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Board of Regents, State of Iowa

**REQUEST TO IMPLEMENT A NEW BACCALAUREATE, MASTERS,
DOCTORAL OR FIRST PROFESSIONAL DEGREE PROGRAM**

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THE PURPOSE OF ACADEMIC PROGRAM PLANNING: Planning a new academic degree program provides an opportunity for a Regent University to demonstrate need and demand as well as the university's ability to offer a quality program that is not unnecessarily duplicative of other similar programs offered by colleges and universities in Iowa.

Institution: Iowa State University

Departments involved: Electrical and Computer Engineering Department

Computer Science Department

CIP Discipline Specialty Title: Software Engineering

CIP **Discipline Specialty Number (six digits):** CIP 14.0903

Level: B

Title of Proposed Program: Curriculum in Software Engineering leading to the degree Bachelor of Science

Degree Abbreviation (e.g., Minor, B.S., B.A., M.A.): B.S

Approximate date to establish degree: Month August   Year   2007

Contact person(s): (name, telephone, and e-mail)   Arun Somani (294-0442, **arun@iastate.edu**),   Carl Chang (294-6516, **chang@iastate.edu**), or Suraj C. Kothari (294-7212, **kothari@iastate.edu**)

Please provide the following information (use additional pages as needed).

1.   Describe the proposed new degree program, including the following:

   a.   A brief description of the program and a statement of objectives including the student learning outcomes and how the learning outcomes will be assessed;

Software Engineering is aimed at creating high-quality software in a systematic, controlled, and efficient manner. The specific objective of the program is to educate students on principles, processes, techniques, and tools for producing, analyzing, specifying, designing and evolving software. A broader objective is to cultivate among students intellectual curiosity, problem solving skills, good learning habits, effective communication skills, leadership, and teamwork.

The expected learning outcomes:

1. show mastery of the software engineering knowledge and skills, and professional issues necessary to begin practice as a software engineer;

2. work as an individual and as part of a team to develop and deliver quality software;

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3. reconcile conflicting project objectives, finding acceptable compromises within limitations of cost, time, knowledge, existing systems, and organizations;

4. design appropriate solutions in one or more application domains using engineering approaches that integrate ethical, social, legal, and economic concerns;

5. demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for problem identification and analysis, software design, development, implementation, verification and documentation;

6. demonstrate an understanding and appreciation for the importance of negotiation, effective work habits, leadership, and good communication with stakeholders in a typical software development environment; and

7. learn new models, techniques, and technologies as they emerge and appreciate the necessity of such continuing professional development.

Outcome assessments will include regular and on-going course and curriculum assessment, based on student course evaluations, published benchmark standards, examination results, feedback from industrial employers, and faculty review of the curriculum. Both the feedback from these sources and the revisions implemented as the result of the feedback will be documented.

b.   The relationship of the proposed new program to the institutional mission and how the program fits into the institution's, college's, and department/program's strategic plan;

The proposed program is important for Iowa State University to remain at the forefront of engineering disciplines by providing education in a key emerging area of engineering. The two key professional organizations IEEE/ACM emphasize the need for degree programs in software engineering. In May 2004, ACM and IEEE issued a joint report on model curriculum for developing undergraduate degree programs in software engineering. ABET, the key organization that accredits engineering programs, has recognized software engineering as a separate engineering discipline and established accreditation guidelines for it. The proposed program complements the existing Computer Engineering and Computer Science programs. Establishing this program is a high priority decision for the Electrical and Computer Engineering and Computer Science departments.

c.   The relationship of the proposed new program to other existing programs at the institution; describe how the proposed program will enhance other programs at the university.

The proposed program complements the existing Computer Engineering and Computer Science programs. Software has become a critical part of infrastructure for medical, energy, transportation, and financial applications. Industry is experiencing an acute shortage of qualified software engineers and the need for such engineers continues to grow. The proposed program allows focusing on education on engineering aspects of developing and evolving complex software.

d.   The relationship of the proposed new program to existing programs at other colleges and universities in Iowa, including how the proposed program is different or has a different emphasis than the existing programs;

This will be the first B.S. degree program in software engineering in Iowa. Computer science and computer engineering are related programs offered by the Iowa State University and the University of Iowa. The University of Northern Iowa offers computer science.

The specifics of the curriculum are different. The professional organizations ACM, IEEE, and the accreditation board ABET consider Computer Science, Computer Engineering, and Software Engineering as different degree programs and specify different model curriculums for them. Unlike the existing program in computer engineering and computer science, the software engineering program will specifically focus on education on engineering aspects of developing and evolving complex software.

e. **Special features or conditions that make the institution a desirable, unique, or appropriate place to initiate such a degree program.**

Iowa State University has been strong in engineering education and research. The Electrical and Computer Engineering (ECE) and the Computer Science (CS) are strong and growing departments at ISU.

f. **Does the proposing institution have personnel, facilities, and equipment adequate to establish and maintain a high quality program?**

Yes. The ECE and CS departments have significant resources in terms of faculty, facilities, and equipment. Both the departments have aggressively hired faculty in software engineering. The ECE department has received seed funding from industry to establish a strong software engineering program. A software engineering lab has been set up with the help of industry funding.

g. **How does student demand for the proposed program justify its development?**

There is a strong student demand fuelled by a strong job market.

2. **Describe the state and/or national workforce need and/or demand for graduates of the proposed program currently and in the near future (provide documentation about the sources of data used to estimate need and demand.)**

Industry is experiencing an acute shortage of qualified software engineers and the need for such engineers continues to grow. Indeed, the highest projected U.S. growth rates among occupational categories over a ten-year period ending in 2010 are in software engineering, with a projected growth of 95.4% for computer software engineers (Hecker, D.E., Occupational Employment Projections to 2010, Monthly Labor Review, vol. 124, no. 11, Nov. 2001, Bureau of Labor Statistics, U.S. Dept. of Labor. **http://stats.bls.gov/opub/mlr/2001/11/art4full.pdf**) This corresponds to increase of 664,000 total positions (in the U.S.) in software engineering.

3. **List all other public and private institutions of higher education in Iowa currently operating programs similar to the proposed new degree program. (For comparison purposes, use a broad definitional framework, e.g., such identification should not be limited to programs with the same title, the same degree designation, having the same curriculum emphasis, or purporting to meet exactly the same needs as the proposed program.)**

This will be the first B.S. degree program in software engineering in Iowa. Computer science and computer engineering are related programs offered by the Iowa State University and the University of Iowa. The University of Northern Iowa offers computer science. The letters from the other two institutions are attached

If the same or similar program exists at another public or private institution of higher education in Iowa, respond to the following questions:

   a. **Could the other institution reasonably accommodate the need for the new program through expansion? Through collaboration?**

   b. **With what representatives of these programs has there been consultation in developing the program proposal? Provide a summary of the response of each institution consulted.**

   c. **Has the possibility of an inter-institutional program or other cooperative effort been explored? What are the results of this study? (Consider not only the possibility of a formally established inter-institutional program, but also how special resources at other institutions might be used on a cooperative basis in implementing the proposed program solely at the requesting institution.)**

4. **Estimate the number of majors and non-majors students that are projected to be enrolled in the program during the first seven years of the program.**

   a. **Undergraduate**

   The focus will be on majors because of limited resources including the faculty, teaching assistants, and lab facilities with limited number of seats.

   The estimates are expected to vary within 10% to account for dropouts. We do not expect significant number of dropouts. However, if that happens we can recruit more students in subsequent years. Given the job opportunities for software engineers and their limited supply, we will be able to sustain this level of enrollment.

   The estimates are based on the resources we expect to have to support the program; we can enroll 48 new students every year. Given the demand in the industry, more students are likely to be interested in the program, but we expect to control the number because of limited resources (personnel and laboratory facilities)

Undergraduate	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Majors	24	48	120	144	192	192	192
Non-Majors							

   b. **Graduate**

   Not applicable.

Graduate	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7
Majors							
Non-Majors							

   c. **What are the anticipated sources of these students?**

   We expect that some of the current computer science and computer engineering students may move to the software engineering program. However, it is expected that more than half of the students will be new student who otherwise would not have come to ISU. Thus the two departments will attract new students specifically interested in software engineering.

5. **If there are plans to offer the program away from the campus, briefly describe these plans, including potential sites and possible methods of delivery instruction.**

No such plans.

6. **Has the proposed program been reviewed and approved by the appropriate campus committees and authorities? List them:**

Electrical and Computer Engineering Curriculum Committee

Computer Science Curriculum Committee

Engineering College Curriculum Committee

LAS College Curriculum Committee

7. **List date the program proposal was submitted to the Iowa Coordinating Council for Post High School Education (ICCPHSE) and the results of listserv review.   (THIS WILL BE FILLED IN BY THE PROVOST OFFICE.)**

8. **Will the proposed program apply for accreditation? When?**

Yes. ABET (**http://www.abet.org/**) accredits undergraduate programs in software engineering. We expect to follow a six-year cycle. The year for the first visit is to be determined.

9. **Will articulation agreements be developed for the proposed program? With whom?**

Yes, if possible. So far, we have approached DMACC and they are interested. We are working through the College of Engineering Dean's office to explore the possibilities.

10. **Describe the faculty, facilities, and equipment that will be required for the proposed program. From where will the financial resources for the proposed program come (list all that apply, e.g., department reallocation, college reallocation, grants, new to the university)?**

We expect to run the program with 8 faculty members, 10 teaching assistants, and two laboratories

SOURCES	TOTAL AMOUNT
Department Reallocation (ECE and CS will contribute equal resources. Together they will contribute 6 FTE, 6 Teaching Assistants	$690,000
New Resources from College and University: 2 new FTE and 4 teaching assistants, advising/computer support staff.	$310,000
Departments and External Funding: New Software Engineering Labs	$300,000

The 6 FTE include the two new software engineering faculty hired in 2005 in anticipation of launching the new program.

Industry has contributed seed funding, hardware, and software. The ECE department established a new software engineering laboratory in 2005 with funding and software from industry.

The new resources (as described in the next table) will come from the two departments and the colleges. See the attached letters.

11. **Estimate the total costs/total new costs (incremental increases each year in expenditures) that will be necessary for the next seven years as a result of the new program:**

	TOTAL COSTS	TOTAL NEW COSTS
Year 1	$990,000	None
Year 2	$1,000,000	$310,000
Year 3	$1,000,000	None
Year 4	$1,000,000	None
Year 5	$1,100,000	$100,000
Year 6	$1,000,000	None
Year 7	$1,000,000	None

Budget Explanation:

Year 1: 6 FTE with an average of $100,000 per FTE; salaries for 6 teaching assistants an average of $15,000 per teaching assistant, New Laboratories $300,000.
Year 2: Salary expenses as in year 1 plus two new FTE and 4 new teaching assistants, and advisor or computer support staff salary expenses of $50,000.
Year 5: $100,000 for renovating the laboratories.

Supplemental materials
(to be used at Iowa State University in the review of the proposal):

The complete proposal is found on the Faculty Senate Curriculum Committee web page at:

www.iastate.edu/~catalog/fscc/reports.shtml