THE UNIVERSITY OF ARIZONA

New Academic Program Workflow Form

General

Proposed Name: Comp Science and Engineering

Transaction Nbr: 00000000000158

Plan Type: Major

Academic Career: Undergraduate

Degree Offered: Bachelor of Science

Do you want to offer a minor? Y

Anticipated 1st Admission Term: Fall 2023

Details

Department(s):

ENGR

DEPTMNT ID	DEPARTMENT NAME	HOST
2303	Electrical & Computer Engr	Y

Campus(es):

DIST

LOCATION	DESCRIPTION
CHANDLER	Chandler
YUMA	Yuma

MAIN

LOCATION	DESCRIPTION
TUCSON	Tucson

ONLN

LOCATION	DESCRIPTION
ONLN	Online

Admission application terms for this plan: Spring: Y Summer: Y Fall: Y

Plan admission types:

Freshman: Y Transfer: Y Readmit: Y Graduate: N

Non Degree Certificate (UCRT only): N

Other (For Community Campus specifics): N

Plan Taxonomy: 11.0701, Computer Science.

Program Length Type: Program Length Value: 0.00

Report as NSC Program:

SULA Special Program:

Print Option:

Diploma: Y Bachelor of Science Computer Science and Engineering

Transcript: Y Bachelor of Science Computer Science and Engineering

Conditions for Admission/Declaration for this Major:

All students are enrolled as Engineering, no major selected until they have completed the following:
- Calculus I with a grade of C or better
- 12 or more UA credits of coursework within the Engineering curriculum (shown above)

New first-year students CAN be admitted into the degree program, prior to enrolling at the University of Arizona--a student's eligibility for this option is conveyed to admitted students by the ENGR Academic Affairs Office, if/when a student is also admitted to Honors College.

Admissions GPA of 2.0 or higher

Requirements for Accreditation:

Computing Accreditation Commision (CAC) of Accreditation Board for Engineering and Technology (ABET)

Program Comparisons

University Appropriateness

Two of the UA College of Engineering's strategic pillars are:

1) Driving student success for a rapidly changing world, and
2) Tackling critical problems at the edges of human endeavor

The new BS Computer Science and Engineering degree plays a critical role in both pillars. The students graduating with a BS in Computer Science and Engineering will be well positioned to develop the skills and mindsets to be leaders in the areas of computing, machine learning, ever-increasing automation and connectivity, human and intelligent systems, data science, and network sciences.

By offering competitive, relevant, and experiential-based learning to prospective students, the proposed program has the potential to build a strong pipeline for undergraduate and graduate education in Computer Science and Engineering. It will contribute to the much-needed workforce development to close the talent gap in computing and expand the ability to grow research programs that are attractive to forthcoming undergraduate and graduate students. All of which contribute to higher recruitment numbers and bringing additional revenue to the College and University. To support the proposed program, we will recruit faculty who can significantly impact computing areas of research and education. These faculty will pursue externally funded, competitive research to advance the state-of-the-art in applied computer science and engineering and integrate their research into the curricula. The broader impacts of these faculty will ultimately lead to a nationally recognized computer science and engineering program at the University of Arizona. It is also anticipated to catalyze collaboration and strengthen the existing electrical and computer engineering program and other engineering disciplines in the College of Engineering.

Another goal of offering the BS Computer Science and Engineering degree is to increase the number of female and other underrepresented students in the College of Engineering by leveraging Broaden Participation in Computing (BPC) ¿ a national initiative by the Computing Research Association with support from the National Science Foundation (NSF) Directorate for Computer and Information Science and Engineering (CISE). Additional features and programs that contribute to enhancing student success and increasing diversity and inclusion will be included in the support infrastructure for the degree, aiming to foster academic cultures that are more inclusive of non-dominant identities and infuse policy-driven, identity-inclusive strategies throughout the entire program.

Arizona University System

NBR	PROGRAM	DEGREE	#STDNTS	LOCATION	ACCRDT
1	Computer Science	BS	1406	Univ of Arizona - Main Campus	N
2	Software Engineering	BS	100	Univ of Arizona - Main Campus	N
3	Software Engineering	BS	1494	ASU - Main	Y
4	Computer Science	BS	3358	ASU - Main	Y
5	Computer Science	BS	225	NAU	Y

Peer Comparison

See attached file for a comparison of the proposed program to other universities with similar programs.

The UA Computer Science and Engineering degree program is similar to the three peer programs that require and build strong foundational skills in math and/or physics (or other natural sciences), and computing applications as part of their curriculums. The math courses are similar and deviate only after Calculus II. All programs also offer several introductory and advanced programming courses using a variety of computer programming languages. Additional programming skill development/experience is an integral part of the experiential course work and projects in other required courses. All programs offer a course in algorithm analysis, and a variety of technical electives to match student special interest areas. Students in all the programs will be able to pursue software development careers in a variety of diverse and expansive applications areas including web-based development, mobile application development, embedded systems, robotics, machine learning, artificial intelligence, and other software-related fields.

The three Computer Science and Engineering programs (UA, UC Davis, and UofM) are interdisciplinary and offer full-semester courses in computer organization, probability and statistics, introductory hardware courses, and a capstone or major design project. The student learning outcomes (SLOs) and curriculum for the newly proposed College of Engineering CSE degree program, UC Davis and UofM¿s CSE degrees comply with the ABET /CAC program criterion for Computer Science programs. UC Davis and UofM¿s CSE programs are fully CAC accredited and the new UArizona CSE program will apply for accreditation after graduating our first student. (Note: The University of Arizona¿s current Computer Science program offered in the College of Science is not ABET / CAC accredited.)

While there are many similarities in the CSE and CS degree programs at UArizona, there are also key differences that are very attractive to incoming and prospective UArizona students. First and foremost, one of the CSE degree major strengths is the multi-disciplinary influences provided by the Systems and Industrial Engineering, and Electrical and Computer Engineering Departments. The elective options available to students are very diverse and can include courses that give students a broad-based experience in not only software engineering, but also Electrical Engineering and/or Systems Engineering specialties. The intersections of the ECE, SE, and the CSE degree programs, foster the ability to tackle interdisciplinary engineering problems to meet the evolving technological changes and requirements to meet society¿s needs. This manifests itself in CSE students being an integral part of the highly successful Interdisciplinary Capstone course (ENGR 498A/B) where students work on multi-disciplined teams to develop products for a diverse set of industry and/or

academia sponsors.

The new UArizona CSE courses will be developed using relevant and industry-focused technology solutions, tools, languages, and methodologies in a diverse portfolio of applications. Wherever possible, the software development tools and platforms used in the coursework will consist of widely available open-source integrated development environments (IDEs), operating systems (OS), and cloud-based infrastructures. The Software DevSecOps course uses a state-of-the-art software DevOps workflow approach integrated with security considerations using common tools used in the industry. Software DevSecOps enables students to develop, test, and deliver secure software products faster and more efficiently, while at the same time providing a development pipeline of new capabilities and features to consumers. Using DevOps workflows and continuous integration / continuous delivery (CI/CD) approaches, students will be able to plan, develop, and deliver software features to meet customer¿s ever-evolving needs. Students will also learn to track and evaluate how the software¿s quality, security and reliability is increased using the SW DevSecOps approaches.

As is often asked, what are the differences between the UArizona BS Computer Science Engineering degree and the UArizona CoS Computer Science degree? To begin with, the Computer Science Engineering degree complies with the ABET/CAC criteria for Computer Science degrees. The Computer Science degree is not compliant with ABET / CAC accreditation requirements. The CSE degree is comprised of 17 units of math, while the CS program has only 12 units of math. While there are some intersections in both programs between the topics and types of classes in each respective degree, the focus of each program is very different. In Computer Science, students focus more on the programming fundamentals and computer science theory. Computer Science and Engineering students, on the other hand, focus on the application of computer science principles to solve complex, multi-faceted/multi-disciplined engineering problems and product development. Computer Science and Engineering will provide a unique opportunity for students to deepen their knowledge of computer science and engineering topics by combining theory-based concepts with advanced, enabling computational techniques and technologies to create solutions that address the grand challenges of the 21st century, and beyond.

The BS Computer Science and Engineering curriculum applies computer science theory and software development fundamentals to produce computing-based solutions. It includes substantial coverage of engineering principles applied to the design of large, networked, scalable computing systems. Competencies include algorithms and complexity, concepts of multiple programming languages, software development, real-time, embedded, and IoT systems design and other broad-based engineering principles.

Both programs offer students the opportunity to select technical computing

electives that allow them to focus in areas they are interested in. Both programs also offer students the opportunity to pursue supplementary study in another field such as a minor or potentially even double majoring in an adjacent program.

Faculty & Resources

Faculty

Current Faculty:

INSTR ID	NAME	DEPT	RANK	DEGREE	FCLTY/%
00747035	Richard Scholes	2303	Adj. Lect.	Master of Science	.25
00823636	Michael Wu	2303	Professor	Doctor of Philosophy	.25
00971536	Donald Bruyere	2302	Lecturer	Doctor of Philosophy	.25
02600592	Kenneth Head	2302	Professor	Doctor of Philosophy	.25
03308095	Jerzy Rozenblit	2303	Distinguished Prof	Doctor of Philosophy	.25
09605103	Marwan Krunz	2303	Distinguished Prof	Doctor of Philosophy	.25
22060179	Ratchaneekorn Thamvichai	2303	Assoc. Prof. Pract.	Doctor of Philosophy	.25
22072066	Sharon O'Neal	2302	Prof. Pract.	Master of Science	.25
22083818	Diana Saldana Jimenez	2302	Assit. Prof. Pract.	Doctor of Philosophy	.25
22094595	Mohammad Abu matar	2303	Assoc. Prof	Doctor of Philosophy	.25
23113566	Umar Amjad	ENGR	Assit. Prof	Doctor of Philosophy	.25

Additional Faculty:

Projected Additional Resource Acquisition Plan (by Year) (On Campus + Online)

Resource Type	2023 - 2024	2024 - 2025	2025 - 2026	Total New Instructors Acquired Over 3 Years
Tenured Track Faculty	4	2	2	8
Professor of Practice	1	0	1	2
Adjunct	0	0	2	2

In summary, 8 Tenure Track faculty over 3 years, 2 Professor of Practice faculty

over 3 years, and 2 Adjunct faculty over 3 years

Current Student & Faculty FTE

DEPARTMENT	UGRD HEAD COUNT	GRAD HEAD COUNT	FACULTY FTE
2303	465	305	60.00

Projected Student & Faculty FTE

	UGRD HEAD COUNT			GRAD HEAD COUNT			FACULTY FTE		
DEPT	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3	YR 1	YR 2	YR 3
2303	525	605	765	305	320	350	65.00	70.00	76.00

Library

Acquisitions Needed:

None

Physical Facilities & Equipment

Existing Physical Facilities:

Office and laboratory space will be required for new faculty. It is currently anticipated that for the first 3 years of the program, the new facilities required can be accommodated in the current Electrical and Computer Engineering building.

Additional Facilities Required & Anticipated:

New laboratory equipment needed for Tenure Track faculty is included in estimated start-up packages and will vary depending on the nature of the research for acquired new faculty members.

Other Support

Other Support Currently Available:

The College of ENGR and ECE Dept is currently well structured and to be able to accommodate the new program, including IT support. Additional staff will be required and described below.

Other Support Needed over the Next Three Years:

It is anticipated that a new undergraduate advisor will be required to support new CSE students. It is also anticipated that an additional staff member will be required to support the ECE business office with grant writing, HR, and other support functions.

Comments During Approval Process

THE UNIVERSITY OF ARIZONA

NEW ACADEMIC PROGRAM – MAJOR
Preliminary Proposal Form

I. **Program Details**
   i. **Name (and Degree Type) of Proposed Academic Program:** BS Computer Science and Engineering (CSE)
   ii. **Emphases (if applicable):** None

b. **Academic Unit(s)/College(s):** College of Engineering, 2303 - Electrical and Computer Engineering Dept

c. **Campus/Location(s):** All campuses (including Main, Online, and Distance campuses in Yuma and Chandler)

d. **First Admission Term:**
   i. Fall 2023

e. **Primary Contact and Email:** Sharon ONeal sharononeal@arizona.edu

II. **Executive Summary:**

Develop a 120-unit ABET accredited Computer Science and Engineering (CSE) BS program with a planned Fall 2023 start date.

- The BS program will seek accreditation thru ABET's Computing Accreditation Commission (CAC) and/or the Engineering Accreditation Council (EAC).
- Provides an interdisciplinary engineering curriculum in closely related computing fields (computer science, software engineering, and computer engineering) .
- Serve local, state, and national increasing needs in engineering computing talent related to economic development and national security.
  a. Aligned with Arizona's New Economic Initiative
- Support and enable the University of Arizona's growth goals / initiatives.
  a. Increase student enrollments
  b. Increase research opportunities and collaborations

III. **Brief Program Description:**

The BS in Computer Science and Engineering provides a unique opportunity for students to deepen their knowledge of computer science and engineering topics by combining theory-based concepts with advanced, enabling computational techniques and technologies to create solutions that address the grand challenges of the 21st century, and beyond.

The BS Computer Science and Engineering curriculum applies computer science theory and software development fundamentals to produce computing-based solutions. It includes substantial coverage of engineering principles applied to the design of large, networked, scalable computing systems. Competencies include algorithms and complexity, computer science theory, concepts of multiple programming languages, software development, and real-time, embedded and IoT systems design and other engineering principles. The proposed CSE program offers distinct curriculum and learning outcomes for undergraduate students compared to other existing programs at the UA as the proposed program takes a holistic approach to coupling computing theory and applications with computer systems design and data science in a unified flow.

The program has a firm engineering foundation that is ABET CAC / EAC compliant and encompasses a discovery-based education utilizing an experiential learning approach. As a part of the curriculum, students complete projects in nearly every semester of the program that emphasize computing theory, communication, teamwork, critical thinking, and engineering professionalism. The program's flexibility allows students to design their course of study and select technical electives from a diverse pool of courses in software, computer science and computer engineering domains such as web and mobile applications, embedded systems, cybersecurity, machine learning, systems, and other interdisciplinary areas.

Program Rationale:

Two of the College of Engineering's strategic pillars are:

1) Driving student success for a rapidly changing world, and
2) Tackling critical problems at the edges of human endeavor

The new BS Computer Science and Engineering degree plays a critical role in both pillars. The students graduating with a BS in Computer Science and Engineering will be well positioned to develop the skills and mindsets to be leaders in the areas of computing, machine learning, ever-increasing automation and connectivity, human and intelligent systems, data science, and network sciences.

By offering competitive, relevant, and experiential-based learning to prospective students, the proposed program has the potential to build a strong pipeline for undergraduate and graduate education in Computer Science and Engineering. It will contribute to the much-needed workforce development to close the talent gap in computing and expand the ability to grow research programs that are attractive to forthcoming undergraduate and graduate students. All of which contribute to higher recruitment numbers and bringing additional revenue to the College and University. To support the proposed program, we will recruit faculty who can significantly impact computing areas of research and education. These faculty will pursue externally funded, competitive research to advance the state-of-the-art in applied computer science and engineering and integrate their research into the curricula. The broader impacts of these faculty will ultimately lead to a nationally recognized computer science and engineering program at the University of Arizona. It is also anticipated to catalyze collaboration and strengthen the existing electrical and computer engineering program and other engineering disciplines in the College of Engineering.

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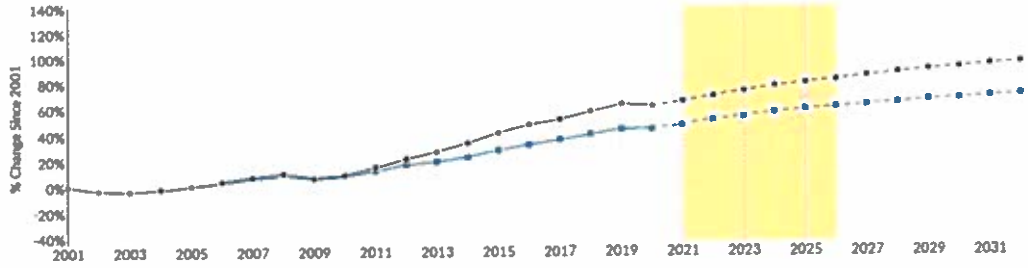
IV. **Projected Enrollment for the First Five Years:** The projected enrollment in the Computer Science and Engineering BS degree program across all campuses is shown in the table below *(note that the projections are extended to a 5-year period to be consistent with the extended financial analysis timeframe)*. The basis for these projections was derived by comparing enrollments at other AAU universities that have a dual Computer Science program in both their College of Engineering (or similar) and another college.

Degree	Year 1 (2023 / 2024)	Year 2 (2024 / 2025)	Year 3 (2025 / 2026)	Year 4 (2026 / 2027)	Year 5 (2027 / 2028)
BS	60	140	300	425	500

V. **Evidence of Market Demand:** The market demand for those trained in engineering computing disciplines is projected to have significant growth in both the near- and long-term futures. Specifically, the chart below shows the growth in computing-related jobs up to 2021, as well as the projected growth through 2033, both regionally (Arizona, California, Nevada, New Mexico, Utah) and nationally.[1]



Region	2021 Jobs	2026 Jobs	Change	% Change
Region	1,010,147	1,115,128	104,981	10.4%
Nation	5,406,515	5,892,114	485,599	9.0%

Note that computing-related job growth within our region is projected to grow at a faster pace than the nation as a whole. Thus, this new degree program will serve both local, state, and national needs related to employment, economic development, and national security. Indeed, these degree programs are among the most important in support of the ongoing fourth industrial revolution and in close alignment with Arizona's New Economy Initiative[2].

The full marketing and analysis report for the state of Arizona can be found at the following link:
https://arizona.box.com/s/k4d8cj657sqv6bban2yyi4gcf0paqi0e

[1] Emsi Q2 2022 Data Set, www.economicmodeling.com
[2] World Economic Forum. https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

The full marketing and analysis report for the nation can be found at the following link:
https://arizona.box.com/s/stizctd27mfeltaxsv2ylmgfa8zgsoco

VI. **Similar Programs Offered at Arizona Public Universities:**

University	Program	College
University of Arizona	BS Software Engineering	College of Engineering
University of Arizona	BA and BS Computer Science	College of Science
University of Arizona	BS Computer Science BAS Applied Computing	College of Applied Science and Technology
Arizona State University	BS Software Engineering	School of Computing and Augmented Intelligence, IRA A Fulton Schools of Engineering
Arizona State University	BS Computer Science	School of Computing and Augmented Intelligence, IRA A Fulton Schools of Engineering
Northern Arizona University	BS Computer Science	School of Informatics, Computing, and Cyber Systems

VII. **Resources**

a. **Summarize new resources required to offer the program *time phased over the next 5 years*:**

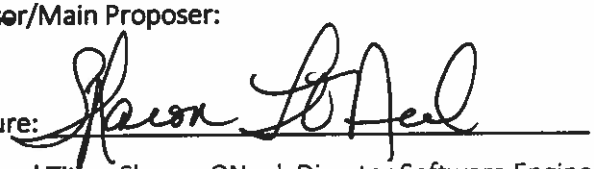
Resources	Quantity
Faculty	**13**
Staff	**2**
Other (TAs, Graders, LAs) *(total # Semester hires over 5 years)*	**28 TAs** *(over 5 years)* **30 Graders** *(over 5 years)* **28 Lab Assistants** *(over 5 years)*
Equipment	**New research and lab equipment is included in the startup packages for new TT faculty**

Facilities	Office and lab space *(for new faculty)*

b. Estimate total expected cost: $13, 135,688 *(extrapolated over 5 years)*
c. Estimate total expected revenue of the program: $12,076,989 *(extrapolated over 5 years)*

VIII. Required Signatures

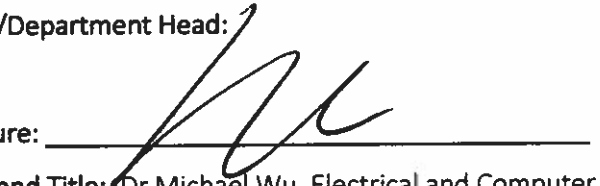
a. ~~Program Director~~/Main Proposer:

i. Signature: 

ii. **Name and Title:** Sharon ONeal, Director Software Engineering

iii. **Date:** 10/21/2022

b. **Managing Unit/Department Head:**

i. **Signature:** 

ii. **Name and Title:** Dr Michael Wu, Electrical and Computer Engineering (ECE) Dept Head

iii. **Date:** 10/21/2022

c. **College Dean/Associate Dean:**

i. **Signature:** 

ii. **Name and Title:** Dr David Hahn, Dean College of Engineering

iii. **Date:** 10/21/2022

THE UNIVERSITY OF ARIZONA

ACADEMIC PROGRAM – ADDITIONAL INFORMATION FORM

To be used once the preliminary proposal has been approved.

I. MAJOR REQUIREMENTS

UNDERGRADUATE

Total units required to complete the degree	120
Upper-division units required to complete the degree	62
Foundation courses	
Second language	None required
Math	• MATH 122 A/B - Calculus I (5 units) • MATH 129 – Calculus II *(included in GenEd Foundations)* (3 units) • Math 243 – Discrete Math (3 units) • SIE 305 – Introduction to Probability and Statistics (3 units) • MATH Elective (Linear Algebra, Number Theory, Numerical Methods, or Vector Calculus) (3 units)
General education requirements	• UNIV 101 - Introduction to Gen-Ed Experience (1 unit) • Foundations - ENGL 101 and ENGL 102 - English Composition I and II (6 units) • Foundations – MATH 129 (3 units) • Exploring Perspectives – Artist (3 units) • Exploring Perspectives – Humanist (3 units) • Exploring Perspectives – Social Scientist (3 units) • Exploring Perspectives – Natural Scientist (3 units) • Building Connections – (9 units) • UNIV 301 - General Education Portfolio (1 unit)
Pre-major? (Yes/No). If yes, provide requirements. Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.	Yes. Completion of 12 or more UA credits of coursework within the Engineering curricula may that include: • MATH 122 A/B or MATH 125 – Calculus I • MATH 129 – Calculus II • ENGL 101 – English Composition I • ENGR 102 – Intro to Engineering

	• CSE 101 – Programming I • Natural Science (varying courses)
List any special requirements to declare or gain admission to this major (completion of specific coursework, minimum GPA, interview, application, etc.)	All students are enrolled as *Engineering*, *No Major Selected* until they have completed the following: • Calculus I with a grade of C or better • 12 or more UA credits of coursework within the Engineering curriculum (shown above) Admissions GPA of 2.0 or higher New first-year students CAN be admitted into the degree program, prior to enrolling at the University of Arizona. A student's eligibility is conveyed to admitted students by the ENGR Academic Affairs Office, if/when a student is also admitted to Honors College.
Major requirements	
Minimum # of units required in the major (units counting towards major units and major GPA)	55
Minimum # of upper-division units required in the major (upper division units counting towards major GPA)	41 units
Minimum # of residency units to be completed in the major	30
Required supporting coursework (courses that do not count towards major units and major GPA, but are required for the major).	MATH 122 A/B Calculus I (5 units) MATH 129 Calculus II (3 units) MATH 243 Discrete Math (3 units) 200-level Natural Science with Lab (4 units) MATH Elective (3 units)
Major requirements. List all major requirements including core and electives. If applicable, list the emphasis requirements for each proposed emphasis*. Courses listed count towards major units and major GPA. Courses listed must include prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions	**Major Core (46 units)** ENGR 102 A/B - Introduction to Engineering (3 units) CSE 101 – Programming I (4 units) NEW CSE 201 – Programming II (3 units) NEW ECE 274A – Digital Logic (4 units) CSE 301 Data Management (3 units) NEW SIE 305 – Engineering Probability and Statistics (3 units)

needed (house number limit, etc.). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.	CSE 302 – Theory of Computation (3 units) NEW CSE 303 – Fundamentals of Computer Architecture (3 units) NEW ECE 311 – Engineering Ethics (1 unit) SFWE 302 – Software Architecture and Design (3 units) CSC 355 – Data Structures and Algorithms (3 units) SFWE 402 – Software DevSecOps (4 units) CSE 401 – Operating System Design (3 units) NEW ENGR 498A – Interdisciplinary Capstone (3 units) ENGR 498B – Interdisciplinary Capstone (3 units) **Technical Electives (9 units)** Select 9 units of UD computing technical electives from other Engineering courses (i.e. ECE, SIE, or other applicable engineering courses), CSC or ISOC. See major advisor for course approval.
Internship, practicum, applied course requirements (Yes/No). If yes, provide description.	Complete 6 units: ENGR 498 A and ENGR 498B (Interdisciplinary Capstone in Senior year)
Senior thesis or senior project required (Yes/No). If yes, provide description.	Yes. Interdisciplinary Design project that is part of ENGR 498 A/B.
Additional requirements (provide description)	None
Minor (specify if optional or required)	Optional. There are 18 units of General Electives that can count toward a minor if the student so desires.
Any double-dipping restrictions (Yes/No)? If yes, provide description.	No

II. CURRENT COURSES

Course prefix and number (include cross-listings)	Units	Title	Pre-requisites	Modes of delivery (online, in-person, hybrid)	Typically Offered (F, W, Sp, Su)	Dept signed party to proposal? (Yes/No)
UNIV 101	1	Intro to the Gen-Ed Experience	None	online, in-person	F, Sp, Su	N/A
ENGL 101	3	Freshman Composition I	None	online, in-person	F, Sp, Su	N/A
ENGL 102	3	Freshman Composition II	None	online, in-person	F, Sp, Su	N/A
Student Selected	3	Exploring Perspectives – Artist	Gen Ed (varying)	online, in-person	F, Sp, Su	N/A
Student Selected	3	Exploring Perspectives – Humanist	Gen Ed (varying)	online, in-person	F, Sp, Su	N/A
Student Selected	3	Exploring Perspectives – Social Scientist	Gen Ed (varying)	online, in-person	F, Sp, Su	N/A
Student Selected	3	Exploring Perspectives – Natural Scientist	Gen Ed (varying)	online, in-person	F, Sp, Su	N/A
Student Selected	9	Building Connections – (3 courses)	Gen Ed (varying)	online, in-person	F, Sp, Su	N/A
UNIV 301		UNIV 301 - General Education Portfolio (1 unit)	None	online, in-person	F, Sp, Su	N/A
MATH 122 A/B	5	Calculus I	MATH 120R or PPL 75	online, in-person	F, Sp, Su	Yes
MATH 129	3	Calculus II	MATH 122B or MATH 125	online, in-person	F, Sp, Su	Yes
MATH 243	3	Discrete Math	MATH 129	online, in-person	F, Sp, Su	Yes

Student Selected	4	Exploring Perspectives – Natural Scientist w/Lab	Varying/Placement	online, in-person	F, Sp, Su	N/A
ENGR 102	3	Introduction to Engineering	MATH 112 or PPL 60	online, in-person	F, Sp	N/A
ECE 274A	4	Digital Logic	ECE 175 (or CSE 101)	online, in-person	F, Sp	N/A
ECE 311	1	Engineering Ethics	None	online, in-person	Contact Dept	N/A
CSC 355	3	Algorithm Design and Analysis	MATH 243 and CSE 201	online, in-person	F	Yes
SIE 305	3	Introduction to Probability / Statistics	MATH 129	online, in-person	F, Sp, Su	Yes
MATH 313 or MATH 315 (or other MATH courses as approved by department)	3	Introduction to Linear Algebra *or* Introduction to Number Theory and Modern Algebra	Varying	online, in-person	F, Sp, Su F, Sp	Yes
SFWE 302	3	Software Architecture and Design	ECE 275 (or CSC 202)	online, in-person	Sp	Yes
SFWE 402	4	Software DevSecOps	ECE 275 (or CSE 201) and SFWE 302	online, in-person	F	Yes
Student Selected	9	Upper Division Computing Electives (varying)	Varying	online, in-person	F, Sp	N/A
Student Selected	18	General Electives (varying)	Varying	online, in-person	F, Sp	N/A
ENGR 498 A/B	6	Interdisciplinary Capstone	Senior Status	online, in-person	F, Sp	N/A

III. NEW COURSES NEEDED

Course prefix and number (include cross-listings)	Units	Title	Pre-requisites	Modes of delivery (online, in-person, hybrid)	Status*	Anticipated first term offered	Typically Offered (F, W, Sp, Su)	Dept signed party to proposal? (Yes/No)	Faculty members available to teach the courses
CSE 101	4	Programming I	MATH 112 (Co-requisite)	online, in-person	D	Spring 2024	F, Sp	Yes	TBR (potentially new faculty)
CSE 201	3	Programming II	CSE 101	online, in-person	D	Fall 2024	F, Sp	Yes	TBR (potentially new faculty)
CSE 301	3	Data Management	CSE 201	online, in-person	D	Spring 2025	Sp	Yes	TBR (potentially new faculty)
CSE 302	3	Theory of Computation	Math 243	online, in-person	D	Fall 2025	F	Yes	TBR (potentially new faculty)
CSE 303	3	Fundamentals of Computer Architecture	ECE 274A	online, in-person	D	Fall 2025	F	Yes	TBR (potentially new faculty)
CSE 401	3	Operating System Design	CSE 201 and CSE 303	online, in-person	D	Spring 2026	Sp	Yes	TBR (potentially new faculty)

*In development (D); submitted for approval (S); approved (A)

IV. FACULTY INFORMATION-

Faculty Member	Involvement	UA Vitae link or Box folder link
Dr Mohammad Abu Matar	Teach SFWE 302	https://arizona.box.com/s/7trdpezytljufs2b1bn8fzgawtq8k46g
Dr Diana Saldana	Teach CSC 355	https://profiles.arizona.edu/person/dianasaldana
Dr Larry Head	Teach ENGR 498 A/B	https://profiles.arizona.edu/person/klhead
Sharon ONeal	Teach SFWE 402 Software DevSecOps	https://profiles.arizona.edu/person/sharononeal
Dr Umar Amjad	Teach ENGR 102	https://arizona.box.com/s/i8vkk0nswc3cqo76bp3i73qost5xishl
Dr Ratchaneekorn Thamvichai	Teach 274A	https://profiles.arizona.edu/person/rthamvichai
Richard Scholes	Teach ECE 311	https://arizona.box.com/s/x1v3dd0cgjnrmm5yfr8cwe1f6ptep916
Don Bruyere	Teach SIE 305	https://profiles.arizona.edu/person/dbruyere
Dr Jerzy Rozenblit	Conduct/collaborate in CSE related research	https://profiles.arizona.edu/person/jerzyr
Dr Marwan Krunz	Conduct/collaborate in CSE related research	https://profiles.arizona.edu/person/krunz
Dr Ming Li	Conduct/collaborate in CSE related research	https://profiles.arizona.edu/person/lim
Dr Michael Wu	Conduct/collaborate in CSE related research	https://arizona.box.com/s/zktwrqsna7r7f53bcubhe4b82m7w9mkd
Dr Salim Hariri	Conduct/collaborate in CSE related research	Salim A Hariri | UA Profiles (arizona.edu)

V. GRADUATION PLAN

Semester 1		Semester 2		Semester 3		Semester 4	
Course prefix and number	Units	Course prefix and number	Units	Course prefix and number	Units	Course prefix and number	Units
ENGL 101	3	ENGL 102	3	MATH 243	3	SIE 305	3
ENGR 102	3	MATH 129	3	CSE 201	3	CSE 301	3
MATH 122 A/B	5	CSE 101	4	ECE 274A	4	CSC 355	3
Gen-Ed (Expl Persp (EP) Artist)	3	Science Natural w/Lab	4	Gen-Ed (EP Humanist)	3	SFWE 302	3
UNIV 101	1			Gen-Ed (EP Social Scientist)	3	MATH 313 or MATH 315	3
Total	15	Total	14	Total	16	Total	15

Semester 5		Semester 6		Semester 7		Semester 8	
Course prefix and number	Units	Course prefix and number	Units	Course prefix and number	Units	Course prefix and number	Units
CSE 302	3	CSE 401	3	ENGR 498A	3	ENGR 498B	3
CSE 303	3	UD Computing Elective 1	3	SFWE 402	4	UD Computing Elective 3	3
General Elective 1	3	General Elective 3	3	UD Computing Elective 2	3	General Elective 5	3
General Elective 2	3	General Elective 4	3	UNIV 301	1	General Elective 6	3
Gen-Ed (EP Natural Scientist)	3	Gen-Ed (Building Connections)	3	Gen-Ed (Building Connections)	3	Gen-Ed (Building Connections)	3
		ECE 311	1				
Total	15	Total	16	Total	14	Total	15

VI. Curriculum Map and Assessment Map

Program: BS Computer Science and Engineering

Learning Outcome #1: *Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.*
Concepts: Students will apply knowledge of various programming languages, algorithms, and computational elements to satisfy complex computing problems. Students will take courses in computer programming in multiple languages, digital logic, probability and statistics, data structures and algorithms, data collection, organization and management, theory of computation and operating system design.
Competencies: Students will demonstrate knowledge of the design, implementation, and test/analysis of computing solutions. Throughout their coursework, students will learn and use at least 2 different programming languages, understand digital logic and fundamental computer architectures, learn to apply probability and statistics to engineering applications, and apply computing theory and algorithms to analyze and develop diverse computing solutions.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: “Exemplary”, “Satisfactory”, “Developing”, and “Unsatisfactory”. Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores “Developing” or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for the following existing courses will be used: ECE 274A, SIE 305, CSC 355 and ENGR 498A/B. Specific sources of evidence (homework, exams, student projects) and measures will be identified in each of the following new courses and used in a rubric based assessment: CSE 101, CSE 201, CSE 301, CSE 302, and CSE 401. For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.
Learning Outcome #2: *Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline.*
Concepts: Students will apply knowledge of various programming languages, algorithms, and computational elements to satisfy specified requirements. They will use various modeling techniques such as the Unified Modeling Language (UML) and other object-

oriented concepts to design solutions that meet specified requirements. Students will implement their designs in an appropriate programming language and evaluate/verify whether the implemented code adequately meets the functional and nonfunctional requirements specified.
Competencies: Students will learn modern design / modeling techniques used to capture and evaluate the design of a computing solution. Students will also develop unique designs that meet specified requirements. Additionally, students will evaluate and verify that the specified requirements have been satisfied in the implementation of the product design.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: "Exemplary", "Satisfactory", "Developing", and "Unsatisfactory". Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores "Developing" or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for following existing courses will be used: SFWE 302. Specific sources of evidence (homework, exams, student projects) and measures will be identified in each of the following new courses and used in a rubric based assessment: CSE 201, CSE 301, CSE 302, CSE 303, and CSE 401. For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.
Learning Outcome #3: *Communicate effectively in a variety of professional contexts.*
Concepts: Students will apply different communication strategies to share engineering principles and solutions with a wide variety of audiences. They will utilize their writing skills gained in English composition courses to develop technical specifications, documents, and presentations related to the computing-based coursework and projects that are shared in written and presentation-style formats with a variety of audiences including other students, faculty, and industry representatives for sponsored capstone projects.
Competencies: Students will demonstrate their ability to communicate engineering and computing-based solutions via written reports, presentations, and interactions with team members and other stakeholders.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: "Exemplary", "Satisfactory", "Developing", and "Unsatisfactory". Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores "Developing" or

below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for following existing courses will be used: SFWE 302 and ENGR 498A/B. (Additional measures may be used as new courses are developed that have significant projects requiring students to document and communicate their technical solutions to computing based problems.) For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.
Learning Outcome #4: *Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.*
Concepts: Students will effectively utilize knowledge of legal and ethical standards and guidelines used in computing practices. They will apply their knowledge throughout the development of their capstone project as they complete trades related to their design solutions. Students will likely utilize/integrate commercially, and potentially proprietary elements provided by project sponsors in their capstone projects. Students complete a 1-unit course in engineering ethics that consists of various case studies in ethical aspects involved with engineering and using computing-based solutions/products.
Competencies: Students will demonstrate their ability to understand and utilize legal and ethical practices followed in computing professions. They will understand concepts such as intellectual property, the safety, health, and welfare of the public, academic and professional integrity, and other similar topics related to engineering ethics.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: “Exemplary”, “Satisfactory”, “Developing”, and “Unsatisfactory”. Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores “Developing” or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for following existing courses will be used: ECE 311 and ENGR 498A/B. (Additional measures may be used as new courses are developed that have significant projects requiring students to employ ethical practices as they develop technical solutions to computing based problems.) For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.
Learning Outcome #5: *Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline.*
Concepts: Students will utilize teaming, communication, and collaboration skills to develop large scale and complex computing solutions/products. Students will learn how to break a large project into smaller segments/subsystems/tasks that are allocated and

performed across teams which have at least 4+ team members. Students will use a learn and use a variety of communication strategies that allow them to share their own progress on tasks and also contribute to peer tasking to achieve common goals. Students will also learn fundamental leadership strategies used to coordinate and facilitate teamwork, resolving conflict with peers and others, collecting and reporting status to others, and keeping the team focused on achieving their commitments.
Competencies: Students will develop skills that allow them to plan, communicate status, perform tasking required to meet project milestones, resolve conflict, and work as a team to achieve goals and deliver computing products.
Assessment Methods: This outcome will predominately be assessed in peer / team evaluations that are provided throughout the 2 semesters of ENGR 498A and ENGR 498B. The evaluations are required of all team members working on the interdisciplinary capstone project after each interim project deliverable or review is submitted/conducted (approximately 3 times per semester). The evaluation requires each team member to evaluate the other team members contributions to the project at each major milestone. Team members are evaluated based on their overall technical contributions, ability to work with the team, amount of effort continued to the project, and dependability. At the completion of the capstone project, the project's sponsor also completes an evaluation of each team members contributions and performance on the project throughout the 2 semesters. The course instructor also provides an assessment of how each team member and team leaders worked together throughout the semester on achieving the project goals and implementation.
Measures: Instructor grading of the ENGR 498 A/B team and project sponsor evaluations submitted by each student and the project sponsors. (Additional measures may be used as new courses are developed that have significant projects requiring students to work in teams to develop technical solutions to computing based problems.) A student self-assessment survey will also be used for indirect measures of the outcome
Learning Outcome #6: *Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]*
Concepts: Students will utilize their acquired mathematical, automation, and computation theory knowledge to analyze and develop computing-based solutions to meet a given problem statement. They will demonstrate their ability to analyze complex problems to determine whether solutions can be automated, evaluate resources required to implement / automate the problem as a function of the size and complexity of the anticipated input stimuli and other key parameters, and develop optimal implementations to address a given problem statement.
Competencies: Students will use mathematical analysis and computer theory to evaluate the complexities and magnitude of a given problem space, evaluate different approaches and designs that could be used to implement computing-based solutions to said problems, and implement the solutions developed.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: "Exemplary", "Satisfactory", "Developing", and "Unsatisfactory". Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment

	identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores "Developing" or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
	Measures: The currently defined measures for following existing courses will be used: ECE 274A, SFWE 302 and ENGR 498A/B. Specific sources of evidence (homework, exams, student projects) and measures will be identified in each of the following new courses and used in a rubric based assessment: CSE 302 and CSE 401. For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.

The Taskstream Curriculum Map is shown below:

9/29/22, 11:15 AM Curriculum Map - Courses and Activities Mapped to BS Computer Science & Engineering

University of Arizona AMS » Sandboxes
Ingrid Novodvorsky Playspace

BS Computer Science and Engineering

Courses and Activities Mapped to BS Computer Science & Engineering

	Outcome					
	Outcome 1: Analysis Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	Outcome 2: Design, Implementation, & Evaluation Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	Outcome 3: Communicaton Communicate effectively in a variety of professional contexts.	Outcome 4: Ethics Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	Outcome 5: Teamwork Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	Outcome 6: Application Apply computer science theory and software development fundamentals to produce computing-based solutions.
Courses and Learning Activities						
ENGL 101 Freshman Composition			P/A			
ENGL 102 Freshman Composition			P/A			
MATH 122 A/B Calculus I	I/A					I/A
MATH 129 Calculus II	P/A					
Basic Science Including Lab	I/A					
ENGR 102 Intro to Engineering		I			I	
CSE 101 Programming I	IPA					
MATH 243 Discrete Math	P/A					
CSE 201 Programming II	P/A	P/A				
ECE 274A Digital Logic	P/A				P/A	P/A
CSE 301 Data Management	P/A	P/A				
CSE 302 Theory of Computation	P/A	P/A				IPA
CSE 303 Fund. of Computer Architecture		P/A				
ECE 311 Engineering Ethics			I/A	I/A		
SIE 305 Probability & Statistics	P/A	P/A				
SFWE 302 Software Architecture & Design		P/A	P/A		P/A	P/A

https://folio.taskstream.com/Folio/CurMap/view.asp?qyz=QM56SPQCTbaich67RV6&folder_id=p6cgzqcs00pezbz0h6cpcscscj&map_id=fkhffxcjzrhrct&viewMode=Print&bShowAll=1 1/2

9/29/22, 11:15 AM

Curriculum Map - Courses and Activities Mapped to BS Computer Science & Engineering

	Outcome					
	Outcome 1: Analysis Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	Outcome 2: Design, Implementation, & Evaluation Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	Outcome 3: Communicaton Communicate effectively in a variety of professional contexts.	Outcome 4: Ethics Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	Outcome 5: Teamwork Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	Outcome 6: Application Apply computer science theory and software development fundamentals to produce computing-based solutions.
CSE 401 Operating Systems	P/A	P/A				P/A
ENGR 498A/B Senior Capstone			P/A	P/A	P/A	P/A
Exit Survey Indirect Measure	A	A	A	A	A	A

Legend : I Introduced; P Practiced; A Assessed; I/P Introduced/Practices; P/A Practiced/Assessed

VII. PROGRAM ASSESSMENT PLAN

Assessment Measure	Source(s) of Evidence	Data Collection Point(s)
Student Academic Advising Report (SAAR)	Online record keeping database to which the student and advisor have access.	At the end of an academic year at a minimum
ABET Academic Program Review	ABET Program Evaluators responses	Every 6 years
Rubrics for ***existing*** CSE courses used to assess each student outcome that identifies criteria, measure of assessment, and an achievement level rating *(i.e., Exemplary, Satisfactory, Developing, Unsatisfactory).*	Class assignments Exams Course Projects Course Reports Other forms of student work tailored to any specific course)	End of each semester the specific courses are taught
Rubrics for all ***new*** CSE courses used to assess each student outcome that identifies criteria, measure of assessment, and an achievement level rating *(i.e., Exemplary, Satisfactory, Developing, Unsatisfactory).*	Class assignments Exams Course Projects Course Reports Other forms of student work tailored to any specific course)	End of each semester the specific courses are taught
Root cause and corrective action plans	Results of individual course rubric assessments	End of each semester the specific courses are taught
Senior exit survey (used for indirect measures of outcomes).	Student survey	At student graduation

Continuous improvement opportunities (recommended by the Undergraduate Committee (UGC))	Assessment Data	At the end of an academic year
Industry needs assessment	Required Curriculum	Every 4 years
CSE educational objectives	Course / Program Objectives	Annually prior to faculty retreat
Senior degree check	Review of student degree requirements	Semester prior to graduation

VIII. ANTICIPATED STUDENT ENROLLMENT-complete the table below. What concrete evidence/data was used to arrive at the numbers?

5-YEAR PROJECTED ANNUAL ENROLLMENT					
	1st Year	2nd Year	3rd Year	4th Year	5th Year
Number of Students	60	140	300	425	500

Data/evidence used to determine projected enrollment numbers:

Several AAU universities with dual Computer Science BS programs in either the College of Engineering (or equivalent) and another university were canvassed for program enrollment. The table below shows the total enrollment in several of these programs[1]:

[1] Enrollments derived from https://shinyapps.asee.org/apps/Profiles/

Summary of AAU Universities with Dual Computer Science Degree Programs in Different Colleges *(including Engineering)*

University	College	Degree Type	Degree Name	Total Enrollment (2020)**
University of California - Berkeley	College of Engineering	BS	Electrical Engineering and Computer Science (EECS)	1519
	College of Letters and Science	BA	Computer Science	1465
University of California - Davis	College of Engineering	BS	Computer Science and Engineering	349
	College of Letters and Science	BS	Computer Science	931
University of Florida	College of Engineering	BS	Computer Science (CSE)	758
	College of Liberal Arts and Sciences	BS	Computer Science (CSC)	464
University of Illinois - Urbana-Champaign	Grainger College of Engineering	BS	Computer Science	2001
	Grainger College of Engineering	BS	Mathematics and Computer Science	*UNK*
	Grainger College of Engineering	BS	Statistics and Computer Science	*UNK*
	College of Liberal Arts and Sciences	BS	CS + X Programs (where X = several different disciplines)	*UNK*
University of Iowa	College of Liberal Arts and Sciences	BA	Computer Science	*UNK*
	College of Liberal Arts and Sciences	BS	Computer Science	*UNK*
	Dual Program: CLAS & Engineering	BSE	Computer Science and Engineering	*UNK*
University of Michigan	College of Engineering	BSE	Data Science	100
	College of Engineering	BSE	Computer Science	1261
	College of Literature, Science and the Arts	BS	Computer Science	542
The Ohio State University	College of Engineering	BS	Computer Science and Engineering	1754
	College of Engineering	BA	Computer and Information Science	617
	College of Engineering	BS	Computer and Information Science	
University of Minnesota - Twin Cities	College of Science and Engineering	BS	Computer Science	1104
	College of Liberal Arts and Sciences	BA	Computer Science	*UNK*

IX. ANTICIPATED DEGREES AWARDED.

PROJECTED DEGREES AWARDED ANNUALLY					
	1st Year	2nd Year	3rd Year	4th Year	5th Year
Number of Degrees	0	40	60	100	125

Data/evidence used to determine number of anticipated degrees awarded annually:

These estimates are based on the projected total enrollments over the first 5 years of the program, which includes potential student transfers into the program in the earlier years of the program. For example, it is anticipated that some students in the 1st year of the program will transfer from other majors, while continuing to add new students that enroll in the program as freshman. Students are expected to graduate as soon as the third year of the program, based on other similar programs that were recently started at UArizona (i.e., BS Software Engineering).

Additionally, an analysis of other AAU university graduation rates in similar programs was performed as defined in the National Center for Education Statistics[2]. We also looked at the degrees awarded published on the ASEE Profile of Engineering Technology[3] website for computer science programs specifically awarded within engineering. In particular, the AAU universities considered are shown in the table below:

AAU University	Number of BS Awards Conferred in 2020-2021 (NCES)	Number of BS Awards Conferred in 2020 (ASEE)
University of California - Berkeley	696	440 (includes EE & CS counts)
University of California – Davis	329	64
University of Florida	308	180
University of Illinois – Urbana Champaign	381	508
University of Iowa	138	Unknown
University of Michigan	1142	524
The Ohio State University – Main Campus	113	421
University of Minnesota – Twin Cities	689	329

X. PROGRAM DEVELOPMENT TIMELINE

[2] https://nces.ed.gov/collegenavigator/
[3] https://shinyapps.asee.org/apps/Profiles/

The BS CSE program utilizes several existing courses within the College of Engineering, Department of Mathematics, and other colleges/schools (i.e., Gen-Eds, natural sciences, general electives).

The table below shows the preliminary plan for the new BS Computer Science and Engineering course development required for the program. We will work closely with UA's University Center for Assessment, Teaching and Technology (UCATT) and UA Online to execute the plan shown in the table below.

Course Number / Name	Planned Development Timeframe	First Semester Offered
CSE 101 – Programming I	Fall 2023	Spring 2024
CSE 201 – Programming II	Spring 2024	Fall 2024
CSE 301 - Data Management	Fall 2024	Spring 2025
CSE 302 – Theory of Computation	Spring 2024	Fall 2025
CSE 303 – Fundamentals of Computer Architecture	Spring 2024	Fall 2025
CSE 401 – Operating Systems	Fall 2025	Spring 2026

We will work closely with the recruitment and marketing teams within the College of Engineering to market the program as soon as the degree program is approved by ABOR. Additionally, we will also work with Arizona Online and Distance learning to market the program through their marketing channels.

IX. **Program Fees and Differential Tuition (PFDT) Request** – For implementation of fees, you must work with University Fees. The annual deadline is December 1. For any questions, please contact the University Fees Program Manager.

We are currently not proposing that there be program fees associated with any new courses or the program at large.

Appendix A. Minor or Master's Requirements. Complete if requesting a corresponding minor/master's.

MINOR:

Minimum total units required	19
Minimum upper-division units required	12
Total transfer units that may apply to the minor	6
List any special requirements to declare/admission to this minor (completion of specific coursework, minimum GPA, interview, application, etc.)	• Meet with academic advisor and obtain permission to declare minor • Complete all pre-requisite coursework

Minor requirements. List all minor requirements including core and electives. Courses listed must include course prefix, number, units, and title. Mark new coursework (New). Include any limits/restrictions needed (house number limit, etc.). Provide email(s)/letter(s) of support from home department head(s) for courses not owned by your department.	• CSE 101 Programming I (4 units) (New)
	• (New) CSE 201 Programming II (3 units)
	• CSC 355 Algorithm Design and Analysis (3 units)
	• CSE 302 Theory of Computation (3 units) (New)
	• Choose 2 electives from the following courses (minimum 6 units):
	  ○ CSE 301 Data Management (3 units) (New)
	  ○ CSE 303 Fundamentals of Computer Architecture (3 units) (New)
	  ○ SFWE 302 Software Design Process (3 units)
	  ○ SFWE 402 Software DevSecOps (4 units)
	  ○ UD Computing Elective (3 units) *(consult with advisor)*

Internship, practicum, applied course requirements (Yes/No). If yes, provide description.	None
Additional requirements (provide description)	None
Any double-dipping restrictions (Yes/No)? If yes, provide description.	No

MASTER'S:

A separate proposal is being submitted for a MS and PhD in Computer Science and Engineering.

Appendix B. Emphasis Print Information-if applicable, complete the table below to indicate if proposed emphases should be printed on transcript and diploma. Add rows as needed. Note: emphases are displayed on transcript and diplomas as " _____ Emphasis".

Emphasis	Print on transcript	Print on diploma
Not Applicable	N/A	N/A

THE UNIVERSITY OF ARIZONA

ACADEMIC PROGRAM – ADDITIONAL INFORMATION FORM

To be used once the preliminary proposal has been approved.

Appendix C. ABOR Form

Request to Establish New Academic Program in Arizona

Please complete all fields. Boxes may be expanded to accommodate longer responses. Clarifying field descriptions can be found below. Should you have any questions or concerns, please email Helen Baxendale, Director of Academic Affairs and Policy at helen.baxendale@azregents.edu

University: University of Arizona

Name of Proposed Academic Program: Bachelor of Science (BS) Computer Science and Engineering
Academic Department: College of Engineering, 2303 - Electrical and Computer Engineering Department
Geographic Site: All University of Arizona campuses including Main Campus (Tucson), Arizona Online, Distance campuses (Yuma, Chandler, Sierra Vista)
Instructional Modality: Primary modality will be Immersion / In-person, online / ONLN and Distance campuses. (However, there may be iCourses and/or hybrid courses offered to complement the In-person and Online modalities.)
Total Credit Hours: 120 Credit Hours
Proposed Inception Term: Fall 2023
Brief Program Description: The BS in Computer Science and Engineering provides a unique opportunity for students to deepen their knowledge of computer science and engineering topics by combining theory-based concepts with advanced, enabling computational techniques and technologies to create solutions that address the grand challenges of the 21st century, and beyond. The curriculum applies computer science theory and software development fundamentals to produce computing-based solutions. It includes substantial coverage of engineering principles applied to the design of large, networked, scalable computing systems. Competencies include algorithms and complexity, computer

science theory, concepts of multiple programming languages, software development, and real-time, embedded and IoT systems design and other engineering principles. The proposed CSE program offers distinct curriculum and learning outcomes for undergraduate students compared to other existing programs at the UA as the proposed program takes a holistic approach to coupling computing theory and applications with computer systems design and data science in a unified flow.

The program has a firm engineering foundation that is ABET CAC / EAC compliant and encompasses a discovery-based education utilizing an experiential learning approach. As a part of the curriculum, students complete projects in nearly every semester of the program that emphasize computing theory, communication, teamwork, critical thinking, and engineering professionalism. The program's flexibility allows students to design their course of study and select technical electives from a diverse pool of courses in software, computer science and computer engineering domains such as web and mobile applications, embedded systems, cybersecurity, machine learning, systems, and other interdisciplinary areas.

Learning Outcomes and Assessment Plan:

Define the core concepts and competencies that the program will convey and stipulate how these key learning outcomes will be measured and assessed.

Learning Outcome #1: *Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.*
Concepts: Students will apply knowledge of various programming languages, algorithms, and computational elements to satisfy complex computing problems. Students will take courses in computer programming in multiple languages, digital logic, probability and statistics, data structures and algorithms, data collection, organization and management, theory of computation and operating system design.
Competencies: Students will demonstrate knowledge of the design, implementation, and test/analysis of computing solutions. Throughout their coursework, students will learn and use at least 2 different programming languages, understand digital logic and fundamental computer architectures, learn to apply probability and statistics to engineering applications, and apply computing theory and algorithms to analyze and develop diverse computing solutions.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: “Exemplary”, “Satisfactory”, “Developing”, and “Unsatisfactory”. Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores “Developing” or below. Assessment results are documented and formally maintained in

a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for the following existing courses will be used: ECE 274A, SIE 305, CSC 355 and ENGR 498A/B. Specific sources of evidence (homework, exams, student projects) and measures will be identified in each of the following new courses and used in a rubric based assessment: CSE 101, CSE 201, CSE 301, CSE 302, and CSE 401. For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.
Learning Outcome #2: *Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline*.
Concepts: Students will apply knowledge of various programming languages, algorithms, and computational elements to satisfy specified requirements. They will use various modeling techniques such as the Unified Modeling Language (UML) and other object- oriented concepts to design solutions that meet specified requirements. Students will implement their designs in an appropriate programming language and evaluate/verify whether the implemented code adequately meets the functional and nonfunctional requirements specified.
Competencies: Students will learn modern design / modeling techniques used to capture and evaluate the design of a computing solution. Students will also develop unique designs that meet specified requirements. Additionally, students will evaluate and verify that the specified requirements have been satisfied in the implementation of the product design.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: "Exemplary", "Satisfactory", "Developing", and "Unsatisfactory". Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores "Developing" or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for following existing courses will be used: SFWE 302. Specific sources of evidence (homework, exams, student projects) and measures will be identified in each of the following new courses and used in a rubric based assessment: CSE 201, CSE 301, CSE 302, CSE 303, and CSE 401. For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.

Learning Outcome #3: *Communicate effectively in a variety of professional contexts.*
Concepts: Students will apply different communication strategies to share engineering principles and solutions with a wide variety of audiences. They will utilize their writing skills gained in English composition courses to develop technical specifications, documents, and presentations related to the computing-based coursework and projects that are shared in written and presentation-style formats with a variety of audiences including other students, faculty, and industry representatives for sponsored capstone projects.
Competencies: Students will demonstrate their ability to communicate engineering and computing-based solutions via written reports, presentations, and interactions with team members and other stakeholders.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: "Exemplary", "Satisfactory", "Developing", and "Unsatisfactory". Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores "Developing" or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for following existing courses will be used: SFWE 302 and ENGR 498A/B. (Additional measures may be used as new courses are developed that have significant projects requiring students to document and communicate their technical solutions to computing based problems.) For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.
Learning Outcome #4: *Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.*
Concepts: Students will effectively utilize knowledge of legal and ethical standards and guidelines used in computing practices. They will apply their knowledge throughout the development of their capstone project as they complete trades related to their design solutions. Students will likely utilize/integrate commercially, and potentially proprietary elements provided by project sponsors in their capstone projects. Students complete a 1-unit course in engineering ethics that consists of various case studies in ethical aspects involved with engineering and using computing-based solutions/products.
Competencies: Students will demonstrate their ability to understand and utilize legal and ethical practices followed in computing professions. They will understand concepts such as intellectual property, the safety, health, and welfare of the public, academic and professional integrity, and other similar topics related to engineering ethics.

Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: "Exemplary", "Satisfactory", "Developing", and "Unsatisfactory". Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores "Developing" or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for following existing courses will be used: ECE 311 and ENGR 498A/B. (Additional measures may be used as new courses are developed that have significant projects requiring students to employ ethical practices as they develop technical solutions to computing based problems.) For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.
Learning Outcome #5: *Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.*
Concepts: Students will utilize teaming, communication, and collaboration skills to develop large scale and complex computing solutions/products. Students will learn how to break a large project into smaller segments/subsystems/tasks that are allocated and performed across teams which have at least 4+ team members. Students will use a learn and use a variety of communication strategies that allow them to share their own progress on tasks and also contribute to peer tasking to achieve common goals. Students will also learn fundamental leadership strategies used to coordinate and facilitate teamwork, resolving conflict with peers and others, collecting and reporting status to others, and keeping the team focused on achieving their commitments.
Competencies: Students will develop skills that allow them to plan, communicate status, perform tasking required to meet project milestones, resolve conflict, and work as a team to achieve goals and deliver computing products.
Assessment Methods: This outcome will predominately be assessed in peer / team evaluations that are provided throughout the 2 semesters of ENGR 498A and ENGR 498B. The evaluations are required of all team members working on the interdisciplinary capstone project after each interim project deliverable or review is submitted/conducted (approximately 3 times per semester). The evaluation requires each team member to evaluate the other team members contributions to the project at each major milestone. Team members are evaluated based on their overall technical contributions, ability to work with the team, amount of effort continued to the project, and dependability. At the completion of the capstone project, the project's sponsor also completes an evaluation of each team members contributions and performance on the project

throughout the 2 semesters. The course instructor also provides an assessment of how each team member and team leaders worked together throughout the semester on achieving the project goals and implementation.
Measures: Instructor grading of the ENGR 498 A/B team and project sponsor evaluations submitted by each student and the project sponsors. (Additional measures may be used as new courses are developed that have significant projects requiring students to work in teams to develop technical solutions to computing based problems.) A student self-assessment survey will also be used for indirect measures of the outcome
Learning Outcome #6: *Apply computer science theory and software development fundamentals to produce computing-based solutions. [CS]*
Concepts: Students will utilize their acquired mathematical, automation, and computation theory knowledge to analyze and develop computing-based solutions to meet a given problem statement. They will demonstrate their ability to analyze complex problems to determine whether solutions can be automated, evaluate resources required to implement / automate the problem as a function of the size and complexity of the anticipated input stimuli and other key parameters, and develop optimal implementations to address a given problem statement.
Competencies: Students will use mathematical analysis and computer theory to evaluate the complexities and magnitude of a given problem space, evaluate different approaches and designs that could be used to implement computing-based solutions to said problems, and implement the solutions developed.
Assessment Methods: This outcome will be assessed in specifically designated homework, exams, papers, or student projects. A rubric will be created for each new CSE course that identifies Criteria, Measures of Assessment, and an Achievement level rating for the different criteria/categories evaluated. The Achievement levels will include: "Exemplary", "Satisfactory", "Developing", and "Unsatisfactory". Rubrics already exist for existing engineering courses. For new courses developed in the curriculum, a plan for identifying the courses of evidence and assessment measures will be developed as the courses are developed. At the end of every semester, a team comprised of the course instructor and the ECE UGCs, will score the rubric using the measures of assessment identified for the course. A Root Cause and Corrective action plan will be developed for any course that scores "Developing" or below. Assessment results are documented and formally maintained in a controlled location at the end of each semester and will be published at the UArizona Assessment website. The scores will be tracked over time to facilitate the Continuous Improvement and corrective action plans remain effective from semester to semester, year to year.
Measures: The currently defined measures for following existing courses will be used: ECE 274A, SFWE 302 and ENGR 498A/B. Specific sources of evidence (homework, exams, student projects) and measures will be identified in each of the following new courses and used in a rubric based assessment: CSE 302 and CSE 401. For each rubric category, a rating will be given commensurate with the rubric criteria rating scheme. A student self-assessment survey will also be used for indirect measures of the outcome.

The Taskstream Curriculum map is shown below:

University of Arizona AMS » Sandboxes
Ingrid Novodvorsky Playspace

BS Computer Science and Engineering

Courses and Activities Mapped to BS Computer Science & Engineering

Courses and Learning Activities	Outcome 1: Analysis Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	Outcome 2: Design, Implementation, & Evaluation Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	Outcome 3: Communicaton Communicate effectively in a variety of professional contexts.	Outcome 4: Ethics Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	Outcome 5: Teamwork Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	Outcome 6: Application Apply computer science theory and software development fundamentals to produce computing-based solutions.
ENGL 101 Freshman Composition			P/A			
ENGL 102 Freshman Composition			P/A			
MATH 122 A/B Calculus I	I/A					I/A
MATH 129 Calculus II	P/A					
Basic Science Including Lab	I/A					
ENGR 102 Intro to Engineering		I			I	
CSE 101 Programming I	IPA					
MATH 243 Discrete Math	P/A					
CSE 201 Programming II	P/A	P/A				
ECE 274A Digital Logic	P/A				P/A	P/A
CSE 301 Data Management	P/A	P/A				
CSE 302 Theory of Computation	P/A	P/A				IPA
CSE 303 Fund. of Computer Architecture		P/A				
ECE 311 Engineering Ethics			I/A	I/A		
SIE 305 Probability & Statistics	P/A	P/A				
SFWE 302 Software Architecture & Design		P/A	P/A		P/A	P/A

9/29/22, 11:15 AM

Curriculum Map - Courses and Activities Mapped to BS Computer Science & Engineering

	Outcome					
	Outcome 1: Analysis Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	Outcome 2: Design, Implementation, & Evaluation Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.	Outcome 3: Communicaton Communicate effectively in a variety of professional contexts.	Outcome 4: Ethics Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.	Outcome 5: Teamwork Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	Outcome 6: Application Apply computer science theory and software development fundamentals to produce computing-based solutions.
CSE 401 Operating Systems	P/A	P/A				P/A
ENGR 498A/B Senior Capstone			P/A	P/A	P/A	P/A
Exit Survey Indirect Measure	A	A	A	A	A	A

Legend : I Introduced | P Practiced | A Assessed | I/P Introduced/Practices | P/A Practiced/Assessed

A summary of the Program Assessment Plan and measures is shown in the table below:

Assessment Measure	Source(s) of Evidence	Data Collection Point(s)
Student Academic Advising Report (SAAR)	Online record keeping database to which the student and advisor have access.	At the end of an academic year at a minimum
ABET Academic Program Review	ABET Program Evaluators responses	Every 6 years
Rubrics for ***existing*** CSE courses used to assess each student outcome that identifies criteria, measure of assessment, and an achievement level rating *(i.e., Exemplary, Satisfactory, Developing, Unsatisfactory).*	Class assignments Exams Course Projects Course Reports Other forms of student work tailored to any specific course)	End of each semester the specific courses are taught
Rubrics for all ***new*** CSE courses used to assess each student outcome that identifies criteria, measure of assessment, and an achievement level rating *(i.e., Exemplary, Satisfactory, Developing, Unsatisfactory).*	Class assignments Exams Course Projects Course Reports Other forms of student work tailored to any specific course)	End of each semester the specific courses are taught

Root cause and corrective action plans	Results of individual course rubric assessments	End of each semester the specific courses are taught
Senior exit survey (used for indirect measures of outcomes).	Student survey	At student graduation
Continuous improvement opportunities (recommended by the Undergraduate Committee (UGC))	Assessment Data	At the end of an academic year
Industry needs assessment	Required Curriculum	Every 4 years
CSE educational objectives	Course / Program Objectives	Annually prior to faculty retreat
Senior degree check	Review of student degree requirements	Semester prior to graduation

Projected Enrollment for the First Five Years:

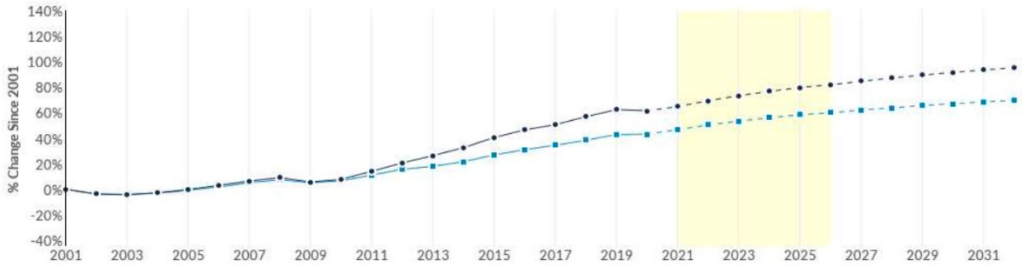
5-YEAR PROJECTED ANNUAL ENROLLMENT					
	1st Year	2nd Year	3rd Year	4th Year	5th Year
Number of Students	60	140	300	425	500

Evidence of Market Demand:

Please provide an estimate of the future state-wide and national demand for graduates of the proposed academic program. Please specify the source (e.g., Burning Glass; Jobs EQ; US Department of Labor) of workforce demand data and detail the assumptions that underpin these projections. If job market data is unavailable or not applicable, please explain why and elaborate another justification for the proposed program.

The market demand for those trained in engineering computing disciplines is projected to have significant growth in both the near- and long-term futures. Specifically, the chart below shows the growth in computing-related jobs up to 2021, as well as the projected growth through 2033, both regionally (Arizona, California, Nevada, New Mexico, Utah) and nationally.[4]

[4] Emsi Q2 2022 Data Set, www.economicmodeling.com



Region	2021 Jobs	2026 Jobs	Change	% Change
Region	1,010,147	1,115,128	104,981	10.4%
Nation	5,406,515	5,892,114	485,599	9.0%

Note that computing-related job growth within our region is projected to grow at a faster pace than the nation as a whole. Thus, this new degree program will serve both local, state, and national needs related to employment, economic development, and national security. Indeed, these degree programs are among the most important in support of the ongoing fourth industrial revolution and in close alignment with Arizona's New Economy Initiative[5].

The full marketing and analysis report for the state of Arizona can be found at the following link:
https://arizona.box.com/s/k4d8cj657sqv6bban2yyi4gcf0paqi0e

The full marketing and analysis report for the nation can be found at the following link:
https://arizona.box.com/s/stizctd27mfeltaxsv2ylmgfa8zgsoco

Similar Programs Offered at Arizona Public Universities:

List existing programs at Arizona public universities that deliver similar concepts and competencies to the proposed new program.

University	Program	College

[5] World Economic Forum. https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

University of Arizona	BS Software Engineering	College of Engineering
University of Arizona	BA and BS Computer Science	College of Science
University of Arizona	BS Computer Science BAS Applied Computing	College of Applied Science and Technology (CAST)
Arizona State University	BS Software Engineering	School of Computing and Augmented Intelligence, IRA A Fulton Schools of Engineering
Arizona State University	BS Computer Science	School of Computing and Augmented Intelligence, IRA A Fulton Schools of Engineering
Northern Arizona University	BS Computer Science	School of Informatics, Computing, and Cyber Systems

FOR CURRICULAR AFFAIRS USE ONLY

Objection(s) Raised by Another Arizona Public University? YES NO

Has another Arizona public university lodged a written objection to the proposed program with the proposing university and the Board of Regents within seven days of receiving notice of the proposed program?

If Yes, Response to Objections:

Please provide details of how the proposing university has addressed the objection. If the objection remains unresolved, please explain why it is in the best interests of the university system and the state that the Board override it.

New Resources Required? (i.e., faculty and administrative positions; infrastructure, etc.):

Please provide an estimate of the personnel and infrastructure requirements of the proposed new program and the corresponding costs. Please specify if the proposed program requires new resources (e.g., new faculty lines; a new laboratory; new teaching assistantships or scholarships) or whether resource needs may be met through the reassignment or extension of existing ones. If resource extension or reassignment will impact extant programs and/or operations, please make this clear.

Resources	Quantity
Faculty	13
Staff	2

Other (TAs, Graders, LAs) *(# Semester hires over 5 years)*	28 TAs *(over 5 years)* 30 Graders *(over 5 years)* 28 Lab Assistants *(over 5 years)*
Equipment	New research and lab equipment is included in the startup packages for new TT faculty
Facilities	Office and lab space *(for new faculty)*

Plan to Request Program Fee/Differentiated Tuition? No

Estimated Amount: N/A

Program Fee Justification: N/A

Note: The fee setting process requires additional steps and forms that need to be completed. Please work with your University Fees office to complete a fee request.

Specialized Accreditation? YES

Accreditor: Computing Accreditation Commission (CAC) of Accreditation Board for Engineering and Technology (ABET)

THE UNIVERSITY OF ARIZONA

BUDGET PROJECTION FORM

Name of Proposed Program or Unit: Computer Science and Engineering BS

Budget Contact Person:	Projected					
	1st Year 2023- 2024	**2nd Year** 2024 - 2025	**3rd Year** 2025- 2026	**4th Year** 2026- 2027	**5th Year** 2027- 2028	
METRICS						
Net increase in annual college enrollment UG - on campus	50	115	250	350	400	
Net increase in college SCH UG - on campus	900	2,070	4,500	6,300	7,200	
Net increase in annual college enrollment UG - online	10	25	25	75	100	
Net increase in college SCH UG - online	180	450	450	1,350	1,800	
Net increase in annual college enrollment Grad						
Net increase in college SCH Grad						
Number of enrollments being charged a Program Fee	60	140	300	425	500	
New Sponsored Activity (MTDC)						
Number of Faculty FTE	4	6	8	10	10	
FUNDING SOURCES						
Continuing Sources						
UG AIB Revenue - On Campus enrollment	12,500	28,750	62,500	87,500	100,000	
UG AIB On Campus Degree	150,000	345,000	750,000	1,050,000	1,200,000	
UG SCH - On Campus	166,500	382,950	832,500	1,165,500	1,332,000	Based on 18 units per student
UG AIB Revenue - Online enrollment	2,750	6,875	6,875	20,625	27,500	
UG AIB Online Degree	40,000	100,000	100,000	300,000	400,000	
UG SCH - Online	45,000	112,500	112,500	337,500	450,000	Based on 18 units per student
Grad AIB Revenue						
Program Fee Revenue (net of revenue sharing)	54,000	126,000	270,000	382,500	450,000	Based on $450 per semester
F and A AIB Revenues			319,999	426,666	319,999	
Reallocation from existing College funds (attach description)						
Other Items (attach description)						
Total Continuing	**$ 470,750**	**$ 1,102,075**	**$ 2,454,374**	**$ 3,770,291**	**$ 4,279,499**	
One-time Sources						
College fund balances						
Institutional Strategic Investment						
Gift Funding						
Other Items (attach description)						
Total One-time	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	
TOTAL SOURCES	**$ 470,750**	**$ 1,102,075**	**$ 2,454,374**	**$ 3,770,291**	**$ 4,279,499**	
EXPENDITURE ITEMS						
Continuing Expenditures						
Faculty	520,000	793,000	1,072,825	1,093,146	1,120,474	
Other Personnel	144,160	215,140	352,132	468,722	479,556	
Employee Related Expense	210,623	316,621	435,427	487,663	499,837	
Graduate Assistantships	20,080	40,160	60,240	80,320	80,320	
Other Graduate Aid	14,958	29,917	44,875	59,834	59,834	
Operations (materials, supplies, phones, etc.)	140,500	140,500	140,500	140,500	140,500	
Additional Space Cost						
Other Items (attach description)						
Total Continuing	**$ 1,050,322**	**$ 1,535,338**	**$ 2,105,999**	**$ 2,330,184**	**$ 2,380,521**	
One-time Expenditures						
Construction or Renovation						
Start-up Equipment	533,332	799,998	1,066,664	799,998	533,332	
Replace Equipment						
Library Resources						
Other Items (attach description)						
Total One-time	**$ 533,332**	**$ 799,998**	**$ 1,066,664**	**$ 799,998**	**$ 533,332**	
TOTAL EXPENDITURES	**$ 1,583,654**	**$ 2,335,336**	**$ 3,172,663**	**$ 3,130,182**	**$ 2,913,853**	
Net Projected Fiscal Effect	**$ (1,112,904)**	**$ (1,233,261)**	**$ (718,289)**	**$ 640,108**	**$ 1,365,646**	

THE UNIVERSITY OF ARIZONA

New Academic Program
PEER COMPARISON

Program name, degree, and institution	Proposed UA Program	BS Computer Science and Engineering University of California – Davis BS CSE UC Davis	BSE Computer Science University of Michigan BSE CSE UofM	BA / BS Computer Science University of Arizona BS CS UArizona
Current number of students enrolled	[redacted]	350[1]	1435[2]	1406 (UA enrollment data - Fall 2022)
Program Description	The Computer Science Engineering curriculum applies computer science theory and software development fundamentals to produce computing-based solutions. It includes substantial coverage of algorithms and complexity, computer science theory, concepts of multiple programming languages, software development, and engineering principles. The program has a firm engineering foundation that is ABET CAC / EAC compliant and encompasses a discovery-based education utilizing an experiential learning approach. As a part of the curriculum, students complete projects in nearly every semester	The Computer Science Engineering major prepares students to do further work in hardware, software, theory, or electronics, either in industry or in postgraduate study. The primary differences between the Computer Science Engineering and the Computer Science majors are the extent of course work covering hardware and the flexibility of the curriculum. The Computer Science Engineering major develops a solid understanding of the entire machine, including hands-on experience with its hardware components. The Computer Science major has some course work on hardware, at the digital-design level, on simulators. The Computer	Computer scientists are experts in computation – both in terms of the theory of computation and its innumerable practical applications. A computer scientist understands how to design and analyze algorithms, how to store and retrieve information, how computers function, and how to develop software systems that solve complex problems. Specialists within computer science might have expertise in developing software applications, in designing computer hardware, or in analyzing algorithms, and in many other current and emerging specializations. The Computer Science Engineering major available through the College of	Computer science emerges from the interaction of two powerful kinds of machines: computers and the human brain. Computer scientists are inventive, innovative, collaborative thinkers creating software solutions and synergies on the cutting edge of technology. The Information Age is here; computer scientists are shaping it. All undergraduate students begin the program as Pre-Computer Science. Students are admitted to the BA or BS in Computer Science program once pre-major courses are completed, and admission criteria are met.

[1] https://shinyapps.asee.org/apps/Profiles/
[2] CS-Eng Enrollment and Graduation Data (umich.edu)

	of the program that emphasize computing theory, communication, teamwork, critical thinking, and engineering professionalism. The program's flexibility allows students to design their course of study and select technical electives from a diverse pool of courses in software, computer science and computer engineering domains such as web and mobile applications, embedded systems, cybersecurity, machine learning, systems, and other interdisciplinary areas.	Science Engineering major has fewer free electives. The CS major's more generous electives make it easier to complete a minor or double major. A key theme of the Computer Science Engineering curriculum is the hardware/software interaction, a theme reflected in the courses required and the orientation of the courses themselves. The Computer Science & Engineering major provides students with a solid background in mathematics, physics, chemistry, and electronic circuits and systems, all supporting the computer hardware and computer software courses that constitute the focus of the curriculum.	Engineering will prepare students for a world of incredible opportunities. The world-class faculty will challenge students to deepen their intellectual curiosity, and the curriculum will allow students to tailor their computing studies to their specific areas of interest. Along the way, students will develop both algorithmic fundamentals and a framework for understanding that will enable students to keep pace with the ever-changing world of computer science.	
Target Careers	• Software developer • Computer Science engineer for variety of application areas: ○ Web ○ Mobile ○ Embedded systems ○ Avionics ○ Robotics ○ Machine Learning ○ Data Management / Data Science ○ Mobile Application developer	• Software developer • Computer Science engineer for variety of application areas: ○ Web ○ Mobile ○ Embedded systems ○ Avionics ○ Robotics ○ Machine Learning ○ Data Management / Data Science ○ Mobile Application developer	• Software developer • Computer Science engineer for variety of application areas: ○ Web ○ Mobile ○ Embedded systems ○ Avionics ○ Robotics ○ Machine Learning ○ Data Management / Data Science ○ Mobile Application developer	• Computer programmer • Software developer • Artificial Intelligence programmer • Machine Learning programmer • Database specialist • Mobile application developer • Web developer • Tool developer

	○ Other software related fields	○ Other software related fields	○ Other software related fields	
Emphases? (Yes/No) List, if applicable	No	No	No	No
Minimum # of units required	120	144	128	120
Level of Math required (if applicable)	**Significant** Includes 17 total units of Calculus I & II, Discrete Math, Probability / Statistics and one additional Math course of the student's choosing.	**Substantial** Includes 28 total units of Calculus I & II, Vector Analysis, Linear Algebra, Differential Equations and Discrete Math	**Significant** Includes 16 total units of Calculus I & II, Linear Algebra, and Discrete Math	**Significant** Includes 12 units of Pre-Calculus, Calculus I, and Calculus II or Linear Algebra
Level of Second Language required (if applicable)	None	None	None	2nd semester proficiency

Pre-Major? (Yes/No) If yes, provide requirements.	Yes
	• *Admitted as "Engineering - No Major Selected"*
	• Completion of 12 or more UA credits of coursework within the Engineering curricula may that include:
	  • MATH 122 A/B – Calculus I
	  • MATH 129 – Calculus II
	  • ENGL 102 – English Composition II
	  • Natural Science w/Lab
	  • ENGR 102 – Intro to Engineering
	  • CSE 101- Programming I
		No	Yes
			(See requirements in the category that follows below for admission to the major)
				Yes
				• CSC 110 - Intro to Computer Programming 1
				• CSC 120 - Intro to Computer Programming 2
				• CSC 210 - Software Development
				• CSC 245 - Intro to Discrete Structures

Special requirements to declare/gain admission? (i.e. pre-requisites, GPA, application, etc.)	All students are enrolled as *Engineering*, *No Major Selected* until they have completed the following: • Calculus I with a grade of C or better • 12 or more UA credits of coursework within the	• History/social science = 2 years • English (or language of instruction) = 4 years • Mathematics = 3 years (4 years recommended) • Laboratory science = 2 years (3 years recommended)	Due to capacity constraints, students who are admitted to the University of Michigan in Fall 2023 or later must first be selected for the CS major before they can declare the major.	• Completion of the Pre-Major Courses (shown above) • GPA of 3.0 or higher in CSC 230, 210, and 245 • Cumulative GPA of 2.4 or higher • GPA of 2.0 or higher in all attempts at UA CSC courses

	Engineering curriculum (shown above) Admissions GPA of 2.0 or higher New first-year students CAN be admitted into the degree program, prior to enrolling at the University of Arizona. A student's eligibility is conveyed to admitted students by the ENGR Academic Affairs Office, if/when a student is also admitted to Honors College.	• Language other than English (or other second language) = 2 years (3 years recommended) • Visual and performing arts = 1 year • College preparatory elective = 1 year • Admissions GPA = 3.0 or higher	To declare a major in CS-Eng, students must be a College of Engineering student and: 1. Have completed at least one full term at UM Ann Arbor 2. Have an overall UM GPA of 2.0 or better in courses taken at the UM Ann Arbor campus and be in good standing 3. Have completed or earned credit by exam or transfer for at least one course in each of these categories all with a grade of C or better (no Optional P/F): a) Calculus (e.g., Math 115, 116 or 156) b) Calculus-based physics lectures (e.g., Physics 140 or 160) or chemistry lectures (e.g., Chem 130) c) Required engineering courses (Engr 100, 101, or 151)	• Complete at least 2 programming courses at UA
Internship, practicum, or applied/experiential requirements? If yes, describe.	Yes Senior Interdisciplinary Capstone (ENGR 498A and ENGR 498B)	Yes Senior Design Project (2 semesters)	Yes Major Design Project	Optional Students may earn up to 6 units of internship credit.

Additional questions:

1. How does the proposed program align with peer programs? Briefly summarize the similarities between the proposed program and peers, which could include curriculum, overall themes, faculty expertise, intended audience, etc.

The UA Computer Science and Engineering degree program is similar to the three peer programs that require and build strong foundational skills in math and/or physics (or other natural sciences), and computing applications as part of their curriculums. The math courses are similar and deviate only after Calculus II. All programs also offer several introductory and advanced programming courses using a variety of computer programming languages. Additional programming skill development/experience is an integral part of the experiential course work and projects in other required courses. All programs offer a course in algorithm analysis, and a variety of technical electives to match student special interest areas. Students in all the programs will be able to pursue software development careers in a variety of diverse and expansive applications areas including web-based development, mobile application development, embedded systems, robotics, machine learning, artificial intelligence, and other software-related fields.

The three Computer Science and Engineering programs (UA, UC Davis, and UofM) are interdisciplinary and offer full-semester courses in computer organization, probability and statistics, introductory hardware courses, and a capstone or major design project. The student learning outcomes (SLOs) and curriculum for the newly proposed College of Engineering CSE degree program, UC Davis and UofM's CSE degrees comply with the ABET /CAC program criterion for Computer Science programs. UC Davis and UofM's CSE programs are fully CAC accredited and the new UArizona CSE program will apply for accreditation after graduating our first student. (Note: The University of Arizona's current Computer Science program offered in the College of Science is ***not*** ABET / CAC accredited.)

2. How does the proposed program stand out or differ from peer programs? Briefly summarize the differences between the proposed program and peers, which could include curriculum, overall themes, faculty expertise, intended audience, etc.

While there are many similarities in the CSE and CS degree programs at UArizona, there are also key differences that are very attractive to incoming and prospective UArizona students. First and foremost, one of the CSE degree major strengths is the multi-disciplinary influences provided by the Systems and Industrial Engineering, and Electrical and Computer Engineering Departments. The elective options available to students are very diverse and can include courses that give students a broad-based experience in not only software engineering, but also Electrical Engineering and/or Systems Engineering specialties. The intersections of the ECE, SE, and the CSE degree programs, foster the ability to tackle interdisciplinary engineering problems to meet the evolving technological changes and requirements to meet society's needs. This manifests itself in CSE students being an integral part of the highly successful Interdisciplinary Capstone course (ENGR 498A/B) where students work on multi-disciplined teams to develop products for a diverse set of industry and/or academia sponsors.

The new UArizona CSE courses will be developed using relevant and industry-focused technology solutions, tools, languages, and methodologies in a diverse portfolio of applications. Wherever possible, the software development tools and platforms used in the coursework will consist of widely available open-source integrated development environments (IDEs), operating systems (OS), and cloud-based infrastructures. The Software DevSecOps course uses a state-of-the-art software DevOps workflow approach integrated with

security considerations using common tools used in the industry. Software DevSecOps enables students to develop, test, and deliver secure software products faster and more efficiently, while at the same time providing a development pipeline of new capabilities and features to consumers. Using DevOps workflows and continuous integration / continuous delivery (CI/CD) approaches, students will be able to plan, develop, and deliver software features to meet customer's ever-evolving needs. Students will also learn to track and evaluate how the software's quality, security and reliability is increased using the SW DevSecOps approaches.

As is often asked, what are the differences between the UArizona BS Computer Science Engineering degree and the UArizona CoS Computer Science degree? To begin with, the Computer Science Engineering degree complies with the ABET/CAC criteria for Computer Science degrees. The Computer Science degree is not compliant with ABET / CAC accreditation requirements. The CSE degree is comprised of 17 units of math, while the CS program has only 12 units of math. While there are some intersections in both programs between the topics and types of classes in each respective degree, the focus of each program is very different. In Computer Science, students focus more on the programming fundamentals and computer science theory. Computer Science and Engineering students, on the other hand, focus on the *application* of computer science principles to solve complex, multi-faceted/multi-disciplined engineering problems and product development. Computer Science and Engineering will provide a unique opportunity for students to deepen their knowledge of computer science and engineering topics by combining theory-based concepts with advanced, enabling computational techniques and technologies to create solutions that address the grand challenges of the 21st century, and beyond.

The BS Computer Science and Engineering curriculum applies computer science theory and software development fundamentals to produce computing-based solutions. It includes substantial coverage of engineering principles applied to the design of large, networked, scalable computing systems. Competencies include algorithms and complexity, concepts of multiple programming languages, software development, real-time, embedded, and IoT systems design and other broad-based engineering principles.

Both programs offer students the opportunity to select technical computing electives that allow them to focus in areas they are interested in. Both programs also offer students the opportunity to pursue supplementary study in another field such as a minor or potentially even double majoring in an adjacent program.

3. How do these differences make this program more applicable to the target student population and/or a better fit for the University of Arizona?

The University of Arizona College of Engineering currently does not offer an engineering degree related explicitly to Computer Science and Engineering. UA engineering students that have historically leaned more toward software development careers have typically obtained Electrical and Computer Engineering degrees, with an emphasis towards Computer Engineering, and take various computer programming courses as electives. Alternatively, these students obtain a Computer Science degree from the College of Science that lead to future software career opportunities but lack the specific engineering discipline and emphasis offered with the CSE degree curriculum. Since

software development as an engineering discipline is a 'in high-demand' field (as shown by the market analysis), it is likely that students are selecting other programs or universities since UArizona does not currently offer Computer Science and Engineering. It is believed that by offering an innovative and industry relevant CSE degree, new students will be attracted to the university. As we have seen over the past decade, software has become an integral element/component within the systems, products, and technologies that are part of the 4th industrial revolution.

Given the ever-increasing demand in the industry for computer scientists and software engineers, there is an equally increasing opportunity for the College of Engineering to diversify their degree offerings by offering this new degree. This too will attract more students to the University of Arizona.

Additionally, two of the colleges' strategic pillars are:

1) Driving student success for a rapidly changing world, and
2) Tackling critical problems at the edges of human endeavor.

The new CSE degree plays a critical role in both pillars. The students graduating with the degree in CSE will be better positioned to develop the skills and mindsets to be ***leaders*** in the areas of space exploration, automation and connectivity, human and artificial intelligent systems, data science, machine learning, and network sciences.

By offering a competitive, relevant, and experiential-based learning Computer Science and Engineering program to prospective students, it increases not only the net enrollment in the college, but also the ability to grow research programs that are attractive to forthcoming undergraduate and graduate students. All of which contribute to higher recruitment numbers and bringing additional revenue to the College and University. Hence, we will recruit faculty that can significantly impact applied computing areas of research and education. These faculty will pursue research grants to advance the state-of-the-art in applied computer science and engineering and integrate their research into the curriculum. The broader impact of these faculty will ultimately drive the program's national ranking higher.

Another goal of offering the Computer Science and Engineering degrees is to increase the number of female and other underrepresented students in the College of Engineering by leveraging Broaden Participation in Computing (BPC) – a national initiative by the Computing Research Association with support from the National Science Foundation's (NSF) Directorate for Computer and Information Science and Engineering (CISE). Additional features and programs that contribute to enhancing student success and increasing diversity and inclusion will be included in the support infrastructure for the degrees, aiming to foster academic cultures that are more inclusive of non-dominant identities and infuse policy-driven, identity-inclusive strategies throughout the entire program.

From:	Valerdi, Ricardo - (rvalerdi)
To:	ONeal, Sharon L - (sharononeal)
Cc:	Wu, Michael H. - (mhwu); Hahn, David W - (dwhahn)
Subject:	Re: Letter of Support - Computer Science and Engineering Degree Programs
Date:	Saturday, October 8, 2022 6:25:23 PM
Attachments:	image001.png image002.png

Sharon,
The SIE Department supports the proposed degree programs and commits to ongoing offerings of the courses listed below.

Regards,

-Ricardo

From: ONeal, Sharon L - (sharononeal) <sharononeal@arizona.edu>
Sent: Saturday, October 8, 2022 8:08:00 PM
To: Valerdi, Ricardo - (rvalerdi) <rvalerdi@arizona.edu>
Cc: Wu, Michael H. - (mhwu) <mhwu@arizona.edu>; Hahn, David W - (dwhahn) <dwhahn@arizona.edu>
Subject: Letter of Support - Computer Science and Engineering Degree Programs

Ricardo,
The College of Engineering and the Electrical and Computer Engineering Department are proposing a new BS undergraduate degree in Computer Science and Engineering (CSE) beginning in Fall 2023 to be taught in both the In-person and Online modalities. We are also planning to subsequently offer a MS and PhD program to begin in 2024/2025 academic year.

The CSE curriculum applies computer science theory and software development fundamentals to produce computing-based solutions. It includes substantial coverage of algorithms and complexity, computer science theory, concepts of multiple programming languages, software development, and engineering principles. The program has a firm engineering foundation that is ABET CAC / EAC compliant.

We have obtained very enthusiastic endorsements from Provost Folks, Vice-Provost Heileman and Dean Hahn (CoE) for this new degree.

The table below summarizes the full-time projected enrollments in the CSE program extrapolated out over the first 5 years, at which we believe we will achieve a steady enrollment number. These numbers were estimated based on actual enrollments[1] in other AAU universities that have dual computer science programs in the College of Engineering and a Computer Science program in another college.

Computer Science and Engineering Projected Enrollments *(all programs)*					
Degree	Year 1 (2023 / 2024)	Year 2 (2024 / 2025)	Year 3 (2025 / 2026)	Year 4 (2026 / 2027)	Year 5 (2027 / 2028)
BS	60	140	300	425	500
MS	0	10	30	60	120
PhD	0	5	15	30	50

As part of the BS curriculum, the following course(s) from your Dept will be required for the degree:

SIE 305 – Introduction to Probability and Statistics
SFWE 302 – Software Architecture and Design *(co-owned with ECE)*
SFWE 402 – Software DevSecOps *(co-owned with ECE)*

As part of the graduate program, the following classes may be taken as electives by the MS / PhD CSE students:

SIE 533 –Fundamentals of Data Science for Engineers
SIE 578 –Artificial Intelligence for Health and Medicine

I'm writing to obtain your support for our plan to require these courses in our supporting coursework. Kindly respond with your acknowledgement and support for these new degree programs, so that it can be incorporated in the proposal that we are finalizing to submit for ABOR approval in early 2023.

If you have any questions, please feel free to reach out either via email or by cell at (520) 822-4040.

Sharon ONeal

Software Engineering

SOFTWARE ENGINEERING est. 2021

Sharon ONeal
Professor and
Director, Software Engineering

Phone: 520-621-2558
Mobile: 520-822-4040 *(preferred)*
Email: sharononeal@email.arizona.edu

[1] Enrollments derived from https://shinyapps.asee.org/apps/Profiles/

THE UNIVERSITY OF ARIZONA
Online, Distance & Continuing Education

October 2022

Prof. Sharon ONeal
Professor and Director, Software Engineering
College of Engineering
University of Arizona

Re: BS/MS Computer Science and Engineering online and distance degree programs – Letter of support

Dear Prof. ONeal,

On behalf of the University of Arizona's Online, Distance and Continuing Education (ODCE) division, I am pleased to offer this letter of support for your proposal to offer bachelor's and master's degrees in Computer Science and Engineering to online and distance students. Increased access to this critical field will provide our students, many of whom are adults with family and job responsibilities and cannot travel to Tucson, a great opportunity to achieve their educational goals.

As the university's in-house full-service enterprise for online and distance education we look forward to collaborating with you. Here is a snapshot of our services and support:

- Online curriculum planning and program development;
- Online course design;
- Marketing, student recruitment, and enrollment management; and,
- Student success coaching for increased retention and graduation.

Our ODCE team will work with you in efforts to help increase diversity, accessibility, and degree completion for students enrolled in these innovative STEM programs.

If you require more information about our support for this proposal, please feel free to contact Caleb Simmons (calebsimmons@arizona.edu), executive director for online education; and/or, Carla Holloway (carlaholloway@arizona.edu), executive director for distance education.

Sincerely,

Craig Wilson, JD, PhD
Vice Provost, Online, Distance and Continuing Education
Professor of Practice, College of Education