



ARIZONA STATE UNIVERSITY  
PROPOSAL TO ESTABLISH A NEW GRADUATE DEGREE

This template is to be used only by programs that have received specific written approval from the University Provost's Office to proceed with internal proposal development and review. A separate proposal must be submitted for each individual new degree program.

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**DEGREE PROGRAM**

**College/School(s) offering this degree:** College of Technology and Innovation

**Unit(s) within college/school responsible for program:** Department of Engineering

**Proposed Degree Name:** Master of Science in Software Engineering

**Master's Degree Type:** MS

**Proposed title of major:** Software Engineering

**Is a program fee required?** Yes  No

**Requested effective term:** Fall **and year:** 2013

(The first semester and year for which students may begin applying to the program)

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**PROPOSAL CONTACT INFORMATION**

(Person to contact regarding this proposal)

**Name:** Ann McKenna

**Title:** Chair of Engineering

**Phone:** 727-5121

**email:** ann.mckenna.asu.edu

**DEAN APPROVAL**

This proposal has been approved by all necessary unit and College/School levels of review, and the College/School(s) has the resources to offer this degree program. I recommend implementation of the proposed degree program. (Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.)

**College Dean name:** Mitzi Montoya

**College Dean Signature** See attached email approval **Date:** 12-17-2012

**College Dean name:**  
(if more than one college involved)

**College Dean Signature** \_\_\_\_\_ **Date:** \_\_\_\_\_

**ARIZONA STATE UNIVERSITY  
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This proposal template should be completed in full and submitted to the University Provost's Office [mail to: [curriculumplanning@asu.edu](mailto:curriculumplanning@asu.edu)]. It must undergo all internal university review and approval steps including those at the unit, college, and university levels. A program **may not** be implemented until the Provost's Office notifies the academic unit that the program may be offered.

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**DEGREE PROGRAM INFORMATION**

**Master's Type:** MS  
(E.g. MS, MA, MAS, PSM, or other)

**Proposed title of major:** Software Engineering

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**1. PURPOSE AND NATURE OF PROGRAM:**

**A. Brief program description**

The MS in Software Engineering Program focuses on developing advanced knowledge and abilities in the design and application of software. The program involves the application of engineering principles to software development including design methodologies, operation principles, and maintenance and testing approaches. The MS in Software Engineering Program builds upon the BS in Software Engineering program and is aimed at developing professional skills in this discipline as well as providing opportunities for students to engage in and develop research abilities.

**B. Will concentrations be established under this degree program?**  Yes  No  
(Please provide additional concentration information in the operational appendix – number 5A.)

**2. PROGRAM NEED -** Explain why the university should offer this program (include data and discussion of the target audience and market).

ASU currently does not have an MS degree in Software Engineering (although there is a concentration in software engineering under the Ira A. Fulton Schools of Engineering MSE in Engineering Science degree). The popularity of software engineering has grown over the past decade making software engineering “one of the fastest growing fields in the world”. The Occupational Outlook Handbook projects a 30% growth in this area between now and 2020, and considers this one of the leading growth industries. InformationWeek ranked Software Engineering as the number one top job for 2012.

The College of Technology and Innovation has demonstrated growth in the undergraduate BS in Software Engineering Program, but has struggled to attain growth in the Master of Computing Studies program. We feel this is largely due to a lack of name recognition of the degree and that having the master's degree aligned with the BS degree would be of great benefit to the growth of the college. Growth would come from our current students that desire to matriculate into an MS program. There is also significant growth potential from students in international markets who would matriculate to ASU either as traditional two-year MS students or who would matriculate into a planned 3+2 MS in Software Engineering. When we visited China to market 3+2 programs we were repeatedly asked if we had a master's degree in software engineering. We envision an international partnership in 3+2 programs that would bring 100 MS Software Engineering students to ASU.

**3. IMPACT ON OTHER PROGRAMS -** Attach any letters of collaboration/support from impacted programs. (see Checklist coversheet)

The proposal was forwarded to Ira A. Fulton Schools of Engineering for review (support approval included with this proposal).

- 4. **PROJECTED ENROLLMENT** - How many new students do you anticipate enrolling in this program each year for the next five years? Please note, The Arizona Board of Regents (ABOR) requires nine masters and six doctoral degrees be awarded every three years. Thus, the projected enrollment numbers must account for this ABOR requirement.

<b>5-YEAR PROJECTED ANNUAL ENROLLMENT</b>					
<b>Please utilize the following tabular format.</b>	<b>1<sup>st</sup> Year</b>	<b>2<sup>nd</sup> Year</b> (Yr 1 continuing + new entering)	<b>3<sup>rd</sup> Year</b> (Yr 1 & 2 continuing + new entering)	<b>4<sup>th</sup> Year</b> (Yrs 1, 2, 3 continuing + new entering)	<b>5<sup>th</sup> Year</b> (Yrs 1, 2, 3, 4 continuing + new entering)
Number of Students Majoring (Headcount)	40	75	100	150	150

5. **STUDENT LEARNING OUTCOMES AND ASSESMENT:**

- A. **List the knowledge, competencies, and skills** students should have attained by graduation from the proposed degree program. (You can find examples of program Learning Outcomes at <http://www.asu.edu/oue/assessment.html>).

**Technical Competence**

- a. Apply and adapt knowledge of software engineering and mathematics appropriate to engineering complex software systems.
- b. Analyze a software engineering problem; identify and define the computing requirements appropriate to its solution.
- c. Effectively develop and deploy advanced software systems to meet the needs of the user environment.
- d. Understand and apply computer science and software engineering best practices and standards.

**Design**

- e. Design, evaluate, and adapt software processes and software development tools to meet the needs of an advanced software development project.
- f. Elicit user needs and design an effective software solution.

**Communication and Team Skills**

- g. Function effectively on teams, and apply and adapt teaming strategies to influence the productivity of the team in accomplishing a software solution.
- h. Communicate effectively with a range of audiences.

**Professionalism and Perspective**

- i. Identify and understand professional, ethical, legal, security, social issues and responsibilities relevant to engineering software systems.
- j. Understand the local and global impact of software engineering on individuals, organizations, and society.
- k. Recognize the need for and engage in continuing professional development.

- B. **Describe the plans and methods to assess** whether students have achieved the knowledge, competencies and skills identified in the Learning Outcomes. (You can find examples of assessment methods at <http://www.asu.edu/oue/assessment.html>).

The assessment plan has the dual purpose of determining student achievement of educational objectives and student outcomes, as well as evolution and improvement of the MS in Software Engineering program. Program assessment is accomplished by periodically collecting information from various sources, which is evaluated by program faculty and administration to determine appropriate program and curriculum changes. Assessment information includes: student and faculty course assessment, graduating student survey, graduating student interview, direct measures of student outcome achievement in relation to completion of key project courses, alumni survey (three and five year out), alumni employer survey, and industry council input.

Information from these sources is evaluated to determine student achievement of student outcomes and program objectives, and it is evaluated in conjunction with information received from the program's industry advisory council to refine and evolve the program. Program faculty and administration are responsible for conducting regular evaluations, as well as initiating and documenting appropriate curricular action based upon the evaluations. Each required course in the program identifies course level outcomes that are tied to program level student outcomes. The course outcomes and their mapping to program student outcomes validate each course's place in the program.

Student performance based outcome assessment is aimed at identifying student strengths and weaknesses relative to each student outcome in addition to determining whether the collective student body is adequately achieving outcomes. The assessments are used to continuously improve the MS in Software Engineering program. Faculty committees evaluate student performance upon completion of project spine courses and a combination of student interviews, student reflection and student portfolio. Faculty committees assess project activities annually.

- 6. ACCREDITATION OR LICENSING REQUIREMENTS (if applicable):** Provide the names of the external agencies for accreditation, professional licensing, etc. that guide your curriculum for this program, if any. Describe any requirements for accreditation or licensing.

**none**

**7. FACULTY, STAFF, AND RESOURCE REQUIREMENTS:**

**A. Faculty**

- i. Current Faculty** - List the name, rank, highest degree, area of specialization/expertise and estimate of the level of involvement of all current faculty members who will teach in the program.

**Ashish Amresh**, Assistant Professor, Ph.D. Video Game Development

**Amiya Bhattacharya**, Lecturer, Ph.D. Network Security, Wireless Sensor Networks

**Srividya Kona Bansal**, Assistant Professor, Ph.D. Service Oriented Architectures, Software Engineering

**John Femiani**, Assistant Professor, Ph.D. Computer Science, Visual Analytics

**Ashraf Gaffar**, Assistant Professor, Ph.D. Human-Computer Interface Design

**Kevin Gary**, Associate Professor, Ph.D. Software Engineering, Web Applications

**Arbi Ghazarian**, Assistant Professor, Ph.D. Software Requirements Engineering

**Timothy Lindquist**, Professor, Ph.D. Mobile Systems, Computer Science

**Anshuman Razdan**, Professor, Ph.D. Computer Science, Visual Analytics

- ii. New Faculty** - Describe the new faculty hiring needed during the next three years to sustain the program. List the anticipated hiring schedule and financial sources for supporting the addition of these faculty members.

None

- iii. Administration of the program** - Explain how the program will be administered for the purposes of admissions, advising, course offerings, etc. Discuss the available staff support.

The program will be administered by the Department of Engineering at the Polytechnic campus. The Chair, Dr. Ann McKenna and departmental support staff will provide administrative oversight. Advising will be provided by the College of Technology and Innovation using the same model currently in use for all other programs in the college. Admission, registration, course scheduling, and graduation (audit) support will be provided as is currently provided for the other programs in the Department of Engineering – through a combination of support at the departmental, college and university levels.

**B. Resource requirements needed to launch and sustain the program:** Describe any new resources required for this program’s success such as new staff, new facilities, new library resources, new technology resources, etc.

None

**8. COURSES:**

**A. Course Prefix(es):** Provide the following information for the proposed graduate program.

i. Will a new course prefix(es) be required for this degree program?  
Yes  No

**B. New Courses Required for Proposed Degree Program:** Provide course prefix, number, title, and credit hours and description for any new courses required for this degree program.

No new courses are needed

**APPENDIX  
OPERATIONAL INFORMATION FOR GRADUATE PROGRAMS**

(This information is used to populate the [Graduate Programs Search](#)/catalog website.)

**1. Provide a brief (catalog type - no more than 150 words) program description.**

The MS in Software Engineering degree program focuses on developing advanced knowledge and abilities in the design and application of software. Students will learn to apply engineering principles to software development including design methodologies, operation principles, and maintenance and testing approaches. The MS in Software Engineering program is aimed at developing professional skills in this discipline as well as providing opportunities for students to engage in and develop research abilities.

**2. Campus(es) where program will be offered:**

*(Please note that Office of the Provost approval is needed for ASU Online campus options.)*

**ASU Online only (all courses online)**

**All other campus options (please select all that apply):**

Downtown                       Polytechnic  
 Tempe                                 West

**Both on-campus and**  **ASU Online (\*) - (Check applicable campus from options listed.)**

(\*) Please note: Once students elect a campus option, students will not be able to move back and forth between the on-campus (in-person) or hybrid options and the ASU Online campus option.

**3. Admission Requirements:**

**Degree:** Minimum of a Bachelor's or master's degree in the fields below, or a closely related field from a regionally accredited College or University (or International equivalent).

Information Technology, Computer Science, Applied Computing, and Engineering

**GPA:** Minimum of a 3.00 cumulative GPA (scale is 4.0=A) in the last 60 hours of a student's first bachelor's degree program. Minimum of 3.00 cumulative GPA (scale is 4.0 = A) in the applicable Master's degree, if appropriate.

**English Proficiency Requirement for International Applicants:** The English proficiency requirements are the same as the Graduate College requirement. (see Graduate College requirement [http://graduate.asu.edu/admissions/international/english\\_proficiency](http://graduate.asu.edu/admissions/international/english_proficiency)):  **Yes**  **No**

If applicable, list any English proficiency requirements that are supplementary to the Graduate College requirement.

**Foreign Language Exam:**

Foreign Language Examination(s) required?  Yes  No

**Required Admission Examinations:**  GRE  GMAT  Millers Analogies  None required (Select all that apply.)

**Letters of Recommendation:**  Yes  No

**4. Application Review Terms (if applicable Session):** Indicate all terms for which applications for Admissions are accepted and the corresponding application deadline dates, if any:

- Fall (regular)      Deadline (month/year): Feb 15
- Session B              Deadline (month/year):
- Spring (regular)      Deadline (month/year): Oct 15
- Session B              Deadline (month/year):
- Summer I      Deadline (month/year): Jan 15
- Summer II      Deadline (month/year):

**5. Curricular Requirements:**

(Please expand tables as needed. Right click in white space of last cell. Select "Insert Rows Below")

**5A. Will concentrations be established under this degree program?**  Yes  No

**5B. Curricular Structure:**

Required Core Courses for the Degree			Credit Hours
(Prefix & Number)	(Course Title)	(New Course?) Yes or No?	15 hours
CST 501	Advanced Data Structures and Algorithms	No	3
CST 502	Emerging Languages and Programing Paradigms	No	3
CST 515	Software Enterprise: Inception and Elaboration	No	3
CST 516	Software Enterprise: Project and Process Management	No	3
CST 500	Research Methods	No	3

<b><u>Elective or Research Courses</u></b> (as deemed necessary by supervisory committee) <b>Student must choose 12 credit hours from the list below as indicated or others as approved by the supervisory committee – only 6 credit hours of 400 level courses may be taken</b>			<b><u>Credit Hours</u></b>
<b>(Prefix &amp; Number)</b>	<b>(Course Title)</b>	<b>(New Course?) Yes or No?</b>	<b>12 hours</b>
CST 520	Computer Architecture	No	<b>3</b>
CST 533	Database-Centric Enterprise Applications Development	No	<b>3</b>
CST 557	Embedded Applications Development	No	<b>3</b>
Or any other committee approved graduate-level computing courses for a total of 12 credit hours			
* Please also see note below regarding elective courses.			
<b><u>Culminating Experience</u></b> <i>E.g. - Capstone course, applied project, <b>thesis (masters only)</b> – 6 credit hours) or <b>dissertation (doctoral only)</b> – 12 credit hours) as applicable</i>  <i>Students take one of the following</i>			<b><u>Credit Hours</u></b>
<b>CST 599 Thesis</b>			<b>6</b>
<b>CST 593 Applied Project and CST 517 Software Factory I</b>			<b>6</b>
<b>CST 517 Software Factory I and CST 518 Software Factory II</b>			<b>6</b>
<b><u>Other Requirements</u></b> <i>E.g. - Internships, clinical requirements, field studies as applicable</i>			<b><u>Credit Hours</u></b> <b>(Insert Section Sub-total)</b>
<b>For doctoral programs</b> – when approved by the student's supervisory committee, will this program allow 30 credit hours from a previously awarded master's degree to be used for this program? If applicable, please indicate the 30 credit hour allowance that will be used for this degree program.			
<b>Total required credit hours</b>			<b>33</b>

- List all required core courses and total credit hours for the core (required courses other than internships, thesis, dissertation, capstone course, etc.).
- Omnibus numbered courses cannot be used as core courses.
- Permanent numbers must be requested by submitting a course proposal to Curriculum ChangeMaker for approval. Courses that are new, but do not yet have a new number can be designated with the prefix, level of the course and X's (e.g. ENG 5XX or ENG 6XX).

\* **Please note:** The computing tenure-track faculty are re-defining the graduate course offerings available to students based on previous offerings within the Master of Computing Studies (MCST) degree program. In addition to the courses shown in this proposal as electives, such courses currently include (and will be modified or proposed as SER courses) the following.

SER 5xx Semantic Web (already offered as CST 594)

SER 5xx Advanced Software Design (already offered as CST 594)

SER 5xx Mobile Computing (currently being offered as CST 594)

SER 5xx Visual Analytics and Advanced Graphics

SER 5xx Human-Centered Design for Software Engineering

**6. Comprehensive Exams:**

**Master's Comprehensive Exam (when applicable), please select the appropriate box.**

**(Written comprehensive exam is required)**

- Oral comprehensive exam is required – in addition to written exam
- No oral comprehensive exam required - only written exam is required

**7. For Doctoral Degrees that require a dissertation, submission of a written dissertation prospectus and its oral defense are required. (Please include any required timelines for defense of the prospectus.) It is expected that the submission of a written dissertation prospectus and its oral defense will take place no later than the end of the fourth year.**

**8. Allow 400-level courses:**  **Yes**  **No** (No more than 6-credit hours of 400-level coursework can be included on a graduate student plan of study).

**9. Committee:** Required Number of Thesis or Dissertation Committee Members (must be at least 3, including chair or co-chairs). A minimum of three committee members, with at least two from the unit.

**10. Keywords** (List all keywords that could be used to search for this program. Keywords should be specific to the proposed program.)

Computing, Computer, Software, Graphics, Game Development, Software Engineering, Software Development, Mobile Applications, Game Design, Video Game, Web, Web Applications, World Wide Web, Network Administration, Network Security, Information Technology, Animation, Multimedia

**11. Area(s) of Interest**

A. Select one (1) primary Area of Interest from the list below that applies to this program.

- |   |  |
|---|--|
| <input type="checkbox"/> Architecture, Construction & Design    | <input type="checkbox"/> Engineering & Technology            |
| <input type="checkbox"/> Artistic Expression & Performance      | <input type="checkbox"/> Environmental Issues & Physical Sci |
| <input type="checkbox"/> Biological Sciences, Health & Wellness | <input type="checkbox"/> Interdisciplinary Studies           |
| <input type="checkbox"/> Business, Management & Economics       | <input type="checkbox"/> Languages & Cultures                |
| <input type="checkbox"/> Communication & Media                  | <input type="checkbox"/> Law & Justice                       |
| <input checked="" type="checkbox"/> Computing & Mathematics     | <input type="checkbox"/> Social Science, Policies & Issues   |
| <input type="checkbox"/> Education & Teaching                   |  |

B. Select any additional Areas of Interest that apply to this program from the list below.

- Architecture, Construction & Design
- Artistic Expression & Performance
- Biological Sciences, Health & Wellness
- Business, Management & Economics
- Communication & Media
- Computing & Mathematics
- Education & Teaching
- Engineering & Technology
- Environmental Issues & Physical Sci
- Interdisciplinary Studies
- Languages & Cultures
- Law & Justice
- Social Science, Policies & Issue



## Scott Danielson

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**From:** Mitzi Montoya  
**Sent:** Monday, December 17, 2012 5:40 PM  
**To:** Scott Danielson  
**Subject:** Re: MS in Software Engineering Proposal Approval

Approved.

*Mitzi Montoya*  
*Sent from my DROID*

Scott Danielson <[Scott.Danielson@asu.edu](mailto:Scott.Danielson@asu.edu)> wrote:

Dean Montoya,

I am asking for your approval on the attached proposal for a MS in Software Engineering to be offered in the College of Technology and Innovation at the Polytechnic campus. Your approval is needed before I can send the proposal forward to the Provost's office.

Your approval indicates that the proposal has been approved by the Department and College levels of review and the College has the resources to offer this degree program. Thus, you recommend implementation of the proposed degree program.

Thank you.

Scott Danielson, Ph.D., P.E.  
Associate Dean for Academic Programs  
College of Technology and Innovation  
Arizona State University  
480-727-1185

# MS Software Engineering

Friday, December 14, 2012 2:25 PM

**From:** James Collofello <[JAMES.COLLOFELLO@asu.edu](mailto:JAMES.COLLOFELLO@asu.edu)>

**Date:** December 13, 2012, 5:02:18 PM EST

**To:** Chell Roberts <[Chell.Roberts@asu.edu](mailto:Chell.Roberts@asu.edu)>

**Subject: RE: MS Software Engineering**

Chell,

The Fulton Schools of Engineering does not have any concerns with this proposal.

jim

James S. Collofello  
Associate Dean of Academic and Student Affairs  
Professor of Computer Science and Engineering

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From: Chell Roberts

Sent: Thursday, December 13, 2012 9:49 AM

To: James Collofello

Subject: MS Software Engineering

Jim,

I am asking for your comment on the attached proposal for a Master of Science in Software Engineering to be offered in the College of Technology and Innovation and the Polytechnic campus. It is my understanding that our Dean's reached an agreement on our offering this degree in previous communications and have attached that email exchange.

--

Chell Roberts  
Executive Dean  
College of Technology and Innovation

## (NEW GRADUATE INITIATIVES)

### PROPOSAL PROCEDURES CHECKLIST

Academic units should adhere to the following procedures when requesting new curricular initiatives (degrees, concentrations or certificates).

**Obtain the required approval from the Office of the Provost to move the initiative forward for internal ASU governance reviews/approvals.**

- Establishment of new curricular initiative requests; degrees, concentrations, or certificates
- Rename requests; existing degrees, concentrations or certificates
- Disestablishment requests; existing degrees, concentrations or certificates

**Submit any new courses that will be required for the new curricular program to the Curriculum ChangeMaker online course approval system for review and approval.**

- Additional information can be found at the Provost's Office Curriculum Development website: [Courses link](#)
- For questions regarding proposing new courses, send an email to: [courses@asu.edu](mailto:courses@asu.edu)

**Prepare the applicable proposal template and operational appendix for the proposed initiative.**

- New degree, concentration and certificate templates (contain proposal template and operational appendix) can be found at the Provost's Office Curriculum Development website: [Academic Programs link](#)

**Obtain letters or memos of support or collaboration. (if applicable)**

- When resources (faculty or courses) from another academic unit will be utilized
- When other academic units may be impacted by the proposed program request

**Obtain the internal reviews/approvals of the academic unit.**

- Internal faculty governance review committee(s)
- Academic unit head (e.g. Department Chair or School Director)
- Academic unit Dean (will submit approved proposal to the [curriculumplanning@asu.edu](mailto:curriculumplanning@asu.edu) email account for further ASU internal governance reviews (as applicable, University Graduate Council, CAPC and Senate)

**Additional Recommendations** - All new graduate programs require specific processes and procedures to maintain a successful degree program. Below are items that the Graduate College strongly recommends that academic units establish after the program is approved for implementation.

**Set-up a Graduate Faculty Roster for new PhD Programs** – This roster will include the faculty eligible to mentor, co-chair or chair dissertations. For more information, please go to [http://graduate.asu.edu/graduate\\_faculty\\_initiative](http://graduate.asu.edu/graduate_faculty_initiative).

**Establish Satisfactory Academic Progress Policies, Processes and Guidelines** – Check within the proposing academic unit and/or college to see if there are existing academic progress policies and processes in place. If none have been established, please go to [http://graduate.asu.edu/faculty\\_staff/policies](http://graduate.asu.edu/faculty_staff/policies) and scroll down to the **academic progress review and remediation processes** (for faculty and staff) section to locate the reference tool and samples for establishing these procedures.

**Establish a Graduate Student Handbook for the New Degree Program** – Students need to know the specific requirements and milestones they must meet throughout their degree program. A Graduate Student Handbook provided to students when they are admitted to the degree program and published on the website for the new degree gives students this information. Include in the handbook the unit/college satisfactory academic progress policies, current degree program requirements (outlined in the approved proposal) and provide a link to the Graduate College Policies and Procedures website. Please go to [http://graduate.asu.edu/faculty\\_staff/policies](http://graduate.asu.edu/faculty_staff/policies) to access Graduate College Policies and Procedures.

**Check Box Directions** – To place an “X” in the check box, place the cursor on the left-side of the box, right click to open the drop down menu, select **Properties**, under **Default value**, select **Checked** and then select **Ok**.