College: **College of Engineering & Computer Science**
Department: **Biomedical, Industrial & Human Factors Engineering**

Academic Programs Reviewed:

Program 1. Biomedical Engineering-BSBE
Program 2. Biomedical Engineering-MSEG, MSBME
Program 3. Industrial & Systems Engineering-BSISE
Program 4. Industrial & Human Factors Engineering-MSEG, MSIHE
Program 5. Graduate Certificate: Lean Ergonomics for Manufacturing and Healthcare

Program Review Committees

BSBE, MSBME

Caroline Cao	Professor
Tarun Goswami	Professor
Thomas Hangartner	Department Chair, ex officio
Ping He	Professor
Nasser Kashou	Assistant Professor
Dave Kender	Senior Lecturer
Chandler Phillips	Professor
David Reynolds	Associate Professor, Program Committee Chair
Joe Tritschler	Instructor

BSISE, MSIHE

Caroline Cao	Professor
Frank Ciarallo	Associate Professor, Program Committee Chair
Mary Fendley	Assistant Professor
Jennie Gallimore	Professor
Subhashini Ganapathy	Assistant Professor
Thomas Hangartner	Department Chair, ex officio
Dave Kender	Senior Lecturer
Yan Liu	Associate Professor
Pratik Parikh	Associate Professor
Chandler Phillips	Professor
Joe Tritschler	Instructor
Xinhui Zhang	Associate Professor

Graduate Certificate

Dr. Chandler Phillips	Professor
Dr. Thomas Hangartner	Department Chair

Submitted **15 January 2015**
Department Chair **Thomas N. Hangartner, PhD**
Dean **Nathan Klingbeil, PhD**

Program 1. Biomedical Engineering-BSBE

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	183	221	233	260	320
Graduates	25	26	43	30	38

BSBE Program description

There are two curricula for the BME program.

Curriculum A: The traditional BME program prepares graduates for engineering industry employment. The traditional track is for those who would like to work in a health-care-related industry that develops medical and surgical devices like prosthetics or artificial organs, who would like to work in the area of medical imaging, or who would like to design rehabilitative technology to assist people. The program also prepares students for graduate training in biomedical engineering or in a traditional engineering area.

Curriculum B: The pre-med option also satisfies the admission requirements for medical, osteopathic, dental, or veterinary schools. Graduates are well prepared to pursue graduate training in engineering or the life sciences. This track is unique since it trains students not only in the traditional areas of biology and chemistry but also in emerging medical technology. Historically, our students score 10% higher on the MCAT and have a 10% higher acceptance rate to medical schools than students from traditional pre-med programs.

BSBE Alignment with university mission, strategic plan

Graduates of Wright State University's Biomedical Engineering program fulfill the university's vision of an innovative spirit and the college's mission of bringing discovery and innovation to the world as they face an environment where change occurs at an ever increasing rate and the competitive arena is constantly shifting. The following considerations support the validity of these two goals.

The marketplace continues to develop towards a global community as a premium is placed on product specialization and personalization. Time allocated to the product design cycle continues to decrease, and intelligent use of the overwhelming amounts of information made available on the Web will be critical for survival. Organizational agility and adaptability is rewarded, while those without the infrastructure to support change and learning suffer. New medical technologies not only enter hospital and medical centers but also the home and workplace. Consideration of the end-user of medical devices becomes paramount in product acceptability and market share. Devices themselves in many cases are becoming hybrid, comprised of synthetic and living components. The Program Educational Objectives are well aligned to help our graduates succeed in this world of global change and to provide the basis for continued self-development.

BSBE Program distinctiveness

- ABET accredited
- Pre-med option prepares students for taking entrance exams for medical, dental, veterinary, and other post-baccalaureate professional medical education.
- Technical elective options include an engineering service-learning study-abroad experience.
- Proximity to Wright-Patterson Air Force Base, which offers ongoing and unique research opportunities.

BSBE Recognitions of quality of the program

- ABET accredited
- First place at Rice University's national 4th Annual Undergraduate Global Health Technologies Design Competition, 2014.
- Preferred WSU engineering program by the brightest high-school graduates demonstrated by the highest high-school GPA of all programs at WSU.

BSBE Program learning outcomes

BME student learning outcomes comprise ABET general engineering student outcomes 'a-k'. These outcomes are:

a. an ability to apply knowledge of mathematics, science and engineering
b. an ability to design and conduct experiments and to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering and scientific solutions in a global and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. use techniques/skills/modern engineering tools

BSBE Description of learning outcomes assessment program

Student learning outcomes are assessed on a three year cycle. Faculty-approved assessment items are used to collect data reflecting student achievement of several learning outcomes every year. The following year, the data is analyzed, and any changes made as a result of the data analysis are implemented in the third year. Outcomes assessment is staggered so that all outcomes are being addressed in some way each year, either through data collection, analysis, or change implementation as necessary. The most recent revision of the outcomes assessment cycle began in Fall 2013. This revision optimizes data collection so that a majority of the outcomes are assessed in courses that all students in the department are required to take, with the remaining assessments assigned to courses that are more major-specific.

For each a-k outcome, two thresholds were set to indicate an acceptable performance:

Threshold 1: 80% of the students achieve a score of 60% or above;
Threshold 2: 15% of the students achieve a score of 85% or above.

These 2 thresholds indicate the lower and upper limits of the class distribution. We expect that less than 20% of the students achieve a score below 60%, and we also would like to see 15% of our students perform at a level of 85% or higher.

BSBE Summary of assessment findings for past five years

The overall evaluation of student outcomes assessment shows a very positive outcome, giving credence to our continuous evaluation process. In fact, as reported in the ABET self-study, eleven of the fourteen student outcomes show at least one course where the 80/60 standard was met by 100% of the students, and eight of the fourteen show at least one course where the 15/85 standard was met by 100% of the students. Only three outcomes show courses with

*No*s, indicating that one of these standards was not met. Further detail regarding changes made as a result of these negative findings can be found in Criterion 4 Page 6 of the BME self-study that accompanies this report.

Since the self-study, there have been three revisions of the student outcomes assessment schedule, as the program has adjusted from a quarter to a semester system. Through these revisions, the assessment schedule was maintained, and findings have been mostly positive, with only a few indications that changes may be needed to ensure learning outcomes are met. The program faculty members have responded promptly to address any questionable or negative findings.

BSBE Major curricular changes since last review (or past five years)

- University transition from quarters to semesters, effective Fall 2012
- BME pre-med option now requires psychology, sociology, and biochemistry to ensure that students are prepared for the MCAT, effective Spring 2015.
- 4+1 BS/MS combined degree program was created. The first entrants into the combined degree program completed the BS portion in Spring 2012.
- 3-year program options were created.

BSBE Graduate placement data, employer satisfaction

Exit interviews of BSBE graduates show educational and employment plans and placement:

Program	Year	n (total)	Future Education				Employment Information	
			Future ed plans-yes	Future ed plans-no	Master's/ Additional master's-yes	Doctorate-yes	Currently employed in chosen field-yes	Currently employed in chosen field-no
BSBME	2008-09	16	14	2	13	1	4	12
	2009-10	12	12		9	4	2	10
	2010-11	24	21	3	18	9	1	23
	2011-12	25	23	2	13	10	3	20
	2012-13	19	13	1	7	2	3	8

For the same years as shown in the table above, future educational institutions and employers of students reporting in an exit interview include:

Year	Current/ future employer	Future school
2009	NDSEG/NSR/GRFP; SMART; Zoekordiao-Columbia	Stanford, MIT, Oxford, Berkeley, Cambridge, Harvard, Michigan, Rice; Carnegie Mellon, Purdue; OSU (2); WPAFB/ASC; WSU (12)
2010	(Radar Analyst); AFRL	WSU (8); Drexel; University of Cincinnati (MD) (2); Vanderbilt /U of Florida
2011	Celsus Lab Inc.; Millat Industries	WSU (5)
2012	IMDS; Infoscitex; LA AFB; Timken; UES (2); WPAFB	WSU (8); OSU; University of Cincinnati
2013	Nationwide Children's Hospital; ORISE; Upper Valley Medical Center	OSU (2); Rensselear Poly Tech Institute; UD; WSU (3)

If program has professional accreditation, attach most recent review findings and recommendations

ABET final statement, dated 14 August 2012, is attached.

Program 2. Biomedical Engineering-MSEG, MSBME

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	38	47	37	34	49
Graduates	11	23	22	17	24

MSBME Program description

Biomedical Engineering (BME) is the application of engineering principles and methods to solve problems in the medical and biological areas. Students in this program work with living systems, apply advanced technology to complex problems in medical care, and observe how their work directly impacts the delivery of human health care. Students have five focus areas from which to choose: Biomaterials/Biomechanics, Ergonomic Engineering, Biomedical Signals/Image Processing, Biomedical Systems, and Neuroengineering.

Students should expect to be prepared for their program with knowledge of topics such as calculus, differential equations, linear algebra, statistics, calculus-based physics, chemistry, computations/programming, statics, circuits, linear systems, anatomy, physiology, and/or other core engineering courses, depending on the student's focus area.

MSBME Alignment with university mission, strategic plan

Graduates of Wright State University's MS in Biomedical Engineering program fulfill the university's vision of an innovative spirit and the college's mission of bringing discovery and innovation to the world as they face an environment where change occurs at an ever increasing rate and the competitive arena is constantly shifting. The following considerations support the validity of these two goals.

The marketplace continues to develop towards a global community as a premium is placed on product specialization and personalization. Time allocated to the product design cycle continues to decrease, and intelligent use of the overwhelming amounts of information made available on the Web will be critical for survival. Organizational agility and adaptability is rewarded, while those without the infrastructure to support change and learning suffer. New medical technologies not only enter hospital and medical centers but also the home and workplace. Consideration of the end-user of medical devices becomes paramount in product acceptability and market share. Devices themselves in many cases are becoming hybrid, comprised of synthetic and living components. The program learning outcomes are well aligned to help our graduates succeed in this world of global change and to provide the basis for continued self-development.

MSBME Program distinctiveness

- Five focus areas
- Flexible program of study which offers both coursework and thesis options

MSBME Recognitions of quality of the program

- High quality faculty with PhDs from universities including University of Southern California, University of Virginia, and The Ohio State University
- Many MSBME students continue on for the PhD in Engineering in the Medical and Biological Systems focus area

MSBME Program learning outcomes

Master of Science students in BME will:

- Objective 1: Obtain depth in one area of specialization and breadth in complimentary areas.
- Objective 2: Acquire scientific knowledge and research skills to solve problems in their chosen area.
- Objective 3: Prepare for an advanced professional career or further graduate studies.

MSBME Description of learning outcomes assessment program

Final GPA distribution

All graduate students are required to complete their programs with a 3.0 GPA or higher.

Program of Study components

All MSBME students' programs of study meet the following criteria to accomplish the standards of depth and breadth expected of master's degree students with uniformity while maintaining flexible program options:

- 30 credits total
- 18 credits of degree-specific coursework
- 15 credits of 7000-level coursework in the BIE Department
- 6 credits of math-intensive coursework
- BME/IHE 6010

Mastery of In-Depth Content

The Graduate School requires that no more than 6 credits of graduate coursework completed with a grade of "C" may count toward a student's master's degree program.

MSBME Summary of assessment findings for past five years

Assessment findings are pending data from a report to be distributed from the College.

MSBME Major curricular changes since last review (or past five years)

- Transition from quarter to semester system, effective Fall 2012
- Degree designation changed from MSEG to MSBME
- Addition of Neuroengineering focus area
- Addition of policy stating that a minimum of 18 semester hours must be discipline-specific

MSBME Graduate placement data, employer satisfaction

Program	Year	n (total)	Future Education				Employment Information	
			Future ed plans-yes	Future ed plans-no	Master's/ Additional master's-yes	Doctorate-yes	Currently employed in chosen field-yes	Currently employed in chosen field-no
MSBME	2008-09	7	3	4		3	2	5
	2009-10							
	2010-11	10	1	9	1		1	9
	2011-12	8	4	4		4	2	6
	2012-13	7	4	3		5	5	1

During the same years as shown in the table above, students reported future employment at UES, Inc., Design Knowledge, USAF, Consortium Research Fellows Program, ORISE, US Air Force, Kettering College of Medical Arts, and Saudi Food & Drug. Students were interested in further education at University of Illinois-Chicago, Cleveland State, and WSU.

Program 3. Industrial and Systems Engineering-BSISE

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	38	53	34	71	107
Graduates	7	9	12	13	9

BSISE Program description

Industrial and Systems Engineering is concerned with how to make things work better, more safely, and more economically. Industrial and systems engineers improve quality and productivity by engineering processes and systems. Industrial and systems engineers often work in a manufacturing environment and deal with system design and optimization, quality control and human factors of engineering. They also work in many other industries including healthcare and logistics. WSU's BSISE program provides students with fundamental knowledge in computer applications, human factors engineering, engineering economy, optimization, and logistics and supply chain design so they will be better prepared to apply their background knowledge in the essential math and sciences of engineering.

BSISE Alignment with university mission, strategic plan

Graduates of Wright State University's Industrial and Systems Engineering program fulfill the university's vision of an innovative spirit and the college's mission of bringing discovery and innovation to the world as they face an environment where change occurs at an ever increasing rate and the competitive arena is constantly shifting. The following considerations support the validity of these two goals.

The marketplace continues to develop towards a global community; simultaneously, a premium is given to product specialization and personalization. Time allocated to the product design cycle continues to decrease, and intelligent use of the overwhelming amounts of information made available on the web will be critical for survival. Organizational agility and adaptability is rewarded, while those without the infrastructure to support change and learning will suffer. New technologies entering the home and workplace continue to increase the value of knowledge and information. The ability of humans to access and use product features becomes increasingly important, as technological innovations expand the capabilities of machines.

BSISE Program distinctiveness

- ABET accredited
- Technical elective options include an engineering service-learning study-abroad experience.
- Proximity to Wright-Patterson Air Force Base, which offers ongoing and unique research opportunities.
- Senior capstone design project teams work with local companies to apply ISE techniques in a practical setting.
- Active student chapter of Institute of Industrial Engineers, which achieved Gold Status in recent years.

BSISE Recognitions of quality of the program

- ABET accredited
- Next to the BSBE program, also in our department, these students have the highest high-school GPA of all students entering the university.
- Graduates employed by local, regional and national organizations including USAF School of Aerospace Medicine, Air Force Research Laboratory, Honda, Toyota, Boeing, Honeywell, General Dynamics Land Systems, Ethicon,

Federal Aviation Administration, Caterpillar, Kettering Health Network, Navistar, Husky Energy, MacAulay Brown.

- Focus on experiential learning, including industry tours, guest speakers, and networking with other ISE students via a very active student chapter of IIE
- Students receive nationally competitive scholarships, including, recently, the IIE Harold and Inge Marcus Scholarship

BSISE Program learning outcomes

ISE student learning outcomes comprise ABET general engineering student outcomes 'a-k'. These outcomes are:

a. an ability to apply knowledge of mathematics, science and engineering
b. an ability to design and conduct experiments and to analyze and interpret data
c. an ability to design a system, component, or process to meet desired needs within realistic constraints
d. an ability to function on multi-disciplinary teams
e. an ability to identify, formulate, and solve engineering problems
f. an understanding of professional and ethical responsibility
g. an ability to communicate effectively
h. the broad education necessary to understand the impact of engineering and scientific solutions in a global and societal context
i. a recognition of the need for, and an ability to engage in life-long learning
j. a knowledge of contemporary issues
k. use techniques/skills/modern engineering tools

BSISE Description of learning outcomes assessment program

Student learning outcomes are assessed on a three year cycle. Faculty-approved assessment items are used to collect data reflecting student achievement of several learning outcomes every year. The following year, the data is analyzed and any changes made as a result of the data analysis are implemented in the third year. Outcomes assessment is staggered so that all outcomes are being addressed in some way each year, either through data collection, analysis, or change implementation as necessary. The most recent revision of the outcomes assessment cycle began in Fall 2013. This revision optimizes data collection so that a majority of the outcomes are assessed in courses that all students in the department are required to take, with the remaining assessments assigned to courses that are more major-specific.

For each a-k outcome, two thresholds were set to indicate an acceptable performance:

Threshold 1: 80% of the students achieve a score of 60% or above;
Threshold 2: 15% of the students achieve a score of 85% or above.

These 2 thresholds indicate the lower and upper limits of the class distribution. We expect that less than 20% of the students achieve a score below 60%, and we also would like to see 15% of our students perform at a level of 85% or higher.

BSISE Summary of assessment findings for past five years

The overall evaluation shows a positive outcome, giving credence to our continuous evaluation process. In fact, as reported in the ABET self-study, twelve of the fourteen student outcomes show at least one course where the 80/60 standard was met by 100% of the students, and eleven of the fourteen show at least one course where the 15/85 standard was met by 100% of the students. Of the 72 scores that have been calculated for the self-study, 9 (12.5%) resulted in *No*, indicating that one of the standards was not met. None of the outcomes is associated with less than two thirds *Yes*, with the exception of Outcome i *Recognition of the need for life-long learning*, which shows only 50% *Yes*. This latter outcome is somewhat difficult to assess, as the real data can only be collected after the students have left the program.

Since the self-study, there have been three revisions of the student outcomes assessment schedule, as the program has adjusted from a quarter to semester system. Through these revisions, the assessment schedule was maintained, and findings have been mostly positive, with only a few indications that changes may be needed to ensure learning outcomes are met. The program faculty members have responded promptly to address any questionable or negative findings.

BSISE Major curricular changes since last review (or past five years)

- University transition from quarters to semesters, effective Fall 2012
- 4+1 BS/MS combined degree program was created. The first entrants into the combined degree program completed the BS portion in Spring 2012.
- 3-year program options were created.

BSISE Graduate placement data, employer satisfaction

Exit interviews of BSISE graduates show educational and employment plans and placement:

Program	Year	n (total)	Future Education				Employment Information	
			Future ed plans-yes	Future ed plans-no	Master's/ Additional master's-yes	Doctorate-yes	Currently employed in chosen field-yes	Currently employed in chosen field-no
BSISE	2008-09	1		1			1	
	2009-10	4	2	2	2			4
	2010-11	3	1	2			1	2
	2011-12	6	5		4	1	3	2
	2012-13	11	9	1	7	2	3	8

During the same years as shown in the table above, six students reported plans to attend Wright State University for future education. One student planned to attend AFIT to further his or her education. Additionally, employers mentioned include the US Air Force, Booz-Allen Hamilton, Huskey Energy, Wright-Patterson AFB (2), and Wright State Research Institute.

If program has professional accreditation, attach most recent review findings and recommendations

ABET final statement, dated 14 August 2012, is attached.

Program 4. Industrial and Human Factors Engineering-MSEG, MSIHE

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	58	44	31	47	60
Graduates	29	27	19	18	28

MSIHE Program description

Industrial and Human Factors Engineering (IHE), a highly customizable degree in the College of Engineering and Computer Science, prepares working professionals towards effective design and operation of a variety of systems in healthcare, manufacturing, aerospace, distribution, retail, and many others. Whereas industrial engineers utilize the tools of simulation, optimization, computing, and statistics to design and improve modern technology-laden systems, human factors engineers design systems that effectively integrate human abilities/limitations and machines/tools. Students enrolled in the program are diverse in both geography and work-profile.

Students have five focus areas from which to choose: Systems Modeling, Logistics and Supply Chain, Human System Integration, Ergonomic Engineering, and Neuroengineering.

Students should expect to be prepared for their program with knowledge of topics such as calculus, calculus-based physics, statistics, computer programming, statics, dynamics, psychology, human factors engineering, and/or other core engineering courses, depending on the student's chosen degree and focus area.

MSIHE Alignment with university mission, strategic plan

Graduates of Wright State University's MS in Industrial and Human Factors Engineering program fulfill the university's vision of an innovative spirit and the college's mission of bringing discovery and innovation to the world as they face an environment where change occurs at an ever increasing rate and the competitive arena is constantly shifting. The following considerations support the validity of these two goals.

The marketplace continues to develop towards a global community; simultaneously, a premium is given to product specialization and personalization. Time allocated to the product design cycle continues to decrease, and intelligent use of the overwhelming amounts of information made available on the web will be critical for survival. Organizational agility and adaptability is rewarded, while those without the infrastructure to support change and learning will suffer. New technologies entering the home and workplace continue to increase the value of knowledge and information. The ability of humans to access and use product features becomes increasingly important, as technological innovations expand the capabilities of machines.

MSIHE Program distinctiveness

- Five focus areas
- Flexibility of program of study, which offers both coursework and thesis options
- Strong ties with the 711th Human Performance Wing of the USAF and local companies
- Program is available completely online via distance education or completely in residence or a blend of the two.

MSIHE Recognitions of quality of the program

- US News & World Report ranked the online MSIHE 38th in the US in January 2015
- High quality faculty with PhDs from universities including Carnegie Mellon, Georgia Tech, Purdue, Texas-Austin and Virginia Tech
- Funding of graduate students from national and industry sources including: National Science Foundation, Intel, Federal Aviation Administration, National Highway Transportation and Safety Administration, Air Force Research Laboratory, Leonard Wood Institute, Dayton VA Medical Center, Genzyme and Cardinal Health
- Many MSIHE students continue on for the PhD in Engineering in the Industrial & Human Systems focus area
- Students have received nationally competitive scholarships, including, recently, the Gilbreth Memorial Fellowship from IIE and Integrated Systems and Controls Council Honor Scholarship from Material Handling Education Foundation, Inc

MSIHE Program learning outcomes

Master of Science students in IHE will:

- Objective 1: Obtain depth in one area of specialization and breadth in complimentary areas.
- Objective 2: Acquire scientific knowledge and research skills to solve problems in their chosen area.
- Objective 3: Prepare for an advanced professional career or further graduate studies.

MSIHE Description of learning outcomes assessment program

Final GPA distribution

All graduate students are required to complete their programs with a 3.0 GPA or higher.

Program of Study components

All MSIHE students' programs of study meet the following criteria to accomplish the standards of depth and breadth expected of master's degree students with uniformity while maintaining flexible program options:

- 30 credits total
- 18 credits of degree specific coursework
- 15 credits of 7000-level coursework in the BIE Department
- 6 credits of math-intensive coursework
- BME/IHE 6010

Mastery of In-Depth Content

The Graduate School requires that no more than 6 credits of graduate coursework completed with a grade of "C" may count toward a student's master's degree program.

MSIHE Summary of assessment findings for past five years

Assessment findings are pending data from a report to be distributed from the College.

MSIHE Major curricular changes since last review (or past five years)

- Transition from quarter to semester system, effective Fall 2012
- Degree designation changed from MSEG to MSIHE
- Addition of Neuroengineering focus area
- Addition of policy stating that a minimum of 18 semester hours must be discipline-specific

MSIHE Graduate placement data, employer satisfaction

Program	Year	n (total)	Future Education				Employment Information	
			Future ed plans-yes	Future ed plans-no	Master's/ Additional master's-yes	Doctorate-yes	Currently employed in chosen field-yes	Currently employed in chosen field-no
MSIHE	2008-09	4	1	3		1	2	1
	2009-10	3	2	1		2	2	1
	2010-11	10	3	7		1	4	6
	2011-12	4	2	2	2		2	2
	2012-13	6	3	3	2	1		6

During the years shown in the table, students reported current or future employment at Agile Development Corporation, American Electric Power, American Hospital & World Sea Co., Design Knowledge, Department of Defense, Goodrich, Jieddo Op, Miami Valley Hospital, NCR, Semantics, US Air Force, VA Medical Center, and Wright-Patterson Air Force Base.

Program 5. Graduate Certificate: Lean Ergonomics for Manufacturing and Healthcare

Enrollment and Graduate History

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	20	6	1	10	19
Graduates	24	9	13	9	21

Certificate Program description

This certificate program is to enhance the technical expertise in Ergonomics and Lean Manufacturing. Upon completion of this certificate program, the graduate will be knowledgeable in the utilization of the Ergonomics and Lean Manufacturing methods in industrial environments. The program consists of 5 courses (15 credit hours) that can be completed in two semesters.

IHE 6310 Ergonomics
IHE 6850 Six Sigma
IHE 7310 Advanced Ergonomics
IHE 7850 Lean Process Improvement for Engineers
Choose one:
IHE 6980 Computational Neuroergonomics & Healthcare Applications
OR
IHE 7370 Medical Devices

Certificate Alignment with university mission, strategic plan

Students who complete the Lean Ergonomics for Manufacturing and Healthcare gain in-depth, specific knowledge and acquire a relevant skill set that is directly beneficial to current needs of the engineering profession that can be applied across multiple industries.

Certificate Program distinctiveness

- May be completed entirely online
- May be earned as a stand-alone certificate or incorporated into a full degree program

Certificate Recognitions of quality of the program

No documented recognitions specific to this certificate program.

Certificate Program learning outcomes

Students who complete the certificate program will:

- Gain technical expertise in ergonomics and lean manufacturing
- Be knowledgeable in the utilization of ergonomics and lean manufacturing methods in industrial and healthcare environments

Because the certificate program can be earned as an incorporated part of a full MSBME or MSIHE program, the learning outcomes fulfill, in part, the learning outcomes for the Master of Science programs: specifically, depth in one area of specialization, acquisition of scientific knowledge, and preparation for and advanced professional career.

Certificate Description of learning outcomes assessment program

Courses taken by certificate program enrollees are also part of the MSBME and MSIHE programs, so assessment data for the certificate is part of the total data used to assess the MS degree programs.

Certificate Summary of assessment findings for past five years

Findings are part of the assessment data for MSBME and MSIHE.

Certificate Major curricular changes since last review (or past five years)

- University transition from quarters to semesters, effective Fall 2012
- The name of the certificate changed from Lean Ergonomics for Manufacturing to Lean Ergonomics for Manufacturing and Healthcare, effective Fall 2012 with the semester transition.
- Additional options for completing the healthcare component of the program have been added since Spring 2013.

Certificate Graduate placement data, employer satisfaction

Most students who have completed the certificate program were also in an MS degree program. Graduate placement and employer satisfaction data for certificate students who also completed an exit interview as part of their degree program are contained in this item under the MSBME and MSIHE portions of this report.

If program has professional accreditation, attach most recent review findings and recommendations.

Not applicable

Departmental Summary

Faculty demographics

Position	2008	2009	2010	2011	2012
Full Professor	5.9	5.9	4	5	6
Associate Professor	3	4	4	4	4
Assistant Professor	4	4	2	2	3.3
Instructor/Lecturer	1	1	1	1	2.6
Adjunct Professor	1.5	1.4	2.8	2.8	2.1
Total	15.4	16.3	13.8	14.8	18.1

Staffing Summary

Position	2008	2009	2010	2011	2012
Unclassified	1.5	1.4	1.2	1.0	1.0
Classified	4.0	3.8	3.0	3.0	3.0
Total	5.2	5.2	4.2	4.0	4.0

This data set includes Unclassified Hourly as Classified so that all hourly staff members are accounted for in the same category.

Student/faculty ratio

	2008	2009	2010	2011	2012
Student FTE/Fac FTE	7.8	9.3	10.8	9.5	9.3

Average class size

Class Type	2010	2011	2012
Lecture	15.2	19.6	16.1
Lab only	13.1	15.5	14.6
Lecture/Lab	15.2	19.6	18.6

Total of student data for all programs in unit

Category	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment (total)	330	379	378	427	557
Graduates (total)	72	87	103	83	104

Total courses taught for unit

(Data represent total number of courses/sections available, but not necessarily taught, including independent research options)

Level	AY 09-10	AY 10-11	AY 11-12	AY 12-13	AY 13-14
Undergraduate	63	59	76	59	62
Graduate	283	277	253	212	186
Total	346	336	329	271	248

Total credit hours generated for unit

Level	2009-10	2010-11	2011-12	2012-13	2013-14
Undergraduate	2204	2607	2406	3530	4869
Graduate	2215	1892	1695	1938	2064
Total	4419	4499	4101	5468	6933

Course completions

Level	2008	2009	2010	2011	2012
Undergraduate	92.7%	92.6%	94.0%	94.7%	91.9%
Master's	94.6%	93.4%	91.5%	96.6%	94.9%

Expense per student and revenue-to-expense ratio

	2008	2009	2010	2011	2012
Expense per student	$15,781	$14,614	$11,617	$15,423	$13,325
Revenue/Expense	1.66	1.75	2.09	1.45	1.73

Research and External Funding

	2008	2009	2010	2011	2012
External funding (expenditures)	$1,281,968	$4,421,202	$2,793,798	$840,238	$1,459,267

Future employment projections for discipline

Program	Completions 2013	Regional Openings 2014	Median Hourly Earnings	Location	Total Jobs 2014	Total Jobs 2017 (projected)	Growth
Biomedical Engineering	52	6	$53.45	Region	1,554	1,530	-1.5%
				Ohio	8,197	8,224	0.30%
				US	220,348	227,567	3.30%
Industrial Engineering	7	86	$41.33	Region	3,916	3,823	-2.40%
				Ohio	18,731	18,456	-1.50%
				US	428,629	435,726	1.70%
General/ Architectural and Engineering Manager	n/a	47	Included in other occupation data	Region	Numbers included in both other occupation categories		
				Ohio			
				US			

As shown in the table, while growth in the region is projected to fall slightly, modest growth is expected nationally in both BME and ISE disciplines. Based on current program completions, regional demand is much more favorable for ISE graduates than for BME graduates. BME graduates are more likely to find timely employment outside the Dayton region, while ISE graduates have more local opportunities.

Description of how unit programs and curricula are "mission critical" to the core Wright State educational experience

BIE Department programs fulfill the WSU mission in every aspect:

WSU Mission—We will:	Evidence that BIE programs are "mission critical":
• build a solid foundation for student success at all levels through high-quality, innovative programs;	• Undergraduate programs are strong in fundamental math and applicable science courses and have consistently demonstrated achievement of student learning outcomes, which is confirmed by continuous ABET accreditation since 1999. • Graduate programs require 50% of credits to be completed at the 7000-level or higher, demonstrating a mastery of in-depth engineering content in a student's chosen focus area. • Faculty have developed numerous new graduate-level courses. • A new neuroengineering focus area was available starting Fall 2013.

• conduct scholarly research and creative endeavors that impact quality of life;	• There is opportunity at every level for students to be involved in research. • The required senior design sequence demands creative team solutions to real-world problems, often with direct impact on the local community.
• engage in meaningful community service;	• The BIE Department offers a service-learning, multicultural, technical elective option to travel to Africa for a clinical engineering experience. • Student chapters of professional organizations such as IIE, BMES, and Engineers without Borders offer students opportunities to be engaged with the community in ways that will positively impact their future careers and the community.
• drive the economic revitalization of our region and our state and empower all of our students, faculty, staff, and alumni to develop professionally, intellectually, and personally.	• BIE faculty are involved in prominent federally funded research from NIH and NSF; additionally, they are locally well-connected with AFIT and AFRL at WPAFB, one of the largest single-site employers in the State of Ohio. Many employees at WPAFB are WSU alumni. Faculty rely on student research assistants to meet their grant/contract objectives, and students gain invaluable experience as part of their program that will prepare them professionally, intellectually, and personally for their chosen path after graduation.

Faculty accomplishments and recognitions

Caroline Cao:	HERS Bryn Mawr Summer Institute 2013, June 22-July 6, 2013; HERS Summer Institute is a leadership training program that prepares women for leadership roles in higher education
Frank Ciarallo:	Moving Spirit Award, Institute for Operations Research and the Management Sciences, 2012
Subhashini Ganapathy:	Presidential University Faculty Early Career Achievement Award, 2014 SOCHE Excellence in Teaching Award, 2014 CECS Faculty Early Career Achievement Award, 2014 Cognitive, Neural, and Behavioral Sciences Panelist, 2014 National Defense Science and Engineering Graduate Fellowship Selection, ASEE
Dave Kender:	2011-12 Faculty Excellence in Teaching award, as voted by students
Phani Kidambi:	2012-13 Faculty Excellence in Teaching award, as voted by students
Pratik Parikh:	Presidential University Faculty Early Career Achievement Award, 2013 WSU recognition: Advisor of the Year at WSU, 2014 National recognition: Outstanding Faculty Advisor Award from IIE, Great Lakes Region, 2014 Invited as a Panelist by the National Science Foundation, 2014 External International Reviewer (Ph.D. Dissertation), IIT-Bombay, India, 2014
Joe Tritschler:	2013-14 Faculty Excellence in Teaching award, as voted by students
Xinhui Zhang:	INFORMS 2014 QueVision – Real Time Queuing Management System for Kroger System; Semi Finalist, One of Twelve World Wide INFORMS 2014 Franz Edelman Award for Excellence in Operations Research and Management Science 2013 Kroger Pharmacy Inventory Simulation and Optimization Edelman Laureate, One of the Six Finalists World Wide INFORMS 2013 Franz Edelman Award for Excellence in Operations Research and Management Science 2012 Inventory Simulation and Optimization Semi-Finalist, One of Twelve World Wide INFORMS 2012 Daniel H. Wagner Prize for Excellence in Operations Research Practice
Multiple BIE Faculty:	$5 million, 5-year multi-department contract with the Air Force Research Laboratory at WPAFB, awarded 2011

As a noteworthy item, for the past three years consecutively, the winner of the award for excellence in teaching has been from the BIE Department.

Programs and areas of recognized excellence with supporting evidence

- First place at Rice University's national 4th Annual Undergraduate Global Health Technologies Design Competition, 2014.

Capacity for growth of programs

Faculty to student ratio in the ISE and IHE program indicates there is capacity to grow in student enrollment in each of these programs with current faculty resources. However, at the undergraduate level, the fundamental engineering courses (Statistics, Biomechanics I and II, Bioelectronics I, Biothermodynamics) are cross-listed with BME sections in the department. Those courses are currently beyond capacity. To compensate for the increase in student enrollment in the past few years, adjustments have been made to the course offering schedule to make the program more flexible for students. In this regard, additional faculty resources and/or larger classrooms are needed to continue to accommodate increasing enrollment.

The BME programs have fewer faculty members with larger student enrollment. There is little to no room for growth without additional teaching resources in the undergraduate BME program. Since the faculty members are the same for the undergraduate and graduate BME programs, this also limits the growth of the MSBME program. Additionally, two BME faculty members are retiring in 2015. A prompt replacement of both faculty members, with consideration for additional BME faculty members, is necessary.

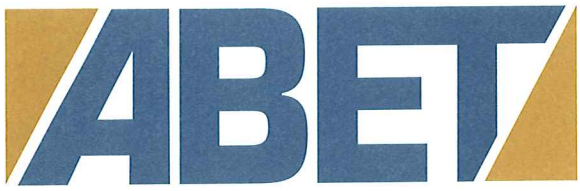
Consideration should be given to staff numbers as well. As all other aspects of the data have increased (enrollment by 68%; credit hours generated by 57%; number of faculty by 17%), the number of staff members has decreased by 23%. For efficient future growth of the programs and retention of students, staff support should also keep pace.

New program opportunities

- The Dean has included an initiative to grow the ISE program in his vision for the College of Engineering and Computer Science.
- Dr. Xinhui Zhang is developing a 2+2 BSISE program in collaboration with Guangdong Technical University.
- Dr. Sharif Elbasiouny is developing an MS in Neuroengineering program that will utilize resources from the biomedical engineering and biomedical sciences programs.
- The new Neuroscience and Engineering Collaboration building is scheduled to open in 2015. Several BIE faculty members will be working on research endeavors using this new resource.
- Replacement of retiring BME faculty members may bring in new ideas and areas of expertise for the growth of programs in the department.

Proposals to enhance programs (if desired)

None at this time



Engineering Accreditation Commission

Final Statement of Accreditation
to

Wright State University

Dayton, Ohio

2011-12 Accreditation Cycle

Leadership and Quality Assurance in Applied Science, Computing, Engineering, and Technology Education

ABET
ENGINEERING ACCREDITATION COMMISSION

WRIGHT STATE UNIVERSITY
Dayton, OH

FINAL STATEMENT
Visit Dates: November 6-8, 2011
Accreditation Cycle Criteria: 2011-12

Introduction & Discussion of Statement Construct

The Engineering Accreditation Commission (EAC) of ABET has evaluated the biomedical engineering, computer engineering, electrical engineering, engineering physics, industrial and systems engineering, materials science and engineering, and mechanical engineering programs of Wright State University.

This statement is the final summary of the EAC evaluation, at the institutional and engineering program levels. It includes information received during due process, including information submitted with the seven-day response. This statement consists of two parts: the first deals with the overall institution and its engineering operation, and the second deals with the individual engineering programs. It is constructed in a format that allows the reader to discern both the original visit findings and subsequent progress made during due process.

A program's accreditation action is based upon the findings summarized in this statement. Actions depend on the program's range of compliance or non-compliance with the criteria. This range can be construed from the following terminology:

- Deficiency: A deficiency indicates that a criterion, policy, or procedure is not satisfied. Therefore, the program is not in compliance with the criterion, policy, or procedure.

- Weakness: A weakness indicates that a program lacks the strength of compliance with a criterion, policy, or procedure to ensure that the quality of the program will not be

compromised. Therefore, remedial action is required to strengthen compliance with the criterion, policy, or procedure prior to the next evaluation.

- Concern: A concern indicates that a program currently satisfies a criterion, policy, or procedure; however, the potential exists for the situation to change such that the criterion, policy, or procedure may not be satisfied.

- Observation: An observation is a comment or suggestion that does not relate directly to the accreditation action but is offered to assist the institution in its continuing efforts to improve its programs.

Wright State University, founded in 1964 and granted full university status in 1967, is a regional university in the state of Ohio higher education system. Enrollment in the university is approximately 19,600 undergraduate students and over 3,000 graduate students. Undergraduate programs are offered in six colleges: Business, Education and Human Services, Engineering and Computer Science, Liberal Arts, Science and Mathematics, and Nursing and Health.

The College of Engineering and Computer Science (CECS) consists of four departments that offer the seven engineering programs under review: the Department of Biomedical, Industrial & Human Factors Engineering, the Department of Computer Science and Engineering, the Department of Electrical Engineering, and the Department of Mechanical and Materials Engineering. The college also offers eight master's programs and has 11 PhD focus areas in engineering and computer science. Enrollment in the college at the time of the visit was approximately 1,650 undergraduate and 400 graduate students. There are approximately 76 full-time faculty members in the college. The dean is new to the college and university, as of July 2010.

The following supporting units of the CECS were reviewed: Office of the Registrar, biology, chemistry, humanities/social sciences, library, mathematics, and physics. All supporting areas appear to adequately support the undergraduate engineering programs.

Biomedical Engineering
Program

Introduction

The biomedical engineering (BME) program has been in existence since 1975 and has been accredited since 1988. The program has two curricular tracks: the "traditional BME program" and the "pre-med option." At the time of the visit the program had approximately 200 students, six tenured or tenure-track faculty members (all of whom teach undergraduate courses), two non-tenure track faculty members, one part-time faculty member and one full-time office staff member. The program graduated 24 students in the most recent academic year. The program relies on college and university staff for computer, instrumentation, and equipment support.

Program Strengths

1. The faculty members are well qualified with a range of competencies appropriate for the program including: biomechanics, medical imaging, biomaterials, instrumentation, physiology, and human factors. The student-faculty interaction is of high quality.

2. The laboratory facilities are very good and support the delivery of the curriculum.

3. The biomedical engineering students are not only engaged in the program, but also in the university by taking advantage of a range of curricular and extracurricular opportunities. Student satisfaction is high.

Program Weaknesses

1. Criterion 1. Students This criterion requires that student progress be monitored to foster success in attaining student outcomes, thereby enabling graduates to attain program educational objectives. However, there is a lack of control for monitoring and enforcing prerequisites. Despite having a procedure in place to control students enrolling in classes without meeting prerequisites, an institutional study showed that multiple students have taken courses without pre-requisites and without permission to do so.

This criterion also requires that the program have and enforce policies for accepting both new and transfer students, awarding appropriate academic credit for courses taken at other institutions, and awarding appropriate academic credit for work in lieu of courses taken at the institution. The program has given authority for approving transfer credit to all faculty members and the program's full-time staff advisor, but there is uneven understanding of the policies among faculty. The current system has led to instances where transfer credit for non-engineering topic courses has been approved for engineering courses.

Criterion 1 further requires that the program have and enforce procedures to ensure and document that students who graduate meet all graduation requirements. However, the university relies on manual analysis by the advisor. There were several errors in an analysis on the program's supplied transcripts. Such errors can potentially result in students graduating without meeting all graduation requirements. Hence the program lacks the necessary strength of compliance with this criterion.

- Due–process response: The EAC acknowledges receipt of documentation that demonstrates the program has put in place a new advisement system starting in the spring of 2012. A review of the new system's performance demonstrates that it has overcome the weaknesses of the previous advisement system. In particular, this new system assures that prerequisites are enforced and that all graduation requirements are met. In addition, the program has a new process that provides more consistency in evaluating transfer credits. A factual error in the draft statement concerning transfer credit of non-engineering topic courses for engineering courses was pointed out in the response, and is acknowledged as valid.

- The weakness is resolved.

2. Criterion 2. Program Educational Objectives This criterion requires that there be a documented and effective process, involving program constituencies, for the periodic review and revision of the program educational objectives. Although the program has a review process, the process appears to be ad hoc. The program has defined four "dominant constituencies" that have participated or will participate in review and revision of the objectives. There is no evidence that the review process is periodic. Reviews were

scheduled in 2009 and 2011, but there is no evidence from these scheduled reviews. There appeared to be some ad hoc review of the program educational objectives just before the visit, and the self-study report does not describe a future review schedule. Hence, the program lacks the necessary strength of compliance with this criterion.

- Due–process response: The EAC acknowledges receipt of documentation that demonstrates changes in the review process for the program educational objectives. The process is periodic and program educational objectives will be reviewed by the program's constituencies every two years starting in 2012. At this time the review process has provided a single data set, and it will be important to demonstrate continued compliance with the criterion.

- The weakness is now cited as a concern.

3. Criterion 4. Continuous Improvement: This criterion requires that the program regularly use appropriate, documented processes for assessing and evaluating the extent to which both the program educational objectives and the student outcomes are being attained. However, the program is lacking a defined periodic schedule for assessing and evaluating program educational objectives and student outcomes. Moreover, there has only been one assessment and evaluation since the last visit. The self-study report contained no future schedule. The chair of the program has indicated there will be assessment and evaluation in 2013 and 2015.

   This criterion also requires that the results of these evaluations be systematically utilized as input for the continuous improvement of the program. However, the evaluations of program educational objectives and student outcomes are not systematically utilized as input to the continuous improvement system. There has only been one review of program educational objectives since the last visit, and the data used for that review are based on a graduate school survey and a medical school survey. There are also data from 18 graduating seniors from 2008-2010; however, these data do not directly measure attainment of the program educational objectives by the graduates. The data from the graduating students suggests that many of the students are not prepared to attain the program educational objectives. The self-study mentions that the BME program committee meets each quarter to discuss student performance in all courses, but there is no evidence in the minutes of the program committee

or elsewhere that evaluation of outcome assessment data has taken place since the last accreditation visit. Moreover, not all outcome data effectively support measurement of the level of attainment of the student outcomes. Hence the program lacks the necessary strength of compliance with this criterion.

- Due-process response: The EAC acknowledges receipt of documentation related to continuous improvements in the program. Additional data from student outcome assessment has been used to stimulate improvements to the program. The program now has in place a process that will continue to assess student outcomes and will use that process to provide input for improvements in the program. In addition, as the assessment process for the program educational objectives proceeds, the program expects to incorporate results of that assessment for continuous program improvement.

- The weakness is now cited as a concern.

Program Concern

1. Program Criteria Program criteria for biomedical engineering programs require the program to prepare graduates to have an understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology. A differential equations course is not an explicit pre-requisite for any BME course, even though it is used in BME 440. Communication with the chair and observations made during the onsite visit revealed that the first year course, EGR 101, contains an introduction to differential equations, with two out of 15 course goals devoted to the topic. Although the chair mentioned that differential equations will become a pre-requisite for BME courses (BME 463 and BME 440) in future curriculum guides, it was not required at the time of the visit. Although this criterion is currently satisfied at a minimal level, there is the potential that future compliance could be jeopardized.

   - Due-process response: The program did not provide a response for this shortcoming.

   - The concern remains.

Industrial and Systems Engineering
Program

Introduction

The industrial and systems engineering program was established in 1997 and is housed in the Department of Biomedical and Human Factors Engineering. There were approximately 42 students in the undergraduate program with seven students graduating in the most recent academic year. The program typically has 70 graduate students with 30 completing a master's degree each year. The program has seven tenured or tenure-track faculty members, three adjunct faculty members and five support staff members.

Program Strengths

1. The faculty members are well qualified with a range of competencies representative of the program's breadth, including: human factors and ergonomics, operations research, and supply chain management. The student-faculty interaction is excellent.

2. The students are actively engaged and take advantage of the wide array of curricular and extracurricular options available to them including co-op or internship experiences, an honors program, and an undergraduate research project. The student chapter of the Institute of Industrial Engineers (IIE) is very active.

3. The program and the college offer an array of notable support services to students that help with the admissions process, transfer process, and academic support. Student satisfaction is generally high.

Program Weaknesses

1. Criterion 2. Program Educational Objectives This criterion requires that a program have published program educational objectives that are consistent with the mission of the institution, the needs of the program's constituencies, and these criteria. There must also be a documented and effective process involving program constituencies for periodic review and

revision of the program educational objectives. The program has described a periodic review schedule for the program's objectives, but the program has not documented that this schedule was followed. Since the accreditation visit in 2005, there has only been one review, which was conducted in 2010. The program indicated that reviews will be conducted in 2013 and 2015 based on their assessment process; however, this schedule has yet to be followed. The program lacks strength of compliance with this criterion.

- Due–process response: The EAC acknowledges receipt of documentation related to the program educational objectives including a new review process. New program educational objectives have been generated through this process. The new program educational objectives describe expected attainments of the program graduates several years after completing the program. The process is periodic and program educational objectives will be reviewed by the program's constituencies every two years starting in 2012. At this time the review process has generated a single set of results, and it will be important for the program to demonstrate continued compliance with this criterion.

- The weakness is now cited as a concern..

2. Criterion 4. Continuous Improvement This criterion requires that the program regularly use appropriate, documented processes for assessing and evaluating the extent to which both the program educational objectives and the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. The program has made improvements to the program several times using the results of assessments. However, no improvements have been made to the program over the last two years because the assessment process has been relatively inactive. There appears to have been a lack of regularity in the exercise of the documented processes for assessing and evaluating the extent to which program educational objectives and student outcomes have been attained, and this has limited the effectiveness of the continuous improvement process. The program lacks strength of compliance with this criterion.

   - Due-process response: The EAC acknowledges receipt of documentation related to continuous improvements in the program. An accreditation director has been appointed at the college level to oversee all accreditation activities for the college. In addition, an

accreditation manager has been appointed by the department that administers the program to oversee program accreditation activities. Neither of these positions previously existed. Furthermore, both the program faculty and a committee of the college review all assessment data for the program. The assessment process is periodic and measures attainment of program educational objectives and student outcomes. At this time the review process has generated a single set of results, and it will be important for the program to demonstrate continued compliance with this criterion.

- The weakness is now cited as a concern.