UNIVERSITY *of* WASHINGTON

Michael K. Young
President

April 8, 2014

Vice Chancellor J.W. Harrington
University of Washington, Tacoma
Box 358430

Dear J.W.:

Based upon the recommendations of the Faculty Council on Academic Policy, the Faculty Assembly has recommended approval of the revised program requirements for the Bachelor of Science degree in Computer Engineering and Systems. A copy of the change is attached.

I am writing to inform you that the Office of Academic Affairs is authorized to specify these requirements beginning winter quarter 2015.

The new requirements should be incorporated in printed statements and in individual department websites as soon as possible. The *General Catalog* website will be updated accordingly by the Registrar's Office.

Sincerely yours,

Michael K. Young
President

Enclosure

cc: Ms. Zaide Chavez (with enclosure)
Mr. Robert Corbett (with enclosure)
Ms. Virjean Edwards (with enclosure)

301 Gerberding Hall • Box 351230 • Seattle, Washington 98195-1230 • 206.543.5010 • Fax 206.616.1784 • president@uw.edu

UNIVERSITY OF WASHINGTON

CREATING AND CHANGING UNDERGRADUATE ACADEMIC PROGRAMS

APR 0 2 2014

OFFICE USE ONLY

Control # TCES-20140225

After college/school/campus review, send a signed original and 1 copy to the Curriculum Office/FCAS, Box 355850.

For information about when and how to use this form: http://depts.washington.edu/uwcr/1503instructions.pdf

College/Campus: UW Tacoma	**Department/Unit:** Institute of Technology	**Date:** 2-25-14

New Programs

- ☐ Leading to a Bachelor of _____ in _____ degree.
- ☐ Leading to a Bachelor of _____degree with a major in _____.
- ☐ Leading to a _____ Option within the existing major in _____.
- ☐ Leading to a minor in _____

Changes to Existing Programs

- ☐ New Admission Requirements for the Major in _____ within the Bachelor of _____.
- ☐ Revised Admission Requirements for the Major in _____within the
- ☒ Revised Program Requirements for the Major in **Computer Engineering and Systems** within the **Bachelor of Science**.
- ☐ Revised Requirements for the Option in _____within the major in _____.
- ☐ Revised Requirements for the Minor in _____.

Other Changes

- ☐ Change name of program from _____ to _____.
- ☐ Change delivery method or location of program.
- ☐ New or Revised Continuation Policy for _____.
- ☐ New Honors Requirements for _____.
- ☐ Eliminate program_____ .

Proposed Effective Date: **Quarter:** ☐ Autumn ☒ Winter ☐ Spring ☐ Summer **Year: 20 15**

Contact Person: George Mobus	Phone: 25894	Email: gmobus@uw.edu	Box: 358426

EXPLANATION OF AND RATIONALE FOR PROPOSED CHANGE

For new program, please include any relevant supporting documentation such as student learning outcomes, projected enrollments, letters of support and departmental handouts. (*Use additional pages if necessary*).

Changes in Curriculum:

This program change describes the second phase of the changes being made in the CES program in order to better serve our engineering students and to strengthen the program for ABET re-accreditation. Phase one of the changes (approved for AY 2013-14) removed core requirements for courses in the CSS program which had allowed the CES program to get started with the resources at hand. As the CES program has grown in student FTE while remaining conservative in hiring additional faculty. With the approval of new faculty hires for AY 2014-15 the program can now offer the course versions that are oriented toward engineering content more so than was the case with the CSS versions.

In this phase we will be introducing three new courses that will fill requirements. The courses are:

- TCES 420 - Principles of Operating Systems - to replace TCSS 422 - Operating Systems
- TCES 460 - Embedded Systems Design - to replace TCSS 465 - Embedded Systems
- TCES 480 - Senior Project I - a new course

The new course applications are submitted with this document along with master syllabi for the courses.

TCES 420 will emphasize principles of general OS designs and expand on real-time OS concepts which are required for engineering designs (in the Embedded Systems Design course and the Senior Design Project capstone). *Note that in the current catalog there is an error listing TCES 422 - Operating Systems for Engineers in the required courses section. At the same time there is no course description for TCES 422. In fact the course was TCSS 422 and the title of that course was not changed. Confusion may have resulted from the fact that we offered a special section of TCSS 422 into which only CES students were admitted (there was significant overflow of the regular TCSS 422 which caused the addition of another section).*

TCES 460 will incorporate the use of a real-time OS in the actual construction of an embedded control system. This has been missing in the CSS versions of the subject and is essential for a complete baccalaureate program in CES.

TCES 480 will be added to the sequence of courses designated TCES 481 and TCES 482, to come before the sequence in order to improve the students' understanding of design projects. The faculty have determined that a full year is needed to undertake senior design projects of sufficient complexity and quality. The program is soliciting project proposals from our external community to increase the real-world aspects of the projects for the students and to establish stronger relations with those constituencies as part of the mission of our urban-serving campus.

Additionally we are submitting a course change form for TCES 372. As described in that form, the faculty have decided that the course need not be a five credit hour course since a fair amount of previously planned content is actually available in other courses. We are evaluating several courses that are currently at 5 hours and are seeking to reduce where appropriate in order to make room for additional electives (currently the program's required courses, at five hours each, prevent students from taking more than one elective, which is not a common situation in other programs nationally).

Changes in Admissions Requirements

In the startup of this degree program, since most of the CTCs and our own 1st and 2nd year students had not been previously advised of the proper preparatory work for this degree, it was decided to be less restrictive about the necessity to complete certain prerequisites before admission to the degree program (see description below). Now with ABET accreditation and a sufficiently long period of adjustment, the faculty feel that it is time to strengthen the admissions requirements as a process of improving our overall outcomes and to positively affect the retention of students who are admitted.

To that end the program seeks to have a more rigorous admissions process that will include completion of required courses and an application for admission form to assure these prerequisites have been met.

OTHER DEPARTMENTS AFFECTED

List all departments/units/ or co-accredited programs affected by your new program or changes to your existing program and acquire the signature of the chair/director of each department/unit listed. Attach additional page(s) if necessary. *See online instructions.		
Department/Unit: Institute of Technology	**Chair/Program Director:**	**Date:**
Department/Unit:	Chair/Program Director	Date:

CATALOG COPY

Catalog Copy as currently written. Include only sections/paragraphs that would be changed if your request is approved. Please cross out or otherwise highlight any deletions.

Delete

~~TCES 422 Operating Systems for Engineers~~

No course description given.

~~TCSS 465 Embedded Real-Time Systems~~

Course description from the TCSS BS degree program unaffected.

Change Course Descriptions

TCES 372 Machine Organization and Architecture for Computer Engineers ~~(5)~~

Covers the general features of computation systems with emphasis on microcontrollers, including an introduction to processor architecture, instruction sets, assembly programming, memory, debug monitors, and translation from higher level languages to machine language. Prerequisite: minimum grade of 2.0 in TCES 230.

TCES 481 Senior Project ~~I~~ (4)

~~Teaches how to prepare plans for the senior project. Explains parts of plan including: project definition, project requirements, preliminary design, and work schedule. Explains the need for addressing human factors, safety, reliability, maintainability, and customer cost. Provides experience preparing and presenting oral and written reports. Prerequisite: a minimum grade of 2.0 in TCES 430; a minimum grade of 2.0 in TCES 455.~~

TCES 482 Senior Project ~~II~~ (5)

~~Focuses on design and implantation, testing, and demonstration of the capstone design project. Prerequisite: a minimum grade of 2.0 in TCES 481.~~

Admission to the Program

~~During the first two years in the~~ CES ~~program,~~ students must ~~expected~~ complete the following courses:

- Calculus I, II, and III; Differential Equations, and Matrix/Linear Algebra.
- 10 credits of Visual, Literary and Performing Arts (Humanities) course work.
- 10 credits of Individuals and Societies (Social Science) course work; microeconomics recommended.
- Minimum of 18 credits of lab-based science (Natural World) which must include calculus-based Physics I, II and III. If Physics I, II and III are completed and 18 credits are not achieved, the remaining credits may be satisfied by any lab-based science course.
- Two CES Programming courses.
- 5 credits of Electrical Circuits

Introduction to Engineering I, II, and III (recommended but not required).

~~**With advisor approval, transfer students may substitute science, engineering or mathematics courses for the Introduction to Engineering courses.**~~ **Students with previous baccalaureate degrees or extensive work experience should meet with an advisor to discuss options. Admission Requirements**

- Completed a minimum of 45 college-level credits total
- Cumulative GPA of at least 2.0 in all college course work
- Cumulative GPA of at least 2.5 in all Computer Engineering pre-requisite course work.

Students transferring from a community college to this program are ***strongly*** encouraged to follow the Associate of Science Transfer Track 2.

Graduation Requirements:

- Have a minimum cumulative grade point average of 2.5 in all CES required and prerequisite courses.
- Each required CES course must be completed with a minimum grade of 2.0.
- If a grade below 2.0 is earned, the course must be repeated.
- Complete all university requirements

PROPOSED CATALOG COPY

Reflecting requested changes (Include exact wording as you wish it to be shown in the printed catalog. Please underline or otherwise highlight any additions. If needed, attach a separate, expanded version of the changes that might appear in department publications). **Please note:** all copy will be edited to reflect uniform style in the General Catalog.

New and Changing Courses

ADD

New required course:
TCES 420 Principles of Operating Systems
Course description:
TCES 420 Principles of Operating Systems (4)
Covers the fundamental principles of operating system design and function for both general purpose computing and real-time application control. Includes concurrent processes, scheduling, inter-process communications, memory management, I/O, and file systems. Prerequisite: Grade of 2.0 in TCES372.

New required course:
TCES 460 - Embedded Systems Development
Course description:
TCES 460 - Embedded Systems Development (4)
Guides the integration of knowledge and skills learned in prior courses in preparation for completion of the senior project in TCES 482. Covers the analysis, design, and prototyping of an embedded control application involving multiple sensor types, actuation, and requiring a real-time OS. Prerequisites: TCES 420, TCES 430, and TCES 455 with minimum 2.0 grades in any one and a 2.5 GPA in all.

New required course:
TCES 480 Senior Project I
Course description
TCES 480 Senior Project I (2)
Covers the preparation for conducting the senior project systems analysis and design (TCES481), and implementation, testing, and delivery (TCES482). Includes case studies of engineering projects. Prerequisites: TCSS 360 with 2.0 GPA.
Add in Required Courses

Change:
Course description
TCES 372 Machine Organization and Architecture for Computer Engineers (4)
Covers the general features of computation systems with emphasis on microcontrollers, including an introduction to processor architecture, instruction sets, assembly programming, memory, debug monitors, and translation from higher level languages to machine language. Prerequisite: a minimum grade of 2.0 in TCES 230.

Course description
TCES 481 Senior Project II (4)
Project teams will analyze client needs, develop problem statement, specifications, and plans for implementation of project deliverables. Prerequisites: TCSS 480 with 2.0 GPA.

TCES 482 Senior Project III (5)
Project teams will implement, test, and deliver project deliverables (product), completing the Senior Design requirement for the degree. Prerequisites: TCSS 481 and TCES 460 with 2.0 GPA.

Admission Requirements

- Completed a minimum of 45 college-level credits total
- Cumulative GPA of at least 2.0 in all college course work
- Cumulative GPA of at least 2.5 in all Computer Engineering pre-requisite course work.

Students transferring from a community college to this program are ***strongly*** encouraged to follow the Associate of Science Transfer Track 2.

Graduation Requirements:

- Have a minimum cumulative grade point average of 2.5 in all CES required and prerequisite courses.
- Each required CES course must be completed with a minimum grade of 2.0.
- If a grade below 2.0 is earned, the course must be repeated.

Pre-requisites

- (TMATH 124, 125, and 126) Calculus I, II, III
- (TMATH 307) Differential Equations
- (TMATH 308) Matrix/Linear Algebra
- (TESC 121,122, and 123) Calculus-based Physics. If Physics I, II and III are completed and 18 credits are not achieved, the remaining credits may be satisfied by any lab-based science course. (18)
- (TCES 201 and TCES 202) CES Programming courses or C, C++, or JAVA based languages (C preferred).
- (TCES 215) Electrical Circuits (must have AC/DC at community colleges).

With adviser approval, transfer students may substitute science, engineering or mathematics courses for the Introduction to Engineering courses.

Students with previous baccalaureate degrees or extensive work experience should meet with an adviser to discuss options.

How to Apply

- To apply for admission into the Computer Engineering and Systems major, a student must fill out a CES major application form and supply the above information.

Current Students

- Please contact an Institute advisor at tacoma.uw.edu/academic-advising-center

Transfer Students

- To apply to the Computer Engineering and Systems program, students must complete the online UW Tacoma transfer application (tacoma.uw.edu/apply).

REQUIRED CES CORE COURSES

Computer Engineering Fundamentals (15)

- TCES 203 Programming Practicum (5)
- TCSS 342 Data Structures (5)
- TCSS 360 Software Development and Quality Assurance Techniques (5)

Electrical Engineering Fundamentals (10)

- TCES 310 Linear Systems and Transforms (5)
- TCES 312 Electronics and Analog Systems (5)

Computer Systems (8)

- TCES 372 Computer Organization and Architecture (4)
- TCES 420 Principles of Operating Systems for Engineers (4)

Math / Theory (10)

- TCSS 321 Discrete Structures I (5)
- TMATH 390 Probability and Statistics (5)

Ethics and Society (5)

- TCSS 325 Computers, Ethics and Society (5)

Computer Engineering (35)
- TCES 230 Introduction to Logic Design (5)
- TCES 330 Digital System Design (5)
- TCES 430 Advanced Digital System Design (5)
- TCES 455 Devices and Controls (5)
- TCES 460 Embedded Systems Design (4)
- TCES 480 Senior Design Project I (2)
- TCES 481 Senior Design Project II (4)
- TCES 482 Senior Design Project III (5)

Electives (5)

- May include TCES, TCSS, 500 level TCSS, directed reading, directed research or internship course.

For transfer students, please use the UW Equivalency Guide to determine how your courses will transfer.

Students with previous baccalaureate degrees or extensive work experience should meet with an advisor to discuss options.

Students who have completed Object-Oriented Programming I (TCSS 142) or its equivalent may go into TCES 202 upon satisfactory completion of a programming placement exam.

An application for entry can be completed and submitted in the quarter in which the final Physics and/or TCES 201 are being completed. Applications will receive provisional acceptance and be allowed to register for TCES 202 (Advanced Programming).

Academic Standards
The following standards apply to all students in the Computer Engineering and Systems program. These standards apply to all major curricula and exist in addition to other academic standards at the University of Washington Tacoma.

- All required prerequisite and major courses (including TCES 201 and TCES 202) must be completed with a minimum grade of 2.0 before advancing to the next academic level. If a lower grade is received, the student must repeat the course. Course credit will be awarded only once but both grades are averaged together to compute the cumulative grade point average.

To substitute a course in the major, Computer Engineering and Systems courses completed at other accredited four-year institutions may not be more than seven years old. If a student wishes to substitute a course, he or she must submit a Petition to Substitute a Course form (tacoma.uw.edu/institute-technology/undergraduate-resources) and supporting documents to the faculty. If a course is more than seven years old, the student will be required to repeat the course at UW Tacoma. Credit will not be awarded twice for the same course. The petition does not guarantee that credit will be awarded for a course; the petitioning student may be required to complete additional course work in place of the waived requirement.

- If after repeating a required CES course a student does not achieve the required grade of 2.0, the student must request permission to take the course a third time. The Petition to Repeat a Course form and instructions are located on the Institute of Technology website at: tacoma.uw.edu/institute-technology/undergraduate-resources.
- Students must complete all non-prerequisite general education courses outside the CES major with a minimum grade of 1.7. If a grade below 1.7 is received in a non-prerequisite elective course, the course will not count towards graduation but the student is not required to repeat the same course.
- Courses in the Computer Engineering and Systems program may not be taken by correspondence (distance learning) without prior faculty approval.
- Courses in the Computer Engineering and Systems program may not be taken S/NS (satisfactory/not

satisfactory).
■ Upper-division Computer Engineering and Systems courses completed at other accredited four-year institutions may be substituted for required major courses but may not be more than seven years old. If a course is more than seven years old, the student will be required to repeat the course at UW Tacoma. Credit will not be awarded twice for the same course.
■ Upper-division courses used for transfer credit are held to the 2.0 grade standard required for all courses in the Computer Engineering and Systems major.
■ Students changing to a Computer Engineering and Systems major from another major will be required to meet program and academic performance requirements in effect at the time the major is changed.

Low Scholarship
An undergraduate Computer Engineering and Systems major who is dismissed from the university for low scholarship is removed from the Computer Engineering and Systems major.
After being removed from the Computer Engineering and Systems major, a student must re-apply for admission to continue as a student in any status.

Computing Labs
The Institute of Technology has dedicated laboratories containing specialized equipment to support its programs. These laboratories are accessible to admitted Institute of Technology students via assigned key card 24 hours a day, seven days a week. Access to facilities is also available through Internet connections.

Graduation Requirements
To qualify for graduation with a baccalaureate degree in Computer Engineering and Systems from the University of Washington Tacoma, a student must:
■ Be a matriculated Computer Engineering and Systems student in good academic standing with the University of Washington Tacoma.
■ Complete all Computer Engineering and Systems prerequisite and required course work with a minimum cumulative grade point average of 2.5 in those courses.
■ Complete 180 credits. At least 85 credits must be upper-division (300-400 level) course work.
■ Complete a minimum of 30 credits of required courses in residence at the University of Washington Tacoma.
■ Complete 75 percent of elective courses in residence at the University of Washington Tacoma.
■ Complete the final 45 credits in residence at the University of Washington Tacoma.
■ Satisfy all of the general university graduation requirements, including five credits of English composition with a minimum grade of 2.0.
■ Have a minimum cumulative grade point average of 2.5 in all Computer Engineering classes.
■ Apply for graduation with an advisor by the application deadline posted by the Graduation and Academic Records Office for the expected date of graduation.
In addition to the general requirements for graduation, students earning the bachelor of science degree must also:
■ Complete the required courses in the Computer Engineering and Systems major.
■ Complete 5 credits of 400-level Computer Engineering and Systems electives.
■ Complete 15 credits of upper division (300 or 400 level) general electives. The electives are expected to consist solely of courses outside the CES program.
In addition to the general requirements for graduation, students earning the bachelor of arts degree must also:
■ Complete the specified 88 credits of required courses in the Computer Engineering and Systems bachelor of Science major.
■ Satisfy the requirements for a declared UW Tacoma minor or have earned a previous bachelor's degree.
Post-baccalaureate students who are admitted to the Computer Engineering and Systems program are required to complete the required core and senior elective courses with a minimum cumulative grade point average of 2.5. Elective credit requirements are waived.

APPROVALS

Chair/Program Director:	**Date:** 11/04/2013
College/School/Campus Curriculum Committee:	Date: 3/24/14
Dean/Vice Chancellor:	Date: 3/24/14
Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:	Date:
POST TRI-CAMPUS APPROVAL (when needed)	
Faculty Council on Academic Standards/ General Faculty Organization/Faculty Assembly Chair:	Date: