2021 Annual Assessment Report
Architectural Engineering Minor program
Department of Art + Architecture

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Mission Statement (totally changed):

The minor in Architectural Engineering draws upon the strengths and offerings of the Architecture and Engineering programs to provide a significant introduction to engineering study, with an interdisciplinary approach which includes cultural, ecological, and community engagement considerations along with the technical aspects of engineering design.

Program Learning Outcomes (unchanged):

Students will:

1. develop and demonstrate knowledge of foundational physics and math skills to apply to techniques of engineering design and engineering science.
2. demonstrate a basic physical intuition for engineering concepts, by incorporating engineering as an integral part of the design process.
3. work with local and international communities to design solutions which best serve the needs of a partnering community.
4. gain knowledge of and exposure to design and engineering decisions creating positive change in the environment, both socially and ecologically.

Curricular Map:

See attached for PLO x ILO map and PLO x Courses map.

Assessment schedule:

The last APR was in Fall 2016 as part of the Dept of Art + Architecture. There was no specific feedback concerning the ARCE minor program during this review, or in the department action plan following it. The wording and structure of the PLOs for this program have changed since that time, and therefore there is not a relevant assessment schedule going backward. Going forward, we propose the following schedule until the next APR in 2023, which looks at two (of three) outcomes per year:

Architectural Engineering Minor Program Assessment Plan (v. Oct 2021)

timing	**AY 22**		**AY 23**	
student outcome	1. develop and demonstrate knowledge of foundational physics and math skills to apply to techniques of engineering design and engineering science	2. demonstrate a basic physical intuition for engineering concepts, by incorporating engineering as an integral part of the design process	3. work with local and international communities to design solutions which best serve the needs of a partnering community	4. gain knowledge of and exposure to design and engineering decisions creating positive change in the environment, both socially and ecologically
data to be analyzed	quizzes, exams, and calculations from design projects	structural design project and experimental research project	community-partner-based research or design projects	community-partner-based research or design projects
evidence will come from	PHYS 130: Concepts in Physics (F), and ENGR 242: Intro to Structural Engineering (Sp)	ENGR 242: Intro to Structural Engineering (Sp) and ENGR 346: Experimental Methods & Design (Sp)	ENGR 346: Experimental Methods & Design (Sp)	ENGR 244: Intro to Construction Materials (F), and ENGR 346: Experimental Methods & Design (Sp)

Assessment methodology:

We have developed rubrics for the performance indicators for each of the three outcomes. These are layered onto the work product assessment done for grading during the course producing those products:

Rubric for performance indicators of ARCE PLO #1:

develop and demonstrate knowledge of foundational physics and math skills to apply to techniques of engineering design and engineering science

performance indicator	**1: introducing**	**2: adequate**	**3: mastery**
identify specific facts of math, science and engineering germane to a problem	* superficial ability to identify facts, many facts missing	* identifies the key facts	* identifies all facts for the given situation

formulate the problem and identify key issues/variables	* basic problem formulation* some issues identified, many missing * many constraints and assumptions missing	* adequate problem formulation * most key issues/variables identified * almost all constraints and assumptions there	* complete and succinct problem formulation * all relevant criteria presented for critiquing alternatives * all relevant constraints & assumptions identified
demonstrate proper use of math, science and engineering knowledge to obtain desired performance goals	* basic understanding of relationship between inputs and performance goals * obtains some performance goals but misses some or obtains some wrong outputs	* adequate understanding of relationship between inputs and performance goals * obtains key performance goals	* complete knowledge of how to apply facts in model * understands limitations of models * obtains desired goals * validates/justifies obtained goals
analyze & justify a solution to an engineering problem	* simple/superficial analysis and justification * missing steps in decision-making process	* adequate analysis and discussion of results * well-documented process * final solution justified based on criteria	* detailed analysis and thoughtful discussion of results * detailed documentation of process * clear, convincing justification for solution based on criteria

Rubric for performance indicators of ARCE PLO #2:

demonstrate a basic physical intuition for engineering concepts, by incorporating engineering as an integral part of the design process

performance indicator	1: introducing	2: adequate	3: mastery
conduct context research to establish factors, constraints and criteria	* superficial/timid search for contextual factors	* earnest if incomplete establishment of contextual factors	* thorough and nuanced establishment of contextual factors
account for contextual factors to determine the most appropriate solution	* solutions have a basic if not thorough accounting of context	* solutions are meaningful and address at least one contextual factor each and can be compared	* solutions address multiple or all contextual factors in combination, and without conflicts or with tradeoffs clearly delineated
document design process and iterative approach	* basic set of notes on progress * superficial or no iteration * may not meet performance goal	* clear and complete documentation * some iteration * performance goal is adequately met	* design is self-derived with alternates, innovations or add-ons * significant iterations evident * fully meets performance goals

Rubric for performance indicators of ARCE PLO #3:

work with local and international communities to design solutions which best serve the needs of a partnering community

performance indicator	1: introducing	2: adequate	3: mastery
capable of meaningful engagement with a community or community partner	* points and method of communications must be directed by instructor	* capable of basic elements of engagement & communication	* sensitive to perspective of community/partner * plans out full communication plan over trajectory of relationship
incorporation of ethical considerations in solution	* responds to prompts on ethical considerations	* capable of listing out ethical considerations * not necessarily fully worked into solution	* thoughtful consideration of ethical issues, apparent in problem solution
incorporation of values of community partner in solution	* responds to prompts about issues brought up by community partner	* capable of listing out considerations valued by community partner * not necessarily fully worked into solution	* thoughtfully worked values of community partner into problem solution

Rubric for performance indicators of ARCE PLO #4:

gain knowledge of and exposure to design and engineering decisions creating positive change in the environment, both socially and ecologically

performance indicator	1: introducing	2: developing	3: mastery
exhibit understanding of engineering decisions creating positive social change	* basic ability to idenitfy positive social change	* capable of describing direct causes and effects that lead to positive social change	* capable of full analysis of engineering design decisions that lead to positive social change
exhibit understanding of engineering decisions creating positive ecological change	* basic ability to idenitfy positive ecological/environmental change	* capable of describing direct causes and effects that lead to positive ecological change	* capable of full analysis of engineering design decisions that lead to positive ecological change
interpret and propose ways to create positive change with engineering decisions	* recognize factors that led to positive social or ecological change in case examples	* capable of making basic proposals for points within engineering design that can orient toward positive change	* works opportunities for positive social and ecological change integrally into design proposal

Description of results:

All of the required courses of this minor program were taught during the 2020-2021 academic year, but in a completely remote format. Therefore, the work products were slightly modified compared to previous offerings. Still, the student work indicates the following highly satisfactory achievement:

PLO1: 6% introducing, 73% adequate, 20% mastery (93% adequate or more)

PLO2: 0% introducing, 59% adequate, 41% mastery (100% adequate or more)

Description of how the results were shared with faculty and how your department/program responded to the results:

Your advice needed here: Hana Böttger is the director of the Architectural Engineering minor program, and is the only full-time faculty member teaching required courses in this program. Who should be involved in the sharing of results and discussions concerning response?

Discussion of any significant feedback from your previous year's report and how your department/program responded to that feedback.

Based on last year's feedback concerning our mission statement, this statement has been completely reworked. Also, from recent work done to create an assessment plan for the new Engineering major, the assessment and review of these courses reflect the fact that they are also part of that ABET-accreditation-based assessment model.

Architectural Engineering Minor Program 2021

	PLO1	PLO2	PLO3	PLO4
Institutional Learning Outcomes X Program Learning Outcomes	Develop and demonstrate knowledge of foundational physics and math skills to apply to techniques of engineering design and engineering science.	Demonstrate a basic physical intuition for engineering concepts, by incorporating engineering as an integral part of the design process.	work with local and international communities to design solutions which best serve the needs of a partnering community.	gain knowledge of and exposure to design and engineering decisions creating positive change in the environment, both socially and ecologically
Institutional Learning Outcomes				
1. Students reflect on and analyze their attitudes, beliefs, values, and assumptions about diverse communities and cultures and contribute to the common good.			x	x
2. Students explain and apply disciplinary concepts, practices, and ethics of their chosen academic discipline in diverse communities.			x	x
3. Students construct, interpret, analyze, and evaluate information and ideas derived from a multitude of sources.	x	x	x	
4. Students communicate effectively in written and oral forms to interact within their personal and professional communities.			x	x
5. Students use technology to access and communicate information in their personal and professional lives.	x	x	x	
6. Students use multiple methods of inquiry and research processes to answer questions and solve problems.	x	x	x	
7. Students describe, analyze, and evaluate global interconnectedness in social, economic, environmental and political systems that shape diverse groups within the San Francisco Bay Area and the world.			x	x

Architectual Engineering minor program 2021

Program Learning Outcomes X Courses	PLO1	PLO2	PLO3	PLO4	
	Develop and demonstrate knowledge of foundational physics and math skills to apply to techniques of engineering design and engineering science.	Demonstrate a basic physical intuition for engineering concepts, by incorporating engineering as an integral part of the design process.	Work with local and international communities to design solutions which best serve the needs of a partnering community.	gain knowledge of and exposure to design and engineering decisions creating positive change in the environment, both socially and ecologically	
Courses or Program Requirement	I = Introductory, D = Developing, M = Mastery				Course
REQUIRED COURSES					
MATH 107: Calculus for the Liberal Arts or MATH 109: General Calculus					**MATH 107/109**
PHYS 110 w/Lab or PHYS 130 w/Lab	I	I			**PHYS 110/130**
ENGR 244: Introduction to Construction Materials		I	I	I	**ENGR 244**
ENGR 242: Introduction to Structural Engineering	I	I		I	**ENGR 242**
SELECT TWO OF THE FOLLOWING (may require prerequisites)					
ARCD 270: BIM and Applications		I			**ARCD 270**
ARCD 300: Computer-Aided Design and Drawing II		I			**ARCD 300**
ARCD 312: Environmental Control Systems	I	I		D	**ARCD 312**
ARCD 370: Construction Innovation Lab		I	D	D	**ARCD 370**
ENGR 346: Experimental Methods & Design	D	D	D	D	**ENGR 346**
ENGR 348: Sustainable Urban Systems	D	D	D	D	**ENGR 348**
ENVS 212: Air and Water w/Lab		I			**ENVS 212**
ENVS 250: Environmental Data Analysis		I			**ENVS 250**
ENVS 350: Energy and Environment				D	**ENVS 350**
ENVS 410: Methods of Environmental Monitoring w/Lab		D	D	D	**ENVS 410**
PHYS 310: Analytical Mechanics	D	D			**PHYS 310**
PHYS 312: Statistical and Thermal Physics	D	D			**PHYS 312**
PHYS 320: Electromagnetism	D	D			**PHYS 320**
RECOMMENDED MINOR ELECTIVES					
CHEM 111: General Chemistry 1					**CHEM 111**
PHYS 210: General Physics	I	I			**PHYS 210**
PHYS 240: Modern Physics	D	D			**PHYS 240**