UTAH SYSTEM OF HIGHER EDUCATION
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MEMORANDUM

TO: State Board of Regents

FROM: David L. Buhler

SUBJECT: University of Utah – Bachelor of Science in Construction Engineering

Issue

The University of Utah (UU) requests approval to offer a Bachelor of Science in Construction Engineering effective Fall Semester, 2016. This proposal was approved by the institutional Board of Trustees April 12, 2016.

Background

An expanded and improved physical infrastructure for public and commerical use is needed to promote population and economic development throughout the world. The UU reported that three independent changes in the construction industry will alter the manner in which infrastructure systems are designed and built. These changes are: 1) increases in the number of design/build projects, 2) utilization of 3-dimentional Building Information Modeling software; and 3) increases in sustainable/resilient development requirements. From beginning planning to final operation and maintenance, engineers are needed to ensure successful projects. Construction Engineers are educated to understand and solve the complexities that arise during the engineering and construction phases.

The proposed Construction Engineering degree provides a hybrid curriculum consisting of a civil engineering foundation coupled with experiential learning in architecture and construction practices. The institution plans to develop program courses for on-line delivery, enabling the program to serve populations in diverse locations. Several other tier-one institutions offer similar programs in construction engineering at the baccalaureate and graduate levels.

While the Utah Department of Workforce Services does not track Construction Engineers as a separate occupational group, it does project Civil Engineers, a related group, to have an annual average job growth rate of 3.6% between 2012 - 2022 and a median income of $74,820 per year. Another related occupational group, Construction Managers, is projected to have a 2.9% growth rate and annual average median income of $77,580.

Policy Issues

The proposed program has been developed through established institutional procedures and Board of Regents policy. Chief academic officers as well as faculty in related departments from the Utah System of Higher Education institutions have reviewed the proposal and have provided input. There are no additional policy issues that need to be addressed relative to approval of the program.

Commissioner's Recommendation

The Commissioner recommends the Board of Regents approve the Bachelor of Science in Construction Engineering.

_____
David L. Buhler
Commissioner of Higher Education

DLB/BKC
Attachment

Program Description – Full Template
University of Utah
Bachelor of Science, Construction Engineering

Section I: The Request

University of Utah requests approval to offer a Bachelor of Science (BS) in Construction Engineering effective Fall Semester, 2016. This program has been approved by the institutional Board of Trustees.

Section II: Program Description

Complete Program Description

Physical infrastructure (roads, buildings, water distribution and treatment, etc.) is needed to promote population and economic developing throughout the world. From beginning planning to final operation and maintenance, engineers are needed to ensure successful projects. Construction Engineers are educated to understand and solve the complexities that arise during the engineering and construction phases. This comprehensive appoach includes initial design through the completion of the exterior building façade. The Construction Engineering degree will teach students to work in both public and private industry positions, improving graduate's skills to meet this growing trend. The program will be offered by the Department of Civil & Environmental Engineering.

Purpose of Degree

According to the American Institute of Steel Construction, three independent movements are converging to radically alter the manner in which infrastructure systems are designed and constructed. These factors represent the emergence of: 1) design/build projects, 2) 3-dimentional Building Information Modeling (BIM) software; and 3) sustainable/resilient development requirements. The national trend for Construction Engineering is very evident in both the public and private sectors. (e.g. $1.59 billion dollar I-15 reconstruction project, 12300 South Design Buld Project in Draper and Riverton Utah, both using the design/build in order to maximize cost saving and innovative design). The Construction Engineering degree requires a hybrid education consisting of a civil engineering foundation coupled with experiential learning in architecture and construction practices. By providing the degree online, the institution anticipates Utah and the surrounding region.

Institutional Readiness

This new degree is a natural extension of Civil & Environmental Engineering Department's offerings as the department already provides electives courses in existing programs that support this degree. Civil Engineering has also been working with the College of Engineering Dean's Office, UOnline, and other institutional support offices to develop and provide on-line options for the program. The Department of Civil & Environmental Engineering has also been in contact with large construction firms that support this effort and that will be represented on the institution's Industry Advisory Board. Resources are in place from Engineering Initiative funds to support the program.

Departmental Faculty

The institution plans to hire 4 additional adjunct faculty members from industry to teach part-time in the program.

To meet ABET requirements, the accrediting body for engineering at the U of U, the program must demonstrate that the majority of faculty who teach design courses are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. The faculty must include at least one member who has had full-time experience and decision-making responsibilities in the construction industry. The institution will meet this requirement by hiring two full time career-line lecturers with the appropriate experience. Funds for new faculty will come from Engineering Initiative funds and from differential tuition.

Department Faculty Category	Dpt Faculty Headcount – Prior to Program Implementation	Faculty Additions to Support Program	Dpt Faculty Headcount at Full Program Implementation
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)			
Full-time Tenured	21.5	1	22.5
Full-time Non-Tenured	1	2	3
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
With Master's Degrees			
Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
With Bachelor's Degrees			
Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	0	0	0
Other			
Full-time Tenured	0	0	0
Full-time Non-Tenured	0	0	0
Part-time Tenured	0	0	0
Part-time Non-Tenured	4	4	8
Total Headcount Faculty in the Department			
Full-time Tenured	21.5	1	22.5
Full-time Non-Tenured	1	2	3
Part-time Tenured	0	0	0
Part-time Non-Tenured	4	4	8
Total Department Faculty FTE *(As reported in the most recent A-1/S-11 Institutional Cost Study for "prior to program implementation" and using the A-1/S-11 Cost Study Definition for the projected "at full program implementation.")*	26.5	X	33.5

Staff

Engineering Initiative funds have been allocated to hiring one additional staff person. This person will serve as the online coordinator in the department, advise the online students, be a point of contact for the UOnline office, and coordinate the creation and recording of classes. One teaching assistant was also budgeted in the request.

Library and Information Resources

The library has verified it has sufficient resources available to provide for any faculty or student research needs.

Admission Requirements

Students are required to be admitted to the University as well as complete a separate admissions application specific to the Construction Engineering program.

Student Advisement

The new staff hire will provide advisement services to students using technology for face-to-face appointments, telephone calls, email correspondence, open house events, or company presentations. A faculty advisor will also be assigned to each student.

Justification for Graduation Standards and Number of Credits

The BS Construction Engineering degree will require 125.5 credit hours with a minimum engineering GPA of 2.50. Students will be expected to maintain an overall 2.0 cumulative GPA. This is consistent with institutional graduation requirements.

External Review and Accreditation

This program will be reviewed by ABET and adhere to ABET accreditation requirements and guidelines.

ABET defined expected learning outcomes include:

a). an ability to apply knowledge of mathematics, science, and engineering
b). an ability to design and conduct experiments, as well as analyze and interpret data
c). an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d). an ability to function on multidisciplinary teams
e). an ability to identify, formulate, and solve engineering problems
f). an understanding of professional and ethical responsibility
g). an ability to communicate effectively
h). the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i). an ability to explain basic concepts in management, business, public policy, and leadership; and explain the importance of professional licensure
j). a knowledge of contemporary issues
k). an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

In addition to student outcomes listed above, ABET requires program educational objectives (PEO). The Construction Engineering PEOs are:

1. Construction Engineering graduates will be engaged in the practice of construction engineering, or related field, or will be pursuing advanced knowledge through post-graduate study and research.
2. Construction Engineering graduates will be on the path towards licensure, when appropriate, and will be active in professional organizations, seeking opportunities for professional development and participating in the betterment of their profession.
3. Construction Engineering graduates will be ascending into leadership roles and be advocating for their profession utilizing their accumulated education and experience solving complex societal issues for the broader good of the community.

Projected Program Enrollment and Graduates; Projected Departmental Faculty/Students

Data Category	Current – Prior to New Program Implementation	PROJ YR 1	PROJ YR 2	PROJ YR 3	PROJ YR 4	PROJ YR 5
Data for Proposed Program						
Number of Graduates in Proposed Program	X	0	10	20	25	25
Total # of Declared Majors in Proposed Program	X	25	30	40	45	50
Departmental Data – For All Programs Within the Department						
Total Department Faculty FTE *(as reported in Faculty table above)*	22.5	23.5	24.5	24.5	25.5	26.5
Total Department Student FTE *(Based on Fall Third Week)*	296	306	321	346	371	396
Student FTE per Faculty FTE *(ratio of Total Department Faculty FTE and Total Department Student FTE above)*	13.16	13.02	13.10	14.12	14.55	14.94
Program accreditation-required ratio of Student FTE/Faculty FTE, if applicable: (Provide ratio here:_____)	-	-	-	-	-	-

Expansion of Existing Program

This is essentially a new degree aimed at a new audience even though it does have some common elements with the Civil and Environmental Engineering curriculum.

Section III: Need

Program Need

The proposal was submitted to further meet objectives of the Engineering Initiave and was approved by Dean of Engineering for funding.

According to the American Institute of Steel Construction, three independent movements are converging to radically alter the manner in which infrastructure systems are designed and constructed. These factors represent the emergence of: 1) design/build projects, 2) 3-dimensional Building Information Modeling (BIM) software; and 3) sustainable/resilient development requirements. These factors have transformed the construction process into a more seamless collaborative team effort between engineers, architects, and contractors. This integrated approach has already begun to revolutionize the delivery of projects designed and constructed to meet client needs for timely delivery of high quality, economically sensitive projects that minimize environmental and energy impacts.

In speaking with several local construction firms the institution understands that the demand for project managers with engineering backgrounds will continue to grow. In light of 2015 legislation raising the gas tax for infrastructure improvements and the law allowing local communities the option of raising sales taxes to help pay for transit, the institution believes the combination of transportation and construction engineering will represent an area of growth area. This is also part of a national movement with a few large universities already moving to address the long-term needs for individuals in this area.

Labor Market Demand

According to the US Bureau of Labor Statistics, employment of construction managers is projected to grow 5 percent from 2014 to 2024, faster than the average for all occupations. Construction managers will be needed as overall construction activity increases over the coming decade. Those with a bachelor's degree in construction science, construction management, or civil engineering, coupled with construction experience, will have the best job prospects. Locally, population growth projections for the state of Utah exceed the national average and we expect job demand to expand even more rapidly. Therefore, an undergraduate degree in Construction Engineering will address an important labor demand.

Student Demand

Currently the department offers four construction related courses that will be used in the Construction Engineering program. These courses are well populated by existing students. In examining national trends and in speaking with several local construction firms the institution believes the demand for project managers with engineering backgrounds will continue to grow.

Similar Programs

While there are no other Construction Engineering programs within the Utah System of Higher Education, baccalaureate program in Contruction Management, a somewhat related discipline, are offered by Weber State University, Southern Utah University, and Utah Valley University

.

Collaboration with and Impact on Other USHE Institutions

The proposed program has been developed through established institutional procedures and Board of Regents policy. Chief academic officers as well as faculty in related departments from the Utah System of Higher Education institutions have reviewed the proposal and have provided helpful input.

Benefits

Population growth in the state of Utah is projected to significantly increase the need for infrastructure for the foreseeable future. There is a need to expand the number of engineering graduates having the skills to assist in constructing roads, buildings, water/wastewater systems, etc. It is anticipated that this program will benefit the community and state by developing a needed workforce and benefit the University by attracting high caliber engineering students and building the University of Utah's reputation.

Consistency with Institutional Mission

The University of Utah contributes to the quality of life and economic development at the local, state, and national levels. This proposed program fits well within the mission of the institution by providing graduates who are prepared to build and improved and expanded public infrastructure required to improve the quality of life and promote economic development.

Section IV: Program and Student Assessment

Program Assessment

The department will implement student surveys, consult with ABET, and query professionals from industry to ensure industry trends are adapted into the program.

Expected Standards of Performance

Program outcomes will be routinely monitored by ABET to maintain relevancy with practicing construction professionals. Likewise, course content will be developed that contribute to these outcomes. It is expected that graduates will maintain a 2.50 GPA.

Section V: Finance

Department Budget

Three-Year Budget Projection							
Departmental Data	Current Departmental Budget – Prior to New Program Implementation	Departmental Budget					
		Year 1		Year 2		Year 3	
		Addition to Budget	Total Budget	Addition to Budget	Total Budget	Addition to Budget	Total Budget
Personnel Expense							
Salaries and Wages	2,164,973	342,000	2,421,973	0	2,421,973	0	2,421,973
Benefits	669,008	118,070	780,278	0	780,278	0	780,278
Total Personnel Expense	$2,833,981	$460,070	$3,202,251	$0	$3,202,251	$0	$3,202,251
Non-Personnel Expense							
Travel	1,000	0	1,000	0	1,000	0	1,000
Capital	0	0	0	0	0	0	0
Library	0	0	0	0	0	0	0
Current Expense	84,100	19,930	104,030	0	104,030	0	104,030
Total Non-Personnel Expense	85,100	19,930	105,030	0	105,030	0	105,030
Total Expense *(Personnel +*	$2,919,081	$480,070	$3,207,281	$0	$3,207,281	$0	$3,207,281

Current)							
Departmental Funding							
Appropriated Fund	2,443,576	480,000	3,307,281	0	2,443,576	0	2,443,576
Other:	13,813	0	13,813	0	13,813	0	13,813
Special Legislative Appropriation	0	0	0	0	0	0	0
Grants and Contracts	0	0	0	0	0	0	0
Special Fees / Differential Tuition	376,432	0	376,432	0	376,432	0	376,432
Total Revenue	$2,833,821	$480,000	$3,307,281	$0	$3,307,281	$0	$3,307,281
Difference							
Revenue-Expense	$-85,260	$0	$6,540	$0	$6,540	$0	$6,540
Departmental Instructional Cost / Student Credit Hour* *(as reported in institutional Cost Study for "current" and using the same Cost Study Definition for "projected")*	$	$	$	$	$	$	$

** Projected Instructional Cost/Student Credit Hour data contained in this chart are to be used in the Third-Year Follow-Up Report and Cyclical Reviews required by R411.*

Funding Sources

The Engineering Initiative will fund this program along with differential tuition generated by engineering courses.

Reallocation

No reallocation is necessary.

Impact on Existing Budgets

None. This program will be managed without diverting existing budget into operations.

Section VI: Program Curriculum

In order to receive ABET Accreditation, the program must prepare graduates to apply knowledge of mathematics through differential and integral calculus, probability and statistics, general chemistry, and calculus-based physics; to analyze and design construction processes and systems in a construction engineering specialty field, applying knowledge of methods, materials, equipment, planning, scheduling,

safety, and cost analysis; to explain basic legal and ethical concepts and the importance of professional engineering licensure in the construction industry; to explain basic concepts of management topics such as economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics, engineering management, and cost control. The curriculum shown below was designed to accomplish these goals. Eight new courses will be developed.

All Program Courses (with New Courses in Bold)

Course Prefix and Number	Title	Credit Hours
Required Courses		
MATH 1310	Engineering Calculus I	4
CHEM 1210	General Chemistry I	4
CHEM 1215	General Chemistry I Lab	1
WRTG 2010	Intermediate Writing	3
LEAP 1501 (BF)	Social and Ethical Implications of Engineering	3
CVEEN 1000	Introduction to Civil Engineering	2
MATH 1320	Engineering Calculus II	4
*CHEM 1220	General Chemistry II	4
PHYS 2210	Physics for Scientists and Engineers I	4
PHYS 2215	Physics for Scientists and Engineers Lab I	1
CVEEN 1400	**Computer-Aided Design**	**3**
MATH 2250	ODEs	4
GEO 1110	Introduction to Earth Systems	3
GEO 1115	Introduction to Earth Systems Lab	1
CVEEN 2000	Sophomore Seminar	0.5
CVEEN 2010	Statics	3
CVEEN 2310	Probability and Statistics	3
MG EN 2400	Surveying	3
LEAP 1500 (DV, HF)	LEAP Seminar in Humanities for Engineers	3
ECON 2010 (BF)	Principles of Microeconomics	3
CVEEN 2140	Strength of Materials	3
CVEEN 2300	Engineering Economics	2
CVEEN 2750	**Construction Computer Tools**	**3**
ARCH 1610 or 1615 (FF)	Architecture LEAP or Intro to Architecture	3
CVEEN 3210	Structural Analysis I	3
CVEEN 3310	Geotechnical Engineering I	3
CVEEN 3315	Geotechnical Engineering I Lab	1
CVEEN 3510	Civil Engineering Materials	3
CVEEN 3800	**Construction Engineering I**	**3**
AI Elective		3
Intellectual Exploration (HF)		3
CVEEN 3100	Technical Communication	3
CVEEN 3520	Transportation Engineering I	3
**CVEEN 3810	**Contract Specifications**	**3**
Intellectual Exploration (FF)		3

Course Prefix and Number	Title	Credit Hours
CVEEN 4221	Concrete Design I	3
**CVEEN 4810	Horizontal Construction	3
CVEEN 5830	Project Management & Contract Administration	3
CVEEN 5810	Cost Estimation and Proposal Writing	3
Intellectual Exploration (IR)		3
**CVEEN 4830	Vertical Construction	3
CVEEN 4850	Façade Engineering I	3
***CVEEN 4920	Construction Design Capstone	3
CVEEN 5820	Project Scheduling	3
	Sub-Total	125.5
Elective Courses		
	Sub-Total	
Track/Options (if applicable)		
	Sub-Total	
	Total Number of Credits	125.5

*CHEM 1225 will not be required. Dr. Atwood, in the Chemistry Department, has ensured our students will not have to take the lab as a co-requisite.
**Environmental issues in construction engineering will be addressed in these courses.
***This course will explore options for community engaged learning.

Program Schedule

First Year:

Fall Semester:
MATH 1310 – 4 credits
CHEM 1210 – 4 credits
CHEM 1215 – 1 credit
WRTG 2010 – 3 credits
LEAP 1501 – 3 credits
CVEEN 1000 – 2 credits
Total Credit Hours: 17

Spring Semester:
MATH 1320 – 4 credits
CHEM 1220 – 4 credits
PHYS 2210 – 4 credits
PHYS 2215 – 1 credit
CVEEN 1400 – 3 credits
Total Credit Hours: 16

Second Year:

Fall Semester:
MATH 2250 – 4 credits
GEOL 1110/1115 – 4 credits
CVEEN 2000 – 0.5 credits
CVEEN 2010 – 3 credits
CVEEN 2310 – 3 credits
MG EN 2400 – 3 credits
Total Credit Hours: 17.5

Spring Semester:
LEAP 1500 – 3 credits
ECON 2010 – 3 credits
CVEEN 2140 – 3 credits
CVEEN 2300 – 2 credits
CVEEN 2750 – 3 credits
Total Credit Hours: 14

Third Year:
Fall Semester:

ARCH 1610 or 1615 – 3 credits
CVEEN 3210 – 3 credits
CVEEN 3310 – 3 credits
CVEEN 3315 – 1 credit
CVEEN 3510 – 3 credits
CVEEN 3800 – 3 credits
Total Credit Hours: 16

Spring Semester:
General Education Course (FF, HF) – 6 credits
CVEEN 3100 – 3 credits
CVEEN 3250 – 3 credits
CVEEN 3810 – 3 credits
Total Credit Hours: 15

Fourth Year:

Fall Semester:
General Education Course (IR) – 3 credits
CVEEN 4221 – 3 credits
CVEEN 4810 – 3 credits
2 CVEEN Technical Electives – 6 credits
Total Credit Hours: 15

Spring Semester:
American Institutions (AI) – 3 credits
CVEEN 4830 – 3 credits
CVEEN 4850 – 3 credits
CVEEN 4920 – 3 credits
1 CVEEN Technical Elective – 3 credits
Total Credit Hours: 15

Section VII: Faculty

All search Committees have been created, and Industry Advisory Board members have been invited to participate. New faculty hires will be recording online classes, mentoring with the Center for Teaching and Learning Excellence, and finalizing the curriculum for the Construction Engineering degree.

Appendix