CALIFORNIA STATE UNIVERSITY CHANNEL ISLANDS
POLICY MANUAL

Division of Academic Affairs | **Policy Number:** SP 15-16

Approved By: Academic Senate, May 10, 2016 | **Effective Date:** Fall 2016

Policy on the Mechatronics Major

PURPOSE:
See pages 2-5

BACKGROUND:
See pages 8-9

POLICY:
Accountability:
See pages 7

Applicability:
See pages 9-16

Definition(s):
See pages 6-7

Policy Text:
See pages 8-23

EXHIBIT(S):
See page 8

Proposing New CSU Degree Programs
Bachelor's and Master's Levels

Offered through Self-Support and State-Support Modes

This document presents the format, criteria, and submission procedures for CSU bachelor's and master's degree program proposals. Please see the Academic Program Planning website for doctoral degree proposal formats. (http://www.calstate.edu/APP/)

Templates for Doctoral Proposals

- CSU Ed.D. Programs
- UC CSU Joint Doctoral Programs
- Joint Doctorates with Independent Institutions

Criteria

Proposals are subjected to system-level internal and external evaluation, through which reviewers seek evidence indicating that current campus budgetary support levels provide sufficient resources to establish and maintain the program. Review criteria include: curriculum, financial support, number and qualifications of faculty, physical facilities, library holdings, responsiveness to societal need and regional and workforce needs, academic assessment plans, and compliance with all applicable CSU policies, state laws, and accreditation standards.

Procedures

Before a proposal is submitted to the Chancellor's Office, the campus adds the projected degree program to the campus academic plan. Subsequent to the CSU Board of Trustees approval of the projection, a detailed, campus-approved program implementation proposal is submitted to Chancellor's Office for review and approval. Proposals are to be submitted in the academic year preceding projected implementation. Only programs whose implementation proposals have been approved by the CSU Chancellor may enroll students. Campus Academic Plans appear in the Educational Policy Committee Agenda Item of the annual March meeting of the Board of Trustees.

Submission

1. The degree program proposal should follow the format and include information requested in this template. If the proposed program is subject to WASC Substantive Change, the Chancellor's Office will accept the WASC Substantive Change Proposal format in place of the CSU format. If campuses choose to submit the WASC Substantive Change Proposal, they will also be required to submit a program assessment plan using the format found in the CSU program proposal template. For undergraduate degrees, the total number of units required for graduation must still be made explicit.
2. Submit **ONE** hard copy of the campus-approved degree implementation proposal, including documentation of campus approval, to:

Academic Programs and Faculty Development
CSU Office of the Chancellor
401 Golden Shore
Long Beach, California 90802-4210

3. Submit **ONE** electronic copy to APP@calstate.edu. A Word version is preferred.

CSU DEGREE PROPOSAL
Faculty Check List

Please confirm (√) that the following are included in the degree proposal:

__√___ Board of Trustees Academic Master Plan approval date.

_133_ The total number of units required for graduation is specified (not just the total for the major):

_√__ a proposed bachelor's program requires no fewer than 120 semester units

_√__ any proposed bachelor's degree program with requirements exceeding 120 units must request an exception to the 120 semester unit limit policy

_____ Please specify the total number of prerequisite units required for the major. Note: The prerequisites must be included in the total program unit count.

List all courses and unit counts that are prerequisite to the major:
_____
_____

__√___Title 5 minimum requirements for bachelor's degree have been met, including:

__√_ minimum number of units in major (BA 24 semester units), (BS 36 semester units)

_√__ minimum number of units in upper-division (BA 12 semester units), (BS 18 semester units)

____Title 5 requirements for proposed master's degree have been met, including:

___ minimum of 30 semester units of approved graduate work are required

____ no more than 50% of required units are organized primarily for undergraduate students

____ maximum of 6 semester units are allowed for thesis or project

____ Title 5 requirements for master's degree culminating experience are clearly explained.

____ **for** graduate programs, at least five-full time faculty with terminal degrees in appropriate disciplines are on staff.

_____**For self-support programs:**
(in conformance with EO 1099 and EO 1102)

____ specification of how all required EO 1099 self-support criteria are met

____ the proposed program does not replace existing state-support courses or programs

____ academic standards associated with all aspects of such offerings are identical to those of comparable state-supported CSU instructional programs

____ explanation of why state funds are either inappropriate or unavailable

____ a cost-recovery program budget is included*

____ student per-unit cost is specified

____ total cost for students to complete the program is specified

* Basic Cost Recovery Budget Elements
(Three to five year budget projection)

Student per-unit cost
Number of units producing revenue each academic year
Total cost a student will pay to complete the program

Revenue - (yearly projection over three years for a two-year program; five years for a four-year program)
- Student fees
- Include projected attrition numbers each year
- Any additional revenue sources (e.g., grants)

Direct Expenses
- Instructional costs – faculty salaries and benefits
- Operational costs – (e.g., facility rental)
- Extended Education costs – staff, recruitment, marketing, etc.
- Technology development and ongoing support (online programs)

Indirect Expenses
- Campus partners
- Campus reimbursement general fund
- Extended Education overhead
- Chancellor's Office overhead

*Additional line items may need to be added based on program needs

CSU Degree Program Proposal Template
Revised September 2015

Please Note:

- Campuses may mention proposed degree programs in recruitment material if it is specified that enrollment in the proposed program is contingent on final program authorization from the CSU Chancellor's Office.

- Approved degree programs will be subject to campus program review within five years after implementation. Program review should follow system and Board of Trustee guidelines (including engaging outside evaluators) and should not rely solely on accreditation review.

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

   g. New Program

2. **Program Identification**

   a. Campus
   California State University Channel Islands

   b. Full and exact degree designation and title (e.g. Master of Science in Genetic Counseling, Bachelor of Arts with a Major in History).
   Bachelor of Science in Engineering Mechatronics

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

   d. Term and academic year of intended implementation (e.g., fall 2017).
   Fall 2017

   e. Total number of units required for graduation. This will include all requirements (and campus-specific graduation requirements), not just major requirements.
   133 units; the program follows requirements for ABET accreditation, hence the high unit count. Campus policy prohibits the double-counting of American Institutions (AIR-Title V) courses with GE Area D, therefore, six units are included.

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

g. Name, title, and rank of the individual(s) primarily responsible for drafting the proposed degree major program.
Ivona Grzegorczyk, Professor of Mathematics
Michael Soltys, Professor of Computer Science
A.J. Bieszczad, Professor of Computer Science
Geoff Dougherty, Professor of Physics
Jason Isaacs, Assistant Professor of Computer Science
David Claveau, Assistant Professor of Computer Science

h. Statement from the appropriate campus administrative authority that the addition of this program supports the campus mission and will not impede the successful operation and growth of existing academic programs.
Provost Gayle Hutchinson (see attached letter)

i. Any other campus approval documents that may apply (e.g. curriculum committee approvals).
Submitted to CC

j. Please specify whether this proposed program is subject to WASC Substantive Change review. The campus may submit a copy of the WASC Sub-Change proposal in lieu of this CSU proposal format. If campuses choose to submit the WASC Substantive Change Proposal, they will also be required to submit a program assessment plan using the format found in the CSU program proposal template.

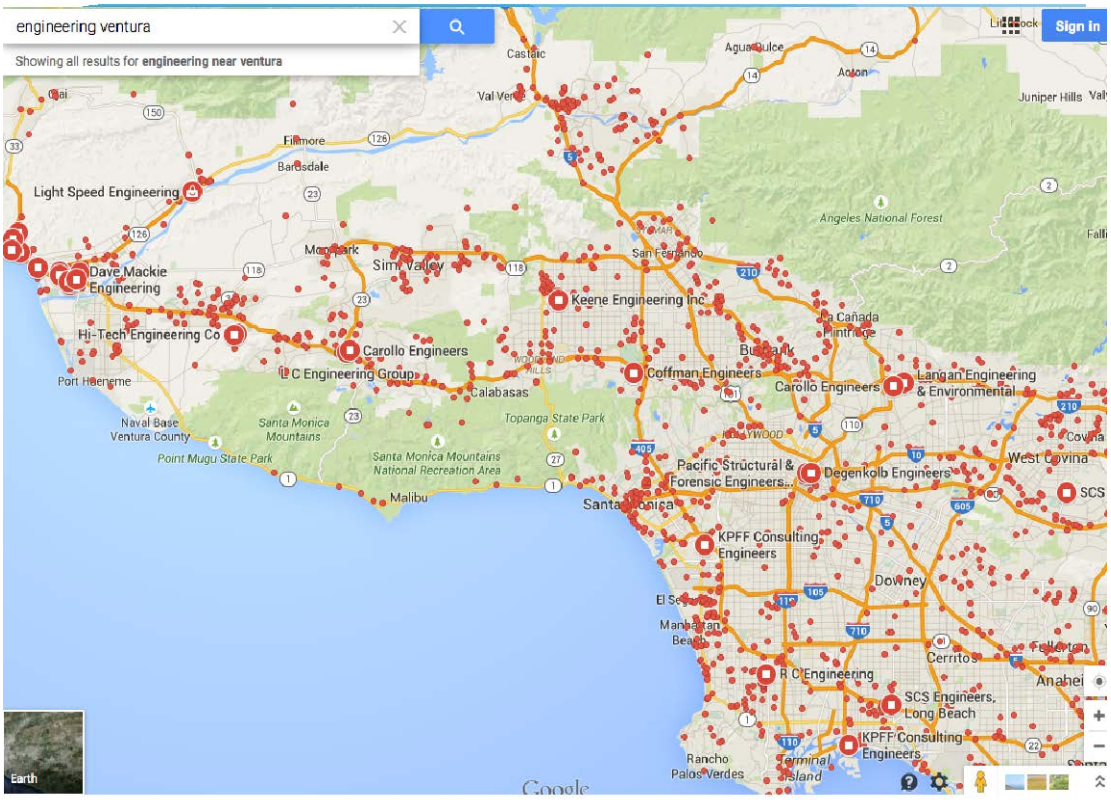
k. Optional: Proposed Classification of Instructional Programs and CSU Degree Program Code
CI Code EMEC
CIP 14.42. Title: Mechatronics, Robotics, and Automation Engineering
CSU Program Code 09102 Mechatronic Engineering
09102 Mechatronic Engineering (9011 Engineering)

Campuses are invited to suggest one CSU degree program code and one corresponding CIP code. If an appropriate CSU code does not appear on the system-wide list at: http://www.calstate.edu/app/resources.shtml, you can search CIP 2010 at http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55 to identify the code that best matches the proposed degree program. The Classification of Instructional Programs (CIP) is a National Center for Education Statistics (NCES) publication that provides a numerical classification and standard terminology for secondary and postsecondary instructional programs. The CSU degree program code (based on old HEGIS codes) and CIP code will be assigned when the program is approved by the Chancellor.

3. Program Overview and Rationale

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

CSU Channel Islands is the only public university in the County of Ventura. The campus is strategically located on the so called "101 Tech Corridor," sharing the neighbourhood with companies such as Amgen, Haas, Teledyne Technologies, HRL Laboratories, and many others, not to mention Point Mugu and Port Hueneme Naval bases, as well as Lockheed, Rocketdyne, and other companies in the greater Los Angeles area. Therefore, there is a great need and demand for engineers in the local industry and community. The map below represents numerous engineering companies in the proximity of CSUCI.



The local companies strongly support the establishment of an Engineering program on the CI campus, and a comprehensive report was produced in 2013 with recommendation for an engineering degree that would meet the needs of the community. In this report it was noted that Ventura County hires about 290 engineers each year, not to mention that the local Naval Bases send their officers to complete their Engineering degrees across the nation, which results in high costs for the Navy, and a loss of revenue for Ventura County.

Mechatronics is a fast growing area of Engineering that is interdisciplinary by nature, as it combines aspects of Mechanics, Control Theory, Computer Science,

and Electronics, in order to improve and optimize the design and functionality of systems, as well as making them more economical and reliable. Industrial robots and drones are quintessential examples of mechatronics systems: they include aspects of electronics, mechanics, and computing. Modern production equipment consists of mechatronic modules that are integrated according to a suitable control architecture. Popular examples include automotive subsystems, including anti-lock brakes and spin-assist, as well as everyday equipment, such as autofocus cameras, video, hard disks and CD players. The complexity of mechatronics requires at least a bachelor's degree to get into the field. Although the U.S. Bureau of Labor Statistics (BLS) does not provide specific salary information for mechatronics engineers, it does show that median annual wages for all specialized engineers not categorized was $92,680 as of May 2013. The middle 50% of these professionals earned between $68,610 and $117,930 yearly.

The local Navy bases, as well as industry, are very interested in a Mechatronics degree at CI. In fact, a recruiter for Lockheed Martin commented that the company is constantly seeking Mechatronics graduates, and that they would prefer to hire local Ventura engineers. CSU Chico started a very successful Mechatronics program over 20 years ago, and it would be a good model for CI to follow. In fact, Chico has one of only 6 ABET accredited Mechatronics programs in the Nation!

A scrutiny of the ABET requirements for Mechatronics shows that many of the courses required for such a degree are already being offered at CI. We have a strong offering in Computer Science, Mathematics, and Physics, and with a modicum of effort we could have a program meeting the requirements for an ABET accreditation. The main investment would be three new faculty members, and appropriate lab equipment.

Furthermore, Mechatronics would blend very well with other degrees already being offered on the CI Campus. We offer Minors in Robotics Engineering, Game Design, and a recently approved Minor in Security Systems Engineering. Mechatronics is particularly close to Robotics, where we already have two faculty members who can teach selected courses in Mechatronics. Both Mechatronics and Robotics converge seamlessly in the field of Unmanned Aerial Vehicles, i.e., Drones, which have applications in a great variety of fields: from Agriculture and Weather, to Amazon's plans for package delivery, to military operations.

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

Mechatronics Engineering is a modern discipline that transcends the boundaries between Embedded Systems, Mechanical, Electrical, and Computer Engineering. It is a discipline that focuses on the design and control of electro-mechanical devices, as well as the integration of electronics, control engineering and mechanical engineering.

4. **Curriculum –** *(These requirements conform to the revised 2013 WASC Handbook of Accreditation)*

a. These program proposal elements are required:

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

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

(WASC 2013 CFR: 1.1, 1.2, 2.3)

Institutional learning outcomes:

CSU Channel Islands' graduates will possess an education of sufficient breadth and depth to appreciate and interpret the natural, social and aesthetic worlds and to address the highly complex issues facing societies. Graduates will be able to:

1. **Identify and describe the modern world and issues facing societies from multiple perspectives including those within and across disciplines, cultures and nations (when appropriate); and**
2. **Analyze issues, and develop and convey to others solutions to problems using the methodologies, tools and techniques of an academic discipline.**

Program Goals and Outcomes:

1. **Provide students with the opportunity to earn a state-supported Bachelor degree in Engineering Mechatronics from the California State University.**
2. **Prepare students for employment in a variety of highly sophisticated and complex high-tech and engineering industries.**
3. **Prepare students for further study in graduate or professional schools.**
4. **Offer all CSUCI students the opportunity to broaden their knowledge and learn engineering skills and apply them to mechatronics problems.**

The proposed Engineering Mechatronics Program at CSUCI has a clear organizational structure that forms a logical sequence of courses and other instructional components. We have designed a course of study that gives our graduates a very solid background in mathematics, computer science, science and engineering, with many interdisciplinary applications, broad connection to other disciplines, and a wide variety of engineering experiences. Our graduates will be highly skilled engineers, problem solvers and project-oriented professionals. They will be flexible, positive, and compassionate, with a willingness to reflect critically on the role of technology in the society, and are ethical decision makers who embrace the diversity of population. We have designed a hands-on program that will enable our candidates to experience a variety of modern applications and technologies and make them competitive on the job market.

Students Learning Objectives:

Students will be able to:

1. Demonstrate critical thinking and problem solving skills by identifying, evaluating, analyzing, synthesizing and presenting fundamental engineering and technical issues and their applications.

2. Demonstrate the knowledge of current engineering practices and broad technology used in industry, including a working knowledge of software, hardware, robotics, automation and other engineering techniques.

3. Be cognizant of emerging new technologies and industrial practices connected to engineering and demonstrate understanding of the role of various technologies in society.

4. Demonstrate cooperation skills by working effectively with others in interdisciplinary group settings – both inside and outside the classroom.

5. Demonstrate technical and presentation skills and a sense of exploration that enables them to pursue rewarding careers in high-tech and engineering industries.

b. These program proposal elements are required:

- Comprehensive assessment plan addressing all assessment elements;

- Matrix showing where student learning outcomes are introduced (I), developed (D), and mastered (M)

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

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

Curriculum Mapping Matrix
Where SLOs are Introduced (I), Developed (D), and Mastered (M)

	MATH COURSES	CS COURSES	PHYSICS COURSES	EMEC 200	CAPSTONE	Electives
SLO 1	I, D	I, D	I	I	M	D
SLO 2		I	I, D	D	M	D
SLO 3	I	I, D, M		D	M	
SLO 4	I	I, D	I, D	D	M	
SLO 5	I	I, D		D	M	D

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

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

Dr. Daniel Wakelee, Associate Provost of California State University Channel Islands, has approved the Engineering Mechatronics Programs' request for an exception to the Title 5 unit limit for this kind of baccalaureate program and the following justification:

In order to properly prepare students graduating from CSUCI with a Bachelor of Science Degree in Engineering Mechatronics for a career in the field and to ensure they are competitive job applicants, the faculty of

the program believe it necessary to include all courses currently in the program and their prerequisites to meet the minimum number of courses required for accreditation by the Accreditation Board of Engineering and Technology (ABET). Both California State University, Chico and California Polytechnic University, San Luis Obispo also have Mechatronic Engineering programs that are ABET accredited and, according to their websites, both have more than 120 semester, or 180 quarter, units. Chico's program has 128 semester units and San Luis Obispo's program has 196 – 202 quarter units, respectively. See below links for further information:

http://www.csuchico.edu/mmem/programs/bs_mechatronic_engineering/curriculum.shtml

http://catalog.calpoly.edu/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/

In addition, all hidden prerequisites have been removed from CI's Engineering Mechatronics program, so as to accurately represent the number of courses and units students will need to complete for it. Lastly, every effort has also been made to meet multiple system-wide, university and program requirements with the minimum number of courses (double- and triple-counting), with the exception of the American Institutions requirement. Campus policy precludes double-counting with GE Area D.

e. If any formal options, concentrations, or special emphases are planned under the proposed major, identify and list the required courses. Optional: You may propose a CSU degree program code and CIP code for each concentration that you would like to report separately from the major program.
None

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

Code	Name	Units	GE	Prerequisites in Place
CHEM 105	Introduction to Chemistry	3		No prerequisites
MATH 150	Calculus I	4	3	Calculus Placement Exam. or MATH 105
COMP 150	Object Oriented Programming	4	3	MATH 105 or equiv., COMP 105 or permission
MATH 151	Calculus II	4		MATH 150
MATH 250	Calculus III	3		MATH 151 with at least a C
COMP 151	Data Structures And Program Design	4		COMP 150
COMP 162	Computer Architecture And Assembly Language	3		COMP 150
MATH/PHIL 230	Logic and Mathematical Reasoning	3	3	No prerequisites
MATH 240	Linear Algebra	3		MATH 151
COMP 232	Programming Languages	3		COMP 150, COMP 151, COMP 162
COMP 262	Computer Organization and Architecture	3		COMP 151, COMP 162
EMEC 200	Logic Circuits	4		MATH 150, MATH 230, COMP 162
EMEC 225	Engineering Design	3		EMEC 200
PHYS 200	General Physics I	4	3	MATH 150
PHYS 201	General Physics II	4		PHYS 200, MATH 151
EMEC/PHYS 221	Engineering Materials	3		CHEM 105, PHYS 200
COMP 350	Introduction to Software Engineering	3		COMP 232, COMP 262
MATH 300	Discrete Mathematics	3		MATH 230
MATH 350	Differential Equations & Dynamical Systems	3		MATH 250
MATH 352	Probability and Statistics	3		MATH 151
MATH 354	Analysis of Algorithms	3		COMP 151, MATH 300
PHYS 310	Electronics	4		PHYS 201
COMP 362	Operating Systems	4		COMP 151, COMP 162, COMP 232, COMP 262
COMP 462	Embedded Systems	3		COMP 350, COMP 362
COMP 470	Mobile Robotics	3		COMP 350, MATH 240, COMP 362
EMEC 463	Feedback Control Systems	3		MATH 240, MATH 350
EMEC 491	Capstone Preparation	1		Senior standing in Mechatronics Major
EMEC 499	Capstone	3		Senior standing in Mechatronics Major
	Lower Division	55		
	Upper Division	36		
	GE & Title V	42		
	Total	133		

EMEC 200 - Logic Circuits: Basics of digital electronic devices and methodologies used in digital circuit design. Design, analysis and trouble shooting of logic gates, counters, registers, memory units, pulse and switching circuits, and control circuits. Comparison of digital TTL integrated circuits with other families of logic devices. Includes student projects.

EMEC/PHYS 221 - Engineering Materials: Examines the interrelationships between processing, structure, properties, and performance of various engineering materials such as metals, polymers, ceramics, composites, and semiconductors. Studies the effects of heat, stress, imperfections, and chemical environments upon material properties and performance. Emphasizes developing an ability to select appropriate materials to meet engineering design criteria.

EMEC 225 - Engineering Design: Introduction to engineering design processes, methods, and decision making using team design projects; design communication methods including graphical, verbal, and written.

EMEC 463 - Feedback Control Systems: Analysis and design of feedback control systems. Topics include representing dynamical systems with transfer functions and state variables, stability and dynamic analysis using techniques from both the time and frequency domains, the design of feedback regulators and controllers, and computer aided design and analysis.

EMEC 491 - Capstone Preparation: Research and develop a proposal for a significant Mechatronics project under faculty supervision.

EMEC 499 - Capstone: Design, implement and present a significant Mechatronics project under faculty supervision.

(WASC 2013 CFR: 2.1, 2.2)

g. List any new courses that are: (1) needed to initiate the program or (2) needed during the first two years after implementation. Include proposed catalog descriptions for new courses. For graduate program proposals, identify whether each new course would be at the graduate-level or undergraduate-level.
None to initiate – Freshmen start with Chemistry, Physics, Mathematics and Computer Science courses
First two years: EMEC 200, EMEC/PHYS 221, EMEC 225, followed by upper division courses
For new courses listed (EMEC 200, EMEC/PHYS 221, EMEC 225, EMEC 463, EMEC 491, EMEC 499) see section 4f (previous section)

h. Attach a proposed course-offering plan for the first three years of program implementation, indicating likely faculty teaching assignments.

(WASC 2013 CFR: 2.2b)

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

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

(WASC 2013 CFR: 2.2b)

k. For graduate degree programs, specify admission criteria, including any prerequisite coursework.

(WASC 2013 CFR: 2.2b)

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

m. For undergraduate programs, specify planned provisions for articulation of the proposed major with community college programs.
Program will follow articulation agreements already in place and will develop articulation for new specialized courses

n. Provide an advising "roadmap" developed for the major.

FALL Year 1		SPR Year 1		FALL Year 2		SPR Year 2	
CHEM 105	(3)	MATH 151 (MATH 150)	(4)	EMEC 200 (COMP 162, MATH 150, 230)	(4)	MATH 350 (MATH 250)	(3)
MATH 150	(4)	PHYS 200 (MATH 150)	(4)	MATH 240 (MATH 151)	(3)	COMP 262 (COMP 151, 162)	(3)
MATH/PHIL 230	(3)	COMP 162 (COMP 150)	(3)	PHYS 201 (PHYS 200)	(4)	EMEC 225 (EMEC 200)	(3)
COMP 150	(4)	COMP 151 (COMP 150)	(4)	EMEC/PHYS 221 (CHEM 105, PHYS 200)	(3)	COMP 232 (COMP 150, 151, 162)	(3)
GE requirement	(3)			MATH 250 (MATH 151)	(3)	GE requirement	(3)
						American Institutions	(3)
	17		15		17		18

FALL Year 3	SPR Year 3	FALL Year 4	SPR Year 4
COMP 350 (COMP 232, 262) (3)	MATH 352 (MATH 151) (3)	COMP 462 (COMP 350, 362) (3)	EMEC 499 (3)
COMP 362 (COMP 151, 162, 232, 262) (4)	COMP 470 (COMP 350, 362, MATH 240) (3)	EMEC 491 (1)	GE requirement (3)
MATH 300 (MATH 230) (3)	MATH 354 (COMP 151, MATH 300) (3)	EMEC 463 (MATH 240, 350) (3)	GE requirement (3)
PHYS 310 (PHYS 201) (4)	GE requirement (3)	GE requirement (3)	GE requirement (3)
GE requirement (3)	GE requirement (3)	GE requirement (3)	GE requirement (3)
	American Institutions (3)	GE requirement (3)	
17	18	16	15

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

(WASC 2013 CFR: 1.8)
No special accreditation from WASC is required.
No initial accreditation is required. Accrediting body for Mechatronic Engineering is ABET and the curriculum follows the requirements. The program has to grow to include 5 permanent faculty to start the accreditation process (which is required by the majority of employers). We expect to start the accreditation process in 6 years.

Accreditation Note:

Master's degree program proposals
If subject to accreditation, establishment of a master's degree program should be preceded by national professional accreditation of the corresponding

bachelor's degree major program.

Fast-track proposals
Fast-track proposals cannot be subject to specialized accreditation by an agency that is a member of the Association of Specialized and Professional Accreditors unless the proposed program is already offered as an authorized option or concentration that is accredited by an appropriate specialized accrediting agency.

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

a. List other California State University campuses currently offering or projecting the proposed degree major program; list neighboring institutions, public and private, currently offering the proposed degree major program.
Currently only CSU Chico has a program in Mechatronics which specializes in the Mechatronics of large machinery and is located in Northern California. CSUCI program will be focused on autonomous vehicles and mobile robotics, and will be located in the proximity to aerospace industry and navy. There are only 8 other accredited programs nationwide (all outside of California).

b. Describe differences between the proposed program and programs listed in Section 5a above.
CSUCI program will be based on autonomous vehicles and mobile robotics, hence will address significantly different needs than CSU Chico's program, which is oriented towards machinery. Our program will address aerospace industry, transportation, data collecting research mobiles and military needs.

c. List other curricula currently offered by the campus that are closely related to the proposed program.
Existing courses in Computer Science, Mathematics, Applied Physics and Chemistry will be included in the major.

d. Describe community participation, if any, in the planning process. This may include prospective employers of graduates.
We are working with the local schools, community colleges and industry on program development. We are strongly supported by the Ventura County Office of Education (specifically Tiffany Morse, Director, Career Education); with Lockheed Martin (specifically with William Daubert, a Lockheed Martin Engineer, Manager and Recruiter); with Ventura College and Moorpark College, (specifically with engineering faculty Michelle Millea and Scarlett Relle, with whom we were discussing collaboration and introductory program for potential transfer students) as well as the staff form Ventura County Navy Bases.

e. Provide applicable workforce demand projections and other relevant data.
Ventura County is lagging in preparation of the engineering work force for the local industry. County data shows a great potential for development of engineering jobs and reduction of local unemployment rates. See map and labor stats in 3a. The report on engineering in Ventura County found about 300 engineering positions needed every year. As Mechatronics is multidisciplinary, its graduates will be attractive to a wide spectrum of employers.

Note: Data Sources for Demonstrating Evidence of Need

APP Resources Web http://www.calstate.edu/app/resources.shtml

US Department of Labor, Bureau of Labor Statistics

California Labor Market Information

6. **Student Demand**

a. Provide compelling evidence of student interest in enrolling in the proposed program. Types of evidence vary and may include (for example), national, statewide, and professional employment forecasts and surveys; petitions; lists of related associate degree programs at feeder community colleges; reports from community college transfer centers; and enrollments from feeder baccalaureate programs.
Mechatronics is already central to the modern global economy. According to a study by the National Instruments Corporation, machine manufacturers all over the world report having to build machines that are increasingly more complex and software controlled, yet have less and less time to bring those machines to market. In response to this pressure, most design companies and manufacturers are relying increasingly on mechatronics. According to the Aberdeen Group, a technology think-tank, the most successful companies are the ones that use mechatronics or similar collaborative processes. See more at: http://www.ecpi.edu/blog/what%E2%80%99s-career-outlook-mechatronics-engineering#sthash.Sx56hJ52.dpuf

Although the U.S. Bureau of Labor Statistics (BLS) does not provide specific salary information for mechatronics engineers, it does show that median annual wages for all specialized engineers not categorized was $92,680 as of May 2013. The middle 50% of these professionals earned between $68,610 and $117,930 yearly.

At this time Ventura County has several existing mechatronics and robotics programs at high school and community college levels (as well as summer engineering programs for elementary and middle school pupils).

These students as well as others from across the state will join the proposed CI program.

b. Identify how issues of diversity and access to the university were considered when planning this program. Describe what steps the program will take to insure ALL prospective candidates have equitable access to the program. This description may include recruitment strategies and any other techniques to insure a diverse and qualified candidate pool.
CSUCI is a Hispanic serving institutions. There is a concerted effort supported by grants and the State to bring students to STEM majors. Local partners offer numerous engineering internships, many targeting minority students and/or women (who are currently strongly underrepresented in the engineering community). We plan to offer an introductory interdisciplinary course for freshmen attracting students to computational and engineering majors.

c. For master's degree proposals, cite the number of declared undergraduate majors and the degree production over the preceding three years for the corresponding baccalaureate program, if there is one.
Not applicable

d. Describe professional uses of the proposed degree program.
Anywhere where there is automation or robotics. See item a) above for specific example. We wish to emphasize mobile robotics for underwater explorations and aerospace.

e. Specify the expected number of majors in the initial year, and three years and five years thereafter. Specify the expected number of graduates in the initial year, and three years and five years thereafter.

	Year 1	Year 2	Year 3	Year 4	Year 5
Number of Students	10	18	24	32	40
Number of Graduates				25	32

f.

7. Existing Support Resources for the Proposed Degree Major Program

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

8. List faculty who would teach in the program, indicating rank, appointment status, highest degree earned, date and field of highest degree, professional experience,

and affiliations with other campus programs. Note: For all proposed graduate degree programs, there must be a minimum of five full-time faculty members with the appropriate terminal degree. (Coded Memo EP&R 85-20)

1. **Cindy Wyels, Professor of Mathematics, PhD Mathematics, University of California, Santa Barbara, 1994**
2. **Geoff Buhl, Associate Professor of Mathematics, PhD Mathematics, University of California, Santa Cruz, 2003**
3. **Ivona Grzegorczyk, Professor of Mathematics, PhD Mathematics, University of California, Berkeley, 1990**
4. **Michael Soltys, Professor of Computer Science, PhD Computer Science and Mathematics, University of Toronto, 2001**
5. **A.J. Bieszczad, Professor of Computer Science, Ph.D. Electrical Engineering, Carleton University, Ottawa, Canada**
6. **Geoff Dougherty, Professor of Physics, PhD Biophysics, Keele University**
7. **Gregory Wood, Associate Professor of Physics, PhD Physics, University of California, Riverside, 2000**
8. **Jason Issacs, Assistant Professor of Computer Science, PhD, University of California, Santa Barbara, 2015**
9. **David Claveau, Assistant Professor of Computer Science, PhD, Concordia University**
10. **Jorge Garcia, Professor of Mathematics, PhD Mathematics, University of Wisconsin, Madison, 2002**
11. **Brian Thoms, Assistant Professor of Computer Science, PhD**
12. **Cynthia Flores, Assistant Professor of Mathematics, PhD Mathematics, University of California, Santa Barbara**
13. **Selenne Banuelos, Assistant Professor of Mathematics, PhD Mathematics, University of Southern California**

a. Describe facilities that would be used in support of the proposed program.
Sierra Hall Physics and CS Labs, especially the dedicated Robotics, Embedded Systems, and Networks labs and other campus computer labs.

b. Provide evidence that the institution provides adequate access to both electronic and physical library and learning resources.
Currently, most of the resources are on line and are accessible by the SiNet provided by the library.

c. Describe available academic technology, equipment, and other specialized materials.
Sierra Hall Physics and CS Labs and other campus computer labs. Here is the summary of costs for a very basic Mechatronics lab for 24 students, where students would learn to use microcontrollers and

programmable logic devices for intelligent control of mechanical and electromechanical devices and systems. Note that such a lab could be initially shared with the existing Embedded Systems lab, as the equipment can serve both Embedded Systems and Mechatronics.

Computers: 8 x $3,000 $24,000
Specialized software for programming microprocessors, inexpensive
Microcontrollers: 3 x 8 x $200 $4,800
Programmable logic controllers (PLCs) [CLICK series] 3 x 8 x $300 (http://bit.ly/1E6VPpE) $7,200
Logic analyzers [Tektronix TLA5204B] 8 x $5,000 (http://bit.ly/1NBzMwx) $40,000
High bandwidth oscilloscopes [DOP 7000c series] 8 x $40,000 (http://bit.ly/1E6Wbwr)
$320,000
For a Total: $396,000

It is important to stress that in this lab the focus would be on the use of microcontrollers for smart control of machines. In particular, students' activities would be the following:

Program microcontrollers to control machine prototypes;
Use logic analyzers and oscilloscopes to test electronic circuits to verify and debug system performance;
Learn to program PLCs.

Note that hands on experience of applications can often be simulated in the robotics lab.

9. Additional Support Resources Required

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

a. Describe additional faculty or staff support positions needed to implement the proposed program.
The program can start with the current faculty if new engineering faculty were to be hired in the first year, in order to lead specialized mechatronics offerings.

Year	Nr of Faculty
First	2
Second	3
Third	3+

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

c. Include a report written in consultation with the campus librarian which indicates any necessary library resources not available through the CSU library system. Indicate the commitment of the campus to purchase these additional resources.
None, as the technical resources and publications required for the students are available on the Internet.

d. Indicate additional academic technology, equipment, or specialized materials that will be (1) needed to implement the program, and (2) needed during the first two years after initiation. Indicate the source of funds and priority to secure these resource needs.
Several local industrial partners expressed interest to donate or loan engineering equipment to CI. We have already signed an educational agreement with the local Navy.

10. Self-Support Programs

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

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

c. Explain how at least one of the following additional criteria shall be met:
   i. The courses or program are primarily designed for career enrichment or retraining;
   ii. The location of the courses or program is significantly removed from permanent, state-supported campus facilities;
   iii. The course or program is offered through a distinct technology, such as online delivery;
   iv. For new programs, the client group for the course or program receives educational or other services at a cost beyond what could be reasonably provided within CSU Operating Funds;
   v. For existing programs, there has been a cessation of non-state funding that previously provided for educational or other services costing

beyond what could be reasonably provided within CSU Operating Funds.

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

Submit completed proposal packages to:
APP@calstate.edu

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