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Chair of the Assembly of the Academic Senate
Faculty Representative to the Regents
University of California
1111 Franklin Street, 12th Floor
Oakland, California 94607-5200

September 29, 2016

AIMÉE DORR
PROVOST AND EXECUTIVE VICE PRESIDENT
UNIVERSITY OF CALIFORNIA

Re: Approval of Master of Embedded and Cyber-Physical Systems (MECPS) at UC Irvine

Dear Aimée:

In accordance with the *Universitywide Review Processes For Academic Programs, Units, and Research Units* (the "Compendium"), and on the recommendation of CCGA, the Academic Council has approved UC Irvine's proposal to establish a self-supporting Master of Embedded and Cyber-Physical Systems (MECPS) degree program.

Because this is a new degree, and the Assembly of the Academic Senate is not meeting within 30 days of CCGA's approval, Council must approve the program per Senate Bylaw 125.B.7.

I am enclosing CCGA's report on its review of the new degree, and respectfully request that your office complete the process of obtaining the President's approval.

Sincerely,

Jim Chalfant, Chair
Academic Council

Cc: Academic Council
        Senate Director Baxter
        Senate Executive Directors

COORDINATING COMMITTEE ON GRADUATE AFFAIRS (CCGA)
Valerie Leppert, Chair
vleppert@ucmerced.edu

ACADEMIC SENATE
University of California
1111 Franklin Street, 12th Floor
Oakland, California 94607-5200

August 23, 2016

ACADEMIC COUNCIL CHAIR DAN HARE

Dear Dan:

At its August 2016 meeting, the Coordinating Committee on Graduate Affairs (CCGA) voted unanimously to approve a proposal to establish a self-supporting Master of Embedded and Cyber-Physical Systems (MECPS) at the Irvine campus. This program is designed as a one-year program with option for a two-year curriculum. Coursework includes seven foundational courses with lectures and laboratory, and two project courses leading to a final project.

The proposed MECPS degree will be highly integrated with UCI's Center for Embedded & Cyber-Physical Systems (ECPS), which will supply many of the faculty. The target audience is a mix of students from an undergraduate curriculum in computer science or engineering, and working professionals. The courses will be developed initially for in-class delivery, supplemented by online material, with potential expansion to an online degree.

CCGA and the reviewers noted many strengths of the program, including the internationally recognized faculty who would be delivering it and the high demand for graduates of such a program. It would address a growing need for people trained to bridge computer science and engineering. However, most reviewers wanted more detailed information, especially regarding the integration of laboratory components into the coursework. UCPB raised concerns about the coverage of cyber security and the program's potential for impact on state-supported activities. In addition, UCPB requested more details on the "return to aid" protocol. Similarly, CCGA raised questions about the proposed program's impact on state-supported programs, due to the increased faculty teaching load that would result, and requested clarification on the policy that would guide overload teaching by program faculty. Previous CCGA SSGPDP proposals have regarded teaching within such programs as an outside teaching responsibility (not part of the regular departmental duties) and proposed using APM-025 to guide faculty workload, and this was mentioned to the proposers.

The proposers responded with a strong support letter from the dean and a separate letter of commitment to maintaining the quality of education, including recruitment of additional faculty. The campus revised and resubmitted the proposal to provide more details on the contents of each course, including integration of laboratory components and areas where cyber security is addressed in each course. The revision also added details about the syllabus and a plan to incorporate case studies to help facilitate continuity across courses.

UCI also provided a separate letter from the Vice-Provost for Graduate Education and Chair of the Graduate Council, in which they stated they do not believe teaching in SSGPDPs qualifies as an outside

teaching responsibility, and that therefore APM-025 should not apply. CCGA considered the letter and came to the conclusion that it does not agree with the campus position on this issue, and so this was not considered a supporting factor for approval of the program. Further, approval of this program should not be considered a precedent for future proposers planning to make a similar argument. This issue will need further discussion in order to arrive at a common understanding across the university of how the impact of teaching in non-state supported programs by state-supported faculty will be managed.

As you know, CCGA's approval is usually the last stop of the Academic Senate side of the systemwide review and approval process except when the new degree title must be approved by the President, under delegated authority from the Board of Regents. According to the Academic Senate Bylaws, the Assembly of the Academic Senate (or the Academic Council if the Assembly is not meeting within 30 days of CCGA's approval) must approve new degree titles. Given its status as a new graduate program title on the Irvine campus, CCGA submits its approval of the Master of Embedded and Cyber-Physical Systems degree program for formal approval by the Assembly of the Academic Senate. For your information, I have included CCGA's final report as an enclosure. If you have any questions, please let me know.

Sincerely,

Valerie Leppert, Ph.D.
Chair, CCGA

cc: Jim Chalfant, Academic Council Vice Chair
        CCGA Members
        Shane White, UCPB Chair
        Hilary Baxter Academic Senate Executive Director
        Michael LaBriola, Academic Council Analyst
        Ken Feer, UCPB Analyst
        Kimberly Peterson, Academic Planning Analysis Manager
        Chris Procello, Academic Planning and Research Analyst
        Frances Leslie, UCI Graduate Division Dean
        Natalie B. Schonfeld, UCI Academic Senate Executive Director
        Adriana Collins, UCI Senate Analyst

Enclosures (1)

Report for the UC Irvine (UCI) Proposal for a Self-Supporting Graduate Program leading to a Master of Embedded and Cyber Physical Systems degree

Laurel Beckett, Lead Reviewer
July 29, 2016

Description of the proposed Degree program:
The proposal is to establish at UC Irvine a new, self-supporting Master of Embedded & Cyber-Physical Systems (MECPS) degree program. The program will be managed by the Center for Embedded & Cyber-Physical Systems, with faculty drawn from the Henry Samueli School of Engineering (HSSoE) and the Donald Bren School of Information & Computer Science (DBSICS). The program is designed as a one-year program with option for a two-year curriculum. Coursework includes seven foundational courses with lectures and laboratory, and two project courses leading to a final project (thesis). The target audience is a mix of students from an undergraduate curriculum in computer science or engineering, and working professionals. The courses will be developed initially for in-class delivery, supplemented by online material, with potential expansion to an online degree. Projected surplus funding would be used to develop this option, with help from University Extension.

Relationship with other UCI programs:
The proposed MECPS degree is completely new and has little overlap with any existing programs in the UC system. Within UCI, it will be highly integrated with the Center for Embedded & Cyber-Physical Systems (ECPS), which will supply many of the faculty.

Comparison to other existing programs outside UCI:
On other UC campuses, the only comparable degree is a track within the Master of Engineering program at UCB, which is one of 20 tracks and has only 6 students enrolled. Moreover, the UCB track emphasizes a different aspect of ECPS, focused on civil engineering. Comparable programs exist at Portland State and U Penn; a related program, focused more on automotive systems, exists at U Michigan.

Degree requirements:
The MECPS degree is a Plan II (non-thesis) program requiring 7 core courses, one case studies course, and one project course, leading to a final project report. Detailed information is provided on course content, including laboratory components and training in cyber security.

Faculty and other resources:
Eleven key faculty members are named; each course will have two existing lead faculty from among the full-time tenure-track faculty. One additional full-time lecturer will be hired to manage the laboratory sections and teach 2-3 courses; otherwise, no new faculty will be hired. Existing faculty will be compensated either through course buy-outs or with a stipend for instruction and for administrative duties (overload). The impact on teaching load is addressed in an MOU from the Deans that is attached to the proposal.

Program cost:
Tuition is placed at $30,000 per year to start, increasing 3% per year to reflect costs. This cost does not seem out of line with other professional programs, and indeed is substantially less than that proposed for a recently reviewed self-supporting Masters in Human Computer Interaction and Design at UCI.

Financial support for students:
In the initial budget, $30K per year was allocated for financial aid, available based both on financial need and program performance. This is more than 33% of the projected surplus. If the surplus increases beyond $90K per year, the program will switch to a 33% allocation to financial aid.

Reviewers:
Four expert reviewers, all of whom waived confidentiality, provided evaluations of the program. Two reviews came from within the UC system: Rajiv Gupta, Professor of Computer Science and Engineering, UC Riverside (suggested by the proposer; review received 4 January 2016) and Ryan Kastner, Professor of Computer Science and Engineering, UC San Diego (suggested by the Lead Reviewer, review received 24 March 2016). Two additional reviews came from outside of UC: Sarma Vrudhula, Professor in the School of Computing, Informatics, and Decision Engineering Systems, Arizona State (suggested by the proposer, review received 6 April 2016) and Jim Freudenberg, Director, Systems Laboratory and Master of Engineering in Automotive Engineering, Department of Electrical and Computer Engineering, University of Michigan (suggested by Lead Reviewer, review received 1 March, 2016). All four reviewers have expertise in the area of the program and are senior faculty in their departments. In addition, the University of California University Committee on Planning and Budget (UCPB) provided a detailed review (received 27 January 2016).

Timeline of reviews and responses:
All reviews were posted to the CCGA website. The UCPB concerns and the first three reviews were discussed at the CCGA meeting on 6 April 2016 where it was decided that the Program should be given a chance to respond.

Copies of the reviews and a bullet-point summary of key questions were provided to the proposers at UCI on 14 April 2016. The program response was received on 3 May 2016 and discussed on a CCGA conference call on 5 July 2016.

One remaining concern was raised by CCGA about the impact on state-supported programs and activities of faculty time for the proposed Program, and this concern was shared with the Program chair. The Program responded to this concern via email on 21 July 2016, with further clarification on 29 July. In addition, UC Irvine has provided a separate letter with general information on their policy on Self Supporting Graduate Programs and their impact, also dated 21 July 2016.

Reviewer comments are summarized below, beginning with strengths, followed by concerns raised by reviewers, with program responses summarized briefly. A revised version of the Proposal has also been posted to the CCGA website.

Strengths:

All four reviewers praised the overall quality of the program, especially the faculty. Several reviewers noted that the faculty members are "world class" and "internationally recognized." Dr. Kastner noted that the Center has one of the largest groups in the world focused on this area of research and that the program offers a unique opportunity for UCI to become a leader in advanced education in this important area. All four reviewers concurred on the high demand for the program, although initially the pool is likely to draw more from current applicants to MS programs than from industry.

Concerns:

Quality and rigor of the program: All reviewers generally rated the program as very strong, but noted that more detail would be helpful. In particular, three of the reviewers wanted more detail about the integration of laboratory components into the coursework. A number of minor typographical errors were noted (mislabeled course number, for example). In addition, UCPB raised concerns about the coverage of cyber security, which was not described in the brief summaries of courses. CCGA echoed this concern. Another concern raised was that all the proposed classes are new, and it might require several iterations to settle into a solid class. Several reviewers also noted that while developing an online version of courses and program would be appealing, it would require substantial work. This would be more user-friendly for industry students, as would having flexible hours.

Some questions were raised about prerequisites and preparation of students for advanced work.

Program response: The Program has edited the proposal to provide more details on the contents of each course, including integration of laboratory components and areas where cyber security is addressed in each course. The detailed response from the Program enumerated the following responses:

- More details were added to the syllabus.
- Case studies will be incorporated to help facilitate continuity across courses.
- While the courses themselves are new, several are based on courses already being taught or on components of existing courses. What will be new is streamlining of laboratory components across courses to allow more time to learn core material in each course. Details of the lab components were provided for each course, including what platform and network.
- All lectures will be videotaped and available online within 24 hours; students do not need to attend lectures but must attend labs and assessment sessions. As the program matures, they will consider scheduling classes after work hours. For further online development, the Program may seek a partnership with University Extension.
- Additional details were given on how they plan to address gaps in engineering background for students from CS, and computing background for students from engineering.

Adequacy of size and expertise of faculty: All four reviewers praised the quality of the faculty, with several calling them world class and internationally recognized. Some questions were raised about the use of a lecturer, and how much work this person would do, and whether there would be adequate faculty support to cover all 9 courses with two tenure-track faculty per course.

Program response: The Program clarified that the lecturer would be primarily responsible for helping faculty with course development, especially the laboratory component. The lecturer would be responsible for maintaining laboratories, and in addition, might teach some courses. In addition, the Program communicated via later email that an additional 10 faculty have expressed interest in affiliation with the Program, bringing the total to 21 faculty.

Adequacy of facility and budgets: Reviewers noted the strong support from the Dean. Some questions were raised about the magnitude of the undertaking for conversion to online coursework. Questions were also raised about the laboratory components and facilities. UCPB requested more details on the "return to aid" protocol. A major concern, raised by both UCPB and CCGA, was the potential for impact on state-supported activities.

Program response: Conversion to online coursework is envisioned as a step in the future, not immediate. Help would be sought from University Extension before moving to an online program. Laboratory components and facilities were clarified, in considerable detail, in the expanded discussion of the syllabus and how labs are integrated across courses. The "return to aid" protocol was clarified as beginning with $30K/year in direct aid, to be increased if the program's surplus increases. The program noted that in traditional MS programs, MS-only students rarely receive any financial aid, thus they expect their program to be, at least potentially, more competitive than traditional programs.

The issue of impact on state-supported activities is more complex. The program's initial response did not clarify how many courses each participating faculty member would be expected to teach, or how the total (9 courses, with 10 faculty and one lecturer) would avoid impact on other faculty responsibilities. CCGA requested additional clarification. The Program has now clarified that with 21 faculty and one lecturer, they would teach an average of 0.4 courses per year (one every 2.5 years), and that this could readily be accommodated by an overload without impact on state-supported activities. UCI has also provided a separate letter of commitment to maintaining the quality of education, including recruitment of additional faculty.

Applicant pool and placement prospects: All four reviewers noted the high demand for graduates of such a program. UCPB raised some concerns about an apparent slacking of demand in 2013, but the expert reviewers report increasing demand.

Program response: The program has provided additional data supporting the rapid growth of demand in this area, consistent with the views of all 4 experts in the field.

In summary, the proposed program addresses a growing need for people trained to bridge computer science and engineering in the "internet of things". The program faculty are internationally known in this area, and the curriculum will build on established coursework at UC Irvine. All four reviewers praised the high quality of the faculty and the goals of this degree, and noted the high demand in this area. Reviewer and UCPB concerns focused on two areas: more detail about coursework, especially with regard to prerequisites, laboratory components, and training in security issues; and potential resource issues with regard to teaching and laboratories. The proposers provided a very detailed set of responses and incorporated these changes into a revised proposal.

I believe all issues raised have been adequately addressed in the responses and revised proposal. I have no further questions or issues with the proposal and commend the proposers for being very responsive to the reviews. I recommend its approval.

Sincerely,

Laurel A. Beckett, Ph.D.
Professor and Chief, Division of Biostatistics
Department of Public Health Sciences
School of Medicine
University of California, Davis