May 13, 2015

To: Dean Wendy Crone, Graduate School Interim Dean
    Sarah Mangelsdorf, Provost

From: Jake Blanchard, Executive Associate Dean, College of Engineering

Subject: Request for GFEC Review and Approval of New Named Option in Applied Computing and Engineering Data Analytics for Master of Engineering Degree

Please accept the attached proposal for review and requested approval. This proposal addresses a new named option, Applied Computing and Engineering Data Analytics, to be offered to practicing professionals enrolled as graduate engineering students under the College of Engineering’s Master of Engineering, Engineering Major degree program.

The proposed program aligns precisely with UW-Madison Education Innovation (El) efforts. Specifically, the program delivers on UW-Madison’s El goals to:

- “Build innovative, professional Master’s-level degrees and other lifelong learning opportunities;”
- “Extend our educational mission to Wisconsin and the world using new technology and partnerships.”

We expect that the Graduate School shares the College of Engineering’s appreciation for the broad cross-campus partnerships opportunities, especially with collaborating departments in the College of Letters and Sciences. Faculty from the Departments of Statistics and Computer Sciences, and from the School of Library and Information Sciences have helped to develop the program’s curriculum and plans for program implementation.

The College’s online graduate programs have maintained strong enrollment and are highly respected nationally and internationally for educational quality. Our marketing studies affirm the need for this program and have helped to guide the proposed curriculum.

The College’s Master of Engineering Oversight Committee approved this proposal December 1, 2014, and the College’s Academic Planning Council approved this proposal on February 11, 2015.

Thank you for your review and decision regarding this important opportunity to advance UW-Madison’s educational mission. I, and all partners in this endeavor, look forward to GFEC’s action on this item at the Committee’s June 6, 2015 meeting. If any questions arise before the meeting, please contact Phil O’Leary, EPD Department Chair (608-262-0493).

XC: Marty Gustafson, Graduate School Assistant Dean
     Jocelyn Milner, Director of Academic Planning and Institutional Research
     College of Engineering: Ian Robertson, Phil O’Leary, Dan Negrut, Wayne Pferdehirt, Carl Vieth
REQUEST FOR APPROVAL OF A NEW OPTION IN THE EXISTING MASTER OF ENGINEERING DEGREE, ENGINEERING MAJOR; NEW NAMED OPTION: APPLIED COMPUTING AND ENGINEERING DATA ANALYTICS (FULLY ONLINE)

1.0 SUMMARY AND REQUESTED ACTION

Approvals from the Graduate Faculty Executive Committee and the University Academic Planning Council are requested by the College of Engineering, with the support of the College of Letters and Sciences, for a new non-pooled revenue, fully online, named option. The proposed new named option will be offered under the existing Master of Engineering (MEng), Engineering major, named option in Applied Computing and Engineering Data Analytics, in accordance with the flexibility of the College to create and retire options within the MEng degree as part of the UW System Regents’ 1998 authorization of the MEng degree. The proposal has been reviewed and approved by the College of Engineering Academic Planning Council, the College of Engineering’s Master of Engineering Oversight Committee, the Department of Engineering Professional Development, and the Department of Mechanical Engineering.

A project team (Table 1) studied the feasibility of the proposed online option in 2013-2014 and designed the program now recommended for approval, with support from a number of additional departments and faculty across campus working in the “Big Data” and analytics space. The initial program development team, detailed below, received an Educational Innovation grant from the Division of Continuing Studies in 2013.
Table 1. Applied Computing and Engineering Data Analytics Development Team

<table>
<thead>
<tr>
<th>Department</th>
<th>Name</th>
<th>Notes</th>
<th>Contact email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Engineering</td>
<td>Jaal Ghandhi</td>
<td>Chair, Professor</td>
<td><a href="mailto:ghandhi@engr.wisc.edu">ghandhi@engr.wisc.edu</a></td>
</tr>
<tr>
<td></td>
<td>Dan Negrut</td>
<td>Assoc. Professor</td>
<td><a href="mailto:negrut@wisc.edu">negrut@wisc.edu</a></td>
</tr>
<tr>
<td></td>
<td>Xiaoping Qian</td>
<td>Assoc. Professor</td>
<td><a href="mailto:xqian29@wisc.edu">xqian29@wisc.edu</a></td>
</tr>
<tr>
<td></td>
<td>Krishnan Suresh</td>
<td>Assoc. Professor</td>
<td><a href="mailto:suresh@engr.wisc.edu">suresh@engr.wisc.edu</a></td>
</tr>
<tr>
<td></td>
<td>Radu Serban</td>
<td>Assoc. Scientist</td>
<td><a href="mailto:serban@wisc.edu">serban@wisc.edu</a></td>
</tr>
<tr>
<td>Engineering Professional Development</td>
<td>Phil O’Leary</td>
<td>Chair, Professor</td>
<td><a href="mailto:oleary@engr.wisc.edu">oleary@engr.wisc.edu</a></td>
</tr>
<tr>
<td></td>
<td>Wayne Pferdehirt</td>
<td>Director, Graduate</td>
<td><a href="mailto:wayne.pferdehirt@wisc.edu">wayne.pferdehirt@wisc.edu</a></td>
</tr>
<tr>
<td></td>
<td>Marty Gustafson</td>
<td>EPD Program Director (former)</td>
<td><a href="mailto:marty.gustafson@wisc.edu">marty.gustafson@wisc.edu</a></td>
</tr>
<tr>
<td></td>
<td>Carl Vieth</td>
<td>Director, Corporate Education</td>
<td><a href="mailto:vieth@wisc.edu">vieth@wisc.edu</a></td>
</tr>
<tr>
<td>Statistics</td>
<td>Peter Qian</td>
<td>Professor</td>
<td><a href="mailto:peterq@stat.wisc.edu">peterq@stat.wisc.edu</a></td>
</tr>
<tr>
<td>Computer Sciences</td>
<td>Eftychios Sifakis</td>
<td>Asst. Professor</td>
<td><a href="mailto:sifakis@cs.wisc.edu">sifakis@cs.wisc.edu</a></td>
</tr>
</tbody>
</table>

Key conclusions from the team are:

- While quantifying the market for this program is difficult as the degree concept and target audience do not fit into conventional industry segments or standard job classifications, the U.S. is in midst of an explosion in big data, data analytics, and applied computing. In their report, “Big Data: The Next Frontier for Innovation, Competition, and Productivity” the McKinsey Global Institute predicts that the demand for deep analytical talent in the US could be 50-60 percent greater than its projected supply by 2018.\(^1\)

- The proposed curriculum provides competencies in problem solving for engineers working at the boundaries between engineering, science and business, including a number of subjects prioritized by the marketing study.

- The proposed revenue program’s design maximizes course enrollment and therefore is expected to be financially viable long term. Including $60,000 in development funding awarded to the program development team in December 2013 by the Division of Continuing Studies for an Educational Innovation grant, the program can generate positive cash flow in its third year of operation.

- EPD and ME Chairs and key faculty from many departments have been actively engaged in program planning and are committed to this effort.

We respectfully request GFEC to review and approve development of the proposed program to enable UW-Madison to establish a visible leadership position in Applied Computing and Engineering Data Analytics and allow the first class of students to begin studies in the 2016 summer session.

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\(^1\) *Big Data: The Next Frontier for Innovation, Competition, and Productivity*: McKinsey Global Institute, 2011
2.0 BACKGROUND AND RATIONALE

2.1 Background

The proposed new online Master of Engineering degree in Engineering, named option Applied Computing and Engineering Data Analytics (MEng, AC & EDA), is designed for engineers working in detailed testing and design or within the crossroads of engineering, science and business. These engineers analyze, process, and build conclusions based on vast amounts of information generated by the rapidly growing use of data collection in the design, testing and operations phases of numerous engineering processes.

These engineering job functions are predicted to experience growth at a rate much faster than the domestic labor market. For Database Administrators, the US Bureau of Labor Statistics (BLS) prediction is for 31% increase, or an additional 33,900 positions added to the labor market from 2010-2020.\(^2\) For Computer Systems Analysts, BLS projects an additional 120,400 positions, a 22% growth rate, faster than average.\(^3\) Finally, for Information Security Analysts, Web Developers and Computer Network Architects, one can expect 65,700 new positions, a 22% increase for the decade 2010-2020.\(^4\)

Additionally, a study commissioned by the UW-Extension on the market potential for a Master’s Degree in “Big Data” found that the vast majority of related job postings require a Bachelor’s Degree (66%) or a Graduate or Professional Degree (30%).\(^5\) The same study reported a higher demand for Data Analysts (95%) than for MBA’s graduating from highly ranked, peer programs (58-88%).\(^6\) The large number of jobs and the tremendous demand for these and similar emerging job roles points to a robust market need for a MEng with a named option in Applied Computing and Engineering Data Analytics.

2.2 Rationale

To determine the feasibility of a Masters level Applied Computing and Engineering Data Analytics option, EPD conducted a market study in 2013. The study included a survey of both working professionals and employers. The first survey invitation was sent to 8,632 professionals, including EPD customers with IT, computer engineering and electrical engineering interest codes, UW Electrical and Computer Engineering (ECE) and Computer Science alumni, and a group of randomly selected, US based, Design/Systems engineer/Software Engineer selects from PennWell Publishing’s High Tech Masterfile.

For the commercially purchased list (PennWell) the open rate was 19.76% and the click thru rate was 1.82%, a remarkably high number for unsolicited email survey invitations. Of the 167 who began the survey, 128 (77%) completed it. Key takeaways indicated:

\(^2\) http://www.bls.gov/ooh/computer-and-information-technology/database-administrators.htm
\(^5\) Industry Insights – Big Data: Education Advisory Board, 2013
\(^6\) IBID.
1. An applied computing degree is a valued credential for roughly half of the target population.
2. Any degree program for the target population should be fully online.
3. Technical coursework that advances knowledge and skill competencies is most valued in the target audience.
4. Nontechnical topics, especially Project Management and team leadership are highly valued in the target audience.
5. Employer funding for graduate education is diminishing.
6. Career advancement is not the primary motivation for potential participants.

For the second survey, senior leaders and engineers from a cross-section of employers in high-tech industries were interviewed. The participants include private and public sector organizations interviewed by members of EPD and the Division of Continuing Studies (DCS) in July 2013.

In general, the employer respondents felt that:

1. A Master’s Degree was a desirable, if not required, credential for professional practice in engineering roles typically occupied by those in the target job functions.
2. About one-third of those interviewed reported that their organizations would only hire engineers that have a Master’s Degree.
3. A number of employers were also vocal for the need of such a program in the market.
   One employer was particularly supportive of such a program at UW, pointing to our reputation for computer science, engineering, and biological sciences. Another had similar observations with our regional ties to healthcare informatics.

In addition to these market surveys a competitive survey was also conducted. Among peer institutions, notable on-campus Applied Computing or Data Analytics programs exist at Northwestern, Illinois UC, Cal-Berkeley, MIT, Stanford, Carnegie-Mellon, Michigan State, Maryland, Rutgers, and NYU. Many of these programs offer both Master’s Degrees or Certificate credentials. Among notable universities that have programs tied to engineering programs are Cal-Berkeley, Columbia, Harvard, Stanford, and Northwestern.

Big data and data analytics programs are also expanding into the online learning space. Northwestern, City University of New York (CUNY), University of Maryland’s University College (UMUC), University of San Francisco, and University of South Florida have all launched programs in recent years. UW-Extension has also engaged the Education Advisory Board in a market study for an online data analytics degree program at the Master’s level.

It is important to note that there is little standardization of curricular approaches, and many degree programs straddle business, engineering, computer science and information management disciplines. The common thread is the use of the term data analytics, and though it has come to mean many things, it has become the term institutions use to define programs and people use to find them.
3.0 NAMED OPTION STRUCTURE AND ADMINISTRATION

3.1 Master of Engineering Degree

The existing Master of Engineering Degree was approved in 1998 as a way to serve both students and employers by providing specific options focused on practice-oriented Master’s degrees that would allow students to keep up with the latest science and technology and maintain their competitiveness. The Master of Engineering is a terminal degree, following a Bachelor’s degree from an ABET, Inc., accredited engineering program.

The topics emphasized by these options are expected to shift fairly rapidly as the relevant industrial practices and technologies evolve. The Department of Engineering Professional Development currently offers five named options in the Master of Engineering degree, Engineering major, and is requesting that a sixth be added, as shown in Table 2.

Table 2. Existing Offerings in the Master of Engineering Degree

<table>
<thead>
<tr>
<th>Degree</th>
<th>Major</th>
<th>Named Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master of Engineering</td>
<td>Engineering</td>
<td>Engineering Management (MEM)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engine Systems (MEES)</td>
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<tr>
<td></td>
<td></td>
<td>Technical Japanese (METJ)</td>
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<tr>
<td></td>
<td></td>
<td>Sustainable Systems Engineering (SSE)</td>
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<tr>
<td></td>
<td></td>
<td>Manufacturing Systems Engineering (MSE) (approved by GFEC May 2015)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Applied Computing and Engineering Data Analytics (AC &amp; EDA)</td>
</tr>
<tr>
<td>Master of Engineering</td>
<td>Civil and Environmental Engineering</td>
<td>Environmental Engineering</td>
</tr>
<tr>
<td>Master of Engineering</td>
<td>Mechanical Engineering</td>
<td>Polymer Science</td>
</tr>
</tbody>
</table>

3.2 Administrative Structure

This named option will be managed by EPD. The option will be coordinated by a Program Director (to be hired following GFEC approval of program) under the supervision of EPD’s Director of Distance Degree Programs (Wayne Pferdehirt). Mechanical Engineering Vilas Associate Professor Dan Negrut, Co-Director of the Wisconsin Applied Computing Center (WACC), will serve as Academic Director and faculty advisor. Supporting staff from EPD has also been assigned to lead educational technology management, marketing, admissions, instructional design and program assistance.

All degrees managed by EPD are governed by the EPD Curriculum Committee (for course and degree approvals) and the EPD Executive Committee (for yearly review and oversight). The program is also subject to initial approval and yearly review by the MEng Oversight Committee.

7 Graduates of allied sciences may be accepted if certain pre-requisites are satisfied.
within the College of Engineering. EPD’s Gary Henderson, Director of Student Services, will also create and lead an admissions committee consisting of the EPD Program Director, the Academic Program Director, the Director of Student Services, and three faculty members teaching in the program.

Finally, the faculty teaching in the program will join with the EPD directors to form an advisory committee to oversee continuous improvement and assessment. The committee will meet prior to degree launch to coordinate degree implementation and promote an overarching content delivery strategy for the program. After the degree has launched, the committee will be expanded to include select students from the program and industrial representatives (members of WACC).

3.3 Program Assessment and Continuous Improvement

EPD uses a program assessment strategy that measures impact to students and their employers and the quality of services to students, faculty, and alumni. EPD will use its existing Master of Engineering program assessment process for this option. Elements of the assessment program will include:

- Mid-course surveys for all new course to enable early detection and corrective action to ensure course content and logistics are responsive to students’ needs and interests
- An end-of-semester evaluation of each course by students and the instructor focusing on achievement of learning outcomes and additional outcomes established for the program
- A detailed programmatic evaluation by students at graduation
- An impact survey conducted 9-12 months after graduation that includes graduates, and workplace supervisors and/or professional peers.

Feedback from all sources will be reviewed with faculty, staff and the program’s advisory committee to identify opportunities and actions for continuous quality improvement.

Additionally, the EPD Executive Committee and the College of Engineering Master of Engineering Oversight Committee will review the program’s performance annually. Reviews of the program will also be conducted and reported to the Provost’s Office in coordination with the Graduate School as part of the regular review process of the Master of Engineering degree.
4.0 ADMISSIONS AND DEGREE REQUIREMENTS

4.1 Admission Requirements

The admission requirements for the MEng AC & EDA option were created to meet or exceed the requirements for a Master of Engineering degree and the Graduate School:

- A BS degree from a program accredited by the Accreditation Board for Engineering and Technology (ABET)
- A minimum undergraduate grade-point average (GPA) of 3.00 overall or on the equivalent of the last 60 semester hours (approximately two years of work). (Applicants with less than a 3.0 may be admitted at the discretion of the department.)
- Applicants whose native language is not English must provide scores from the Test of English as a Foreign Language (TOEFL). The minimum acceptable score on the TOEFL is 580 on the written version, 243 on the computer version, or 92 on the Internet version.
- International applicants must have a degree comparable to an approved US bachelor's degree. Applicants from an international institution must have a strong academic performance comparable to a 3.00 for an undergraduate or master's degree.
- Three letters of recommendation

An additional computer programming course requirement may be included by the advisory committee at its first meeting in Spring 2015 to ensure best chances for student success in the program. Exceptions to any of these requirements could be made on an individual basis at the discretion of the admissions committee. Each student recommended for admission by the committee must then receive admission approval from the Graduate School.

4.2 Degree Requirements

The requirements for completion of a Master of Engineering degree are as follows:

<table>
<thead>
<tr>
<th>Table 3. Degree Requirements for MEng in AC &amp; EDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Graduate Degree Credit Requirement</td>
</tr>
<tr>
<td>Minimum Graduate Residence Credit Requirement</td>
</tr>
<tr>
<td>Minimum Graduate Course Work (50%) Requirement</td>
</tr>
</tbody>
</table>

Up to 6 credits of prior coursework at the graduate level or credits of prior coursework in the curriculum from an undergraduate degree completed at the University of Wisconsin-Madison will be accepted. Prior coursework must be approved by the program’s Academic Director and comply with the Graduate School’s policy for acceptance of graduate work from other institutions.
4.3 Satisfactory Progress

The Graduate School requires that students maintain a minimum graduate GPA of 3.00 in any course taken as a graduate student at 300 or above (excluding research, audit, credit/no credit, and pass/fail courses), unless probationary admission conditions require higher grades. In addition, to fulfill the Master of Engineering degree requirements, any individual class in which the student receives a ‘C’ or lower must be repeated.

The Graduate School also considers Incomplete (I) grades to be unsatisfactory if they are not removed during the subsequent semester of enrollment; however, the instructor may impose an earlier deadline.

A student may be placed on probation or suspended from the Graduate School for low grades or for failing to resolve Incomplete grades in a timely fashion. In special cases the Graduate School permits students who do not meet these minimum standards to continue on probation upon recommendation and support of their advisor.
5.0 CURRICULUM

5.1 Learning Outcomes

As previously noted in our market study summary, there is little standardization of curriculum or learning outcomes for existing Applied Computing and Data Analytics graduate programs. A few bodies of knowledge have been published in similar fields however. One document of particular interest is the IEEE Computer Society’s Software Engineering Body of Knowledge (SWEBOK). Addressed in the SWEBOK are guidelines for software engineers that address data management and mining, parallel computing, statistical analysis and modeling. Specific examples of their recommended learning outcomes include the following:

- Defines and develops the content, relationships and structures of a database based on a relational, network, or object model.\(^9\)
- Performs statistical analysis and pattern discovery on the content of a database using data mining relevant techniques.\(^10\)
- Understands the differences between distributed and parallel computing and the models used to coordination among components.\(^11\)
- Models or simulates a designed experiment to provide a prediction of system behavior and relationships between subsystems as a method for design analysis.\(^12\)
- Uses statistical techniques to collect and sample reliable data and analyzes results that can be understood with respect to the population.\(^13\)

Another document considered was the American Statistical Association’s (ASA) Report on Master’s Degrees. After a study of master’s degree level statistical workforce, this organization’s recommended the following goals for all master’s level programs:

- Graduates should have a solid foundation in statistical theory and methods.
- Programming skills should be infused throughout the graduate student experience.
- Communication skills are critical and should be developed and practiced throughout graduate programs.
- Collaboration, teamwork and leadership development should be part of graduate education.
- Students should encounter non-routine, real problems throughout their graduate education, preferably with immersive work experiences.\(^14\)

\(^12\) Ibid, p. 15-10.
In addition to these considerations, the team examined results taken from EPD’s surveys of working professional and employers. In the working professional survey, participants were asked to identify up to four technical topics from a list of options that would be desirable for inclusion in an Applied Computing Master’s Degree curriculum. Table 4 presents topical preferences. From the ranked options, software and systems engineering, data analytics, algorithms and data structures, and data visualization were predominant as a preference. It is important to note that survey participants were allowed up to four selections in this question, and that the individual items were randomly presented in the survey instrument.

The survey identified topics that were important to potential students, but were not considered to be technical engineering courses. These courses ranged from project management to technical communications. Leading technical teams, project management, operations management and technical communications were predominant in participant selections. Table 5 presents nontechnical topical preferences. It is important to note that survey participants were allowed up to three selections in this question, and that the individual items were randomly presented in the survey instrument.

Table 4. Technical Topic Preferences for an Applied Computing Master’s Degree Curriculum from Survey of Working Professionals

<table>
<thead>
<tr>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software engineering</td>
<td>34</td>
<td>55%</td>
</tr>
<tr>
<td>Systems engineering</td>
<td>28</td>
<td>45%</td>
</tr>
<tr>
<td>Data analytics</td>
<td>27</td>
<td>44%</td>
</tr>
<tr>
<td>Algorithms and data structures</td>
<td>23</td>
<td>37%</td>
</tr>
<tr>
<td>Data visualization</td>
<td>22</td>
<td>35%</td>
</tr>
<tr>
<td>High performance computing</td>
<td>17</td>
<td>27%</td>
</tr>
<tr>
<td>Networking</td>
<td>17</td>
<td>27%</td>
</tr>
<tr>
<td>Large scale / high throughput computing</td>
<td>13</td>
<td>21%</td>
</tr>
<tr>
<td>Artificial intelligence</td>
<td>13</td>
<td>21%</td>
</tr>
<tr>
<td>Physics-based modeling and simulation</td>
<td>12</td>
<td>19%</td>
</tr>
<tr>
<td>Hardware engineering</td>
<td>10</td>
<td>16%</td>
</tr>
<tr>
<td>Computational / numerical methods</td>
<td>10</td>
<td>16%</td>
</tr>
<tr>
<td>Computer graphics</td>
<td>8</td>
<td>13%</td>
</tr>
<tr>
<td>Computer architecture</td>
<td>6</td>
<td>10%</td>
</tr>
</tbody>
</table>
Table 5. Professional Skills Preferences for an Applied Computing Master’s Degree Curriculum from Survey of Working Professionals

<table>
<thead>
<tr>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leading technical teams</td>
<td>34</td>
<td>55%</td>
</tr>
<tr>
<td>Project management</td>
<td>32</td>
<td>52%</td>
</tr>
<tr>
<td>Operations and management</td>
<td>26</td>
<td>42%</td>
</tr>
<tr>
<td>Technical communication</td>
<td>25</td>
<td>40%</td>
</tr>
<tr>
<td>Economic analysis of designed systems</td>
<td>17</td>
<td>27%</td>
</tr>
<tr>
<td>Quality systems</td>
<td>15</td>
<td>24%</td>
</tr>
<tr>
<td>Finance and accounting</td>
<td>14</td>
<td>23%</td>
</tr>
<tr>
<td>Statistics</td>
<td>10</td>
<td>16%</td>
</tr>
<tr>
<td>Globalization of engineering</td>
<td>9</td>
<td>15%</td>
</tr>
</tbody>
</table>

Using these preferences, an early curriculum concept was outlined in the employer survey. Of the organizations that would most likely sponsor students, the concept was well received. Modeling and simulation as well as business data analytics were consistently identified as most desirable. For organizations that hire at the Master’s level, advanced level programming was most often identified as a critical skill set, as it also was in the ASA report. Perhaps of greater importance was that both surveys identified the need to include “soft skill” elements in the program curriculum. There was strong and consistent identification of technical and interpersonal communications as a subject. Similarly, employers identified business analysis, team leading, and project management as important curricular elements.

Combining these surveys with the earlier references noted, the concepts used for these surveys were then expanded into learning outcomes for the program, using the Graduate School’s Learning Goals as a guide (Table 6).
Table 6. Learning Outcomes for Named Option in AC & EDA

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>Knowledge and Skills</th>
</tr>
</thead>
</table>
| Knowledge        | • Articulates, critiques, or elaborates the theories, methods, and approaches to analyzing and solving engineering problems through applied computing  
                   • Identifies sources and assembles and analyzes data effectively pertaining to challenges in engineering systems  
                   • Evaluates advanced computing tools to select and design appropriate systems for engineering problem solving |
| Skills           | • Selects and/or utilizes the most appropriate technologies and statistical methodologies and practices for data collection, analysis and management  
                   • Evaluates or synthesizes information pertaining to simulation, modeling and engineering optimization challenges  
                   • Communicates data clearly in ways appropriate to engineering and management |
| Professional Conduct | • Recognizes and applies principles of professional engineering competencies in project management, leading teams and effective communication through demonstration in a professional context |

Assessment of these learning outcomes will be conducted using several methodologies. At the course level, students’ exam and project performance will be monitored yearly by the Academic Director and the advisory board. On the program level, end-of-semester evaluations given during each course will focus on achievement of learning outcomes. At graduation, a detailed programmatic evaluation by students at graduation will look at achievement of all program learning goals, with an additional impact survey conducted 9-12 months after graduation. A yearly check-in for the Master of Engineering Oversight committee will also be conducted.

5.2 Courses

Figure 1 provides a visual depiction of the proposed three-year, 30-credit curriculum combining eight 3-credit courses and six 1-credit modular courses. All students begin in the summer term with an 8-week course in connected learning and digital proficiency, followed by courses in a three-year sequence. Four of the 1-credit modules are part of an existing professional competency series under development by EPD and DCS. Courses offered from the Department of Industrial and Systems Engineering may also be shared with another new MEng named option in Manufacturing Systems Engineering program approved recently by GFEC (May 2015). Overall, the curriculum works to provide subject matter requested in the potential student surveys while still maximizing course enrollment and allowing instructors to teach each course just once every three years.

Working with faculty, the courses were also scheduled in such a way to ensure any prerequisites were addressed by earlier semesters. Each course will also be encouraged to allow students greater flexibility in application projects to address the varying engineering backgrounds and industries of the student body.
This curriculum also takes advantage of the interdisciplinary nature of data analysis and the large number of departments on campus that teach aspects of this topic. Courses from Mechanical Engineering, Electrical and Computer Engineering, Industrial and Systems Engineering, Statistics, Computer Science, Engineering Professional Development, and Library and Information Studies provide rigorous engineering depth with breadth in professional skills. Table 7 provides a summary of courses and instructors. The courses on “R” will be developed as a joint effort between Statistics and this program. The established financial model for MEng degree programs provides financial support for the design, and development of each course. Furthermore, faculty are provided instructional systems design and production support through existing EPD infrastructure.
Figure 1. Student Degree Planning for the MEng in Engineering: Applied Computing and Engineering Data Analytics
# Table 7. Course and Instructor Summary for MEng: Applied Computing and Engineering Data Analytics, First Class Cohort Progression Shown

<table>
<thead>
<tr>
<th>Course</th>
<th>Cr.</th>
<th>Term</th>
<th>Title</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPD 705</td>
<td>1</td>
<td>Summer 1 [2016]</td>
<td>Connected Learning and Digital Fluency</td>
<td>EPD, Millard</td>
</tr>
<tr>
<td>STAT 424</td>
<td>3</td>
<td>Fall 1 [2016]</td>
<td>Statistical Experimental Design for Engineers</td>
<td>STAT, P. Qian</td>
</tr>
<tr>
<td>EPD 709</td>
<td>1</td>
<td></td>
<td>Leading Teams</td>
<td>EPD, Nicometo</td>
</tr>
<tr>
<td>LIS 751</td>
<td>3</td>
<td>Spring 1 [2017]</td>
<td>Intro to Database Design and Management</td>
<td>LIS, Salo</td>
</tr>
<tr>
<td>STAT 327</td>
<td>1</td>
<td></td>
<td>Intermediate Data Analysis with R</td>
<td>STAT, Staff</td>
</tr>
<tr>
<td>ME 759</td>
<td>3</td>
<td>Summer 2 [2017]</td>
<td>Intro to Parallel Computing for Engineering Applications</td>
<td>ME, Negrut</td>
</tr>
<tr>
<td>CS 412</td>
<td>3</td>
<td>Fall 2 [2017]</td>
<td>Intro to Numerical Methods</td>
<td>CS, Sifakis</td>
</tr>
<tr>
<td>STAT 327</td>
<td>1</td>
<td></td>
<td>Advanced Data Analysis with R</td>
<td>STAT, Staff</td>
</tr>
<tr>
<td>ME 748 or ISyE 635</td>
<td>3</td>
<td>Spring 2 [2018]</td>
<td>Optimum Design of Mech Elements and Systems or Tools and Environments for Optimization</td>
<td>ME, Suresh ISyE, Linderoth</td>
</tr>
<tr>
<td>EPD 706</td>
<td>1</td>
<td></td>
<td>Effective Personal Communication</td>
<td>EPD, Nicometo</td>
</tr>
<tr>
<td>ECE/ME 532</td>
<td>3</td>
<td>Summer 3 [2018]</td>
<td>Theory and Applications of Pattern Recognition</td>
<td>ECE, Nowak</td>
</tr>
<tr>
<td>ME 535</td>
<td>3</td>
<td>Fall 3 [2018]</td>
<td>Computer-Aided Geometric Design</td>
<td>ME, X. Qian</td>
</tr>
<tr>
<td>EPD 707</td>
<td>1</td>
<td></td>
<td>Project Management</td>
<td>EPD, Davis</td>
</tr>
<tr>
<td>ISyE 691</td>
<td>3</td>
<td>Spring 3 [2019]</td>
<td>Introduction to Industrial Data Analytics</td>
<td>ISyE, Zhou</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>Graduation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.2 Course Learning Objectives

In addition to the program learning outcomes and assessment plan outlined in Section 5.0 above, Table 8 provides a summary of learning outcomes for each course in the proposed MEng with a named option in AC &EDA curriculum. These outcomes will be assessed at the course level in support of the overall learning goals.
Table 8. Learning Objectives (Student Achievements and Capabilities) for Courses in the MEng in Engineering: Applied Computing and Engineering Data Analytics

<table>
<thead>
<tr>
<th>Course</th>
<th>Learning Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected Learning and Digital Proficiency</td>
<td>• Identify and use collaboration and communication tools effectively for online learning and professional work.</td>
</tr>
<tr>
<td></td>
<td>• Demonstrate effective use of enterprise document management system and features used for online learning and virtual teamwork.</td>
</tr>
<tr>
<td></td>
<td>• Evaluate and apply cyber security and identity management strategies in a networked world.</td>
</tr>
<tr>
<td>Statistical Experimental Design for Engineers</td>
<td>• Examine the structure of variation and apply core descriptive methods for characterizing and comparing populations</td>
</tr>
<tr>
<td></td>
<td>• Design and execute a physical experiment and present the results.</td>
</tr>
<tr>
<td>Intermediate Data Analysis with R</td>
<td>• Implement statistical techniques to engineering data analysis using the statistical language R</td>
</tr>
<tr>
<td></td>
<td>• Demonstrate graphical techniques of data visualization in R</td>
</tr>
<tr>
<td>Effective Interpersonal Communication</td>
<td>• Apply methods and tools in the communication of complex technical and business information through written and verbal channels</td>
</tr>
<tr>
<td></td>
<td>• Demonstrate use of processes and tools to effectively manage meetings</td>
</tr>
<tr>
<td></td>
<td>• Systematically evaluate the quality of communication and the accurate transmission of information</td>
</tr>
<tr>
<td>Advanced Data Analysis with R</td>
<td>• Apply advanced standard statistical models in R, graphics and visualization in R.</td>
</tr>
<tr>
<td></td>
<td>• Apply tools and methods in the debugging, organizing and commenting R code.</td>
</tr>
<tr>
<td></td>
<td>• Understand and discuss relevant topics in statistical data analysis and optimization</td>
</tr>
<tr>
<td>Leading Teams</td>
<td>• Demonstrate methods and techniques to build trust, cooperation, and team affiliation among team members</td>
</tr>
<tr>
<td></td>
<td>• Apply methods to work across organizational and cultural boundaries in case studies</td>
</tr>
<tr>
<td></td>
<td>• Establish technical systems and structures to enhance the functionality and effectiveness of team activities</td>
</tr>
<tr>
<td>Introduction to Parallel Computing for Engr.</td>
<td>• Demonstrate basic software design patterns for high performance parallel computing</td>
</tr>
<tr>
<td>Applications</td>
<td>• Apply emerging hardware architectures that use parallel computing programming languages to solve computationally intensive engineering problems</td>
</tr>
<tr>
<td>Course</td>
<td>Learning Objectives</td>
</tr>
<tr>
<td>----------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| **Introduction to Numerical Methods**                     | • Demonstrate the use of advanced engineering software platforms to solve non-linear equations, polynomial interpolation, numerical differentiation, linear systems and differential equations.  
• Understand and apply numerical methods and techniques to engineering design and data analysis problems. |
| **Project Management**                                    | • Plan a systematic approach to project management by applying methods, processes and tools appropriate to scale and complexity  
• Build a project plan including scope, deliverables, schedule, resources, communication, finance and risk  
• Implement a project measurement and control systems |
| **Optimum Design of Mechanical Elements and Systems (elective)** | • Apply simulation strategies to large engineering systems to solve computational challenges in design.  
• Demonstrate use of advanced engineering software platforms to optimize mechanical design processes. |
| **Tools and Environments for Optimization (elective)**     | • Formulates optimization and equilibrium models to solve problems in science, business and engineering.  
• Selects and implements appropriate software tools (modeling languages, data management libraries or mathematical tools) to design realistic applications in engineering and the sciences. |
| **Introduction to Database Design and Management**         | • Understand design of relational databases including tables, keys, relationships and commands.  
• Build entity-relationship diagrams and simple relational databases using SQL or GUI interfaces  
• Use SQL to create and manage databases and queries  
• Decompose a poorly designed spreadsheet into a well-designed and documented database |
| **Theory and Applications of Pattern Recognition**         | • Understand basic techniques of machine learning and statistical pattern recognition  
• Demonstrate use of algorithms to build machine decision-making capabilities in applications of control, text understanding, vision, informatics, database mining, and other areas. |
| **Computer-aided Geometric Design**                       | • Demonstrate use of algorithms to define, manipulate and query geometric models in computer-aided design software.  
• Apply three-dimensional wire-frame modeling, surface modeling and solids modeling to case studies in product design, simulation or analysis.  
• Apply techniques of 3D scanning and printing. |
| **Introduction to Industrial Data Analytics**              | • Understand the different data types and data processing techniques in practices and their limitations  
• Understand and be able to implement various data-driven modeling techniques such as regression, classification, and principal component transformation.  
• Understand the concept of model complexity and trade-off between model bias and variation.  
• Improve problem solving capability using realistic industrial datasets |
5.3 Course Delivery

The MEng AC & EDA option is to be offered as a distance-learning program, using the software and methods previously developed and tested for EPD Master of Engineering programs as a baseline. The primary delivery mechanism is via asynchronous Internet delivery, supplemented with weekly web conferences and discussion forums for each course. The UW College of Engineering Moodle Platform or Desire2Learn (Learn@UW) can be used as a learning management system as students can now access courses on either platform through their web-based course dashboard. A degree “portal” or “community website” will also be developed that will act as the single entrance site for students to access student services, technical support, and courses.

New students will take a one-credit summer course in Connected Learning and Digital Fluency as part of their orientation to online learning. This course is designed to help students get off to a strong start in the program, improving their success and retention. Students will not be required to come to campus.

5.4 Faculty Support

EPD offers a unique model for new instructors and online course development designed to provide an exceptional level of support. Faculty will receive up to one month of funding from EPD for developing new courses or adapting campus courses to the online delivery method used in the curriculum, typically used in the summer. In addition to financial support, faculty will be provided with instructional design and production support for developing materials. As an additional benefit, participating faculty will have unrestricted, UW-related use of all online course materials, enabling their use for on-campus instruction.

When participating faculty’s classes are offered, revenue sharing follows the established CoE Revenue Programs Distance sharing model (Figure 2). It assumes that one quarter (25%) of the tuition revenue generated by graduate students enrolled in this program will be returned directly to the department and instructor teaching the course, to be distributed at their discretion through an accessible fund, translated to summer salary, or used for buy-out. Another 25% will be used to provide partnering faculty with funded teaching assistants and instructional support, and student services. A third 25% will be allocated to support the development of future CoE distance learning initiatives. The remaining 25% will be used for marketing, administration (including appointment for an Academic Director), and online delivery infrastructure, as shown below.
5.5 Student Services

Proactive and highly responsive student services are critical to the success of online degree programs. It is essential that from a prospective student’s first inquiry, through application, admission, and their entire program of academic study, students feel personal attention to their interests and needs. In an online environment, students who feel isolated, frustrated, or unsupported will fail to complete courses or will readily transfer to another program. Keeping students engaged, progressing, and confident that their learning goals are being met is critical to student success and to the viability of the program itself.

The student services needs of the AC & EDA named option students will be managed by EPD’s Student Services Director (Gary Henderson) and supporting staff. Student services provided directly by EPD will include:

- communications with prospective students
- assisting applicants with admission
- leading review of applications by a program admission committee of EPD and program faculty
- coordination of student issues with the Graduate School, Financial Aid, Registrar, and other campus offices
- coordination with library services from Wendt Commons, computer-related services from Computer-Aided Engineering, and other resources as needed
- ensuring students with special needs have access to needed services (e.g., McBurney Center)
- ensuring that students have adequate and timely documentation to secure tuition reimbursement from employers
- assisting students with course registration
- ensuring satisfactory progress is maintained
- instructional technology support, including effective and efficient use of online tools used in program courses.

The program’s Academic Advisor, Professor Dan Negrut, will take the lead in academic advising, including:

- helping students choose a plan of study to meet their learning goals;
- determining the acceptability of prior credits that students desire to transfer and use toward meeting degree requirements
- determining the suitability of alternative courses at UW or other universities to meet program requirements
- helping students connect with relevant teaching and research resources within the College of Engineering (e.g., seminars, research projects, student groups, faculty and students with similar project interests)
6.0 COLLABORATIONS AND PARTNERSHIPS

This program is supported by faculty and departments from across campus, recognizing the work and expertise from multiple departments. In addition to EPD and ME, the College of Engineering and Division of Continuing Studies provided financial support for the feasibility study portion of this development project. The campus’s support for this new named option is further evidenced by the commitment by the Division of Continuing Studies to provide $60,000 in start-up funds in an Educational Innovation Grant, awarded in December 2013. Support letters from the College of Engineering and the College of Letters and Sciences are included in the Appendix.
7.0 ENROLLMENT PROJECTIONS

Based on the results of EPD’s market survey and our experience with existing online Master of Engineering options, we project that MEng AC & EDA enrollment will consist of a mix of recent graduates and mid-career engineers studying at a distance. These are students who would be unlikely to resign their jobs and move to Madison to pursue a graduate degree.

Enrollment of matriculated students in the program’s first year is assumed to be 10-15 students. Enrollment in subsequent years is assumed to be 15-20 new students per year. These Base Case levels are “reasonable estimates” based on experience to date with other CoE distance degree programs and are supported by the marketing study for this proposed program.

The program is assuming it will achieve 90% retention and successful degree completion by matriculated students. EPD experience with existing online degree programs has demonstrated that this retention rate is achievable with high-quality courses in a fixed curriculum plan and proactive student services.
8.0 PROGRAM FINANCIAL PLAN

As part of the feasibility study completed by EPD, a Business Plan was developed to examine the financial viability of the proposed program and explores the required logistics, program management, and program support needed to achieve a high-quality, sustainable program that delivers strategic benefits to ME, EPD, the College of Engineering, the Division of Continuing Studies, and the UW-Madison campus.

The program will require substantial investment in the early years as course development proceeds and enrollment builds, however its fixed curriculum allows the program to maximize course enrollments and remain profitable even with a smaller student population (45-60 students at steady state). Therefore the proposed program is expected to be financially viable long term. Given a reasonably likely estimate of enrollment and current tuition pricing, the program is expected to generate positive cash flow in the third year after program launch. Program marketing may be able to improve program financial performance beyond the above Base Case by achieving higher than budgeted enrollment from a strong national market that was identified in the preceding Market Study.

![Projected Revenues and Expenses](image_url)

*Figure 4. Projected Revenue for MEng AC & EDA*
APPENDIX I: SUPPORTING LETTERS

1. College of Engineering
   a. College of Engineering Academic Planning Committee
   b. College of Engineering Master of Engineering Oversight Committee
   c. Dept. of Engineering Professional Development
   d. Dept. of Mechanical Engineering
   e. Dept. of Industrial and Systems Engineering

2. College of Letters and Sciences
   a. Dean
   b. Dept. of Computer Sciences
   c. Dept. of Statistics
   d. School of Library and Information Sciences
Dear Members of the Graduate Faculty Executive Committee:

Engineering Professional Development (EPD) has worked with faculty across campus to develop a new fully online named option focused on Applied Computing and Engineering Data Analytics. As a result of this work, we are submitting the attached proposal for a new Master of Engineering named option for your approval.

This program provides the University of Wisconsin with an opportunity to continue its leadership in continuing professional development and engineering education by offering a new academic credential for working engineers. Our analysis of potential students has determined there is strong interest for credit-based continuing education after the Bachelor’s degree focusing on the tools and strategies for effectively managing data and computing tools to solve engineering problems. This new named option will be our opportunity to educate these engineers working in the growing “big data” world. Faculty and their associated departments will also share this new revenue source.

Based on preliminary inquiries and with additional marketing, we expect to have 15-20 students in the first set of classes planned for Summer 2016. We expect enrollment of early and mid-career engineers who are currently in professional positions or desire to move into engineering analytics roles in the future. The program’s structure will allow students to complete the degree program in three years while continuing to pursue their professional careers.

The College’s online graduate programs have maintained strong enrollment, and utilizing our past experience with online programs as a guide, we are scaling-up our capabilities for faculty and student support. We anticipate strong cooperation within our departments for these students, and expect this program to be financially self-supporting.

Please note, the COE’s Master of Engineering Oversight Committee approved this proposal December 1, 2014, and the COE’s Academic Planning Council approved this proposal on February 11, 2015.

Thank you for your consideration,

Sincerely,

James Blanchard
Executive Associate Dean
Chair of Engineering Physics
jake.blanchard@wisc.edu
MEMORANDUM

To: Marty Anne Gustafson, Program Director, Engineering Professional Development
   Dan Negrut, Associate Professor, Department of Mechanical Engineering

From: Barry Van Veen, Lynn H. Matthias Professor and Chair, Master of Engineering Oversight Committee

Date: December 1, 2014

Re: Master of Engineering, Applied Computing and Engineering Data Analytics

Cc: Susan Hagness

This memorandum is to report that the College of Engineering Master of Engineering Oversight Committee approved and endorsed the Master of Engineering, Applied Computing and Engineering Data Analytics named option at its meeting held on December 1, 2014.

Please contact me if you have any questions.
December 3, 2013

Dan Negrut  
Associate Professor  
NVIDIA CUDA Fellow  
Director, Wisconsin Applied Computing Center  
Department of Mechanical Engineering  
Department of Electrical and Computer Engineering  
University of Wisconsin - Madison  
2035ME, 1513 University Avenue  
Madison, WI 53706-1572

Dear Professor Negrut:

Please accept the support of the Department of Engineering Professional Development (EPD) for the development of a new online Master of Engineering in Data Analytics and Applied Computing (DAAC). We believe that through our partnership we can provide engineers additional skills for analyzing data, improving design, and using new techniques in modeling and simulation to solve engineering problems, and ensure that engineers learn to use new software tools with an understanding of context for better decision making.

This program will complement our existing degree programs, and as the target students are practicing engineers unable to come to campus for graduate study, provide our department with new students and connections to industry.

EPD is committed to providing an additional $20,000 in matching funds to your Education Innovation proposal to complement our previous support. We are convinced that our departments’ commitment to this important effort will deliver strategic advantages to the College, UW, and most importantly to our students, their employers and society at large.

We look forward to moving ahead with you and additional partnering departments in this endeavor.

Sincerely,

[Signature]

Philip R. O’Leary, PhD, PE  
Professor and Chair
October 21, 2014

Dan Negrut  
Vilas Associate Professor / NVIDIA CUDA Fellow  
Co-Director, Wisconsin Applied Computing Center  
Department of Mechanical Engineering  
2035ME, 1513 University Avenue  
Madison, WI 53706-1572

Dear Dr. Negrut,

It is my pleasure to provide this letter confirming the Department of Mechanical Engineering strong support for the development of a new online Masters of Engineering in Applied Computing and Engineering Data Analytics. We believe this initiative will provide working engineers with critical skills for analyzing data, improving design, and using new techniques in modeling and simulation to allow better decision making. These skills encompass an array of important areas of engineering, including those of Mechanical Engineering.

This program will complement our existing degree programs. Because the target students are practicing engineers unable to come to campus for graduate study, it will provide our faculty new connections to industry and expand the reach of the university beyond the boundaries of the state.

We appreciate Engineering Professional Development’s partnership in this endeavor through their assistance with instructional design, funding of teaching assistants, and the delivery support for teaching in a virtual learning environment. The cooperation between our two departments in this important and timely effort will deliver strategic advantages to the College, University, and most importantly to the students, their employers, and society at large.

We look forward to moving ahead with you in this endeavor.

Sincerely,

Jaal Ghandhi  
Professor and Chair
January 26, 2015

Dan Negrut  
Associate Professor  
NVIDIA CUDA Fellow  
Director, Wisconsin Applied Computing Center  
Department of Mechanical Engineering  
Department of Electrical and Computer Engineering  
University of Wisconsin - Madison  
2035ME, 1513 University Avenue  
Madison, WI 53706-1572

Dear Professor Negrut,

The Department of Industrial and Systems Engineering voted unanimously (15 in favor, zero opposed or abstaining) to support the development of a new online Master of Engineering in Data Analytics and Applied Computing. Several of our faculty would be happy to participate in the program (providing coursework in areas such as optimization, data mining, and statistical quality control), pending availability of sufficient resources to accommodate the additional students, and at the discretion of the department.

This program will complement our existing degree programs, and as the target students are practicing engineers unable to come to campus for graduate study, will provide our department with new students and new sources of connection to industry.

We appreciate EPD’s partnership in supporting our faculty with instructional design and delivery support for teaching in a virtual learning environment. We are convinced that our departments’ participation in this important effort will deliver strategic advantages to the College, to the UW, and most importantly to our students, their employers, and society at large.
We look forward to moving ahead with you and the other departments involved in this endeavor.

Sincerely,

Vicki Bier, PhD
Professor and Chair

VB:cbk
6 May 2015

TO: Ian Robertson, Dean, College of Engineering

FROM: John Karl Scholz, Dean

RE: L&S APC Support: Creation of Named Option: Applied Computing and Engineering Data Analytics, Master of Engineering

CC: Marty Gustafson, Assistant Dean for Academic Planning, Graduate School
Elaine Klein, Assistant Dean for Academic Planning, L&S
Daniel Kleinman, Associate Dean, Graduate School
Jocelyn Milner, Associate Provost and Director, Academic Planning and Analysis
Phil O’Leary, Chair, Engineering Professional Development
Eric Wilcots, Associate Dean for Natural and Mathematical Sciences

On May 5, 2015, the L&S Academic Planning Council reviewed the College of Engineering Proposal to create a new “named option” under the Master of Engineering degree. This program will deliver instruction at a distance to serve the data analytics needs of practicing engineers. This is an audience that is not the focus of any current or planned L&S programs, and based on our review of the proposal, this option should not afford a broadening of the audience such that it would include audiences served by L&S programs.

We appreciate the work EPD colleagues have done to communicate with L&S departments that will be involved in this program. Computer Sciences, Library and Information Studies, and Statistics provided letters of support. These units worked with EPD to articulate how EPD program revenue will be shared to allow students enrolled in this non-pooled tuition program to take these L&S courses. On a similar note, threshold scores for non-native speakers of English have been set at a level that should not increase pressure on ESL instruction or services for students, though this can be difficult to predict (particularly with online programs). Since ESL is entirely supported by 101 tuition dollars, students in non-pooled revenue programs are expected not to use these services. We will monitor course enrollments and will communicate with EPD should it appear that this new program is having an impact on ESL.

The L&S Academic Planning Council endorsed a request to support this proposal. We wish you all success in offering it.
March 20, 2015

Dan Negrut
Associate Professor
NVIDIA CUDA Fellow
Director, Wisconsin Applied Computing Center
Department of Mechanical Engineering
Department of Electrical and Computer Engineering
University of Wisconsin - Madison
2035ME, 1513 University Avenue
Madison, WI 53706-1572

Dear Professor Negrut,

Please accept the support of the Department of Computer Sciences for the development of a new online Master of Engineering in Applied Computing and Engineering Data Analytics. We appreciate your cooperation with our department and faculty that may provide a course to your practicing engineers looking for additional skills in data presentation in the future. As your target engineers are unable to come to campus for graduate study, they will also provide our participating faculty with new students and connections to industry.

We understand that the College of Engineering’s distance degree model will provide funding for instruction, teaching assistants, and course development time, along with resources to support production of materials if needed to ensure no impact on our department.

Computer Sciences supports this proposal but acknowledges that it will likely develop computational outreach programs in the future. To include this letter to in the package supporting the online "Master of Engineering in Applied Computing and Engineering Data Analytics", those associated with the program should agree in principal to support future Computer Science online endeavors and/or consider increased CS participation in the current program. If on the other hand, such future CS program would be deemed in conflict with the current proposal, this letter should not be used.

We look forward to moving ahead with you in this endeavor.

Sincerely,

Mark D. Hill
Computer Sciences Department Chair
Gene M. Amdahl Professor

Prof. Mark D. Hill
Computer Sciences Department  University of Wisconsin-Madison  1210 W. Dayton Street  Madison, Wisconsin 53706
Phone: 608-262-9196  E-mail: markhill@cs.wisc.edu  Web: http://www.cs.wisc.edu/~markhill
23 April 2015

Dan Negrut
Vilas Associate Professor
NVIDIA CUDA Fellow
Co-Director, Wisconsin Applied Computing Center
Department of Mechanical Engineering
Department of Electrical and Computer Engineering
University of Wisconsin - Madison
2035ME, 1513 University Avenue Madison, WI 53706-1572

Dear Professor Negrut,

The Statistics Department strongly supports the development of the new online Master of Engineering program called “Applied Computing and Engineering Data Analytics” (ACEDA).

As you know, we have recently gone through the approval for a new, non-traditional, MS in Statistics option for Data Science. Much evidence points to the emergence of a new field of “Data Science” or “Data Analytics”, which cuts across many traditional fields (see refs at www.stat.wisc.edu/analytics). We think it is very important at this time of rapid change in the instructional delivery mechanism, particularly in the area of data analytics or data science, that we support each other’s proposals at UW-Madison.

Your program will complement our existing and proposed degree programs. As we discussed during our numerous meetings, we are very interested in understanding how your classes Intro to Numerical Methods, High Performance Computing for Engineering Applications, and Machine Learning could complement our online program. At the same time, we are very committed in jointly working towards making the Data Analysis with R course available to your students as part of the core ACEDA classes. The Educational Innovation funds used by your program to advance the readiness for online delivery of the Statistics course Data Analysis with R bears witness to the close collaboration of our programs and their synergistic co-existence. Indeed, while we expect to draw from engineers, scientists and other researchers for our proposed Data Science masters, we believe the subject matter is sufficiently distinct and complementary for two separate professional programs.

We appreciate EPD’s partnership in supporting our faculty with instructional design and delivery support for teaching in a virtual learning environment. We are convinced that our departments’ commitment to this important effort will deliver strategic advantages to CoE, L&S, UW-Madison, and most importantly to our students, their employers and society at large.

We look forward to moving ahead with you and additional partnering departments in this endeavor. Yours sincerely,

Yours sincerely,

[Signature]

Professor Brian S. Yandell
Departments of Statistics & Horticulture
February 16, 2015

Dear Professor Negrut,

I am writing a letter of support from the School of Library and Information Studies for the development of the new online Master of Engineering in Applied Computing and Engineering Data Analytics. We appreciate the opportunity to make our course, LIS 751, available to your practicing engineers looking for additional skills in database management to solve engineering problems. The new students and new connections to industry will benefit SLIS.

We understand that you will provide the following resources per the College of Engineering’s revenue sharing model so that impact on our department will be a minimum:

- Up to one month of funding (salary or other funds) for an instructor to adapt their existing course to an online environment, along with production support to create materials that can be used both on and off-campus. In addition, the instructor would be eligible for up to one half month of funding for “course refreshment” in order to make significant changes to keep the course updated.
- Funding for a teaching assistant chosen by SLIS to support the instructor during the semester the course is offered to off-campus students
- 25% of the tuition recovered from the students in the course will be returned to SLIS as 131 revenue.
- SLIS will field the course once per year.

We appreciate EPD’s financial and teaching support for our faculty, and we look forward to moving ahead with you in this endeavor.

Sincerely,

Kristin Eschenfelder
Professor and Director
School of Library and Information Studies
APPENDIX II A. CORE CRITERIA CHECKLIST
FOR ACADEMIC PROGRAMS WITH NON-POOLED TUITION

1. New and Additional Student Enrollments to Support Program Costs
   ✔ The program must bring in NEW and ADDITIONAL students. Overall enrollment in
   all other school/college programs must not be eroded. The program cannot
   compete with or draw students away from existing programs that support the
   central tuition pool.
   ✔ Faculty/staff must plan for sufficient enrollments to have enough tuition to cover
   instructional, direct student support costs, and any other fixed or required costs.
   Experience shows that enrollments of at least 30 students are necessary to have
   enough tuition to meet direct program costs.
   ✔ School/college Budget Officers must be involved in planning and must approve
     plans and budgets for these programs before the program is submitted to the
     school/college APC for academic approval.

2. Designed for Non-Traditional Students
   ✔ Has an applied, practice-oriented curriculum, or integrates practice with theory
   ✔ Is offered in a modality that allows non-traditional audiences to attend (evening,
     weekend, online, intensive, or some combination)
   ✔ Has demonstrated a workforce demand for the program graduates
   ✔ Has defined learning goals that are oriented to market considerations
   ✔ Has a clearly defined curriculum that is “self-contained”, meaning that program
     students are confined only to courses from the approved, prescribed curriculum
   ✔ Has a clearly defined (often lockstep) curriculum with few options or electives that
     follows a predictable timeline for offerings and completion

3. Distinctly Identifiable Program (Code) With Governance Approval
   ✔ The program must be distinctly identifiable in the student record system, either as a
     degree/major or as an option of a degree/major, or as a Capstone certificate.
   ✔ The program must develop a proposal for the academic approval process, during
     which it must demonstrate that the school/college Dean and Budget Officer are
     aware and supportive of the program being run on a non-pooled tuition model.
APPENDIX II B. ADDITIONAL REQUIREMENTS CHECKLIST
FOR ACADEMIC PROGRAMS WITH NON-POOLED TUITION

Use this checklist in conjunction with the Core Criteria Checklist

If core criteria are met, the program must adhere to the additional requirements below.
Note: Not all new programs are suited for the non-pooled program requirements. New programs that seek to take advantage of a wide range of course and curricular/program offerings on campus and are not market-oriented should be developed under traditional (101) pooled tuition funding models.

1. Fiscal Requirements:
   - School/college budget officer has approved the budget and fiscal plan.
   - School/college dean and budget officer are committed to assuming fiscal responsibility for costs not covered by non-pooled tuition to the program. The school/college will back up the budget with a commitment to cover any costs not met from tuition from other sources.
   - The program structure fits within standard academic administrative structures and allocates expenses of the program so that the program does not create additional burdens on traditional/101 program resources or student services such as advising, ESL, Registrar’s Office, Bursar’s Office, Graduate School and other support services.
   - Programs have two options for tuition. One option is to charge standard graduate tuition according to the UW-Madison tuition schedule. This includes standard rates for WI resident, MN, and non-resident students and any compulsory fees that apply. Or, for fully online programs, they have the option of charging all students one of tuition tiers (Appendix D). Although not currently allowed, it is potentially possible in the future the tiered tuition may be available to face-to-face programs.
   - Because students who have graduate assistantships receive tuition waivers, some non-pooled tuition graduate degree programs choose to prohibit students from accepting a graduate assistantship (RA/TA/PA). If a program allows their students to take graduate assistantships they it must forgo the tuition revenue. To ensure full receipt of non-pooled tuition and to counter challenges from students, the program must adhere to the following:
     - The program faculty/staff must disclose this program policy to students in the recommendation of admission letter, program website, program handbook, and program orientation.
     - Please see Appendix E for links and Appendix F for a sample of a specific non-pooled program template for a recommendation of admission letter and a general template for a program handbook. The program faculty/staff must provide details on this and any other program policies the program
handbook in at least the following areas: satisfactory progress (good standing) requirements, any ways to return to good standing, and a program grievance process if done does not already exist.

2. Requirements for International Students:
   - Programs may not admit students who need ESL services without building sufficient ESL support into their fiscal model, and having an explicit MOU with the ESL provider about funding to support the ESL services.
   - Graduate degree/major programs must use Graduate School standards for English Proficiency. Capstone certificates should be designed so that admission requirements ensure that ESL support is not needed.
   - If the program is NOT completely online and admits international students, the program is responsible for honoring federal visa regulations related but not limited to: length of stay requirements for visa requests, online course restrictions for visa holders, and waiting for federal program approval (up to a year) if the program represents a new degree type or capstone certificate previously not offered at UW-Madison.

3. Requirements for Program/Course Enrollment:
   - Non-pooled tuition program students can only be enrolled in one program at a time; enrollment in a second major, named option, certificate program, or courses beyond the prescribed program curriculum is not permitted. Non-compliance with this requirement will jeopardize the receipt of tuition for a non-pooled program. Regular audits will be conducted to ensure these requirements are met.
   - To ensure full receipt of non-pooled program tuition and to counter challenges from students who want to be dually enrolled, the program must adhere to the following:
     - The program must provide information to students about prohibitions on concurrent program enrollment and out-of-program course enrollment. Programs must note this in recruiting materials, in recommendations of admission, on the program website, program handbook, and program orientation.
     - Please see Appendix E for links and Appendix F for language for a specific non-pooled program template for a recommendation of admission letter and a general template for a program handbook. The program faculty/staff must provide details on this and any other program policies in the program handbook in in at least following areas: satisfactory progress (good standing) requirements, ways to return to good standing, and a program grievance process if one does not already exist.
The program communicates to students each semester prior to course enrollment the expectation that students can enroll only in program courses and not in courses outside the approved, prescribed curriculum.

For students who enroll in the non-pooled program and then decide they want to pursue traditional/101 programs that allow dual enrollment, the program must help the student transfer to a different program(s) that allow such activity.
APPENDIX II C. IMPLEMENTATION CHECKLIST
FOR ACADEMIC PROGRAMS WITH NON-POOLED TUITION

Review compliance with core criteria and additional criteria outlined for all non-pooled programs before proceeding with this implementation checklist. All three checklists should accompany the academic proposal when it is submitted to the Provost and Dean of the Graduate School and Provost for approval by GFEC and UAPC respectively. The checklist will be reviewed again at the implementation meeting.

1. Program description:
   ✓ Program Name: Applied Computing and Engineering Data Analytics
   ✓ Department/Academic Unit Home: Engineering Professional Development
   ✓ School/College: College of Engineering
   ✓ Type of Program (Capstone, Master’s degree, Master’s degree option, Other):
   ✓ Mode of Delivery - Face-to-Face or Online : Online
   ✓ Format of Delivery – compressed, evening/weekend, part-time, other:
     Standard semester; part-time, combination asynchronous and synchronous (web conference)
   ✓ Start Dates
     a. Accept applications: November 2015
     b. Enroll students: June 2016
     c. Web content is live: August 2015
   ✓ Program handbook is complete
   ✓ Non-pooled program leadership:
     a. Program Faculty Director: Dan Negrut
     b. Program Coordinator : Wayne Pferdehirt (interim)
     c. Other key staff who will need to be included in communications:
        Phil O’Leary (Dept Chair); Gary Henderson (Graduate Program Coordinator)

2. Fiscal Basics
   ✓ If the program is face-to-face, the program charges standard graduate tuition according to the UW-Madison tuition schedule.
   ✓ If the program is on-line, the program has selected ONE of the available tuition tiers for per credit tuition. Selected per credit tuition rate: $1,600/credit
   ✓ The program tuition has NO non-standard features? If yes, explain:
   □ The program faculty/staff and school/college budget officer have completed the “item type” form.
   ✓ Planned enrollment generates enough paid tuition to cover instructional costs, direct student support costs, and any other fixed or required costs. Although
detailed fiscal plans are not required in the academic program proposal, it is helpful
to provide the following summary:

**Fiscal Annual Summary** (numbers below reflect full program buildout)
Planned enrollment: 15-20 new students per year. Total steady-state program
enrollment third year and beyond approx. 50 students
Est paid tuition: $381,000 (Year 3)

- Core Instructional costs: $225,900
- Direct student support costs: $60,000
- Overhead assessment/allocation: $38,100 (@10%)
- Total costs: $285,000 program costs (Year3)
- Excess tuition available for reinvestment: $57,000
- Briefly list planned reinvestment uses: Develop additional online engineering
  graduate degree programs

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### 3. Administrative Basics – This section will be completed by APIR and Graduate School Staff

- The program has been approved by the school/college governance process. Date:
- The program has been approved by the Graduate Faculty Executive Committee.
  Date:
- The program has been approved by the University Academic Planning Council. Date:
- **Program Code/Name Specifics**
  - Program Name:
  - Plan Code:
  - Subplan Code (if applicable):
  - Effective date for first enrollment:
  - Nontraditional?
  - Online/Distance?
  - Educational Innovation?
- Program has provided content for the Graduate Catalog including details for their
  “Satisfactory Progress and Program Requirements” chart
- Program has provided content for the Graduate School website and the campus Career Portal