CALIFORNIA STATE UNIVERSITY SAN MARCOS
NEW PROGRAM PROPOSAL – P Form Signature

For Academic Programs Office Use Only
R.E. _____ Catalog _____ File _____

COLLEGE ☐ CHABSS ☐ CoBA ☐ CoEHHS ☒ CSM

TITLE OF PROGRAM Bachelor of Science Discipline Software Engineering

This form is the signature sheet for new programs and new options/concentrations/emphases/tracks within existing programs. For all changes to existing programs (other than addition of new options/concentrations/emphases/tracks), use the Form P-2.

Check one:
- ☒ New Undergraduate Major or New Graduate Degree — Attach a completed New Program Template
- ☐ New Option/Concentration/Emphasis/Track
- ☐ New Minor
- ☐ New Teaching Credential
- ☐ New Certificate

} Attach a completed New Option/Concentration/ Special Emphasis, Teaching Credential and Minor

Attach a completed New Certificate Template

Does this proposal impact other disciplines? ☒ Yes ☐ No If yes, obtain signature(s).
Any objections or concerns should be stated in writing and attached to this form. Please check the box to indicate whether a memo has been attached.

Term and Academic Year of intended implementation (e.g. Fall 2016): Fall 2017 or later when feasible

Computer Science and Information Systems ✓ Support ____ Oppose
Discipline #1
Signature ☐ Date 12/9/16

Mathematics ✓ Support ____ Oppose
Discipline #2
Signature ☐ Date 5/24/17

Physics ✓ Support ____ Oppose
Discipline #3
Signature ☐ Date 5/2/17

Chemistry&BioChem ✓ Support ____ Oppose
Discipline #4
Signature ☐ Date 5/2/17

Biological Sciences Support ____ Oppose
Discipline #5
Signature ☐ Date 5/3/17

RECEIVED
JUN 14 2017
BY:

P-FORM PREPARATION

1a. Shaun-Inn Wu — Originator (Please print) — 10/19/2016 — Date

1b. _____ — Librarian Liaison for Library Report+ — _____ — Date

1c. _____ — IITS Liaison for IITS Report+ — _____ — Date

PROGRAM/DEPARTMENT-LEVEL REVIEW

2. _____ — Program/Department - Director/Chair* — 5/3/17 — Date

COLLEGE/SCHOOL-LEVEL REVIEW

3. _____ — College/School Curriculum Committee* — 6/13/17 — Date

REVIEW (Signatures must be obtained by proposer)

4a. _____ — Vice President for Student Affairs* — 1/26/17 — Date

4b. _____ — Dean of Library* — 11/7/16 — Date

4c. _____ — Dean of Information and Instructional Technology Services* — 1/26/17 — Date

4d. _____ — Vice President for Finance and Administrative Services* — 5/3/2017 — Date

4e. _____ — Dean of Graduate Studies (if applicable) * — _____ — Date

COLLEGE/SCHOOL-LEVEL RECOMMENDATION

5. _____ — College/School Dean/Director* — 6/13/2017 — Date

UNIVERSITY-LEVEL REVIEW
(May not begin until all signatures numbered 1-5 have been obtained.)

6a. _____ — University Curriculum Committee^ — _____ — Date

6b. _____ — Budget and Long-Range Planning Committee^ — _____ — Date

FACULTY APPROVAL

7. _____ — Academic Senate — _____ — Date

UNIVERSITY-LEVEL APPROVAL

8. _____ — Provost — _____ — Date

9. _____ — Date to Chancellor's Office

+ Please contact the liaisons at the beginning of the process and allow sufficient time for the liaisons to prepare the resource implication report. Upon completion of the report liaisons will sign.
* May attach a memo on program impact on the unit and the ability of the unit to support it.
^ Attach a memo summarizing the curricular and/or resource deliberations.
o summarizing the curricular and/or resource deliberations.

CSU San Marcos Degree Program Proposal Template[1]

1. Program Type (Please specify any from the list below that apply—delete the others)

a. The $6M HSI-STEM grant, philanthropy, and funding associated with FTES generated by the proposed program will be the source of funds related to the Software Engineering program (e.g., equipment and supplies, Software Engineering tenure-track faculty and staff salaries and benefits, renovation costs of FCB, …) over the first 5 years of the SE program.

b. State-Support after 5 years (AY 22/23 and beyond).

2. Program Identification

a. Campus: California State University San Marcos

b. Full and exact degree designation and title:
Bachelor of Science in Software Engineering.

c. Date the Board of Trustees approved adding this program projection to the campus Academic Plan
Spring 2016

d. Term and academic year of intended implementation (e.g. Fall 2016):
Fall 2017 or later when feasible.

e. Total number of units required for graduation. This will include all requirements (and campus-specific graduation requirements), not just major requirements.
120 units

f. Name of the department(s), division, or other unit of the campus that would offer the proposed degree major program. Please identify the unit that will have primary responsibility.
Department of Computer Science and Information Systems

g. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.
Shaun-inn Wu, Professor of Computer Science and Information Systems

h. Statement from the appropriate campus administrative authority that the addition of this program supports the campus mission and will not impede the successful operation and growth of existing academic programs.

As a public university, CSUSM grounds its mission in the public trust, alignment with regional needs, and sustained enrichment of the intellectual and economic life of our region and the state. Based on the thorough Feasibility Study (attached and referenced throughout this P-form), the current LAMP recommendation, and consultation with regional stakeholders, the addition of software engineering supports our campus' mission. This program is strongly aligned with regional needs and educational demands, and its graduates will fuel our regional and state economies. Thus, there is tremendous interest from the public and private sector in partnering with us to establish this engineering program at CSUSM. Resources from external sources, including the recently awarded $6M HSI STEM grant from the Department of Education, will be used to fund the start-up costs of this program. The campus's resource allocation model in dollars and FTES, designed to meet student demand, ensures that adequate funds are available to offer all courses that meet student demand.

[1] When beginning to fill out this form, contact Academic Programs for general guidance and for samples of recent program proposals. It is recommended that program proposers start to fill out the template with the catalog description.

i. Any other campus approval documents that may apply (e.g. curriculum committee approvals).[2] The campus may submit a copy of the WASC Sub-Change proposal in lieu of this CSU proposal format. If campuses choose to submit the WASC Substantive Change Proposal, they will also be required to submit a program assessment plan using the format found in the CSU program proposal template.

See the attached signature page of the P-form.

j. Please specify whether this proposed program is subject to WASC Substantive Change review.[3]

No

k. **Optional: Proposed Classification of Instructional Programs (CIP) Code and CSU Degree Program Code** [4]

CSU degree program code: 07052; CIP Code: 14.0903

Campuses are invited to suggest one CSU degree program code and one corresponding CIP code. If an appropriate CSU code does not appear on the systemwide list at: http://www.calstate.edu/app/documents/HEGIS-CIP2000_102406.xls , you can search CIP 2000 at http://nces.ed.gov/pubs2002/cip2000/ to identify the code that best matches the proposed degree program. The Classification of Instructional Programs (CIP) is a National Center for Education Statistics (NCES) publication that provides a numerical classification and standard terminology for secondary and postsecondary instructional programs. The CSU degree program code (based on old HEGIS codes) and CIP code will be assigned when the program is approved by the Chancellor.

3. Program Overview and Rationale

a. Provide a rationale, including a brief description of the program, its purpose and strengths, fit with institutional mission, and a justification for offering the program at this time. A comprehensive rationale also explains the relationship between the program philosophy, design, target population, and any distinctive pedagogical methods.

Brief Description. Software engineering is the application of engineering principles and techniques in the process of software design, development and construction while dealing with the constraints of computers. With computing as its foundations, software engineering seeks to develop and use systematic models and reliable techniques to produce high-quality software. A software engineer applies a wide range of knowledge from the humanities to the sciences and can lead a team responsible for constructing a software system containing millions of lines of code across hundreds of files written by dozens of programmers, reusing major components of other systems, executing on multiple machines and platforms, interacting with globally distributed systems, and ensuring security across the systems they are configuring.

The CS and SE curricula have some overlaps, such as design and development of programs, discrete structures, data structures, computer architecture, human-computer interaction, information security, and programming languages. However, the CS curriculum includes other knowledge areas such as algorithms and complexity, graphics and visualization, information management, networking and communications, operating systems, whereas the SE curriculum includes other knowledge areas such as software modeling and analysis, requirements analysis and specification; software design; software verification and validation; software process; and software quality; and security.

---

[2] Proposers do not need to supply this item. As the proposal goes through the approval process, memos from curriculum committees are obtained. These will be collected and added to the proposal by Academic Programs as a response for this item.
[3] Generally, this refers to a degree offered at a new level (e.g., a doctorate). To be certain that a WASC Substantive Change review is not necessary, contact the Associate Vice President Academic Programs.
[4] Contact Academic Programs for assistance in proposing CIP and Program (formerly HEGIS) codes.

Rationale. The region critically needs a well-qualified STEM workforce, and all CSUSM students need the opportunity to join this workforce. Among the STEM baccalaureates degree programs now offered are Applied Physics, Biological Sciences, Biotechnology, Biochemistry, Chemistry, Computer Science, and Mathematics. CSUSM has seen very strong growth in these STEM majors during the past three years. The total number of freshman and transfers declaring STEM degrees has grown from 358 in Fall 2011 to 579 in Fall 2016. This growth is insufficient, however, to meet service area or student needs. A degree in Software Engineering is a STEM program with additional potential to meet CSUSM and Hispanic student needs, and provide all students the opportunity to choose majors with high economic value. Engineering tops the list, even among all STEM degree programs, as the degree that leads to the highest paid jobs, even at the entry level (see Anthony Carnevale. *The Economic Value of College Majors*. 2015 report by Georgetown University Center on Education and the Workforce).

There is growing engineering job opportunity in the CSUSM service area. A clear need for engineering was identified for several types of engineering programs in a comprehensive service-area Feasibility Study completed in Spring 2016, which is attached to this P-form, see Appendix A. This market viability Study was prepared by a consulting group (EAB Research) and funded by MiraCosta Community College. The Study established a clear regional need for a Software Engineering program at CSUSM, as shown in Table 1.

Table 1. The number of job postings in Software Engineering (SE) exceeds the number of graduates. ("local" means San Diego, Orange, Irvine, Temecula, and Riverside areas)

Number of local SE job postings	Number of statewide degrees in SE completed	Ratio of local job postings to statewide degrees completed	Projected job growth for SE from 2012 to 2022 (BLS)
8,308	2,096	4.0	24%

Fit with institutional mission. CSUSM's Mission says "CSUSM provides a range of services that respond to the needs of a student body with diverse backgrounds, expanding student access to an excellent and affordable education. As a public university, CSUSM grounds its mission in the public trust, alignment with regional needs, and sustained enrichment of the intellectual, civic, economic, and cultural life of our region and state." Table 1 shows that there are four local job postings in Software Engineering for every relevant degree completion in the State. CSUSM's Vision states, "students will select from a growing array of specialized programs responsive to state and regional needs." The Feasibility Study reported that local employer demand for software engineering-related positions increased 72% from July 2013 to June 2015. The proposed degree in Software Engineering is a specialized degree that will directly address the CSUSM Vision statement by meeting growing regional needs.

Justification for offering the program at this time. The Feasibility Study says that research confirms local suitability for software engineering. Local high school students were surveyed and they expressed interest in engineering and exhibited sufficient standardized test performance. Community college students can complete support courses before they transfer. A degree in Software Engineering is an immediate opportunity for CSUSM because it draws upon a large number of existing courses and require the least amount of faculty course development. In addition, a degree in SE is designed to meet employer demand and respond to unmet local employment need. The proposed degree in Software Engineering follows the Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering by IEEE Computer Society and Association for Computing Machinery in 2014. It prepares students for a career in software engineering, providing a foundation for lifelong learning through professional development and/or graduate study. The upper division topics of software engineering that overlap with the Computer Science degree are data structures, computer architecture, programming languages, and operating systems. The new upper division courses of software engineering would cover the topics of requirements and design, interface design and development, construction and testing, software planning and management, and a yearlong capstone senior project course. Employers value experiential learning across engineering disciplines, such as incorporating capstone projects within program curricula to ensure students conduct at least one large-scale engineering project during their education.

Distinctive pedagogical methods. The engineering pathway curriculum will be built from the ground up around principles of active and project-based learning in an authentically interdisciplinary framework. The HSI-STEM grant will fund an Interdisciplinary Curriculum Specialist to add needed expertise in interdisciplinary curriculum development. This consultative Specialist will have a central role in ensuring that the engineering program is interdisciplinary, that faculty development fosters breakdown of disciplinary silos. The need for the Specialist will expire at the end of the final year of the grant.

The HSI-STEM grant will fund the position of a Research Designer/Specialist. This consultative position is designed to support both formative and summative assessment of progress toward specific measurable objectives and rigorous testing of specific innovative features. CSUSM has a strong institutional research office and capable research faculty, but this project requires additional research capacity with specific interest in the contextual factors of social disparities in STEM.

The HSI-STEM grant will fund the position of an Engineering Pathways Advisor to play a central role in the design of pathway services that are integrated with curriculum and instruction for maximal impact. Advising is crucial to the suite of services, and the advising methods incorporated in the proposed project will be modeled after the best available research and include decentralized, intrusive, and dedicated caseload methodology. Dedicated engineering advising will be added to existing support services for pathway students. A highly capable individual sensitive to the needs of Hispanic students will be selected to serve as the Engineering Pathway Advisor and will: develop, implement and assess strategies to provide dedicated academic advising to engineering pathway students, including community college as well as CSUSM engineering majors; will work with/liaison with all relevant CSUSM advising programs and centers; will assist in recruiting, training and evaluating peer coaches and ambassadors; will assist in developing strategies to institutionalize dedicated engineering advising. This position is developmental during the grant period. The person selected will develop engineering transfer guides and handbooks, will develop an operational plan for pathway cohort services including requirements and incentives, will train counselors and university advising staff to understand engineering course requirements and transfer/completion timelines, will assist assessment of advising services. The continued need for this position will be evaluated in the final year of the grant.

b. Provide the proposed catalog description, including program description, degree requirements, and admission requirements. For master's degrees, please also include catalog copy describing the culminating experience requirement(s).

(See next page …)

SOFTWARE ENGINEERING
Office: Science 2 Hall, Second Floor
Telephone: (760) 750-4273

Faculty:

Computer Science
Ali Ahmadinia, Ph.D.
Rocio Guillén-Castrillo, Ph.D.
Ahmad Hadeagh, Ph.D.
Nahid Majd, Ph.D.
Youwen Ouyang, Ph.D.
Shaun-inn Wu, Ph.D.
Xin Ye, Ph.D.
Rika Yoshii, Ph.D.
Xiaoyu Zhang, Ph.D.

Programs Offered: Bachelor of Science in Software Engineering

IEEE defines software engineering as "The application of a systematic, disciplined, quantifiable approach to the development, operation and maintenance of software; that is, the application of engineering to software." An organized approach to software development is needed because a software system developed today may contain millions of lines of code, reuse major components of other systems, execute on multiple machines and platforms, and interact with globally distributed systems.

Software engineering is the application of engineering principles and techniques in the process of software design, development and construction while dealing with the constraints of computers. With computing as its foundations, software engineering seeks to develop and use systematic models and reliable techniques to produce high-quality software. We offer undergraduate students a rich mix of modern software engineering and computer science courses. Applications of engineering knowledge range from the humanities to the sciences.

The software engineering degree emphasizes both theoretical foundations and practical applications. Students will learn computing essentials, mathematical and engineering fundamentals, professional practice, software modeling and analysis, requirements analysis and specification, software design, software verification and validation, software process, software quality, and security. The degree emphasizes design and development experiences with substantial laboratory work in software development while emphasizing the security issues from requirement analysis, verification and validation as well as software architecture and construction. The Software Engineering major prepares students for careers in applications development, systems analysis, and software engineering, as well as for entrance into graduate and professional schools.

Student Learning Outcomes

Students completing the Software Engineering major will be able to

1. Show mastery of software engineering knowledge and skills and of the professional standards necessary to begin practice as a software engineer.
2. Apply appropriate theories, models, and techniques that provide a basis for problem identification and analysis, software design, development, implementation, verification, validation, security fundamentals, and documentation.
3. Work both individually and as part of a team to develop and deliver quality software artifacts.
4. Demonstrate and appreciate the importance of negotiation, effective work habits, leadership, and good communication with stakeholders in a typical software development environment.
5. Design appropriate solutions in one or more application domains using software engineering approaches that integrate ethical, social, legal, and economic concerns.
6. Reconcile conflicting project objectives, finding acceptable compromises within the limitations of cost, time, knowledge, existing systems, and organizations.
7. Learn new models, techniques, and technologies as they emerge and appreciate the necessity of such continuing professional development.

Career Opportunities

Due to enormous demand, degree holders in software engineering have multiple paths to reach their career goals. Many jobs with excellent pay are available in both the public and private sector with job titles such as: programmers, system analyst/engineer/managers, software analyst/engineer/managers, customer service representative/managers, instructors, technical trainers, technical support, and sales representatives.

Preparation

High school students are encouraged to take four (4) years of English, four years of mathematics including trigonometry, one year of biological science, and one year of physical science. Courses in calculus, physics or chemistry, and computer programming are recommended. Experience in clear, concise, and careful writing is valuable for success in all courses.

Transfer Credits

A maximum of thirty-two (32) lower-division units including courses in computer science, mathematics, and physics may be applied toward the preparation for the major requirements. Of the thirty-two (32) units, twelve (12) units must appropriately match the description for CS 111, 211, and 231 (depending on the articulation agreement between Cal State San Marcos and other institutions; transfer students are also advised to consult with their articulation officer to determine if they need to take CS 112, 212, and 232); twelve (12) units must appropriately match the description for MATH 160*, 242, and 270; and eight (8) units must appropriately match one of the descriptions for PHYS 101/102 or PHYS 201/202 or CHEM 150*/150L/160 for the Software Engineering major.

*Six (6) units of the above-transferred courses, MATH 160 and either PHYS 101 or PHYS 201 or CHEM 150, will count toward the lower-division General Education requirements in Area B. Students are encouraged to consult their faculty advisor to learn about courses that fulfill the General Education requirements.

Special Conditions for the Bachelor of Science in Software Engineering

All courses counted toward the major, including Preparation for the Major courses, must be completed with a grade of C (2.0) or better. A minimum of fifteen (15) upper-division units counted toward the major must be completed at Cal State San Marcos.

BACHELOR OF SCIENCE IN SOFTWARE ENGINEERING

Units General Education*	51
Preparation for the Major*	31
Major Requirements	44

Students must take a sufficient number of elective units to bring the total number of units to a minimum of 120

Preparation for the Major

Lower-Division (12 units)	Units
CS 111	4
CS 211	4
CS 231	4

Non-Computer Science Supporting Courses (19 units)	
MATH 160	5
MATH 242	3
MATH 270	3

One of the following PHYS or CHEM sequences:

PHYS 101	4
PHYS 102	4
or	
PHYS 201	4
PHYS 202	4
or	
CHEM 150	4
CHEM 150L	1
CHEM 160	3

*Six (6) lower-division General Education units in Area B (Math and Science) are automatically satisfied by courses taken in Preparation for the Major. Note that PHYS 202 requires PHYS 201 and MATH 162.

Major Requirements

Upper-Division (44 units)	Units
CS 311	3
CS 331	3
CS 351	3
CS 433	3
CS 441	3
SE 370	3
SE 451	3
SE 461	3
SE 471	3
SE 481	3
SE 490	3
SE 491	3
Software Engineering electives	8

Chosen from SE/CS/CIS courses numbered 400 or higher

4. Curriculum

(These requirements conform to the revised 2013 WASC Handbook of Accreditation)

a. <u>These program proposal elements are required</u>:

- Institutional learning outcomes (ILOs)
- Program learning outcomes (PLOs)
- Student learning outcomes (SLOs)

Describe outcomes (also sometimes known as goals) for the 1) institution, 2) program, and for 3) student learning. Institutional learning outcomes (ILOs) typically highlight the knowledge, skills, and dispositions all students are expected to have upon graduating from an institution of higher learning. Program learning outcomes (PLOs) highlight the knowledge, skills, and dispositions students are expected to know as program graduates. PLOs are more narrowly focused than ILOs. Student learning outcomes (SLOs) clearly convey the specific and measureable knowledge, skills, and/or behaviors expected and guide the type of assessments to be used to determine if the desired level of learning has been achieved. [7] (WASC 2013 CFR: 1.1, 1.2, 2.3)

- Institutional learning outcomes (ILOs)

1. Knowledgeable in their field of study. Students will be able to:
    1. Articulate, integrate, and apply theories and methods of a field of study to create professional, scholarly, and/or artistic work
2. Comprehensive and critical thinkers. Students will be able to:
    1. Identify key concepts and develop a foundation for future inquiry
    2. Analyze complex problems and develop solutions by applying quantitative and qualitative reasoning, integrating knowledge and skills from a variety of disciplines
    3. Construct well-reasoned arguments based on evidence
3. Globally and culturally intelligent. Students will be able to:
    1. Apply multiple perspectives to address local, regional, global, and cultural issues.
    2. Demonstrate an intermediate proficiency in a language other than English
4. Skilled communicators. Students will be able to:
    1. Communicate clearly and effectively in both written and oral forms
    2. Tailor communication to audience and context

PROGRAM GOALS. The degree in Software Engineering will use "Program Goals" instead of Program Learning Outcomes. The Program Goals will not be measured, but they will be used to guide the Student Learning Outcomes (PSLOs), which will be measured. (Note: this form refers to SLOs, but the campus currently refers to PSLOs).

The Program Goals focus on the mastery of Software Engineering knowledge and skills in the following areas:

1. Professional standards necessary to begin practice as a software engineer.
2. Problem identification and analysis, software design, development, implementation, verification, and documentation.
3. Professional collaboration, negotiation, and leadership toward the delivery of quality software artifacts.
4. Effectiveness in communication.
5. Integration of ethical, social, legal, and economic concerns.
6. Reconciliation of conflicting project objectives within the limitations of cost, time, knowledge, existing systems, and organizations.
7. Recognition of emerging models, techniques, and technologies necessary for continued professional development.

PROGRAM STUDENT LEARNING OUTCOMES (PSLOs). The degree program has aligned its Program Student Learning Outcomes (PSLOs) with the University's Undergraduate Learning Outcomes (ULOs) and has developed a biennial assessment cycle to measure student learning. Four courses have been assigned to measure the ten PSLOs (two courses will each measure three PSLOs and two other courses will each measure two PSLOs). The assessment plan was designed in this way so the assessment activity can be embedded in the course, allowing for consistent data collection within a reasonable period of time. The data can then be reviewed, and programmatic changes can be implemented when necessary. Initially, program faculty will be involved in the systematic collection of data, and reported annually, as required, for campus accreditation and program review accessibility.

Graduates of the program will be able to identify, analyze, and apply skills and professional standards in:

1. computing essentials in terms of computer science foundations, construction technologies and tools.
2. mathematical and engineering fundamentals, and engineering economics for software.
3. professional practice in terms of group dynamics and psychology, communications skills, and professionalism.
4. software modeling and analysis
5. requirements analysis and specification, requirements fundamentals, eliciting requirements, requirements specification and documentation, and requirements validation
6. software design concepts, design strategies, architectural design, human-computer interaction design, detailed design, and design evaluation
7. software verification and validation terminology and foundations and its deployment at different points in the life cycle, testing, and problem analysis and reporting
8. software process concepts, process implementation, project planning and tracking, software configuration management, and evolution processes and activities
9. software quality concepts and culture, process assurance, and product assurance
10. security fundamentals, computer and network security, and developing secure software.

b. <u>These program proposal elements are required</u>:

- Comprehensive assessment plan addressing all assessment elements;
- Matrix showing where student learning outcomes are introduced (I), developed (D), and mastered (M)

Include plans for assessing institutional, program, and student learning outcomes. Key to program planning is creating a comprehensive assessment plan addressing multiple elements, including strategies and tools to assess student learning outcomes, (directly related to overall institutional and program learning outcomes). Constructing an assessment matrix, showing the relationship between all assessment elements, is an efficient and clear method of displaying all assessment plan components. [5]

See Appendix B: Matrix of Student Learning Outcomes

[5] See "Tips" Section.

Creating a curriculum map matrix, identifying the student learning outcomes, the courses where they are found, and where content is "Introduced," "Developed," and "Mastered" ensures that all student learning outcomes are directly related to overall program goals and represented across the curriculum at the appropriate times. Assessment of outcomes is expected to be carried out systematically according to an established schedule.

Curriculum Map Matrix	Prep. Courses	SE 370	CS 441	SE 451	SE 461	SE 471	SE 481	SE 490
Student Learning Outcome								
1. Computing essentials	I		D					M
2. Mathematical and Engineering Fundamentals	I	D		M				M
3. Professional Practice			I				DM	
4. Software Modeling and Analysis		I	D				M	
5. Requirements analysis and specification			I	D		M		
6. Software Design			I	DM				
7. Software verification and validation			I		DM			
8. Software Process			I				D	M
9. Software Quality					IDM			
10. Security	I		I	I	I	D		M

c. Indicate total number of units required for graduation.
120 units

d. Include a justification for any baccalaureate program that requires more than 120 semester units or 180 quarter units. Programs proposed at more than 120 semester units will have to provide either a Title 5 justification for the higher units or a campus-approved request for an exception to the Title 5 unit limit for this kind of baccalaureate program.
N/A

e. If any formal options, concentrations, or special emphases are planned under the proposed major, identify and explain fully and list the required courses.
N/A

f. List all requirements for graduation, including electives, for the proposed degree program, specifying course catalog numbers, course titles, total units required for completion of the degree, major requirements, electives, and prerequisites or co-requisites (ensuring there are no "hidden prerequisites that would drive the total units required to graduate beyond the total reported in 4c above). Include proposed catalog descriptions of all new courses. (WASC 2013 CFR: 2.1, 2.2)

Required Courses for Graduation <students take the PHYS or CHEM sequence listed)						
Catalog #	*Title*	*Units*	*Major Reqmt.?*	*Pre Req. or Co Req.? (Y/N)*	*Elective (Y/N)*	*New Course (Y/N)*
MATH 160	Calculus with Applications, I (B4)	5	Y	Strong math background or MATH 125	N	N
MATH 242	Intro to Statistics	3	Y	N	N	N
MATH 270	Basic Discrete Mathematics	3	Y	MATH 160	N	N
	One Physics or Chemistry course sequence:					
PHYS 101*	Introduction to Physics I (B1&B3)	4	Y	High school trigonometry	N	N
PHYS 102*	Introduction to Physics II	4	Y	PHYS 101	N	N
PHYS 201*	Physics of Mechanics and Sound (B1&B3)	4	Y	MATH 160	N	N
PHYS 202*	Physics of Electromagnetism and Optics	4	Y	PHYS 201, MATH 162	N	N
CHEM 150*	General Chemistry (B1)	4	Y	High school chemistry or CHEM 101	N	N
CHEM 150L*	General Chemistry Lab (B3)	1	Y	CHEM 150	N	N
CHEM 160*	General Chemistry II	3	Y	MATH 125 or 160; CHEM 150 and 150L	N	N
CS 111	Computer Science I	4	Y	MATH 160	N	N
CS 211	Computer Science II	4	Y	CS 111	N	N
CS 231	Assembly Language and Digital Circuits	4	Y	CS 111	N	N
CS 311	Data Structures	3	Y	CS 211, MATH 270	N	N
CS 331	Computer Architecture	3	Y	CS 231	N	N
CS 351	Programming Languages	3	Y	CS 311, MATH 270	N	N
CS 433	Operating Systems	3	Y	CS 231, CS 311	N	N
CS 441	Software Engineering	3	Y	CS 311	N	N
SE 370	Software Structure	3	Y	CS 111, MATH 160	N	Y
SE 451	Software Requirements and Design	3	Y	SE 370, CS 441	N	Y
SE 461	Software Testing and Quality	3	Y	SE 451	N	Y
SE 471	Software Architecture	3	Y	SE 451	N	Y
SE 481	Software Project Planning and Management	3	Y	SE 451	N	Y
SE 490	Senior Project I	3	Y	SE 451	N	Y
SE 491	Senior Project II	3	Y	SE 490	N	Y
SE/CS 4XX	Major Electives	8	Y	SE 490	N	Y
Total Units Required for Degree Completion: 120						
Catalog Description of All New Courses:						

SE 370 Software Structures (3 units)
Prerequisites: CS 111 and Math 160
Introduction to the use of mathematical models of software systems for their specification and validation.
Topics include: introduction to mathematical foundations for software engineering modeling; engineering economics for software such as software lifecycle and evaluating cost-effective solutions; modeling foundations such as modeling principles, invariants, and formal notations; models of concurrent systems, verification of models, and limitations of these techniques; analysis fundamentals such as analyzing forms, correctness, dependability, and formal analysis.

SE 451 Software Requirements and Design (3 units)
Prerequisites or Corequisites: SE 370 and CS 441
Basic concepts and principles of software requirements engineering, its tools and techniques, methods for modeling software systems, and security issues. Topics include requirements elicitation/acquisition, types of requirements, functional and non-functional requirements, validation, verification, prototyping, object-oriented techniques, and requirements tracking.

SE 461 Software Testing and Quality (3 units)
Prerequisites: SE 451
Theory and practice of determining whether a product conforms to its specification and intended use. Topics include methods of testing, types of testing, verification and validation, software quality assurance methods, test plans and strategies, unit level and system level testing, software reliability, peer review methods, security-related quality assurance processes and techniques, and configuration control responsibilities in quality assurance.

SE 471 Software Architecture (3 units)
Prerequisites: SE 451
Introduction to the design and implementation of complete and secure software systems. Topics include software architectures, methodologies, model representations, component-based design, patterns, frameworks, architectural principles and alternatives, design documentation, relationships between levels of abstraction, theory and practice of human interface design, creating systems which can evolve, choosing software sources and strategies, prototyping and documenting designs, and employing patterns for reuse.

SE 481 Software Project Planning and Management (3 units)
Prerequisites: SE 451
Major issues and techniques of project management. Topics include: project evaluation and selection, scope management, planning and organizing activities, team building, stakeholder management, project scheduling, directing and control, cost and resource estimation, requirements, design, construction, and configuration management, measurements, quality and monitoring, rework, conflict management, and risk management. Professional issues including career planning, lifelong learning, software engineering ethics, and the licensing and certification of software professionals.

SE 490 Senior Project I (3 units)
Prerequisites: SE 451
Group software engineering project requiring completion of a software system for an approved client. The students will work in teams on projects of interest to industry and will be involved in construction technologies, construction tools, project planning, software requirements elicitation and specification, analysis of requirements, cost estimation, risk analysis, use of standards, scheduling, prototyping, development of project management, configuration management, and quality assurance plans, project reviews and reports, architecture and design, documentation, team management and organization, copyright, liability, security, and handling project failure. The project will be completed in SE 491 in the following semester.

SE 491 Senior Project II (3 units)
Prerequisites: SE 490
Continues the project from SE 490 with the same team. Software design, construction, project implementation and management, integration, configuration management, documentation, quality plan, and deployment. Oral presentation and project demonstration.

g. List of any new courses that are: (1) needed to initiate the program and (2) needed during the first two years after implementation. Only include proposed catalog descriptions for new courses.

(1) No new courses are needed for the first year of implementation.
(2) One new course is needed for the second year of implementation:

SE 370 Software Structures (3 units)
Prerequisites: CS 111 and Math 160
Introduction to the use of mathematical models of software systems for their specification and validation. Topics include: introduction to mathematical foundations for software engineering modeling; engineering economics for software such as software lifecycle and evaluating cost-effective solutions; modeling foundations such as modeling principles, invariants, and formal notations; models of concurrent systems, verification of models, and limitations of these techniques; analysis fundamentals such as analyzing forms, correctness, dependability, and formal analysis.

h. Attach a proposed course-offering plan for the first three years of program implementation, indicating, where possible, likely faculty teaching assignments. (WASC 2013 CFR: 2.1, 2.2)

In the first three years of the program, current faculty in other departments would teach the SE majors their GE and supporting courses, such as GEW 101, GE Area B2, MATH 160, and PHYS 201.

The list below focuses on CS and SE courses within the first three years.

Year	Term	Courses	Faculty
1 (AY 2017 - 18)	Fall	CS 111	**New TTF1**
1 (AY 2017 - 18)	Spring	CS 211	**New TTF1**
1 (AY 2017 - 18)	Spring	CS 231	Existing faculty
2 (AY 2018 - 19)	Fall	CS 111	**New TTF1**
2 (AY 2018 - 19)	Fall	CS 311	Existing faculty
2 (AY 2018 - 19)	Fall	SE 370	**New TTF1**
2 (AY 2018 - 19)	Spring	CS 211	**New TTF1**
2 (AY 2018 - 19)	Spring	CS 231	Existing faculty
2 (AY 2018 - 19)	Spring	CS 331	Existing faculty
2 (AY 2018 - 19)	Spring	CS 351	**New TTF1**
3 (AY 2019 - 20)	Fall	CS 111	Existing faculty
3 (AY 2019 - 20)	Fall	CS 311	**New TTF1**
3 (AY 2019 - 20)	Fall	SE 370	**New TTF2**
3 (AY 2019 - 20)	Fall	CS 441	**New TTF1**
3 (AY 2019 - 20)	Fall	SE 451	**New TTF2**
3 (AY 2019 - 20)	Spring	CS 211	**New TTF1**
3 (AY 2019 - 20)	Spring	CS 231	Existing faculty
3 (AY 2019 - 20)	Spring	CS 331	Existing faculty
3 (AY 2019 - 20)	Spring	CS 351	**New TTF2**
3 (AY 2019 - 20)	Spring	CS 433	Existing faculty
3 (AY 2019 - 20)	Spring	SE 461	**New TTF1**
3 (AY 2019 - 20)	Spring	SE 471	**New TTF2**

i. For master's degree proposals, include evidence that program requirements conform to the minimum requirements for the culminating experience, as specified in Section 40510 of Title 5 of the California Code of Regulations.[6]

N/A

j. For graduate degree proposals, cite the corresponding bachelor's program and specify whether it is (a) subject to accreditation and (b) currently accredited. (WASC 2013 CFR: 2.2b)

N/A

k. For graduate degree programs, specify admission criteria, including any prerequisite coursework. [7] (WASC 2013 CFR: 2.2b)

N/A

l. For graduate degree programs, specify criteria for student continuation in the program [8]

N/A

m. For undergraduate programs, specify planned provisions for articulation of the proposed major with community college programs.

[6] Contact Graduate Studies for assistance in making certain that the program conforms to CSU requirements for a master's program.

[7] This item generally applies to graduate programs and self-support programs. For assistance, contact Graduate Studies for the first situation and Extended Learning for the second. For an undergraduate, state-support program for which admission criteria are desired, contact Academic Programs to discuss this matter.

[8] This item generally only applies to programs with admission criteria (item 4k). For undergraduate programs, the criteria should be that the student remain on good academic standing (i.e., not be subject to Academic Disqualification). For assistance with this item, contact Graduate Studies, Extended Learning or Academic Programs as in item 4k.

The HSI-STEM grant proposes how CSM will work with local feeder community colleges (Mira Costa College, Miramar College, Mount San Jacinto College, and Palomar College).

The California Community College (CCC) Research and Policy (RP) Group has studied engineering transfer issues extensively, and there are evidence-based recommendations to guide CSUSM in developing the CC/CSU transfer pathway in engineering that is responsive to the needs of Hispanic and other at-risk students.

Local feeder community colleges (Mira Costa College, Miramar College, Mount San Jacinto College, and Palomar College) have made development of engineering transfer programs a high priority and recognize fully the need to work with CSUSM to meet service area and student need. The program will offer the lower division courses in the first two years, which gives time to build the needed facilities and for the community colleges to approve, articulate, and implement curriculum. The following are community college and industry partners that we plan to work with:

- Mike Fino, Science Dean, Mira Costa
- Linda Kurokawa, Director Engineering Tech, Mira Costa
- Mary Benard, VP Instruction, Mira Costa
- Kathryn Kailikole, Science Dean, Palomar
- Dan Sourbeer, VP Instruction, Palomar
- Tom Oxford, Mt. San Jacinto College
- Simon Kuo, ViaSat
- Michael Perry, General Atomics
- Tom McCloud, Northrop Grumman

The Pathways Advisor will help streamline the curriculum at local CCs and CSUSM. Pathway curriculum will be aligned, guided by learning outcomes determined by faculty so that community college students do not have to repeat courses upon transfer to CSUSM. Faculty at CSUSM and community colleges will collaborate to integrate effective pedagogy and support services into all engineering pathway courses and evaluate impact on student success.

Feeder CC faculty will be included in CSUSM professional development activities to integrate and contextualize the first year experience for engineering students and help them strengthen their preparedness to succeed in the major.

The lower division requirements of the proposed Software Engineering program are very similar to the Computer Science program. Therefore, it is straightforward to adapt the existing articulation of the Computer Science majors with community college programs.

n. Describe advising "roadmaps" that have been developed for the major. [9]

Appendix C contains the supplemental worksheet for SE, and Appendix D contains the advising roadmap for SE.

o. Describe how accreditation requirements will be met, if applicable, and anticipated date of accreditation request (including the WASC Substantive Change process). (WASC 2013 CFR: 1.8)

The curriculum is designed based on the Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering by IEEE Computer Society and Association for Computing Machinery in 2014. The accreditation requirements have been met in the curriculum. As soon as there are sufficient faculty members and equipment as well as the supporting personnel, and as soon as there are significant number of students going through the program and graduate with the degree, our institution should seek the ABET accreditation for the program, which is the "gold standard" for accreditation in engineering.

[9] Contact the Office of First Year Programs for assistance in developing detailed graduation road maps for the first two years of study.

5. Societal and Public Need for the Proposed Degree Major Program

a. List of other California State University campuses currently offering or projecting the proposed degree major program; list of neighboring institutions, public and private, currently offering the proposed degree major program.[10]

The California State University campuses with a B.S. degree in Software Engineering are San Jose and San Luis Obispo. Two other campuses (East Bay and Monterey Bay) have a concentration or option in SE in their Computer Science degree program.

b. Describe differences between the proposed program and programs listed in Section 5a above.

Our program will not only offer a general Software Engineering degree program but also address the security issues from requirement analysis, to verification and validation, as well as software architecture and construction. These security issues also include cybersecurity when the software systems are connected to the Internet and/or World Wide Web. More courses will be designed in this field after the program is well established.

c. List of other curricula currently offered by the campus that are closely related to the proposed program.

Computer Science and Information Systems.

d. Describe community participation, if any, in the planning process. This may include prospective employers of graduates.

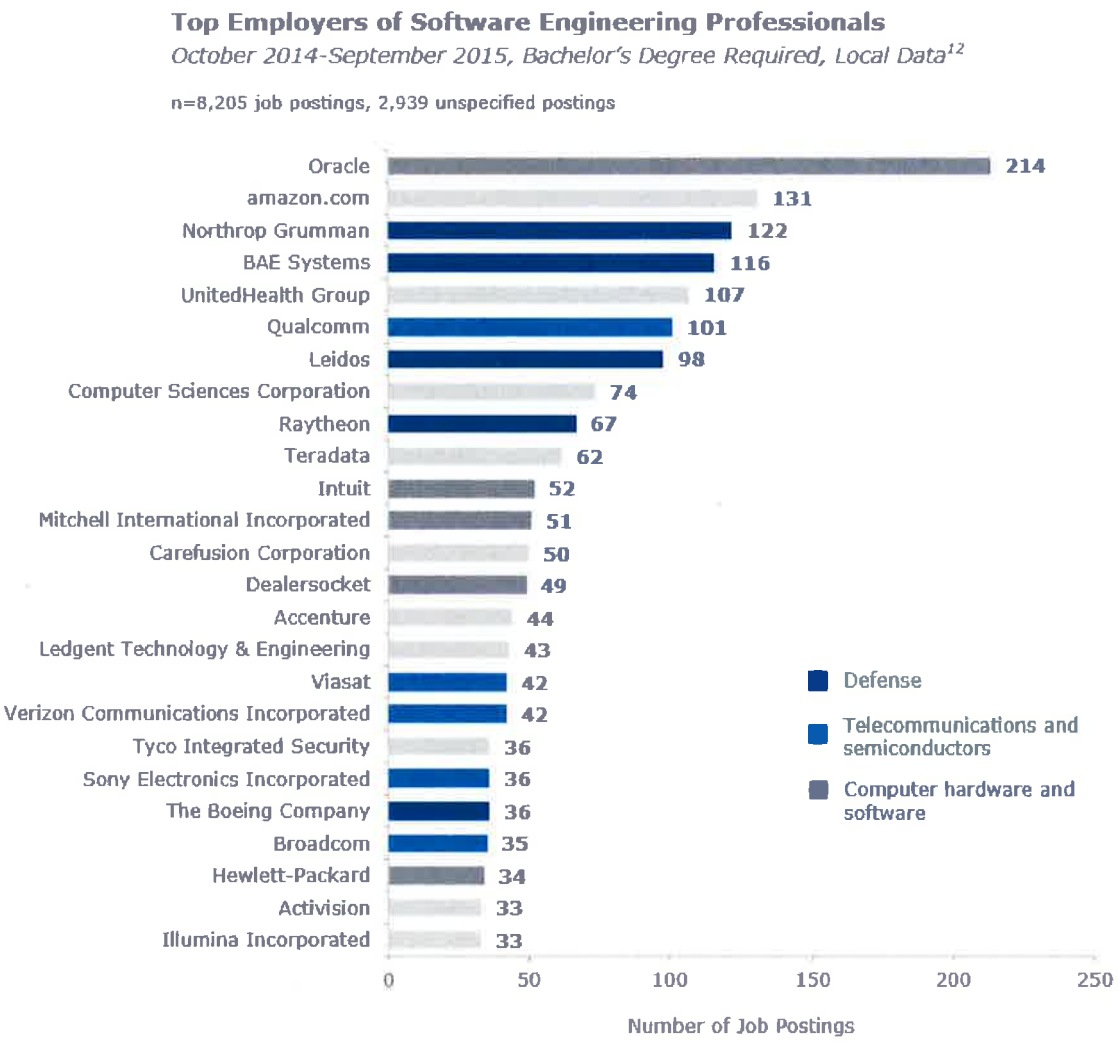
The custom research firm EAB Research conducted the Feasibility Study for engineering at CSUSM. They corresponded or interviewed industry representatives at various companies, such as Cubic Global Defense, D&K Engineering, General Atomics, Hunter Industries, Northrop-Grumman, Qualcomm, and Thermo Fisher Scientific. EAB also contacted recruiting staff at various companies, such as Amazon, Broadcom, Illumina, MDR Engineering, Panasonic Avionics Corporation, parker Aerospace, Siemens, and Verizon Communications. They also corresponded or interviewed administrators at local school districts.

e. Provide applicable workforce demand projections and other relevant data.

Computer hardware and software manufacturers indicate the highest demand for software engineers in California; locally, defense contractors, telecommunications companies, and semiconductor manufacturers also indicate high demand for software engineers.

- The Feasibility Study established a clear regional need for a Software Engineering program at CSUSM (see Table 1) and reported that local employer demand for software engineering-related positions increased 72% from July 2013 to June 2015.
- Figure 1 (from the Feasibility Study) displays a sample of local employers that hire students with a BS in Software Engineering

Figure 1


Top Employers of Software Engineering Professionals
October 2014-September 2015, Bachelor's Degree Required, Local Data[12]
n=8,205 job postings, 2,939 unspecified postings
Oracle 214
amazon.com 131
Northrop Grumman 122
BAE Systems 116
UnitedHealth Group 107
Qualcomm 101
Leidos 98
Computer Sciences Corporation 74
Raytheon 67
Teradata 62
Intuit 52
Mitchell International Incorporated 51
Carefusion Corporation 50
Dealersocket 49
Accenture 44
Ledgent Technology & Engineering 43
Viasat 42
Verizon Communications Incorporated 42
Tyco Integrated Security 36
Sony Electronics Incorporated 36
The Boeing Company 36
Broadcom 35
Hewlett-Packard 34
Activision 33
Illumina Incorporated 33
0
50
100
150
200
250
Number of Job Postings
Defense
Telecommunications and semiconductors
Computer hardware and software

6. Student Demand

a. Provide compelling evidence of student interest in enrolling in the proposed program. Types of evidence vary and may include national, statewide, and professional employment forecasts and surveys; petitions; lists of related associate degree programs at feeder community colleges; reports from community college transfer centers; and enrollments from feeder baccalaureate programs, for example.

As mentioned earlier, a clear need for engineering was identified for several types of engineering programs in a comprehensive service-area Feasibility Study completed in Spring 2016. This Study was prepared by a consulting group and funded by MiraCosta Community College. The Study established a clear regional need for a Software Engineering program at CSUSM (see Table 1).

A high number of impacted engineering bachelor's degree programs indicate excess student demand in the state of California. Local competitors, San Diego State University and California State University-Fullerton, operate impacted engineering bachelor's degree programs. In California, the only public universities offering a bachelor's degree in software engineering are California Polytechnic State University-San Luis Obispo and San Jose State University. Administrators at both institutions operate impacted software engineering bachelor's degree programs, which also indicate excess student demand.

There is strong potential to attract high school students to a new CSUSM engineering program. California high school students select engineering as their intended major 22% more than the national average. The Feasibility Study says that correspondence and interviews with industry representatives, as well the 4 to 1 ratio of local job postings for SE to graduates across the state in SE confirm local suitability for software engineering. Local high school students were surveyed and they expressed interest in engineering and exhibited sufficient standardized test performance. Community college students can complete support courses before they transfer.

b. Identify how issues of diversity and access to the university were considered when planning this program. Describe what steps the program will take to insure ALL prospective candidates have equitable access to the program. This description may include recruitment strategies and any other techniques to insure a diverse and qualified candidate pool.

- CSUSM has been awarded a nearly $6 million grant under the Hispanic-Serving Institutions STEM Program from the Department of Education that will provide foundational funding for establishing an engineering program at CSUSM. The goal of the grant (titled "Si Se Puede!" to Close the Equity Gap in Engineering Degree Completion) is to develop and sponsor activities to improve and expand our campus' capacity to serve Hispanic and other low-income students during the formation of the program.
- The Graduation Initiative on campus is part of this CSU system-wide effort to increase the number of degrees awarded, increase 4 and 6-year graduation rate, close the 6-year achievement gap between at-risk and non-at risk students, maintain impressive retention rates, improve access for students and ensure their success in attaining educational goals.

c. For master's degree proposals, cite the number of declared undergraduate majors and the degree production over the preceding three years for the corresponding baccalaureate program, if there is one.[11]

N/A

[11] Contact Enrollment Management Services for these data.

d. Describe professional uses of the proposed degree program.

Computer hardware and software manufacturers indicate the highest demand for software engineers in California; locally, defense contractors, telecommunications companies, and semiconductor manufacturers also indicate high demand for software engineers. See Figure 1 in Part 5e for a partial list of companies that hire Software Engineers.

e. Specify the expected number of majors in the year of initiation and three years and five years thereafter. Specify the expected number of graduates in the year of initiation, and three years and five years thereafter.[12]

The following data is influenced by the CSM Engineering Resources Taskforce report, consisting of faculty, staff, and industry representatives (see Appendix E), the CSM Curriculum Committee, and the BLP Revenues-Costs worksheet:

Estimated Numbers	Year 1	Year 2	Year 3	Year 4	Year 5
FT freshmen	15	30	50	65	75
FT transfer students	0	0	20	35	55

The following data is lifted from the BLP revenue-cost Excel file.

AY	Year 1	Year 2	Year 3	Year 4	Year 5
FRESHMN	15	30	50	65	75
SOPH	0	14	27	45	59
JUNIOR	0	0	33	61	98
SENIOR	0	0	0	33	61
TOTAL	15	44	110	203	292

The number of graduates each year is expected to vary, about 50% to 100% of the seniors in the AY. The table above from the BLP revenue-cost worksheet assumes 100% of all seniors graduate, so the number of seniors (and therefore the revenue associated the number of majors) may be an underestimate.

Planning Assumptions:
1. 10% attrition from FR to SOPH and 5% attrition from SOPH to JUNIOR.
2. Transfers will be accepted in AY 19/20.

7. Existing Support Resources for the Proposed Degree Major Program

Note: Sections 7 and 8 should be prepared in consultation with the campus administrators responsible for faculty staffing and instructional facilities allocation and planning. A statement from the responsible administrator(s) should be attached to the proposal assuring that such consultation has taken place.

a. List faculty who would teach in the program, indicating rank, appointment status, highest degree earned, date and field of highest degree, professional experience, and affiliations with other campus programs. For master's degrees, include faculty publications or curriculum vitae.

Ali Ahmadinia
Assistant Professor, tenure-track, Ph.D. in Computer Engineering, University of Erlangen-Nuremberg, 2006

Rocio Guillén-Castrillo
Professor, tenured, Ph.D. in Computer Science, New Mexico State University, 1997

Ahmad Hadeagh
Professor, tenured, Ph.D. in Computer Science, University of Manitoba, 1997

[12] Contact Academic Programs for assistance in estimating the number of majors and graduates.

Nahid Majd
Assistant Professor, tenure-track, Ph.D. in Computer Science, New Mexico State University, 2014

Youwen Ouyang
Professor, tenured, Ph.D. in Computer Science, Louisiana State University – Baton Rouge, 1997

Shaun-inn Wu
Professor, tenured, Ph.D. in Computer Science, New Mexico State University, 1988

Xin Ye
Assistant Professor, tenured track, Ph.D. in Computer Science, Ohio University, 2016

Rika Yoshii
Professor, tenured, Ph.D. in Computer Science, University of California Irvine, 1993

Xiaoyu Zhang
Professor, tenured, Ph.D. in Computer Science, University of Texas Austin, 2002

b. Describe facilities that would be used in support of the proposed program.

Sci2 Room 302 is an existing computer lab for supporting majors courses such as CS 111, CS 211, and CS 231. Other computer labs on campus could also be used such as ACD 206 and UNIV 272. The labs have standard academic technology, equipment, and software.

c. Provide evidence that the institution provides adequate access to both electronic and physical library and learning resources [13]

See the attached memo in Appendix F from Dean Jennifer Fabbi.

d. Describe existing academic technology, equipment, and other specialized materials[14]

The computer labs mentioned in Section 7b are smart rooms with appropriate computers, networks, and software.

8. Additional Support Resources Required

Note: If additional support resources will be needed to implement and maintain the program, a statement by the responsible administrator(s) should be attached to the proposal assuring that such resources will be provided.

a. Describe additional faculty or staff support positions needed to implement the proposed program.[15]

In Year 2, the Department of CSIS will have hired an Associate Professor to begin with sufficient time to lay the groundwork of implementing the upper division curriculum for SE, designing the laboratories and ordering required equipment, as well as teaching core courses. In Year 2, the Department of CSIS will have hired an Assistant Professor to teach core SE courses. In Year 3, the Department of CSIS will have another Assistant Professor to teach junior and senior level core CS courses.

---

[13] Contact the Library for this report.
[14] Contact Instructional and Information Technology Services (IITS) for a report addressing information technology and academic computing resources available to support the program. Programs currently possessing additional equipment and specialized material not addressed in the IITS report should include these here.
[15] Include additional faculty lines needed to support the course offerings indicated in 4.h and 4.m. Indicate whether any external funds are expected to support faculty lines.

The HSI-STEM grant will fund the position of an Engineering Laboratory Developer. This project includes new laboratory facilities and resources to support the active, project-based approach to learning at the core of the classroom experience. Project leadership will select a qualified Engineering Laboratory Developer to assist with the planning and design of the new engineering laboratories at CSUSM and assist faculty with purchase, set up, and maintenance of all new science equipment and supplies. To ensure that lab materials and tools are meeting student needs, the Engineering Lab Developer will also assist students in class and oversee all aspects of technology integration in the curriculum. The selected person will also be responsible for cataloging and keeping records of all laboratory equipment and supplies according to Federal, State, and local guidelines, as well as maintain the servers in the computer labs.

b. Describe the amount of additional lecture and/or laboratory space required to initiate and to sustain the program over the next five years. Indicate any additional special facilities that will be required. If the space is under construction, what is the projected occupancy date? If the space is planned, indicate campus-wide priority of the facility, capital outlay program priority, and projected date of occupancy. Major capital outlay construction projects are those projects whose total cost is $610,000 or more (as adjusted pursuant to Cal. Pub. Cont. Code §§ 10705(a); 10105 and 10108).[16]

Initially, the lecture and/or laboratory space needs may be met by the existing space and labs of Department of Computer Science and Information Systems. This degree would need additional computer labs (systems lab; software lab; human computer interface lab) and appropriate computers, networks, software, and hardware by Fall 2019. It is expected that these labs will be in the FCB building when Extended Learning vacates the space and moves into their new building in Fall 2019. The HSI-STEM grant has a budget for equipment (e.g., computers, servers, recording devices, software), supplies (e.g., cables, software, Matlab), and construction (renovation) for both SE and EE engineering. The BLP budget spreadsheet shows the revenues and costs for these needs.

c. Include a report written in consultation with the campus librarian, which indicates any necessary library resources not available through the CSU library system. Indicate the commitment of the campus to purchase these additional resources.[17]

See the attached memo in Appendix F from Dean Jennifer Fabbi.

d. Indicate additional academic technology, equipment, or specialized materials that will be (1) needed to implement the program and (2) needed during the first two years after initiation. Indicate the source of funds and priority to secure these resource needs.[18]

Existing campus labs are already used to high capacity. The new spaces that will be constructed and funded partially by the HSI-STEM grant will provide the campus additional capacity and needed technology, equipment, and software to support the SE curriculum as described in Part 8d.

See the attached memo in Appendix G from Dean Kevin Morningstar on IITS resources for Software Engineering.

9. Self-Support Programs

a. Confirm that the proposed program will not be offered at places or times likely to supplant or limit existing state-support programs.[19] N/A

---

[16] Contact Planning, Design and Construction for assistance in answering questions about space that is under construction or being planned. Indicate whether any external funds are expected to support construction of facilities.

[17] This should follow directly from the Library report in 7.c.

[18] Information technology and academic computing needs should follow directly from the IITS report in 7.d. Additional specialized equipment and materials that will be needed should be addressed here.

b. Explain how state-support funding is either unavailable or inappropriate. N/A

c. Explain how the program is different, in one or more of the following ways, from state-supported campus offerings operating on campus:

   i. Primarily designed for career enrichment or retraining
   ii. Program location is significantly removed from state-supported campus facilities
   iii. The program client group receives educational or other services at a cost beyond what could be reasonably provided under state support.

   N/A

d. For self-support programs, please provide information on the per-unit cost to students and the total cost to complete the program (in addition to the required cost recovery budget elements listed in the CSU degree proposal faculty check list found earlier in this document). N/A

[19] Pursuant to Executive order 1099, "Self-supporting special sessions shall not supplant regular course offerings available on a non self-supporting basis during the regular academic year (Education Coder section 89708)."

	A	B	C	D	E	F
1						
2	**A. ANTICIPATED REVENUES FOR THE PROPOSED NEW UNDERGRADUATE PROGRAM**					
3						
4	**Data about the proposed program.**					
5	**The grey fields in this section should be filled out by the proposer.**					
6	College(s) where the program is housed	CSM				
7	Department(s) which proposes the program	CS				
8	Name of the proposed program	Software Engineering				
9	Number of units of the proposed program	120				
10	Number of units taken inside the program's department(s)	56				
11	Number of units taken inside the department(s)' college(s) but outside the program's department(s)	22				
12						
13		Year 1	Year 2	Year 3	Year 4	Year 5
14	Estimated number of incoming freshmen	15	30	50	65	75
15	Estimated number of incoming transfer students	0	0	20	40	60
16						
17	External funding	$175,000	$650,000	$750,000	$750,000	$750,000
18	Estimated additional internal funding	$0	$0	$0	$0	$0
19	Estimated FTES generated by Service and GE demand	0	0	0	0	0
20						
21						
22	**Projected enrollment and revenue**					
23						
24		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
25	Freshmen	15	30	50	65	75
26	Sophomore	0	14	27	45	59
27	Junior	0	0	33	66	103
28	Senior	0	0	0	33	66
29	TOTAL	15	44	110	208	302
30						
31	**Revenue for the program (based on the enrollment in the major)**	**$28,513**	**$83,639**	**$209,098**	**$395,385**	**$574,068**
32	Revenue for the college (without the revenue for the proposed program)	$11,202	$32,858	$82,146	$155,330	$225,527
33	Revenue for outside colleges	$21,385	$62,729	$156,823	$296,539	$430,551
34	Revenue for AA	$61,100	$179,227	$448,067	$847,253	$1,230,147
35						
36						
37						
38	**Planning assumptions (to be updated by the Office of the Vice-Provost)**					
39	1. 10% attrition from freshman to sophomore:	10%				
40	2. 5% attrition from sophomore to junior:	5%				
41	3. FTES assumes average unit load of 13 units per undergraduate:	13				
42	4. Amount Academic Affairs will receive per FTES:	$4,700				

	A	C	D	E	F	G	H	I	J	K	L
1											
2	**B. ANTICIPATED COST AND REVENUE PROJECTIONS FOR THE PROPOSED NEW UNDERGRADUATE PROGRAM**										
3											
4	**Data about the proposed program**										
5	**The grey fields in this section should be filled out by the proposer.**										
6	**Average cost of TT faculty (without benefit) :**			$95,000							
7											
8		**Year 1**		**Year 2**		**Year 3**		**Year 4**		**Year 5**	
9	**Personnel**										
10	TT Faculty	0	$0	2	$283,100	3	$424,650	3	$424,650	3	$424,650
11	Lecturers	0	$0	0	$0	1	$79,432	1.5	$119,148	1.75	$139,006
12	Staff	0.6	$31,290	2.4	$125,160	2.4	$125,160	2.4	$125,160	2.4	$125,160
13											
14	**Startup if program is self-supported**		$0		$0		$0		$0		$0
15											
16	**Space**										
17	Construction		$0		$0		$0		$0		$0
18	Renovation		$150,000		$150,000		$150,000		$0		$0
19	Rental/Lease		$0		$0		$0		$0		$0
20											
21	**Library Resources**										
22	Acquisition		$0		$1,000		$1,000		$1,000		$1,000
23	Subscription		$0		$7,000		$7,000		$7,000		$7,000
24											
25	**IITS Resources**										
26	Acquisition		$0		$200,000		$200,000		$150,000		$0
27	Other		$0		$0		$0		$0		$0
28											
29	**Equipment/Materials**										
30	Durable		$0		$100,000		$100,000		$0		$0
31	Expendable		$0		$40,000		$30,000		$20,000		$10,000
32											
33	**Miscellanea**		$0		$80,000		$40,000		$0		$0
34											
35											
36	**Projected cost and revenue**										
37											
38	**Program Cost**		**$181,290**		**$986,260**		**$1,157,242**		**$846,958**		**$706,816**
39	**Program Revenue**		**$28,513**		**$83,639**		**$209,098**		**$395,385**		**$574,068**
40	**External funding**		**$175,000**		**$650,000**		**$750,000**		**$750,000**		**$750,000**
41	**Additional internal funding**		**$0**		**$0**		**$0**		**$0**		**$0**
42	**Revenue from GE offerings**		**$0**		**$0**		**$0**		**$0**		**$0**
43	**Program net return**		**$22,223**		**($252,621)**		**($198,144)**		**$298,427**		**$617,253**
44											
45											
46	**Planning assumptions (to be updated by the Office of the Vice-Provost)**										
47	1. Average Lecturer Cost (without benefit):						$53,310				
48	2. Average Staff Cost (without benefit):						$35,000				
49	3. Average Benefit:						49%				

	Year 6	
Number of FT Freshmen	75	(same as the number of FT Freshmen from Year 5)
Number of FT Transfer	60	(same as the number of FT Transfers from Year 5)
Program revenue per SE major from AA	$1,900	(based on 5th year)

	Year 6	
FRESHMEN (first-time)	75	
SOPHOMORES: 10% attrition from previous year	68	
JUNIORS: 5% attrition from previous SOPH + FT Transfers	116	
SENIORS: previous Juniors	103	
TOTAL	**362**	
Total program revenue due to 362 SE majors	$687,800	
Program cost:	($675,526)	(Program cost from Year 5, less the share of grant support coordinator salary and benefits)
Net cost/revenue in Year 6	**$12,274**	

TOTAL Program Net Return over first 5 years (carry forward):	$487,138
Balance after 6 years	$499,412