RECOMMENDATION OF THE COLLEGE OF ENGINEERING & APPLIED SCIENCE ACADEMIC PLANNING COMMITTEE TO ESTABLISH A BIOMEDICAL ENGINEERING PROGRAM DEPARTMENT-LIKE BODY

I. Recommendations:
   A. That a Biomedical Engineering Program department-like body be created in accordance with UWM Policies and Procedures, Chapter 4.02, and the attached statement of parameters (see Appendix A: Administrative Structure).
   B. That the Biomedical Engineering Program be a stand-alone entity in the College of Engineering & Applied Science.

II. Goal:
The goal of this action is to establish the Biomedical Engineering Program as a tenure home in order to increase the number of faculty in this discipline to create critical mass and be sufficient to become a department.

Rationale:
   A. Background
   Biomedical Engineering is a cross-disciplinary program bringing together a number of engineering and science faculty members. In order to establish and maintain a high quality undergraduate and graduate program appropriate to a major urban doctoral university, a Biomedical Engineering department-like body is needed to facilitate the decision-making and development of the program for research, instruction, and economic growth at the local, regional, and state level.

   The creation of a Biomedical Engineering department-like body will address pressing needs at the undergraduate and graduate levels. The development of an undergraduate biomedical engineering program is already in progress. The Master of Science in Engineering Concentration: Biomedical Engineering consists of five separate tracks not currently unified or jointly managed. Additionally, there is no doctoral program in Biomedical Engineering available for interested graduate students. The creation of a Biomedical Engineering department-like body will facilitate developing and implementing of the undergraduate and graduate programs. Under the department-like body the programs are expected to attract more students and faculty members and reflect the national and international trends in biomedical engineering research and instruction.

   Two institutions of higher education in our metropolitan area enroll nearly five hundred students in their biomedical engineering programs. Milwaukee School of Engineering has one undergraduate program in
biomedical engineering and another that is closely related. Marquette University has an undergraduate, master’s, and doctoral program in Biomedical Engineering and another closely related. Already we receive many inquiries from prospective students about the availability of this major at UWM. The proposed program is expected to attract these students along with some of those currently going to the above-mentioned institutions. The other nearby campus offering this kind of program is the University of Wisconsin-Madison. The proposed program is not expected to significantly affect students’ enrollment there. When fully implemented, we expect a total of about 200 students enrolling in the University of Wisconsin-Milwaukee program.

In addition to coordinating research and instruction, a department-like body could better coordinate opportunities, internships, and community partnerships. Biomedical engineering is expected to play an important role in the economic development of the area. Since an aging population will need more medical care, demand for biomedical engineers is expected to continue to be strong. According to the U.S. Department of Labor, employment of biomedical engineers will grow 27 per cent over the period of 2012-2022. This growth is at a much faster rate than the average for all other disciplines. The median annual pay in 2012 was $86,960 and, according to Forbes, biomedical engineering is ranked No. 1 in the major most worth tuition, time and effort, using a rubric of starting pay, median mid-career pay, growth in salary and wealth of job opportunities. It has been ranked not only “one of the highest-paid engineering jobs,” but also an immensely rewarding profession because “it’s a career that gives back to society by helping improve world health.”

The mission statement of the University of Wisconsin-Milwaukee includes furthering academic and professional opportunities for women and minority students. National trends indicate that biomedical engineering is more attractive among these under-represented groups.

Since SE Wisconsin is home to a number of biomedical related industries, there are numerous internship and job opportunities for graduates. Additionally, these organizations need engineers trained in this area. Furthermore, since it is a growing area, there is a strong possibility of entrepreneurshipships that will help with new economic development in the region. The department-like body would be a hub of these activities.

B. Issues Addressed by this Action
The establishment of a department-like body will enable Biomedical Engineering faculty members to have a tenure home, increase the number of faculty FTE, and facilitate the creation and management of the

undergraduate and graduate programs in Biomedical Engineering, with the goal of achieving department status.

- A department-like body will facilitate management of the undergraduate and graduate programs and will allow us to introduce a Biomedical Engineering doctoral program. Every engineering program in CEAS currently has a major area designation within the Ph.D. in Engineering program. A department-like body will allow us to create and manage a Ph.D. in Engineering with a Biomedical Engineering major area in order to better engage in a sustained research effort, enhancing and fulfilling UWM’s mission as a doctoral institution of academic and professional excellence.

- Currently the Master’s of Science in Engineering with a Biomedical Engineering emphasis is spread across five different departments (II.B). This structure is not in accordance to national and international trends in biomedical engineering. A department-like body will facilitate creating a unified program and syllabus and manage the program according to current academic trends, better attracting highly qualified students.

- As a tenure home, Biomedical Engineering could acquire FTE faculty members more rapidly than is currently possible. With 88 ABET accredited undergraduate programs and many highly regarded graduate programs in bioengineering or biomedical engineering in the US, there is a significant potential candidate pool.

- The creation of a department-like body will also help bring together faculty members from different institutions and across programs to work on biomedical engineering research problems.

- A full-time faculty member appointed in Biomedical Engineering could serve as the Director of Biomedical Engineering and, like a department chair, could both administer and teach program courses.

The establishment of the Biomedical Engineering Program as a department-like body with more options to increase FTE will also allow it to grow its individual and coordinated BS, MS, and Ph.D. programs, to the benefit of graduate and undergraduate education at UWM.

Biomedical Engineering is a cross-disciplinary scholarly field, and the establishment of the program as a department-like body would allow for a combination of joint- and full-appointment faculty members that best represents its disciplinary character.
III. Unit Functions

A. Instructional Programs
   The department-like body will develop an undergraduate program. A Bachelor of Science in Biomedical Engineering will complement the existing program array at UWM. Since the program is of interdisciplinary nature, this will build upon several science and engineering courses already offered in our six ABET accredited Bachelor of Science degrees. A Notice of Intent is already in process in order to develop a full-fledge undergraduate program.

B. Graduate Programs
   The formation of a department-like body will help in setting up and managing master’s and Ph.D. programs in Biomedical Engineering. The department-like body will combine all biomedical engineering related activities that are currently scattered throughout CEAS.

For nearly two years the College has offered 10 tracks in a Master of Science in Engineering with Biomedical Engineering as one of the possible concentrations. The College of Engineering & Applied Science has over 12 faculty members with research and teaching interests in biomedical engineering. Students' transcripts reading, “MS in Engineering Concentration: Biomedical Engineering,” the MS in the Biomedical Engineering program incorporates the following five tracks:

1. Biomaterials
2. Biomechanics
3. Ergonomics, Musculoskeletal Biomechanics
4. Imaging
5. Informatics

This structure does not reflect current national and international trends in Biomedical Engineering programs. As a result, it is less attractive to students and does not garner the same attention as other structurally unified programs. A Biomedical Engineering Program department-like body will facilitate creation of a unified program that will aid in recruitment for faculty members and will make the program more attractive and more competitive. The development of an integrated program that reflects national and international trends will attract more graduate students.

The creation of a department-like body will also enable the creation of a biomedical engineering doctoral program, an endeavor in line with UWM’s mission for the development of a balanced array of high quality doctoral programs. At present, the College of Engineering & Applied Science leads a doctoral program in Biomedical and Health Informatics
that is offered in collaboration with the following five schools and the Medical College of Wisconsin.

1. College of Health Sciences
2. College of Nursing
3. Lubar School of Business
4. School of Information Studies
5. Zilber School of Public Health

The proposed department-like body will facilitate the creation of Biomedical Engineering as a major area within existing Ph.D. in Engineering that will be broader than what is currently offered under Biomedical and Health Informatics and is expected to be attractive to many engineering professionals.

C. Research Programs
Biomedical Engineering research is cross-disciplinary in nature and involves collaborations across and outside the university. The department-like body will facilitate and coordinate research projects that provide undergraduate and graduate students with research experience. With a department-like body in place, research personnel can more easily come together in one place, which will make research planning and management much easier. As a result, we expect planning and research in biomedical engineering to greatly increase.

D. Outreach and Community Engagement
As a department-like body, Biomedical Engineering will be better positioned to establish and maintain productive relationships with appropriate public and private organizations at the local, regional, state, national, and international levels. We have already established strong relationships with the Medical College of Wisconsin and with GE Healthcare for research and graduate education in biomedical engineering.

We have a strong commitment from the Medical College of Wisconsin for both teaching and research that will be beneficial to the growth of both institutions. This partnership will help our students to learn real world design, problem-solution techniques, and research collaboration with MCW, attracting stronger research funding. Our newly built Innovation Campus is close to the medical college to facilitate collaborative activities.

Additionally, GE Healthcare has sponsored a Center for Computational Imaging at the College and a number of their engineers attend our classes for advanced degrees. Several senior engineers also teach as adjunct faculty at the College.
E. Affiliation with Other University Programs
Because of its interdisciplinary character and focus, Biomedical Engineering has close ties with many UWM programs, including those indicated under III.B and III.C. Formation of the department-like body is expected to bring a few other programs together for new research and educational endeavors.

IV. Personnel Resources
A. Faculty
1. Minimum Number of Faculty Members Needed: There are over 12 faculty members in CEAS who have research and teaching experience in biomedical engineering. Some of these faculty members will have joint appointments when the department-like body is created. Two of these faculty members have indicated to move to Biomedical Engineering department-like body at least half time. A request for departmental status will be made when the program has a total of six FTE. The quickest route to becoming a department is to be able to hire faculty members who can teach entirely in the program, ideally with degrees in the discipline. Biomedical Engineering realizes that in these budget times, new positions are scarce, and that the program will continue to grow incrementally. The ability to be a tenure home opens possibilities for partner hires and other avenues for acquiring faculty FTE. Current faculty recruitment includes Biomedical Engineering as one area of focus. A successful process may add a couple of faculty in this area soon.

2. Augmentation of Executive Committee: It may be necessary to augment the executive committee of the Biomedical Engineering Program until an appropriate size is reached. Since there are already several faculty members with at least some research and/or teaching interest in biomedical engineering, finding faculty members to augment the BME department-like body Executive Committee should be no problem.

3. Faculty Members from Other Programs and Tenure Homes: Several faculty members currently associated with the Biomedical Engineering Program have indicated their willingness to move a part of their current appointments into the new unit, enlarging the pool of faculty who can carry out the administration and activities of the program, potentially adding more than one FTE.

B. Classified Staff Available/Needs: One half-time Program Assistant (.5 FTE) will be necessary to begin the department-like body. This need is expected to expand to 1.0 FTE as the department grows.

C. Teaching Assistant Available/Needs: The Biomedical Engineering Program currently has no teaching assistantships available to its master’s students. The creation of the department-like body will aid in the
recruitment of Graduate Teaching Assistants. These will be needed to run undergraduate laboratory classes and the discussion sections.

V. Non-Personnel Resources (see Appendix C)
   A. Space Available/Needs: The Biomedical Engineering Program is not currently occupying a space. The program has requested the following and has prepared a description of its current and future space needs (Appendix C).
      • Lab Space: When instructional programs are developed, we estimate that two labs (approx. 1200 sq. feet total) will be needed.
      • Office Space: The program will need office space for each halftime staff.
   B. Capital Equipment Available/Needs: Each joint-appointment faculty member shares an office and has capital equipment including a computer, an office desk and chair, file cabinets, and book shelves. These same pieces of capital equipment would be needed for each new member of the proposed unit. Furniture and computers will be purchased out of the S&E budget. An initial investment of about 250k will be needed for equipment for instructional laboratories.
   C. Supplies and Expenses Available/Needs: The College of Engineering & Applied Science currently provides an S&E budget to each department that is proportional to the number of faculty. This S&E budget is meant to cover some of the operational expenses of the department and the faculty. A similar process will be used to provide S&E funds. Besides recurring expenditures, a one-time start-up of about 15k will be needed for this department-like body.

VI. Other Implementation Matters:
Curricular Areas: Faculty members moving partial appointments into Biomedical Engineering will teach required courses or electives under existing or new course numbers for new curricular content. New courses will be developed with new course numbers (BME.xxx) to meet the needs of this program.

VII. Timetable:

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<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>March 2014</td>
<td>Proposal completed and approved by CEAS Dean; submission to CEAS Planning Committee.</td>
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<tr>
<td>March 2014</td>
<td>Approval by CEAS APC; submission to CEAS Faculty.</td>
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<tr>
<td>April 2014</td>
<td>Approval by CEAS Faculty; submission of proposal by CEAS Dean to Provost, for campus APBC approval.</td>
</tr>
<tr>
<td>Date</td>
<td>Event Description</td>
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<tr>
<td>May 2014</td>
<td>APBC report to Provost; Provost submits proposal to UWM Faculty Senate.</td>
</tr>
<tr>
<td>October 2014</td>
<td>UWM Faculty Senate Approval.</td>
</tr>
<tr>
<td>January 2015</td>
<td>Biomedical Engineering Program operates as department-like body.</td>
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APPENDICES

A. Administrative Structure

B. Current Faculty Members with Teaching and Research Interests in Biomedical Engineering Program

C. Budget and Resource Summary
APPENDIX A
Biomedical Engineering Program Department-like Body
Administrative Structure

The Biomedical Engineering Program department-like body is an interdisciplinary unit within the College of Engineering & Applied Science at the University of Wisconsin-Milwaukee with programs of instruction, research, outreach, and community engagement that focus on training students for further academic study or careers in which expertise in biomedical engineering is a valuable asset.

I. Mission and Goals
A. Mission
Biomedical engineering is an academic discipline that combines innovation, community partnerships, hands-on experience and interdisciplinary research. Built on a solid core of science and engineering courses, it prepares students for careers in the biomedical field including medical instrumentation, imaging, biomaterials, biomechanics, ergonomics, and other relevant biomedical fields.

B. Goals
To carry out its mission, the Biomedical Engineering Program department-like body has established the following goals:

- Assembling and supporting a faculty composed of individuals from varied disciplines with common interests relating to biomedical engineering;
- Organizing teams of researchers/scholars with shared interest who will engage in multidisciplinary research;
- Delivering high quality undergraduate and graduate programs in biomedical engineering;
- Equipping graduate students with the knowledge of their discipline and methodological skills appropriate to their academic or professional career goals;
- Providing opportunities for students to engage in experiential learning and the application of scholarly knowledge through internships or other applied projects;
- Engaging in outreach with the appropriate communities and stakeholders to share knowledge and learning for community benefit;
- Meeting the growing demand for graduate level leaders with knowledge of biomedical engineering.

C. Program Review and Assessment
The Executive Committee of the Biomedical Engineering Department-Like Body will conduct a review of the program’s missions and goals and assess its success in meeting them, in three-year intervals. Faculty, equipment, space, supply and expenses, and other needs will be identified. Assessment of academic programs may utilize the following tools:
• Data on faculty and student involvement in the unit and its programs: The size of the unit's faculty, the enrollment of students in the unit's programs, scholarly productivity of the unit, and the extramural funding will be tracked. This information will be used in planning as well as in disseminating the progress of the unit.
• Exit survey: Graduating seniors will be surveyed regularly as required for accreditation of the program by ABET (Accreditation Board for Engineering and Technology). Master’s and doctoral students will also be surveyed each semester to track how well well prepared they feel.
• Alumni and employers surveys: Alumni and employers will be surveyed at regular intervals to determine views toward their preparation for employment or advanced studies, track career choices, and solicit suggestions for improvement. This procedure is required by the ABET as part of accreditation.
• The undergraduate program will be accredited by ABET. It will be reviewed every 5 years by ABET as soon as it graduates its first group of undergraduate students.
• The graduate programs will be evaluated internally by Graduate School every 10 years.

II. Academic Programs
CEAS will offer instructional programs administered by the Biomedical Engineering Program. The Biomedical Engineering Program department-like body will have primary responsibility for the academic content of its programs, including determining cross-listed courses that can be applied to its credentials, for advising students, and for recommending candidates for degrees or graduate certificate.

III. Administrative Structure
A. Faculty
1. Faculty Membership: The program unit’s core faculty is composed of all individuals with tenure homes in the unit and other faculty members with at least 50% appointments in the program. Faculty members may have tenure homes in other academic units, but maintain intellectual, research, instructional and/or outreach interests that are consistent with the mission of the Biomedical Engineering Program department-like body. These individuals, who hold joint appointments of less than 50% in Biomedical Engineering, are approved for faculty status by the core faculty, and they are granted faculty-voting rights in the unit. The individual, core faculty of the Biomedical Engineering program, the individual’s home department, and the dean must approve the level of appointment of faculty members in the program. Faculty who are members and whose tenure homes are not in Biomedical Engineering are expected to be involved with and contribute to the research, instructional, and outreach goals of the program through such activities as:
   • Teaching Biomedical Engineering and cross-listed courses;
• Participating in events (e.g., conferences, colloquia, speakers series, student orientation, curricular meetings) organized by Biomedical Engineering or CEAS;
• Participating in the graduate admission process;
• Serving as faculty advisor for graduate students;
• Serving on graduate student committees of Biomedical Engineering students;
• Supporting efforts to generate extramural funding to support the research, instructional, and outreach efforts of Biomedical Engineering;
• Serving on Biomedical Engineering program standing and other committees;
• Supporting Biomedical Engineering outreach and community engagement efforts.

Executive Committee reviews the appointment of faculty members every three years for the purpose of removing those individuals who are not meaningfully engaged in the unit in the manner described above.

2. Duties: The faculty has primary responsibility for the immediate governance of the unit, including development and oversight of its academic, research, and outreach programs. The faculty shall carry out the academic planning process on a regular basis, including, but not limited to, the preparation of the program's academic plans and assessment. Admissions, program reviews, and appeals will be the responsibility of the unit's faculty, and any related committees, assigned to these responsibilities for the Biomedical Engineering program.

3. Meetings: The faculty will meet at least once a semester to conduct its business, and minutes reflecting all formal actions taken shall be recorded.

B. Biomedical Engineering Program Department-like Body Committees
1. General: Following Chapter 4 of the P&P, the Biomedical Engineering program department-like body may utilize committees to conduct its business.

2. Standing Committees:
   a. Executive
      i. Membership: The Executive Committee shall consist of tenured individuals holding professor or associate professor rank in the unit's core faculty and faculty members at the professor or associate professor rank with tenure homes in other departments who are appointed to the executive committee. Individuals may serve simultaneously as members of the executive committees of Biomedical Engineering and of another UWM academic unit.

      ii. Duties: The Executive Committee makes recommendations concerning appointments, dismissals, promotions, salaries, merit allocations, and other personnel and budget matters, which are
transmitted through the Chair to the dean. The Executive Committee, by annual vote, may delegate to a smaller committee or to the Chair the authority to make recommendations to the respect to any or all of the following: salaries, non-tenure appointments, appointment or promotion of classified personnel, appointment of assistants, equipment and supplies.

b. Other Committees:
Additional standing and/or ad hoc committees may be appointed by the unit's faculty as necessary to carry out its responsibilities

C. Chair
1. Eligibility: Any member of the Biomedical Engineering Executive Committee may serve as Chair.

2. Appointment Process: Following Chapter 4.06 of the UWM P&P, the Chair is appointed annually by the Dean of the College of Engineering & Applied Science upon recommendation of Biomedical Engineering department-like body faculty.

3. Duties: As defined in Chapter 4.07, the Chair is responsible for the day-to-day administration of the Biomedical Engineering department-like body, which includes, but is not limited to, the following:
   • Serve as the official channel of communication for all matters affecting the unit as a whole between the unit and University administration or departments;
   • Call meetings of the unit's faculty and executive committee, preside over those meetings, and transmit minutes of the meetings to appropriate individuals and offices;
   • Has charge of all official correspondence of the unit and of all announcements in the Undergraduate Catalog, Graduate Bulletin, or University publication, as appropriate;
   • Has responsibility for all unit supplies and records;
   • Submits course and academic program requests for action by appropriate committees and the dean;
   • Reports to the dean regarding the activities and needs of the unit;
   • Acts for the unit in emergencies, pending a meeting of the executive committee;
   • In general, acts as the executive of the unit, including the areas of personnel, student issues, budget, curriculum and research in accordance with established policies of the unit's faculty and its executive committee.

IV. Amendment of Administrative Organization
Any provision of this administrative organization document may be amended by a two-thirds vote of all faculty members holding voting rights in Biomedical Engineering, as long as the proposed changes are in accord with UWM Policies and Procedures Chapters 2 and 4.
APPENDIX B
Current Faculty Members with Teaching and Research Interests in Biomedical Engineering Program

Professors:
Devendra Misra, Electrical Engineering
Susan McRoy, Computer Science
Jun Zhang, Electrical Engineering

Associate Professors:
Adeeb Rahman, Civil and Environmental Engineering
Mukul Goyal, Computer Science
Naira Campbell-Kyureghyan, Industrial and Manufacturing Engineering
Ronald Perez, Mechanical Engineering, Associate Dean, CEAS
Zeyun Yu, Computer Science

Assistant Professors:
Changsoo Kim, Materials Science and Engineering
Mahsa Ranji, Electrical Engineering
Na Jin Seo, Industrial and Manufacturing Engineering
Ramin Pashaie, Electrical Engineering
Woo-Jin Chang, Mechanical Engineering
APPENDIX C
Budget and Resource Summary

I. Faculty: Three to four new full-time faculty members will be needed for continued progress of the teaching and research activities. These will require startup funds as well as lab space for their research activities.

II. Instructional staff salaries: Roughly $60k per academic year will be needed to support instructional staff.

III. Non-instructional staff: Roughly $50k annually.

IV. S&E Funds: The College of Engineering & Applied Science currently provides an S&E budget to each department that is proportional to the number of faculty members. This budget is meant to cover some of the operational expenses of the department and the faculty. A similar process will be used to provide S&E funds. Besides recurring expenditures, a one-time start-up of about 15k will be needed for this department-like body.

V. Space: The Biomedical Engineering Program Space Request is part of this document. The Biomedical Engineering Program is not currently occupying a space. The program has requested the following and has prepared a description of its current and future space needs.

- Lab Space: When instructional programs are developed, we estimate that two labs (approx. 1200 sq. feet total) will be needed.
- Office Space: The program will need office space for each halftime staff.

VI. Start-up Funds: As mentioned in I and IV above, new faculty recruits will need funds to setup their research laboratories and the program will need a one-time start-up of about 15k.