwin@uky.edu	3-7330	509
Kohrs, Nicholas	510	nicholas.kohrs@uky.edu	8-5168	521
Mazdeyasna, Siavash	510	mazdeyasna@uky.edu	3-7330	509
McKenty, Taylor	510	t.mckenty@uky.edu	3-5009	517
Najarzadeh, Amir	510	ahnaja2@uky.edu	8-5168	521
Shojaei, Iman	510	Ish222@uky.edu	3-3976	513
Thalman, Scott	---	scott.thalman@uky.edu		
Thomas, Sarah	510	sarah.thomas3@uky.edu	8-5166	511
Thyagarajan, Sridevi	510	sridevi.thyagarajan@uky.edu	7-2741	515
Vazirian, Milad	510	milad.vazirian@uky.edu	3-3976	513
Wehner, Gregory	---	gregory.wehner@uky.edu	8-1611	B343 (BBSRB)
Wieman, Kevin	510	kevin.wieman@uky.edu	3-5009	517
Zhao, Mingjun	510	mingjun.zhao@uky.edu	3-7330	509

E-mail lists for BME: **all faculty: cbme-faculty@lsv.uky.edu** **all staff: cbme-staff@lsv.uky.edu**
all students: bme-students@lsv.uky.edu

TO EMAIL ALL: bme@lsv.uky.edu

TO REVIEW members on the above lists send an email to: listserv@lsv.uky.edu (body of the message should read):
review bme-students or review bme-faculty **Do not put any additional information**

APPENDIX C

INFORMATION AND REQUIREMENTS FOR ALL ADVANCED DEGREES

[see Graduate School Bulletin for full details
http://www.research.uky.edu/gs/CurrentStudents/bulletin.html]

Please note that the information given below is provided as a courtesy and the Graduate School Bulletin supersedes the information provided here. The bulletin may be updated more frequently than the information provided below, therefore, it is important that the Bulletin is referred for the most current information.

Student Responsibility

It is the student's responsibility to be informed concerning all regulations and procedures required by the course of study being pursued. In no case will a regulation be waived or an exception granted because a student pleads ignorance of the regulation or asserts that information was not presented by advisers or other authorities. Therefore, the student should become familiar with the Graduate School Bulletin, including 1) the section presenting the requirements for degrees and 2) the specific program offerings and requirements.

The Thesis/Dissertation Advisor and the Director of Graduate Studies should be consulted concerning course requirements, any deficiencies, the planning of a program, and special regulations. Programs may have degree requirements that are not listed in the Bulletin. It is to be noted that the Dean of the Graduate School interprets the Graduate Bulletin. Only the Graduate Council may waive requirements stated in this Bulletin.

Graduate Courses

All courses numbered 500 through 799 may be counted for credit toward a graduate degree provided they are approved as an appropriate part of the student's graduate program by the student's graduate adviser or committee. Courses numbered 400G to 499G carry graduate credit for non-majors only.

Academic Load

The total semester or term academic load of a student is the sum of all credits and credit equivalents (e.g., graduate language courses, undergraduate courses, courses audited, etc.) being carried. The normal academic load of a graduate student during any semester is nine credit hours or equivalent. Under no circumstances may it exceed 15 credit hours or equivalent. During the summer term, the maximum academic load for the second summer term is nine credit hours, and for the first summer term are four credit hours. The maximum academic load for any combination of the first and second summer terms is 12 credit hours.

Students satisfactorily completing nine course credits, or equivalent, of graduate level work during a semester, are classified as full-time students by the University. Students satisfactorily completing five course credits, or equivalent, during a summer term are classified as full-time. Those completing less than these amounts are classified as part-time. For the student who is a full-time research assistant or

whose service to the University requires approximately 20 hours per week, the academic load shall not exceed 10 hours. This maximum may be increased to 12 hours for students with lighter service loads upon recommendation of the Director of Graduate Studies and approval of the Dean of the Graduate School.

Full-time students who fall below the minimum full-time equivalent as the result of failing or dropping one or more courses are reclassified as part-time students for that semester or term.

Grades and Grade Point Averages

All incompletes (I grades) must be replaced by a regular final letter grade within 12 months of the end of the academic term in which the I grade was awarded or prior to the student's graduation, whichever occurs first. If an I grade has not been replaced within the allowable period, the University Registrar shall change the I grade to a grade of E on the student's permanent academic record and adjust the student's grade point average accordingly, unless otherwise approved because of exceptional circumstances by the Dean of the Graduate School upon recommendation of the Director of Graduate Studies in the student's program.

All I, S and U grades must be removed prior to the final examination (or qualifying examination for doctoral students), except for those given in Residence Credit 748, 749, 767, and 768, or in graduate courses which carry no credit. An overall average of B (3.0) on all graduate work in the program must be attained before an advanced degree may be awarded. Graduate-level courses (numbers 400G-799) are computed in the graduate grade-point average, with the exception of 400G courses in the student's program.

Scholastic Probation

When students have completed 12 or more semester hours of graduate course work with a cumulative GPA of less than 3.0, they will be placed on scholastic probation. Students will have one full-time semester or the equivalent (nine hours) to remove the scholastic probation by attaining a 3.0 cumulative GPA. If probation is not removed, students will be dismissed from the Graduate School. Students who have been dismissed from the Graduate School for this reason may apply for readmission to the Graduate School after two semesters or one semester and the eight-week summer term. Readmitted students will have one full-time semester or the equivalent (nine hours) to remove the scholastic probation by attaining a 3.0 cumulative GPA. Students placed on scholastic probation are not eligible for fellowships or tuition scholarships and may not sit for doctoral qualifying examinations, or masters or doctoral final examinations.

Time Limit for Degrees

Master's/Specialist Degrees. Activities used to satisfy degree requirements must be completed within eight years preceding the proposed date of graduation. Extensions of time will be considered by the Graduate Council only upon written recommendation by the appropriate Director of Graduate Studies. No activity completed more than 12 calendar years preceding the proposed graduation date will be considered for graduation.

Doctoral Degree. All degree requirements for the doctorate must be completed within five years following the semester or summer session in which the candidate successfully completes the qualifying examination. In the event that all degree requirements are not met during the five-year period, degree candidates who provide evidence of the likelihood of completing the degree during an extension of time may be granted such an extension by the Graduate Council. Requests will be considered only upon written recommendation of the Director of Graduate Studies after the candidate has again successfully completed the qualifying examination process as currently administered by the program. (Note: Failure to pass the re-examination will result in the termination of degree candidacy; a second re-examination is not permitted.) An extension of no more than five years may be granted.

Thesis and Dissertation Fees

Thesis fees cover the cost of binding the thesis, microfilming, and copyright. The Thesis fee for a Plan A master's degree is $14; Fees can change without notice. Authorization forms used for paying and thesis and dissertation fees are issued in Room 106, Gillis, or go to Graduate School website: http://www.research.uky.edu/gs/forms.html.

The base dissertation fee is **$74**. The charge's must be paid in Student Billings Services, 18 Funkhouser Building. No diplomas will be released without payment of the applicable thesis/dissertation fees.
In order to register the dissertation copyright, the candidate must (1) sign the Copyright Authorization statement on the Microfilm Agreement Form and submit this form with the final two copies of the dissertation; (2) pay the copyright fee of **$65** (this copyright charge is in addition to the $74 dissertation fee); and (3) include a copyright notice in the dissertation.

Graduation (Commencement)

Graduate degrees may be conferred at the close of either semester or the second summer session, but Commencement exercises are held only in May and December. Students who are eligible to receive degrees at the end of the summer session or the fall semester may participate in the December Commencement exercises. Appropriate academic regalia must be worn. To be eligible to receive a degree, a student must submit an on-line "Application for Degree" form via: http://myuk.uky.edu/StudentServices/myRecords/GraduateDegreeApplication. Applications must be received in the Graduate School within 30 days of the start of the semester in which the student expects to complete their work (or within 15 days of the start of Summer Session II).

Diplomas

Diplomas for graduate students are ordered after certification of the degrees has been completed. If a letter of certification is needed, the Graduate School will provide one in person to Room 106 Gillis Building or upon written request.

Outstanding Account

All outstanding accounts due to the University must be cleared before a degree is awarded.

GENERAL REQUIREMENTS FOR ALL MASTER'S DEGREES

[see Graduate School Bulletin for full details
http://www.research.uky.edu/gs/CurrentStudents/bulletin.html]

Courses and Curriculum

Candidates for the master's degree must have a major area (defined usually as an academic department) and *must take at least two-thirds of the course work in this area.* The other one-third may be taken in this area or in related graduate areas. In addition, the Council on Postsecondary Education (CPE) requires that *at least one-half of the minimum course requirements be in the major or core area, with three-fourths of these at the 600 to 700-level*. This is in addition to the requirements stated above.

BME Master's Degree Checklist

	Core Curriculum	You
A. Number of Hours Required	26	26
I. CPE Requirements		
Number of hours in core (1/2 of total of A)	13	
[BME 530, 605, 661, 6xx, 772, BME elective]		
¾ must be at the 600-700 level	10	
[BME 605, 661, 6xx, 640]		
II. CPE and GS Requirements		
50% at 600-700 level	13	
[BME 605, 661, 6xx, 772; elective]		
III. GS Requirements		
2/3 of coursework in the major field	18	
[BME 530, 605, 661, 6xx, 640, BME elective; PGY 412G]		
IV. GS Requirements		
2/3 of coursework in regularly schedule courses	18	
[no more than two special topics/problems courses]		

The Thesis

Theses must be prepared in conformity with the instructions provided by the Graduate School. For specific instructions regarding the format of theses, the student should obtain a copy of *Instructions for the Preparation of a Master's Thesis* from the Graduate School or on the Web at: http://www.research.uky.edu/gs/CurrentStudents/theses_prep.html.

Final Examination

A Final Examination (oral and/or written) is given to all candidates for master's degrees not later than eight days before the last day of classes of the semester in which the degree is to be awarded. The examination is scheduled by the Dean of the Graduate School and the report is returned to the Dean upon completion of the examination, which in no case may be later than two weeks after the start of the examination. The examining committee consists of at least three qualified faculty recommended by the Director of Graduate Studies and appointed by the Dean of the Graduate School. At least two committee members (including the chair or co-chair) must be members of the Graduate Faculty, and at least one of the two must be a Full member of the Graduate Faculty. *The recommendation for a final examination must be filed with the Graduate School at least two weeks prior to the date of the examination*. http://www.research.uky.edu/cfdocs/gs/MastersCommittee/Student/Selection_Screen.cfm.

Before the final examination, the thesis director and the Director of Graduate Studies must indicate to the Graduate School that the student's thesis satisfies all requirements of the Graduate School and is complete in content and format with the exception of pagination, and that the student is ready to be examined. Any modification in the thesis which the final examination committee specifies must be made before the degree is conferred.

The final two copies are submitted to the Graduate School after the Thesis Director and the Director of Graduate Studies have signed that they are complete. The thesis in its final form must be received in the Graduate School within 60 days of the Final Examination. Theses must be presented to and accepted in the Graduate School by the last day of the semester if a student plans to graduate that semester.

GENERAL REQUIREMENTS FOR ALL DOCTORAL DEGREES

[see Graduate School Bulletin for full details
http://www.research.uky.edu/gs/CurrentStudents/bulletin.html]

The Major Professor and the Advisory Committee

Each student's program is guided by a major professor and an advisory committee throughout the graduate career. Their purpose is to give continuity of direction and counsel and provide intellectual stimulation from the earliest days of residency through the completion of the doctorate. The advisory committee is normally appointed not later than upon completion of 18 credit hours of graduate work. The advisory committee must be appointed at least one year prior to the qualifying examinations. The major professor and advisory committee are appointed by the Graduate Dean after consultation with the appropriate Director of Graduate Studies. The advisory committee provides advice to the student and specifically sets requirements (within applicable program, Graduate School, and University regulations) which the student must meet in pursuit of the doctorate.

The advisory committee has a core of four members. This core consists of the major professor as chair, two other members from the major area, and at least one representative from any minor area(s). At least one representative must be from outside the academic program (department). All members of the core must be members of the Graduate Faculty of the University of Kentucky and three (including the major professor) must possess full Graduate Faculty status. Additional faculty members may serve as members of the advisory committee.
In addition to advising and program planning, the advisory committee is also involved in the administration of the qualifying examination, the supervision of the preparation of the dissertation, and the administration of the final examination.

Residency Requirements

The purpose of a residency requirement is to encourage doctoral students to experience contact with the academic community: colleagues, libraries, laboratories, on-going programs of research and inquiry, and the intellectual environment that characterizes a university. Such experience is generally as important as formal class work in the process of intellectual development. While the residency requirement is, by necessity, given in terms of full or part-time enrollment, the intent of the requirement is to ensure that the student becomes fully involved in an essential part of scholarly life.

Students must complete the equivalent of two years of residency (36 credit hours) prior to the qualifying examination and one year of post-qualifying residency. Exceptions to this normal pattern may be made with the approval of the Dean of the Graduate School upon the written recommendations of the student's advisory committee and the Director of Graduate Studies, which clearly demonstrate that the principle of residence is preserved. The ultimate goal of these requirements is to lead students to scholarly accomplishment, not solely to amass semester hours or time spent.

Pre-Qualifying Residency

Doctoral students must simply complete the requirement of 36 credit hours of graduate coursework* within five years of entry into the doctoral program. Extensions up to an additional three years may be requested to fulfill the pre-qualifying requirement (see "Pre-Qualifying Time Limit" below). The

graduate faculty of a doctoral program (or group of programs) also has the option to petition Graduate Council to reduce or increase the five year time limit. If approved, this modification will then apply to all doctoral students in that program.

* *some programs require more than 36 hours of graduate coursework prior to the qualifying examination*.

An awarded master's degree from the University of Kentucky or from another accredited school may satisfy 18 of this 36 hour pre-qualifying requirement. Such requests should be made by the DGS to the Senior Associate Dean of the Graduate School. For students with extensive prior graduate work, a waiver of additional pre-qualifying residency hours may be appropriate. Requests should be submitted in writing by the DGS to the Dean of the Graduate School and should include a detailed justification and evidence that the student's Major Professor and Advisory Committee support the request.

Pre-Qualifying Time Limit

Students enrolled in a doctoral program will be required to take the qualifying examination within five years of entry into the program. Extensions up to an additional three years may be requested. Extensions up to twelve months may be approved by the Dean of the Graduate School upon receipt of a request from the Director of Graduate Studies. Requests for extensions longer than twelve months must be considered by Graduate Council and will require the positive recommendation of the Director of Graduate Studies, the chair of the student's doctoral advisory committee, and a majority vote of Graduate Faculty in the program. If the qualifying examination has not been passed at the end of five years, or at the end of all approved time extensions the student will be dismissed from the program.

Post-Qualifying Residency

Students first enrolled in a doctoral program in the fall 2005 semester and beyond are required to enroll in a new 2 credit hour course after successfully completing the qualifying examination, 767; Dissertation Residency Credit. They will be charged at the in-state tuition rate plus mandatory fees. Students will remain continuously enrolled in this course every fall and spring semester until they have completed and defended the dissertation. This will constitute full-time enrollment, as registered in SAP. Students will be required to complete two semesters of 767 before they can graduate. Continuous enrollment in 767 will also apply to students whose programs of study or certification standards require an extended practicum or field experience.

The Qualifying Examination

A qualifying examination consisting of both written and oral components is required of all doctoral students. Its purpose is to verify that students have sufficient understanding of and competence in their fields to become candidates for the degree. In most programs, the advisory committee prepares and administers an individual qualifying examination; typically, that committee also judges the results of the examination. A majority vote of the core of the advisory committee is required for successful completion of the qualifying examination. Programs that give uniform, written qualifying examinations to all of their candidates shall have rules (filed with the Dean of the Graduate School) governing the role of the advisory committee in the preparation, administration, and evaluation of the qualifying examination. The examination is usually given after four semesters of graduate work or the equivalent, and after fulfillment of pre - qualifying residency.

The request to schedule the qualifying examination must be submitted a minimum of two weeks in advance via: http://www.gradschool.uky.edu/CurrentStudents/doctoral_forms.html. The results of the examination must be reported by the Director of Graduate Studies to the Graduate School within 10 days of its conclusion. If the result is failure, the advisory committee determines the conditions to be met before another examination may be given. The minimum time between examinations is four months. A second examination must be taken within one year after the first examination. A third examination is not permitted.
XXX 767, residency credit will be applied for a qualifying examination taken at any time during the first semester of enrollment in this course. Classes must be in session, for the student to sit for the exam.

The Dissertation

Each student must present a dissertation that represents the culmination of a major research project. The dissertation must be a well-reasoned, original contribution to knowledge in the field of study and should provide evidence of high scholarly achievement. The major professor is the primary source of guidance in the planning and preparation of the dissertation. However, other members of the advisory committee may be involved in the process as well. All core members of the advisory committee must read the dissertation prior to signing the dissertation approval form. It is the responsibility of the advisory committee to make suggestions for revisions before the final examination. A majority of the advisory committee core members must indicate that the form and substance of the dissertation are adequate to justify the scheduling of the final examination. The final examination may not be scheduled without the approval of a majority of the advisory committee members.

The style and format of the dissertation must conform with the instructions published by the Graduate School. For specific instructions regarding the format of the dissertation, the student should obtain information from the website at: http://www.research.uky.edu/gs/CurrentStudents/theses_prep.html and direct questions to the Degree Certification officer from the Biomedical Engineering program.

The Final Examination

The Final Examination includes a defense of the dissertation and may be as comprehensive in the major and minor areas as the advisory committee chooses to make it. It is conducted by an expanded advisory committee chaired by the major professor. The Dean of the Graduate School and the President of the University are *ex officio* members of all final examination committees. The examination is a public event and its scheduling is published and announced beforehand. Any member of the University community may attend.

At least 8 weeks prior to the final examination, the Graduate School should be notified of the intent to examine via: http://www.research.uky.edu/gs/CurrentStudents/doctoral_forms.html. At this time the Graduate Dean appoints an Outside Examiner as a core member of the advisory committee. The specific time and date of the examination must be designated by the Graduate School *at least two weeks prior to the actual examination*. All members of the committee except the outside examiner must have an opportunity to suggest revisions prior to scheduling the Final Examination. Thus, most revisions should have been completed at an earlier time. The final examination must take place no later than eight days prior to the last day of classes of the semester in which the student expects to graduate. Final examinations are public events and must take place while the University is officially in session. They

may **not** be scheduled during the periods between semesters or between the end of the second summer session and the beginning of the fall semester.

In all decisions, the majority opinion of the Graduate Faculty members of the advisory committee prevails. If the advisory committee is evenly divided, the candidate fails. In the event of failure, the advisory committee recommends to the Dean of the Graduate School conditions under which the candidate may be re-examined, if re-examination is deemed appropriate. When conditions set by the Dean of the Graduate School have been met, the candidate may be re-examined. A second examination must be taken within one year after the first examination Should any vacancies on the Committee occur between the two examinations, the Dean of the Graduate School shall appoint replacements. A third examination is not permitted.

After the final examination is passed, the final copy of the dissertation is prepared. Final copies are then submitted to the Graduate School along with the signatures of the Major Professor and the Director of Graduate Studies. The dissertation in its final form must be received in the Graduate School within 60 days of the final examination. If this deadline is not met, the candidate must undergo a second examination.

APPENDIX D

STATEMENT ON PLAGIARISM AND COPYRIGHT

You need to be very aware about copyright and plagiarism. It is critically important that in any technical text that you write (paper, thesis, abstract, poster, term paper, project report) you may not use language exactly* as it was written previously by others. It is never permissible to present another person's text, figures, or data, as your own. You may re-state the content of another person's text using different words and give proper credit with a reference. In cases where you decide to quote verbatim, you should put the text inside quotation marks and explicitly identify the author(s) whom you are quoting. The same requirements apply for figures and for material from web pages. In the case of data, it is always necessary to identify the source of the data even if you present it differently than the original author did. Please be aware that failure to adhere to these requirements regarding copyright and plagiarism is a serious violation of professional standards for ethical behavior that may be subject to disciplinary actions as described in the UK Student Code of Conduct (see below). Keep these requirements in mind for ALL documents that you write.

There are many good sources of more detailed information about plagiarism, copyright, and related topics. Here are some recommended ones:

UK Student Code of Conduct, Rules of the University Senate, section 6.3.1:
http://www.uky.edu/StudentAffairs/Code/part2.html

A detailed discussion from Princeton University:
http://www.princeton.edu/pr/pub/integrity/index.html, especially the chapter entitled "When to Cite Sources"

A general discussion from a writing lab at Purdue University:
http://owl.english.purdue.edu/handouts/research/r_plagiar.html

A publisher's perspective from IEEE:
http://www.ieee.org/web/publications/rights/plagiarism_FAQ.html

A broad discussion of the issues, recommended especially for faculty:
http://www.teachtech.ilstu.edu/resources/teachTopics/plagiarism.php

* "exactly" does not mean that the text must be word-for-word identical to text written previously. If the two texts differ only by a re-arrangement of words, or only by replacing a few words or phrases with synonyms, then your text is sufficiently close to the other text that it would be considered plagiarism.

APPENDIX E

Official Staff Holiday Schedule

UK Holiday Schedule for the 2016-2017 Fiscal Year (July 1, 2016 - June 30, 2017)

The University of Kentucky observes the following holidays, except where continuous service is essential, in accordance with UK Human Resources Policies and Procedures #83.0 – Holiday Leave. Please refer to policy #83.0 for detailed information regarding holiday leave.

Holiday	Date observed	Day observed
Independence Day	July 4, 2016	Monday
Labor Day	September 5, 2016	Monday
Election Day	November 8, 2016	Tuesday
Thanksgiving Day	November 24, 2016	Thursday
Day after Thanksgiving*	November 25, 2016	Friday
Christmas Day**	December 26, 2016	Monday
Special Holidays/Bonus Days *** To receive the Special Holidays, you must be employed in a regular position on or before November 1, 2015.	December 27, 2016	Tuesday
	December 28, 2016	Wednesday
	December 29, 2016	Thursday
	December 30, 2016	Friday
New Year's Day	January 2, 2017	Monday
Martin Luther King Jr. Day	January 16, 2017	Monday
Memorial Day	May 29, 2017	Monday
Independence Day	July 4, 2017	Tuesday

* Employees of UK HealthCare who do not normally receive the Friday after Thanksgiving as a holiday are provided a "floating" holiday in place of this calendar day.

**Christmas Day and New Year's Day fall on a Sunday; therefor, the holiday is observed on a Monday.

*** Staff must be employed in a regular position on or before **October 30, 2016,** to receive these days. Regular employees with an FTE of 0.5 or greater shall be granted (4) Special Holidays (Bonus Days) off with pay on a pro-rata basis. Employees who leave employment at UK prior to January 1, 2017 are not eligible for special holidays.

Questions concerning holiday leave should be addressed to Human Resources, Employee Relations Office, at (859) 257-8758.

Appendix F

Building Evacuation Plans/Routes

Primary Safe Place(s): Floor 3
Classroom 309, 323

Secondary Safe Place(s): Floor 3
Stairwells, Bathrooms, Rooms 310, 312, 314, 315, 324