November 15, 2012

To: Walid Najjar, Chair  
Computer Engineering

From: Connie Nugent, Chair  
Graduate Council

Re: COMPUTER-ENGINEERING BS + COMPUTER-ENGINEERING MS FIVE-YEAR COMBINED DEGREE PROGRAM

At its meeting of November 15, 2012, the Graduate Council considered and approved the proposal for a Computer Engineering BS + Computer Engineering MS five year combined degree program. The proposal, which includes catalog entry, is attached for your reference.

The proposal will be submitted to the Division for divisional vote on February 19, 2013.

Cc: Eileen Montoya, BCOE Dean’s Office  
Linda Scott, Graduate Division  
Steve Whitestone, Student Affairs Communications
PROPOSAL FOR A

Computer-Engineering BS + Computer-Engineering MS
Five-Year Combined-Degree Program

May 2012

Proposed by the Faculty of
the Computer Engineering Program
Marlan and Rosemary Bourns College of Engineering
University of California, Riverside
Riverside, CA 92521

1 Introduction

Aims and objectives. This proposal describes a combined BS+MS program, leading to a Computer Engineering BS and a Computer Engineering MS in five years.

The proposed program is within the framework established by UCR’s Committee on Educational Policy and the UCR Graduate Council in 2007. The motivation and means for the program are as established in pages 2-3 of the framework document:\(^1\)

Motivation: Quoting from the document: “Combined programs can better attract top high school graduates, transfer students, and returning students, especially those interested in advanced degrees. Thus, UCR departments can expect a higher proportion of good undergraduates.

Combined program students will be more inclined to stay at UCR for their Masters studies instead of applying to other institutions. Thus, UCR departments can better retain these students.”

In sum, the program should attract top students into both the BS and MS programs.

Method: To make it possible to complete both degrees in five years, the programs can allow double-counting of up to twelve credits of coursework done for the undergraduate degree towards the MS degree. The justification is that many UCR MS programs, including the Computer Engineering (CEN) MS, require up to twelve units of preparatory undergraduate coursework that may be necessary for undergraduates from other institutions but redundant for undergraduates coming from an appropriate UCR program.

Relation to existing programs. The program consists of the regular Computer Engineering BS program, followed by the newly approved Computer Engineering MS program, with minor modifications to the MS degree requirements, allowing up to twelve units of undergraduate technical-elective coursework to be counted towards the MS elective requirements, so that the (Plan II) MS requirements can be met in a single year.

\(^1\)Online at [http://senate.ucr.edu/about/policies/establishment_of_combined_programs_at_ucr.pdf](http://senate.ucr.edu/about/policies/establishment_of_combined_programs_at_ucr.pdf)
As the primary motivation for the program is simply recruitment of top students, the program involves no new courses or requirements.

**Interrelation with other UC institutions.** Beyond making the respective BS and MS programs more attractive, the program does not compete or inter-relate with other UCR or UC programs or institutions. It may indirectly recruit top students into the UCR (or other UC) CSE or EE PhD programs, via the CEN MS program.

**Department that will administer the program.** The BS and MS portions of the program will be administered as part of the Computer Engineering Program in the Bourns College of Engineering. Some administrative tasks will be done by the Engineering Student Academic Affairs Office. Some admissions tasks will be done by the Undergraduate Admissions and Graduate Admissions Offices.

**Timetable for development.** Based on current levels of participation in the CS BS + CS MS program, over the 2012-2015 period, we expect from 3-6 students to participate at the MS level per year.

**Historical development of the field.** Driven by the ubiquity of embedded computing devices and systems over the past two decades, Computer Engineering has expanded from a discipline with a few core areas, mainly focused on the design of chips, to a broad field with many application domains. Meanwhile, commercial applications of Computer Engineering are becoming increasingly sophisticated. Graduate-level training of students has become more applied, and students with graduate-level training (MS or PhD) are better prepared than those without such training to work on sophisticated applications. Thus, demand for, and awareness of, graduate-level training is increasing, making it a good time to leverage interest in the MS program and to facilitate entry into it.

**Plan for evaluation of the program.** The effectiveness of the program will be evaluated by monitoring the extent to which it increases the quality of students in the BS and MS programs.

## 2 Program

Broadly, the program consists of the BS program, followed by the MS program. A student in the combined program must meet the program requirements of both programs, in that order, with minor modifications to the requirements of the MS program. Once the student meets the BS program requirements, s/he is granted the BS degree. Subsequently, once the student meets the (modified) MS program requirements, s/he is granted the MS degree.

The normative time to complete the BS portion is four years; the normative time for the MS portion (with double-counting of twelve credits) is one additional year, provided the student chooses the Plan II (project) option.

The modifications to the MS portion are as follows:

- The MS requirements are modified, allowing up to twelve-units of technical elective coursework may be double-counted. This making it possible to complete the MS portion in a single year.
• The GRE requirement for the MS application is waived. Acceptance of the MS application is pro-forma, provided the program criteria below are met (and subject to some restrictions).

• In the first (and normatively only) year of the MS, the fee-differential (if positive) between undergraduate and graduate student fees is paid by the BCOE.

These minor modifications allow the program to be viewed as a single, 5-year, BS+MS program, making the program even more attractive to incoming students.

2.1 Program requirements and process

1. Performance in junior year. By the end of junior year (specifically, at the end of the last junior-year term during which the student is enrolled), the student must be enrolled in the UCR Computer Engineering BS program, with a cumulative GPA of at least 3.4, and must have completed the following four courses with no grade less than a B-, and average grade at least 3.2: CS 100, 120A, 120B, 161, 161L.

“Junior year” refers to the classification by academic requirements completed (not by number of years in the program). “Senior year” refers to the first academic year following Junior year and during which the student is enrolled.

2. Application to combined program in senior year. Before the deadline for MS applications during the senior year (typically early January), the student applies to the combined program. To apply, the student submits a regular application to the MS program. The student’s MS application must include at least two recommendation letters from UCR Academic Senate faculty members. At least one letter, and preferably both, must be from UCR CSE or EE Departments faculty. All letters must give positive recommendations. The GRE requirement for the application is waived, but it is recommended that the GRE be taken nonetheless, to keep open the option of receiving financial aid if the student later pursues a PhD.

The MS application is normally accepted by the department and graduate school in Winter or Spring of senior year. The application is subject to approval by the relevant graduate program admission committee and (after recommendation by the committee to the Dean) to approval by the Dean of the Graduate Division. Acceptance is expected to be pro-forma provided the student meets the requirements above, except that, in the unlikely event that the number of qualifying applicants exceeds the number of MS slots available, applicants will be ranked and offers will be made according to the normal MS-applicant evaluation process. (It is expected that students meeting the above requirements will be among the top in the MS applicant pool.)

For combined-program applicants, any acceptance of the MS application is conditional: to be accepted the student must subsequently meet this senior-year performance requirement:

3. Performance in senior year. At the end of each senior-year term, the student’s cumulative GPA must be at least 3.4. By the end of senior year, all BS program requirements must be met (at which point the BS degree is granted as usual).

4. Acceptance into the combined program. The student is accepted into the combined program if and when the student’s MS application has been accepted by the department and graduate school and the student has met all requirements above.
If the student does not meet the senior-year performance requirement, the student is not accepted into the combined program or the MS portion of the program. (The student may apply to the MS via the regular application process.)

5. Completion of the combined program; modified MS requirements. Once the student is accepted into the combined program, to complete the program and receive the MS, the student must complete all degree requirements for the MS, with the following modification (in keeping with the established five-year program framework).

Normally, courses taken as an undergraduate at UCR cannot be used to satisfy the MS requirements. For students in the combined program, this constraint is relaxed as follows: up to 12 credits of coursework that the student took as an undergraduate at UCR may be counted towards the 32-unit elective requirement of the MS. The courses that can be double-counted towards the MS elective requirement are those that are eligible to be counted as a technical elective for the BS requirements.

This modification makes it possible for a student to complete the MS requirements in a single year by taking three courses in each of the Fall, Winter, and Spring terms. (See the sample program below.) However, the student is not required to complete the MS requirements in a single year.

Upon completion of the modified MS requirements, the student receives the MS degree.

2.2 Preliminary admission of incoming freshmen

When a freshman applicant applies for admission to the UCR Computer Engineering BS program (typically after high school), if s/he meets the criteria below, s/he may also apply for preliminary admission to the combined program:

1. High-school GPA $\geq 3.6$,
2. SAT-I combined score $\geq 1950$,
3. Satisfaction of the Entry-Level Writing Requirement before matriculation,
4. Ready for MATH 9A or higher.

Preliminary admission status will be granted provided the student meets these requirements and is accepted into the UCR Computer Engineering BS program. To maintain preliminary admission status, the student must remain an undergraduate Computer Engineering student in good standing with a UCR cumulative GPA of at least 3.4; otherwise the student loses preliminary admission status.

A non-freshman student can apply (or reapply) for preliminary admission status, which will be granted if, throughout the student’s three most recent active terms, the student was an undergraduate Computer Engineering BS student in good standing with a cumulative GPA of at least 3.4.

Preliminary admission is intended solely to help identify, recruit, and advise UCR BS students who are interested in the five-year program. Students apply for full admission to the combined program in junior year, as previously described, whether or not they have preliminary admission status. Preliminary admission status does not alter the requirements for full admission to the combined program.
2.3 Sample program

A combined BS+MS Computer Engineering student could satisfy all course requirements by taking courses as follows: in the first four years, take any set of courses that meets the BS degree requirements (e.g. the default course plan at [http://student.engr.ucr.edu/majors/CompE_courseplans.html](http://student.engr.ucr.edu/majors/CompE_courseplans.html)); in year five, complete the MS Plan II (Project option) requirements. The MS (Project option) requires 48 units (meeting some specific constraints about area coverage), up to twelve of which can be graduate or undergraduate technical electives. The latter twelve units can be satisfied by double-counting three CEN technical electives that were taken in the first four years (and happened to be used for the technical elective requirement for the BS). So, in year five, the remaining 48-12=36 units can be satisfied by taking three appropriate 4-credit graduate courses each quarter. For example:

<table>
<thead>
<tr>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
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</thead>
<tbody>
<tr>
<td>CS 218 (4),</td>
<td>CS 203A (4),</td>
<td>CS 201 (4),</td>
</tr>
<tr>
<td>EE 213 (4),</td>
<td>CS 207 (4),</td>
<td>EE 241 (4),</td>
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<tr>
<td>EE 203 (4),</td>
<td>EE 221 (4),</td>
<td>CS 213 (4),</td>
</tr>
<tr>
<td>Design and Analysis of Algorithms</td>
<td>Advanced Computer Architecture</td>
<td>Compiler Construction</td>
</tr>
<tr>
<td>Computer-Aided Electronic Circuit Simulation</td>
<td>Advanced Programming Languages</td>
<td>Advanced Digital Image Processing</td>
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<tr>
<td>Solid-State Devices</td>
<td>Radio-Frequency Integrated Circuit Design</td>
<td>Parallel Processing Architectures</td>
</tr>
</tbody>
</table>

MS students are also required to take a 1-credit colloquium seminar, CS 287 or EE 259, each quarter they are in residence. MS (Project option) students are further required to complete a project and pass an oral examination.

2.4 Catalog entry

**Combined B.S. + M.S. Five-Year Program** The college offers a combined five-year B.S. + M.S. program, designed to allow successful UCR Computer Engineering B.S. graduates to complete the Master of Science degree in Computer Engineering in one year, by allowing up to 12 credits of coursework taken as a UCR undergraduate to be counted towards the 32-unit elective requirements of the M.S. (The courses that can be double-counted are those that are eligible to be counted as technical electives in the B.S. requirements.)

A student may apply at the start of their senior year by submitting an application to the Computer Engineering M.S. program, provided that at the end of junior year, the student was a UCR Computer Engineering B.S. student with cumulative GPA at least 3.4 and had completed the following courses with no grade less than a B- and average grade at least 3.2: CS 100, 120A, 120B, 161, 161L. The application to the M.S. program must include at least two recommendation letters from UCR Academic Senate faculty members (at least one, and preferably both, CSE faculty). Submission of GRE scores with the application is recommended but not required. Matriculation into the combined program occurs in the Fall term following senior year, provided: (a) the M.S. application is accepted, (b) throughout senior year, the student is a Computer Engineering B.S. major with cumulative GPA 3.4 or higher, (c) by the end of senior year, the student completes the Computer Engineering B.S. degree requirements.

Incoming students who are applying to the Computer Engineering B.S. program may simultaneously apply for preliminary admission into the combined program provided their high-school GPA is at least 3.6, their SAT-I combined score is at least 1950, they satisfy the Entry-Level Writing requirement before
matriculation, and they have sufficient math preparation to enroll in calculus upon arrival. Preliminary admission status is maintained as long as the student is a Computer Engineering B.S. student in good standing with a cumulative GPA of at least 3.4. Preliminarily admitted students still need to apply for full admission in their senior year as described above.

3 Projected need, resource requirements, student support

As noted in the introduction, in keeping with the framework established by CEP and Graduate Council, this combined program is primarily a recruitment tool, intended to leverage the increasing interest in graduate education to attract top freshmen into the BS program, and to attract top UCR BS students into the MS program.

In the BS program, it should attract students that are more likely than average to make it through the program. Combined with ongoing increases in admissions standards, this should increase both retention and the overall quality of the students.

In the MS program, we anticipate growth in combined-program enrollment of only a few students per year. But more rapid growth would be welcome and would not significantly increase overall enrollment in the MS: each student accepted into the MS program via the combined program is likely to be near the top of the applicant pool, and thus to simply displace a less-qualified student from admission into the MS. (In the unlikely event that the number of students applying through the combined program exceeds the number of MS students that the school wants to accept, recall that the department can cap the number of students accepted at the MS level.)

In short, the main effect of the program should be to increase the quality of students in the BS and MS programs, without significantly affecting enrollment levels. Similarly, it should increase the employability of students produced by the BS and MS programs, and help meet the increasing demand for CS students with graduate degrees.

Resources. Note that each student in the combined program is essentially just a regular student (in the BS program, or, in fifth year, in the MS program), and requires the same resources as a regular student at the same level. Also, BS and MS enrollments will not be significantly affected. Thus, the program requires no change in faculty, courses, or resources such as library, computing, equipment, space, etc. Likewise, the program requires no change in levels or mechanisms for student funding.

The program does require minor administrative support. The administration of the program at the undergraduate level requires processing applications for preliminary acceptance, tracking preliminarily enrolled students, and identifying and informing juniors who will be eligible to apply in senior year. These administrative tasks are already being performed for other five-year programs by the Admissions Office and the Engineering Student Academic Affairs Office. At the MS level, the college and the Computer Engineering Program will have to track which MS students are in the combined program and account for the double-counting allowance.

Finally, only to the extent that existing resources allow, B.S. students with “preliminary admit” status will be given additional advising appropriate for MS-bound students. This is already being done for existing five-year programs during regular advising activities by the Computer Engineering Program and by the Engineering Student Academic Affairs Office.

2Unless the school chooses to use it increase enrollment levels.
4 Changes in Senate regulations

No changes in Senate regulations are required.