WICHITA STATE UNIVERSITY

Program Review Self-Study Template

Academic unit: Bioengineering

College: Engineering - Interdisciplinary

Date of last review _____

Date of last accreditation report (if relevant) _____

List all degrees described in this report (add lines as necessary)

Degree: BS Bioengineering CIP* code: 14.0501

Degree: _____ CIP code: _____

Degree: _____ CIP code: _____

*To look up, go to: Classification of Instructional Programs Website, http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55

Faculty of the academic unit (add lines as necessary)

Name	Signature
Michael Jorgensen	
Anil Mahapatro	
Nils Hakansson	

Submitted by: Michael Jorgensen, Associate Professor, Coordinator, Bioengineering Date 5/7/2012

1. Departmental purpose and relationship to the University mission (refer to instructions in the WSU Program Review document for more information on completing this section).

a. University Mission:

Wichita State University is committed to providing comprehensive educational opportunities in an urban setting. Through teaching, scholarship and public service the University seeks to equip both students and the larger community with the educational and cultural tools they need to thrive in a complex world, and to achieve both individual responsibility in their own lives and effective citizenship in the local, national and global community.

b. Program Mission (if more than one program, list each mission): The mission of the Bioengineering program is to provide students a comprehensive education, including integration of the life sciences and engineering principles, to prepare the students to address health needs at the local, national and global levels.

c. The role of the program (s) and relationship to the University mission: Explain in 1-2 concise paragraphs. The role of the Bioengineering program is to provide a comprehensive and interdisciplinary education to prepare students to pursue careers to address societal health needs that are becoming increasingly complex in nature, which also require interdisciplinary solutions. The bioengineering program will prepare students, through its integration of science and engineering principles, to understand and contribute to scholarship, both in the classroom as well as participation in research opportunities. Additionally, the bioengineering program is envisioned to involve and contribute to the larger community, by its vision to integrate healthcare entities within its curricular offerings and research endeavors of its faculty.

d. Has the mission of the Program (s) changed since last review? ☐ Yes ☒ No

i. If yes, describe in 1-2 concise paragraphs. If no, is there a need to change?

This is the first program review for the Bioengineering program, which began in Fall 2009, where the program mission was recently reviewed and approved by the faculty of the Bioengineering program.

e. Provide an overall description of your program (s) including a list of the measurable goals and objectives of the program (s) (both programmatic and learner centered). Have they changed since the last review? ☐ Yes ☒ No

Bioengineers are employed in industry, hospitals, research facilities, and government regulatory agencies. To address an increasing need for expertise and a skilled and knowledgeable workforce in bioengineering in this geographic region, the Bioengineering program began in the Fall 2009 semester, as a multidisciplinary program consisting of stakeholders from four different Colleges within Wichita State University (i.e., Engineering, Health Professions, Education, Liberal Arts and Sciences). The undergraduate program is based upon engineering fundamentals, mathematics, physics, chemistry, and biology. It was envisioned when the program began that it would grow such that students would have the choice of graduating with a degree in general bioengineering or with a concentration in Biomedical Device/Instrumentation, Lifespan Engineering, or Bioenergy. Due to the structure of the Bioengineering

curriculum, graduates will have the ability to solve problems and design solutions that link engineering with physical and biological sciences, and pursue professional opportunities related to this ability. Thus, the Bioengineering program has three program educational objectives. Graduates of the WSU Bioengineering program will:

1. Address problems at the interface of engineering, biology and medicine.
2. Pursue professional development, including further study in graduate or professional schools.
3. Assume leadership roles in addressing societal needs at the local, national and global levels.

These are the first program educational objectives, and have been approved by the faculty in the Bioengineering program.

If yes, describe the changes in a concise manner.

2. Describe the quality of the program as assessed by the strengths, productivity, and qualifications of the faculty in terms of SCH, majors, graduates and scholarly productivity (refer to instructions in the WSU Program Review document for more information on completing this section). Complete a separate table for each program if appropriate.

UG Program - BS (No FTE/SCH assigned to program)

Last 3 Years	Tenure/Tenure Track Faculty (Number)	Tenure/Tenure Track Faculty with Terminal Degree (Number)	Instructional FTE (#): TTF= Tenure/Tenure Track GTA=Grad teaching assist O=Other instructional FTE			Total SCH - Total SCH by FY from Su, Fl, Sp	Total Majors - From fall semester	Total Grads – by FY
			TTF	GTA	O			
Year 1→	N/A	N/A	N/A	N/A	N/A	N/A	--	--
Year 2→	N/A	N/A	N/A	N/A	N/A	N/A	19	--
Year 3→	N/A	N/A	N/A	N/A	N/A	N/A	36	--
			Total Number Instructional (FTE) – TTF+GTA+O			SCH/ FTE	Majors/ FTE	Grads/ FTE
Year 1→					N/A	N/A	N/A	N/A
Year 2→					N/A	N/A	N/A	N/A
Year 3→					N/A	N/A	N/A	N/A

Scholarly Productivity	Number Journal Articles		Number Presentations		Number Conference Proceedings		Performances			Number of Exhibits		Creative Work		No. Books	No. Book Chaps.	No. Grants Awarded or Submitted	$ Grant Value
	Ref	Non-Ref	Ref	Non-Ref	Ref	Non-Ref	*	**	***	Juried	****	Juried	Non-Juried				
Year 1				3	3												
Year 2	5		8		2										2	3	720,000
Year 3	4			1	3												

* Winning by competitive audition. **Professional attainment (e.g., commercial recording). ***Principal role in a performance. ****Commissioned or included in a collection. KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

a. Provide a brief assessment of the quality of the faculty/staff using the data from the table above as well as any additional relevant data. Programs should comment on details in regard to productivity of the faculty (i.e., some departments may have a few faculty producing the majority of the scholarship), efforts to recruit/retain faculty, departmental succession plans, course evaluation data, etc.

Provide assessment here: The faculty that support the Bioengineering program must be appointed in an Engineering Department, thus, the scholarly productivity numbers shown in the above table will have also been reported by the department the Bioengineering faculty has an appointment in. The data in Year 1 reflect the productivity of Dr. Jorgensen, Coordinator of the Bioengineering Program, who is appointed to the Industrial and Manufacturing Engineering (IME) Department. Year 2 of the above table reflects the high productivity level of Dr. Shalini Prasad, who joined WSU as the H. Russell Bomhoff Professor of Engineering, and was appointed to the Electrical Engineering and Computer Science (EECS) Department. Unfortunately, Dr. Prasad left WSU after one year, and the Bioengineering Program is currently in an open faculty search to replace her. The majority of the scholarly productivity shown for Year 3 is attributed to Dr. Anil Mahapatro, who joined the Bioengineering Program in August of 2011, and is appointed to the IME Department. Collectively, the new faculty to the Bioengineering program has demonstrated a high level of scholarship productivity in terms of research dissemination through

peer-reviewed journal articles and conference papers and abstracts, as well as grant proposal submissions. Although there were no grant proposal submissions shown for Year 3, Dr. Mahapatro has already submitted two within the first three months of 2012.

The Bioengineering Program has been actively engaged in faculty recruitment over the past two years. The program began with Dr. Jorgensen as the coordinator of the program, charged with developing the program. The first faculty hire was Dr. Shalini Prasad with an expertise area of Biosensors, who started in August 2011 and was appointed to the EECS Department, and subsequently left WSU after one year. Dr. Anil Mahapatro, with an expertise area of Biomaterials, was recruited through a faculty search in the spring of 2011, and started in August 2011, with an appointment in the IME Department. Dr. Nils Hakansson, who has expertise in Biomechanics, has recently joined WSU (December 2011), is supporting Engineering Physics and the Bioengineering program, and has been appointed to the IME Department. Currently, the Bioengineering program is engaged in a faculty search to replace Dr. Prasad for the H. Russell Bomhoff Professorship in Engineering to support the Bioengineering program, with expertise sought in the areas of Biosensors, Biomedical devices, or Bioinstrumentation. Future plans for faculty recruitment, which are based on curriculum needs and/or strategic research thrust areas, includes the recruitment of an Engineering Educator for developing and delivering course modules and courses related to bioengineering design, faculty with the expertise in Microfluidics or areas not recruited in the current faculty search (e.g., Biosensors), and further faculty expertise in the area of Biomechanics.

With respect to faculty retention, the untenured faculty of the Bioengineering Program are matched with a faculty mentor from the College of Engineering's Faculty Mentor Program, where the chosen mentor is not a faculty member in their own Engineering department. Additionally, the untenured program faculty are also part of WSU's Pre-tenure Club, and attend meetings and activities sponsored by this group, under the direction of Dr. William Vanderburgh, Director of the Faculty Development and Student Success Office.

3. Academic Program: Analyze the quality of the program as assessed by its curriculum and impact on students. Complete this section for each program (if more than one). Attach updated program assessment plan (s) as an appendix (refer to instructions in the WSU Program Review document for more information).

a. For undergraduate programs, compare ACT scores of the majors with the University as a whole.

Last 3 Years	Total Majors - From fall semester	ACT – Fall Semester (mean for those reporting)	
		Majors	All University Students - FT
Year 1→	--	--	22.66
Year 2→	19	29.5	22.72
Year 3→	36	26.6	22.81

KBOR data minima for UG programs: ACT≤20 will trigger program.

b. For graduate programs, compare graduate GPAs of the majors with University graduate GPAs.*

Last 3 Years	Total Admitted - By FY		Average GPA (Admitted) – Domestic Students Only (60 hr GPA for those with ≥54 hr reported) By FY					
					Comparisons			
	MS	PhD	MS GPA	PhD GPA	College – MS	College – PhD	Univ - MS	Univ PhD
Year 1→08	N/A							
Year 2→09								
Year 3→10								

*If your admission process uses another GPA calculation, revise table to suit program needs and enter your internally collected data.

c. Identify the principal learning outcomes (i.e., what skills does your Program expect students to graduate with). Provide aggregate data on how students are meeting those outcomes. Data should relate to the goals and objectives of the program as listed in 1e. Provide an analysis and evaluation of the data by learner outcome with proposed actions based on the results.

In the following table provide program level information. You may add an appendix to provide more explanation/details. Definitions:

Learning Outcomes: Learning outcomes are statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire in their matriculation through the program (e.g., graduates will demonstrate advanced writing ability).

Assessment Tool: One or more tools to identify, collect, and prepare data to evaluate the achievement of learning outcomes (e.g., a writing project evaluated by a rubric).

Criterion/Target: Percentage of program students expected to achieve the desired outcome for demonstrating program effectiveness (e.g., 90% of the students will demonstrate satisfactory performance on a writing project).

Result: Actual achievement on each learning outcome measurement (e.g., 95%).

Analysis: Determines the extent to which learning outcomes are being achieved and leads to decisions and actions to improve the program. The analysis and evaluation should align with specific learning outcome and consider whether the measurement and/or criteria/target remain a valid indicator of the learning outcome as well as whether the learning outcomes need to be revised.

Learning Outcomes (most programs will have multiple outcomes)	Assessment Tool (e.g., portfolios, rubrics, exams)	Target/Criteria (desired program level achievement)	Results	Analysis
Please see the table below for Learning Outcomes for Bioengineering Program	Assessment tools will consist of certain exam and quiz questions, student surveys, rubrics for presentations, project reports and teamwork.	For each learning outcome, we have targeted a mean score of 70% on any evaluation method as the minimum level to indicate achievement of the learning outcome.	See below.	See below.

The Bioengineering program has learning outcomes for all Bioengineering courses that have been developed to date, which are communicated to the students on the syllabi of the courses. Additionally, the Bioengineering program has learning outcomes that are defined by the Accreditation Board for Engineering and Technology (ABET), which is the accrediting body for engineering programs. The faculty of the Bioengineering program have mapped specific learning outcomes from specific Bioengineering courses to the ABET defined program outcomes, as shown in the table below.

Learning Outcome	Bioengineering Courses*						
	BioE 452	BioE 462	BioE 477	BioE 480	BioE 482	BioE Practicum	BioE Capstone
1. Ability to apply knowledge of mathematics, science, and engineering	x	x					
Ability to design and conduct experiments, as well as to analyze and interpret data	x		x	x			x
3. Ability to design a system, component or process to meet desired needs with realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability					x		x
4. Ability to function on multidisciplinary teams						x	x
5. Ability to identify, formulate and solve engineering problems		x					x
6. Understanding of professional and ethical responsibility			x			x	x
7. Ability to communicate effectively	x				x		x
8. Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context						x	x
9. Recognition of the need for, and an ability to engage in life-long learning	x			x			x
10. Knowledge of contemporary issues						x	x
11. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice					x		x
12. An understanding of biology and physiology		x	x	x			
13. The capability to apply advanced mathematics to solve problems at the interface of engineering and biology	x	x		x			
14. The ability to make measurements on and interpret data from living systems				x			x
15. Address problems associated with the interaction between living and non-living materials and systems			x		x		x

BioE 452: Biomechanics; BioE 462: Intro to Biofluids; BioE 477: Intro to Biomaterials; BioE 480: Bioinstrumentation; BioE 482: Design of Biodevices.

Results: At this time, only BioE 462 Intro to Biofluids has been assessed for learning outcomes. Other courses will be evaluated for the first time during the Spring 2012 and Fall 2012 semesters (i.e., BioE 452 Biomechanics, BioE 477 Intro to Biomaterials, BioE 480 Bioinstrumentation, BioE 482 Design of Biodevices, Bioengineering Practicum, Bioengineering Capstone Design). Results of the learning outcome assessment for BioE 462, which are based on specific exam question scores, indicate the students met the minimum criteria level for sufficient learning for outcomes 1, 5, and 12, whereas students had difficulty with learning outcome 13.

Analysis: The instructor felt that pacing may have been an issue, where not as much time was devoted to this due to the end of the semester. The instructor indicated more time will be devoted to the topic that addresses this learning outcome.

Learning Outcome	Bioengineering Courses*						
	BioE 452	BioE 462	BioE 477	BioE 480	BioE 482	BioE Practicum	BioE Capstone
1. Ability to apply knowledge of mathematics, science, and engineering		76.1%					
2. Ability to design and conduct experiments, as well as to analyze and interpret data							
3. Ability to design a system, component or process to meet desired needs with realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability							
Ability to function on multidisciplinary teams							
5. Ability to identify, formulate and solve engineering problems		80.3%					
6. Understanding of professional and ethical responsibility							
7. Ability to communicate effectively							
8. Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context							
9. Recognition of the need for, and an ability to engage in life-long learning							
10. Knowledge of contemporary issues							
11. Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice							
12. An understanding of biology and physiology		82.0%					
13. The capability to apply advanced mathematics to solve problems at the interface of engineering and biology		65.1%					
14. The ability to make measurements on and interpret data from living systems							
15. Address problems associated with the interaction between living and non-living materials and systems							

*BioE 452: Biomechanics; BioE 462: Intro to Biofluids; BioE 477: Intro to Biomaterials; BioE 480: Bioinstrumentation; BioE 482: Design of Biodevices.

d. Provide aggregate data on student majors satisfaction (e.g., exit surveys), capstone results, licensing or certification examination results, employer surveys or other such data that indicate student satisfaction with the program and whether students are learning the curriculum (for learner outcomes, data should relate to the goals and objectives of the program as listed in 1e).

The Bioengineering program has not had any graduates yet given it started in the Fall 2009 semester. We anticipate that the first graduates from this program will occur at the end of the Spring 2013 semester. In order to assess student satisfaction with the program when the program ultimately has graduates, measures and surveys will be determined and developed to achieve this.

Student Satisfaction (e.g., exit survey data on overall program satisfaction).* If available, report by year, for the last 3 years			Learner Outcomes (e.g., capstone, licensing/certification exam pass-rates) by year, for the last three years				
Year	N	Result (e.g., 4.5 on scale of 1-5, where 5 highest)	Year	N	Name of Exam	Program Result	National Comparison±
1			1				
2			2				
3			3				

*Available for graduate programs from the Graduate School Exit Survey. Undergraduate programs should collect internally. ± If available.

e. Provide aggregate data on how the goals of the *WSU General Education Program* and *KBOR 2020 Foundation Skills* are assessed in undergraduate programs (optional for graduate programs).

The WSU General Education Program and KBOR 2020 Foundation Skills have not yet been assessed for the Bioengineering program. At this time, we will measure these by having incoming Fall 2012 freshman students into the College of Engineering take the Collegiate Learning Assessment (CLA) test, and have these same students take the CLA test their senior year to allow assessment.

Goals/Skills Measurements of: -Oral and written communication -Numerical literacy -Critical thinking and problem solving -Collaboration and teamwork -Library research skills -Diversity and globalization	Results	
	Majors	Non-Majors

Note: Not all programs evaluate every goal/skill. Programs may choose to use assessment rubrics for this purpose. Sample forms available at: http://www.aacu.org/value/rubrics/

f. Indicate whether the program is accredited by a specialty accrediting body including the next review date and concerns from the last review.

Provide information here: The Bioengineering program is not currently an accredited program. The Bioengineering program will be going up for accreditation by ABET during the next scheduled accreditation visit to the College of Engineering, which will occur in the Fall of 2013.

g. Provide a brief assessment of the overall quality of the academic program using the data from 3a – 3f and other information you may collect, including outstanding student work (e.g., outstanding

scholarship, inductions into honor organizations, publications, special awards, academic scholarships, student recruitment and retention).

Provide assessment here: In its short existence, the Bioengineering program has begun with a high level of quality in terms of its students and student work. The mean ACT scores of the Bioengineering students ranged between 3 to 7 points higher than the overall University-wide student mean ACT score, depending on the year of comparison, approximately 11 of the Bioengineering students are currently in the pre-med curriculum, and several are double-majors in other departments such as Chemistry, Mechanical Engineering, and Medical Technology. Bioengineering students have also achieved success from an academic scholarship perspective, where the student-body consists of Wallace Scholars, Dean's Scholars, and academic scholarships from various other sources such as Project Lead the Way. From a scholarship and research perspective, Bioengineering students have also realized success, where Bioengineering students were awarded 1st and 2nd place on the oral presentation in the Natural Science/Engineering division for the 2011 WSU Undergraduate Research and Creative Activity Forum, and one student was awarded 1st place for her poster in the Natural Science division. Three students have secured internships with the Center for Innovation in Biomaterials in Orthopedic Research (CIBOR), one is currently in an internship at the Orthopedic Research Institute, and another student is currently in an internship in Washington, DC. One student has presented a poster at national conference, and one student has a peer-reviewed journal article, with one in preparation. Finally, one Bioengineering student was awarded the prestigious Kansas IDeA Network of Biomedical Research Excellence (K-INBRE) scholarship for undergraduate research. With the addition of more Bioengineering faculty, the quality of student work and student success is expected to continue to grow.

The overall quality of the academic program is in the process of being assessed given that some of the courses are currently being offered for the first time, with only one completed course being previously assessed in terms of student learning outcomes. We have identified course-specific learning outcomes for all Bioengineering courses that have been developed thus far, and will do the same for the courses that will be developed in the future. Additionally, faculty who teach courses in the Bioengineering program are identifying the assessment tools and metrics that will be used to assess the learning outcomes in each of the courses. Finally, specific student learning outcomes to assess the overall Bioengineering program have been mapped to specific Bioengineering courses, where the faculty teaching these specific courses, including adjunct instructors, are aware of the outcomes to be assessed and reported, and are collecting the necessary outcome data from these courses.

4. Analyze the student need and employer demand for the program. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).

a. Utilize the table below to provide data that demonstrates student need and demand for the program.

Undergraduate - BS

Majors						Employment of Majors*						
Last 3 FYs – Su, Fl, and Sp	No. new applicants or declared majors	No. who enter or are admitted in the major	No. enrolled one year later	1 Year Attrition %	Total no. of grads	Average Salary	Employment % In state	Employment % in the field	Employment: % related to the field	Employment: % outside the field	No. pursuing graduate or professional education	Projected growth from BLS**
Year 1→	--		--	--	--							Current year only ↓
Year 2→	27		19	29.6	--							
Year 3→	28		18	35.7	--							6%

Race/Ethnicity by Major***											Race/Ethnicity by Graduate***								
	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK	NRA	H	AI/AN	A	B	NH/PI	C	MR	UNK
Year 1→	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Year 2→	0	0	0	1	0	0	3	0	0									
Year 3→	1	0	1	5	1	0	9	1	0									

* May not be collected every year

** Go to the U.S. Bureau of Labor Statistics Website: http://www.bls.gov/oco/ and view job outlook data and salary information (if the Program has information available from professional associations or alumni surveys, enter that data)

*** NRA=Non-resident alien; H=Hispanic; AI/AN=American Indian/ Alaskan Native; A=Asian; B=Black; NH/PI=Native Hawaiian/Pacific Islander; C=Caucasian; MR=Multi-race; UNK=Unknown

KBOR data minima for UG programs: Majors=25; Graduates=10; Faculty=3; KBOR data minima for master programs: Majors=20; Graduates=5; Faculty=3 additional; KBOR data minima for doctoral programs: Majors=5; Graduates=2; Faculty=2 additional.

Provide a brief assessment of student need and demand using the data from the table above. Include the most common types of positions, in terms of employment, graduates can expect to find.

Provide assessment here: As the table above indicates, the growth of the Bioengineering program was consistent in 2010 and 2011 with respect to the number of new students declaring Bioengineering as their major. This interest in Bioengineering reflects the national employment growth, where the 2012-2013 Bureau of Labor Statistics (BLS) Occupational Outlook Handbook projects the growth rate in employment for Biomedical Engineers of 62% between 2010 and 2020, compared with 14% for all other occupations and 11% for Engineering in general. Thus, employment growth in this discipline is identified by BLS as 'much faster than average'. As the table above also indicates, the Bioengineering program has not realized graduates from the program yet, where it will see its first graduates in May 2013. The most recent job placement survey by the American Institute for Medical and Biological Engineering (2009) found that of those who graduated with a bachelor's degree in biomedical or bioengineering, 37% obtained a job, 43% pursued further education, whereas 9% continued to seek employment. Of those

who obtained a job after graduation, graduates found employment in the bioengineering industry, hospitals, academia, consulting, and government. Of those who pursued further education, 50% pursued further education in an engineering discipline whereas 31% pursued further education in medicine. Once again, since the program has not realized graduates yet, average salary data are not available for the students from the Bioengineering program. However, recent data reported by the National Association of Colleges and Employers (NACE) Fall 2011 Salary Survey found the mean salary offer for Biomedical and Bioengineering graduates with bachelor's degrees was $55,699. Overall, nation-wide trends suggest a growing job demand for the bioengineering field over the next decade, with graduates with bachelor's degrees in bioengineering experiencing success in job placement or pursuing further education.

5. **Analyze the cost of the program and service the Program provides to the discipline, other programs at the University, and beyond. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).**

Percentage of SCH Taken By (last 3 years)			
Fall Semester	Year 1	Year 2	Year 3
UG Majors	N/A		
Gr Majors			
Non-Majors			

a. Provide a brief assessment of the cost and service the Program provides. Comment on percentage of SCH taken by majors and non-majors, nature of Program in terms of the service it provides to other University programs, faculty service to the institution, and beyond.

Provide assessment here: The Bioengineering program does not have data regarding percentage of student credit hours taken in the last three years, thus, will not be reported in this program review. Given that the Bioengineering program will likely have all required and elective courses in place in the very near future, this data will be reported for the next program review. The faculty of the Bioengineering Program provide service to the program, departments of the College of Engineering, the University, and outside the University. Dr. Jorgensen, who serves as the Coordinator of the Bioengineering Program, is also a tenured faculty in the IME Department in the College of Engineering. Within the Bioengineering Program, Dr. Jorgensen directs the faculty recruitment, advising of students, and accreditation and assessment efforts for the program. Within the IME Department, Dr. Jorgensen has served on various committees, including the Graduate committee and Planning and Budget committee. Within the College of Engineering, Dr. Jorgensen sits on the College Assessment committee, the Strategic Planning committee, the Scholarship committee, and has served on various search committees. At the University level, Dr. Jorgensen is a member of the Institutional Review Board for Human Subjects Research, is the Chair of the Intercollegiate Athletic Advisory Board, and has participated in the Coleman Foundation Fellowship Program with the Center of Entrepreneurship. Outside the University, Dr. Jorgensen is on the Editorial Board of three peer-reviewed journals and has served on proposal review panels for the research granting agencies. Dr. Anil Mahapatro joined WSU in August 2011 and was appointed to the IME Department. Within the Bioengineering Program, Dr. Mahapatro serves on the current faculty search committee, and has been developing several new courses to support the program (i.e., Tissue Engineering, Design of Biodevices, Introduction to Biomaterials). Within the University, Dr. Mahapatro has presented at the Biology Department seminar series. Outside the University, Dr. Mahapatro reviews manuscripts for several peer-reviewed journals, and has been appointed to the International Organization for Standardization and the American Society for Testing and Materials Working Groups for Absorbable Vascular Implants. Finally, Dr. Nils Hakansson joined WSU in January 2012. Dr. Hakansson was appointed to the IME Department, is currently teaching a Biomechanics course for the Bioengineering Program, Engineering Physics I for the College of Engineering, and is developing a graduate course for Fall 2012 that will contribute to both the IME Department and the Bioengineering Program.

6. **Report on the Program's goal (s) from the last review. List the goal (s), data that may have been collected to support the goal, and the outcome. Complete for each program if appropriate (refer to instructions in the WSU Program Review document for more information on completing this section).**

(For Last 3 FYs)	Goal (s)	Assessment Data Analyzed	Outcome
	N/A	N/A	N/A

7. **Summary and Recommendations**

a. Set forth a summary of the report including an overview evaluating the strengths and concerns. List recommendations for improvement of each Program (for departments with multiple programs) that have resulted from this report (relate recommendations back to information provided in any of the categories and to the goals and objectives of the program as listed in 1e). Identify three year goal (s) for the Program to be accomplished in time for the next review.

Provide assessment here: The strengths of the Bioengineering program centers around its students, productivity of its faculty, and an encouraging future of the field of Bioengineering. At this time, there is an unprecedented opportunity for growth and success of the Bioengineering program at WSU. First, this is the only undergraduate Bioengineering program in the State of Kansas, which presents opportunities for growth and impact for WSU in this geographic region. This program has seen steady growth in the past two years, attracting students that have higher mean ACT scores than the University overall undergraduate student population, and possess ethnic as well as gender diversity (approximately 44% female). Several students in the program have been awarded scholarships that reflect academic achievement as well as leadership potential (e.g., Deans Scholars, Wallace Scholars, etc.), and the high caliber of the students is also reflected in the proportion of students who are currently in the pre-med curriculum, and the scholarly achievements of several students through recognition for their research. Another strength of the Bioengineering program is the faculty affiliated with the program. Dr.'s Jorgensen, Mahapatro and Hakansson provide service to the program through their efforts in developing courses and assessing student learning outcomes, their efforts in preparing the program for accreditation, as well as their work and time committed to helping grow the program in terms of faculty and student recruitment and retention. Additionally, they are extremely active collectively with service to the College of Engineering, WSU, as well as the professional societies they belong to.

The concerns of the Bioengineering program center around the limited number of faculty within the program, lab space constraints, and the nature of 'program' vs. 'department' and the impact on the faculty. These concerns may have an impact on the future success of the current Bioengineering faculty, recruitment of additional faculty to the program, and may impact student learning and development. Currently, with Dr. Jorgensen at 0.5 FTE, and Dr.'s Mahapatro and Hakansson also having responsibilities within the IME Department and Engineering Physics, the FTE for Bioengineering program faculty is approximately 2.0. Thus, there is a need to recruit additional faculty into the Bioengineering program, especially due to the increasing number of majors in the program, as well as the need to develop the remaining required courses in the curriculum, but have sufficient Bioengineering courses to complete

the different concentrations. Additional faculty are also needed to reduce the advising load on the faculty, and to provide additional mentoring and undergraduate research opportunities for the increasing number of bioengineering majors. Lab space, for both current and especially future Bioengineering faculty is also limited in quantity. This limitation may impact negatively on attracting future Bioengineering faculty to WSU and the program, and reduces the opportunities for experience-based learning and undergraduate research for Bioengineering students. Finally, the nature of 'program' vs. 'department' contains challenges for current and future Bioengineering faculty. Since Bioengineering faculty have responsibilities to both the Bioengineering program and the department of appointment, challenges exist in terms of assessment and evaluation of faculty, the tenure process, service activities, course responsibilities, and graduate student recruitment for their research.

The three-year goals to be completed by the Bioengineering program by the next program review include 1) recruitment and retention of Bioengineering faculty to bring the Bioengineering program to a level that allows coverage of required and elective courses in the Bioengineering program; 2) increase coop and internship opportunities for Bioengineering students; 3) increase undergraduate research opportunities through development of an undergraduate research program; 4) achieve ABET accreditation of the Bioengineering program; and 5) development of experience-based learning opportunities within the Bioengineering curriculum.

College: Engineering

Department/Program (s): Bioengineering

Degree (s) Offered: BS

Triggers: Majors (14.33)

Brief Description of Each Degree:
The Bioengineering program prepares graduates for graduate study or employment related to societal health needs requiring interdisciplinary solutions. Through integration of science and engineering principles, students are prepared to understand and contribute to scholarship, both in the classroom as well as participation in research opportunities. The program is based upon engineering fundamentals, mathematics, physics, chemistry, and biology. As the program matures, students will have the choice of graduating with a degree in general bioengineering or with a concentration in Biomedical Device/Instrumentation, Lifespan Engineering, or Bioenergy. The educational objectives of the Bioengineering program are to:

1. Address problems at the interface of engineering, biology, and medicine.
2. Pursue professional development, including further study in graduate or professional schools.
3. Assume leadership roles in addressing societal needs at the local, national and global levels.

Assessment of Learning Outcomes (for UG and GR):
Learning outcomes defined by ABET are listed in the department report. Note: these learning outcomes are different than the *program* outcomes listed in Section 1e. Learning outcomes are cross-referenced by Bioengineering courses through which these learning outcomes are met. Each of the 15 learning outcomes is addressed in at least two courses. Assessment tools consist of specific exam and quiz questions, student surveys, rubrics for presentations, project reports and teamwork. Target/Criteria is specified as a mean score of 70% on any evaluation method as the minimum level to indicate achievement of the learning outcome. At the time of the report, only four learning outcomes have been assessed in *one single course*. It is unclear whether the department reported results for mean class performance or the percentage of students passing the assessments at the minimum level of achievement (70% or better). For the one learning outcome cited as deficient, the instructor indicated that more time should be devoted to the topic.

Placement of Graduates (types of positions, starting salary):
The Bioengineering program is new; there have been no graduates of the program to date. However, there is a high employer demand for engineers. The Bureau of Labor Statistics projects a 62% growth in employment for biomedical engineers between 2010 and 2020. The starting annual salaries for biomedical engineering graduates with bachelor's degrees average over $55,000.

Faculty Resources:
The dean has allocated Bioengineering faculty research laboratory and teaching space. Untenured faculty are mentored through the College of Engineering's Faculty Mentor Program. The program is coordinated by Dr. Michael Jorgensen. The program has received approval to search for an engineering educator. A new faculty line has been allocated to the program as well. The number of faculty for the program is adequate, but the program is still searching for the Bomhoff Professorship in Engineering.

Sources of External Support:
The College of Engineering is working on public-private partnerships to obtain additional laboratory and faculty office space.

Conclusions and Recommendations:

Commendations:
The Bioengineering program is an innovative degree program, which will help meet employer demands; graduates of the program will be positioned to address societal health needs. Although early in its implementation, program enrollment is growing rapidly. The program trigger (# majors) is not a concern. Faculty are committed to the mission, goals and learner outcomes.

Recommendations:

1. Draw a direct connection between *program* outcomes and *learning* outcomes.
2. WSU "target/criteria" dictates % students at specified level of minimum performance. Bioengineering program faculty are measuring mean score of students on assessment tools. These are two completely different measures. The department measure does not adequately assess learner outcomes.
3. It is unclear how "teamwork" is measured.
4. For the learner outcome identified as a "deficiency" (applying advanced mathematics…), only one course assessment was used. The interpretation/analysis given by the instructor is fairly benign.
5. Generally, the assessment of learner outcomes is weak. The department is currently working on developing a more rigorous and meaningful outcomes assessment process.
6. As for all engineering programs, adequate space/resources for future growth need to be secured.

College: Engineering

Department/Program (s): Bioengineering

Degree (s) Offered: BS

Triggers: Majors (14.33) – New program

Brief Description of Each Degree:
The Bioengineering program prepares graduates for graduate study or employment related to societal health needs requiring interdisciplinary solutions. Through integration of science and engineering principles, students are prepared to understand and contribute to scholarship, both in the classroom as well as participation in research opportunities. The program is based upon engineering fundamentals, mathematics, physics, chemistry, and biology. As the program matures, students will have the choice of graduating with a degree in general bioengineering or with a concentration in Biomedical Device/Instrumentation, Lifespan Engineering, or Bioenergy. The educational objectives of the Bioengineering program are to:

1. Address problems at the interface of engineering, biology, and medicine.
2. Pursue professional development, including further study in graduate or professional schools.
3. Assume leadership roles in addressing societal needs at the local, national and global levels.

Assessment of Learning Outcomes:
Learning outcomes defined by ABET are listed in the department report. ~~Note: these learning outcomes are different than the *program* outcomes listed in Section 1e~~. Learning outcomes are cross-referenced by Bioengineering courses through which these learning outcomes are met. Each of the 15 learning outcomes is addressed in at least two courses. Assessment tools consist of specific exam and quiz questions, student surveys, rubrics for presentations, project reports and teamwork. Target/Criteria is specified as a mean score of 70% on any evaluation method as the minimum level to indicate achievement of the learning outcome. At the time of the report, only four learning outcomes have been assessed in *one single course*. It is unclear whether the department reported results for mean class performance or the percentage of students passing the assessments at the minimum level of achievement (70% or better). For the one learning outcome cited as deficient, the instructor indicated that more time should be devoted to the topic.

Placement of Graduates (types of positions, starting salary):
The Bioengineering program is new; there have been no graduates of the program to date. However, there is a high employer demand for engineers. The Bureau of Labor Statistics projects a 62% growth in employment for biomedical engineers between 2010 and 2020. The starting annual salaries for biomedical engineering graduates with bachelor's degrees average over $55,000.

Faculty Resources:
The dean has allocated Bioengineering faculty research laboratory and teaching space. Untenured faculty are mentored through the College of Engineering's Faculty Mentor Program. The program is coordinated by Dr. Michael Jorgensen. The program has received approval to search for an engineering educator. A new faculty line has been allocated to the program as well. The number of faculty for the program is adequate, but the program is still searching for the Bomhoff Professorship in Engineering.

Sources of External Support:
The College of Engineering is working on public-private partnerships to obtain additional laboratory and faculty office space. The faculty document $720,000 grant support over the last 3 years.

Conclusions and Recommendations:

Commendations:

- The Bioengineering program is an innovative degree program, which will help meet employer demands.
- Graduates of the program will be positioned to address societal health needs. Although early in its implementation, program enrollment is growing rapidly.
- The program trigger (# majors) is not a concern as this is a new program and expectations are for more than 10 graduates a year.
- Faculty are committed to the mission, goals and learner outcomes.

By April 1, 2013 (send to the Office of the Provost):

- Document that the program review process is a part of a continuous improvement approach involving all departmental faculty. The department measure does not adequately assess learner outcomes. It is unclear how "teamwork" is measured. For the learner outcome identified as a "deficiency" (applying advanced mathematics...), only one course assessment was used. The interpretation/analysis given by the instructor is fairly benign.
- The learning outcomes for the program should be further developed and a revised assessment process needs to be implemented to include the following for all programs:
    - Learning Outcomes: Statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire through their program (e.g., graduates will have the ability to explain information presented in mathematical forms).
    - Assessment Methods: Direct measures used to identify, collect, and prepare data to evaluate the achievement of learning outcomes (e.g., quantitative literacy evaluated by a rubric, not grades or other indirect measures).

- Targets: Expectations of students to achieve the desired outcome to demonstrate program effectiveness (e.g., 90% of students will demonstrate at least the benchmark performance on a project).
- Results: Actual achievement on each measurement (e.g., 94% of the students achieved at least the benchmark performance on the project).
- Analysis: An evaluation that determines the extent to which learning outcomes are being achieved and leads to decisions and actions to improve the program. The analysis and evaluation should align with specific learning outcomes and consider whether the measurement and target remain valid indicators of the learner.

Prior to the next review in 2015:

- Adequate space/resources for future growth need to be secured.
- Include the new university exit and alumni survey data in the program assessment. This will include placement data, salaries, and student satisfaction.