

Supplemental Fee Proposal:

College of Engineering and Applied Science

Executive Summary

Differential tuition and/or fees are commonly charged to engineering students at universities across the country. There are various motivations for the additional fees, but chief among these is the necessity to maintain 5-7 discipline-specific instructional laboratories and computer laboratories for each program within an engineering college. These laboratories are closely monitored by the Engineering Accreditation Commission of ABET as a central component in the education of engineers and computer scientists. At UW, another important driver for increased fees for College of Engineering and Applied Science (CEAS) students is the state-mandate for heightened national prominence and increased contribution to economic development through the “Tier 1 Engineering Initiative” that was initiated by Governor Mead and the Wyoming State Legislature in 2012. Indeed, UW’s tuition and fees are substantially lower than those of the nation’s most prominent engineering programs and several aspirational programs so that substantial fee increases will be necessary for the College to advance its programs to national distinction.

Consistent with declining state support, the need to maintain the high standards demanded by the CEAS accrediting body (ABET), and the need to provide student services at a level consistent with the goals of the Tier 1 Engineering Initiative, CEAS administrators have identified approximately \$2.4M of annual support that is proposed to be generated through student fees. The College generates almost 25,000 student credit hours (SCH) at the undergraduate (UG) level each year, so the proposed fee on UG CEAS-generated coursework is \$97/SCH (\approx \$2.4M/25,000 SCH). With engineering students typically taking 5 years to complete their demanding coursework, this will result in an average fee of about \$1330/student/yr. It is notable that even with the proposed increase, tuition and fees to UW’s CEAS students will still be substantially lower than (in many cases, about half) those at all of the nation’s top-10 programs or our aspirational target institutions.

The new fees to students enrolled in CEAS courses are designed to support discipline-specific instructional laboratories, discipline-specific computer labs and software, a portion of the CEAS machine shop services, and an enrichment fee whose distribution is guided by a committee of students towards various activities in support of the UG educational mission. To support Tier 1 goals, the new fee provides support for a number of badly-needed staff positions, including (6) professional advisors, (3) computer system administrators, (4) staff engineers to support laboratory maintenance and senior design instruction, (1.5 FTE) communications instructors, and (1) internship/career placement professional. These staffing requirements are entirely consistent with the structure at more prestigious engineering institutions, a group which UW’s College of Engineering and Applied Sciences aspires to join.

Background on Differential Tuition/Fees

Throughout higher education in the U.S. it is more expensive to host engineering programs than most other university programs. From a dissertation by Glen Nelson¹ who examined this issue, 45% of 162 public research universities surveyed had differential tuition by UG program. Of the 74 public research universities having some form of differential tuition, 48 had supplemental tuition or fees for engineering students, and 11 had them in place for Computer Science. In 2008 premiums for engineering students ranged from \$100 - \$3792 per year and from \$2 - \$55 per credit hour, averaging about 14% above baseline tuition rates. About one-fourth of schools with “differential tuition” do not use that term but rather use “supplemental fees” to assess higher rates by academic major.

Implementation of differential tuition or fees is a relatively recent event: almost half of schools with differential tuition implemented their programs between 2003 and 2008, and a number of others including Texas A&M and University of Utah have done so in the past 5 years. The most common reasons cited for adopting differential fees are to:

- cover direct costs
- maintain or enhance quality
- provide additional revenue for targeted initiatives
- to replace declining state support.

The following will discuss how each of these motivations is an important driver for this proposal from UW’s College of Engineering and Applied Science (CEAS).

In considering differential tuition or fees, it is important to be sensitive to student access and affordability of our programs since higher tuition or fees will inevitably deter some students from choosing engineering studies. In particular, students in lower socioeconomic groups will likely shift to lower-priced programs. Other observations of differential tuition gathered through Nelson’s study¹ include:

- 2/3 of schools with differential tuition reported no impact on enrollment; the other 1/3 were unsure – notably, none indicated that enrollment declined
- About 1/2 of schools with differential tuition indicated no impact on enrollment of students having low socioeconomic status, with the other 1/2 of schools unsure of impact
- Reaction to differential tuition:
 - by students; 54% positive, 17% negative, 29% no reaction
 - by parents; 0% positive, 24% negative, 76% no reaction.

A Mandate for Tier 1 Excellence in Engineering

In 2012 Governor Matt Mead and the Wyoming State Legislature called for a rise in prominence for UW’s College of Engineering and Applied Science (CEAS) as a means for supporting and diversifying the state’s economy. The resulting “Tier 1 Engineering Initiative” provided a much-needed increase in the level of fiscal support for the College, but by any measure a push for true Tier 1 excellence was significantly underfunded from the outset. This underfunding was due in large part to the fact UW could not meet its

¹ Differential Tuition by Undergraduate Major: Its Use, Amount, and Impact at Public Research Universities, Glen R. Nelson, Univ. of Nebraska – Lincoln, 2008.

commitment to match one-for-one the increased state funding due to revenue challenges and other program costs.

The CEAS responded to the funding shortfall by focusing its Tier 1 efforts and resources on narrow, select areas of research that hold particular promise for emergence on the national stage, and there have been indicators showing the effectiveness of this strategy. For example, in just three years the Tier 1 Engineering Initiative has attracted the attention of several federal agencies that are funding our niche areas of excellence, several industry partners have contributed a total in excess of \$50M to the effort, and more than 100 young student-scholars have been attracted to CEAS degree programs through enhanced scholarships.

For FY 2017, Tier 1 funding has been reduced by the same percentage as the UW block grant, with these two budget reductions resulting in a loss of 8 faculty and 4 staff positions within the CEAS in just a single year, and this at a time when the College needs to be growing its staffing in order to meet the expectations of the Governor, state legislators, industrial partners, and other constituents. Clearly, a reversal of course supported by increased fiscal resources is required to get the Tier 1 Initiative back on track.

With respect to the Tier 1 goal of expanding the state’s economy, engineering and computer science graduates contribute through their salaries (ranging from \$62-81,000 for newly-graduated engineers), as well as their intellectual contributions to technology development. Further, recent data from the Economist (see Figure 1) show that the earnings return on the investment in a college degree is highest for this group and has almost no dependence on their institution’s selectivity. Consequently, UW’s students in the CEAS can expect to benefit fiscally from their degrees as much as graduates from the nation’s top engineering institutions.

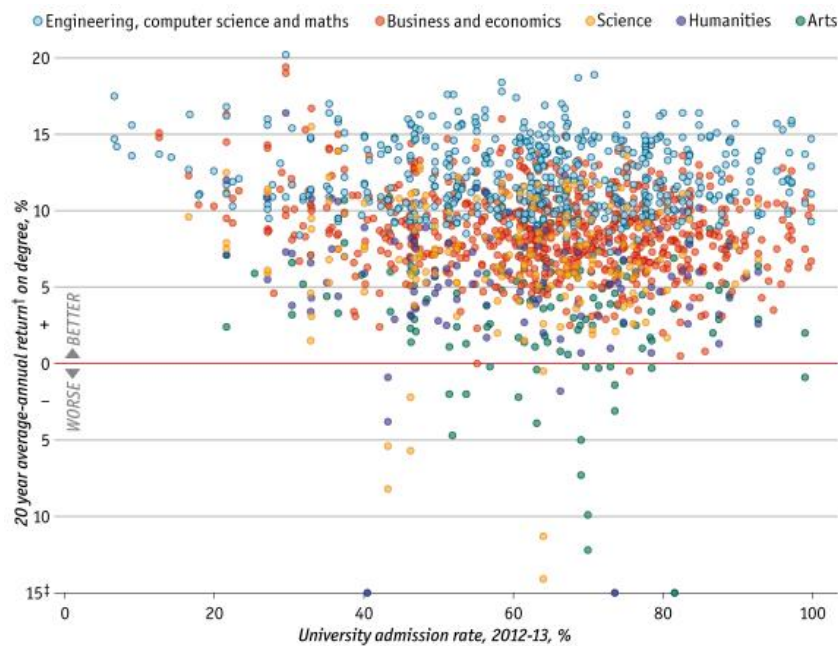


Figure 1. Earnings return on investment in college degree

In a discussion of “Tier 1” stature, it is insightful to consider the premiums charged to engineering students at the nation’s top-ranked programs. Using the rankings by U.S. News and World Reports (USNWR), Table 1 shows the tuition and fees for these programs. The schools in Table 1 are limited to public universities that offer doctoral degrees in engineering. Of particular interest are the three “aspirational institutions” that are dedicated to improving their national prominence – indeed, the premiums charged to their engineering students may be more relevant than the (more complacent ?) schools already at the top of the USNWR rankings.

	2016 USNWR UG Engineering Ranking *	Base Rate Tuition and Fees (30 SCH)	Annual Tuition and Fees for Engineering Student (30 SCH)	Difference in Annual Tuition	% Premium Paid by Eng Students
<u>Tier 1 Institutions</u>					
U. Cal. Berkeley	1	13,518	13,518	0	0%
Georgia Tech	2-Tie	12,212	12,212	0	0%
U. Illinois	2-Tie	12,036	17,040	5,004	42%
U. Michigan	4	16,218	19,534	3,316	20%
Purdue	5	10,002	12,052	2,050	20%
U. Texas	6	10,110	10,520	410	4%
U. Wisconsin	7	10,436	11,836	1,400	13%
Texas A&M	8	10,218	12,030	1,812	18%
Penn State	10	19774	21174	1,400	7%
<u>Aspirational Institutions</u>					
U. Arizona	28	11,788	13,588	1,800	15%
U. Utah	30-Tie	8,604	9,860	1,256	15%
Colorado State	39-Tie	12,697	14,122	1,425	11%
Wyoming	90-Tie	5,056	5,296	240	5%
* U.S. News and World Reports ranking specific to engineering programs at public universities offering engineering doctoral degrees					

Table 1. 2016-17 Annual tuition and fees at selected public U.S. universities

Although their tuition and fees are not tabulated here, the list of UW’s regional competitors that assess differential tuition is extensive. In addition to the University of Utah and Colorado State that are shown above, these include:

- Montana State Univ.
- Univ. of Montana

- North Dakota State
- Univ. of North Dakota
- South Dakota State
- University of South Dakota
- University of Nebraska
- Univ. of Colorado, Denver
- Univ. of Colorado, Boulder
- Univ. of Northern Colorado
- Utah State University
- University of Idaho

Costs and Tuition/Fees at UW

That engineering education is more expensive than most other degree programs is verified by UW’s own data, shown in Figure 2, where expenditures per degree earned, and expenditures per student are second only to UW’s College of Law. A primary reason for the increased expense in engineering education, at UW and elsewhere, is the necessity to maintain numerous instructional laboratories. A typical engineering student will have 5-7 discipline-specific laboratory classes in addition to those encountered in chemistry, physics, and biology. These laboratory classes teach students how to use computing resources, engineering instrumentation, and testing procedures that graduates will be expected to use throughout their careers. In addition to high-cost laboratories, engineering programs face elevated computing costs since computation is an integral part of modern engineering practice. In addition to the computers themselves, licenses for a single engineering software product commonly sell for \$5-10,000 per year, and the different disciplines within the CEAS necessarily subscribe to many of these.

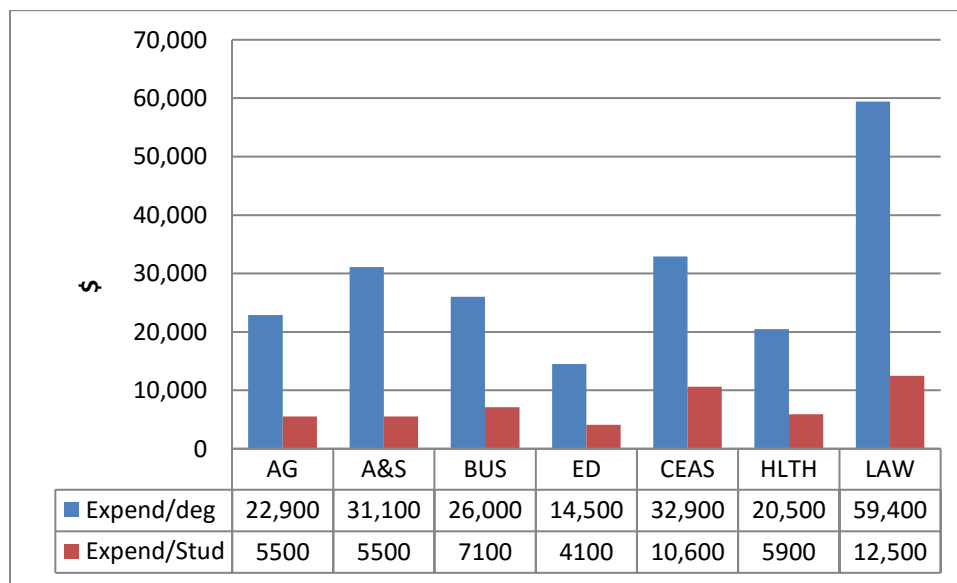


Figure 2. Expenditures (in dollars) per degree and per student, by UW college, FY13 (most recent data available from UW’s Office of Institutional Analysis)

At UW, the pharmacy, law, and MBA programs all have substantial differential tuition charged to their students (see Table 2). Like engineering, these are all professional programs designed to place their graduates in professional practice in disciplines of particular importance to Wyoming. The CEAS also has a very modest program-specific fee charged to its students, but this will need to be substantially increased to provide the laboratory, instructional, advising, and extra-curricular experiences that are essential to a high-quality engineering education.

	Annual Tuition & Fees (30 SCH)	Difference w/r to Base Rate	% Increase over Base Rate
Base T&F (resident)	5,056	0	0%
Law School	15,256	10,200	67%
Pharmacy School	16,160	11,104	69%
MBA Program	18,780	13,724	73%
UW Engineering	5,296	240	5%

Table 2. UW's tuition and fees, academic year 2016-17

Required Program Fees, Rationale, and Benefits to Students

CEAS administration has identified the following student services that are critical to enhancing our programs toward the goal of Tier 1 excellence – these are summarized in Table 3, with detailed explanation following the table.

	Purpose of Fee	Annual Expense	Average Annual Fee to Student (based on 1800 students)
1	Instructional Lab Maintenance	\$348,000	\$193
2	Computer Replacement and Software	\$230,000	\$128
3	Eng Fund for Enrichment	\$72,000	\$40
4	Staff Engineers (4)	\$540,000	\$300
5	Computer Systems Administrators (3)	\$405,000	\$225
6	Technical Communications Instruction (1.5 FTE)	\$101,000	\$56
7	Academic Advising (6 FTE)	\$405,000	\$225
8	Internship/Career Placement Professional (1)	\$87,000	\$48
9	Machine Shop Operations	\$200,000	\$111
	Totals	\$2,388,000	\$1,327
	UG SCH generated by CEAS ≈ 24,700/yr		
	Fee per CEAS-generated SCH = \$2.388M/24,700 SCH = \$97/CEAS SCH		

Table 3. Proposed fee structure for CEAS

If the proposed engineering fee of \$97/CEAS SCH is implemented, tuition and fees for engineering students at UW would still be lower than those at any of the 10 highest-ranked programs in the country or the three aspirational institutions (see Table 1). Following are details about the proposed fee.

- 1) **Instructional Laboratory Maintenance Fee** will provide funds for maintenance and upgrade of both experiments and instrumentation in UG teaching laboratories throughout the college. Each program in the College has 5-7 required, discipline-specific laboratories that are an integral part of preparation in the profession of engineering. Hence, all CEAS students are impacted by the quality of these facilities. It is notable that in the College's two most recent accreditation reviews, there was significant criticism of our laboratories, requiring a one-time emergency infusion of \$400,000 from UW's central administration. The College needs to be updating its laboratories and equipment on a regular basis and not letting them slip into disrepair as was the case in recent years (indeed, the ABET engineering accreditation commission requires a detailed laboratory maintenance plan).

A part of this fee currently exists, but reassessment during a time of reduced section I funding has indicated that the present fee is insufficient for lab maintenance. Lab maintenance requirements were determined by each department and documented in Departmental Laboratory Plans that were scrutinized by the accrediting body (ABET) in fall 2015: \$348,000/yr - or - \$193/stud/yr.

- 2) **Computer Replacement and Software Fee** will provide for replacement of student computing resources on a 4-year cycle, annual purchase of engineering-specific software licenses, and compensation to UW's division of IT for various services. Note the CEAS does not require engineering students to purchase their own computers as is common at many other engineering institutions so the fiscal burden of computing support falls directly on the College. This fee supports computers and software in our Engineering Science labs as well as those housed in discipline-specific computer labs located in each department. Most instructional laboratories have computer-based instrumentation - maintenance of these computers is also included in this fee. Note also that UW's division of Information Technology assesses fees to each CEAS department for data storage, computer imaging, and network maintenance and there is no allocation in section I budgets for CEAS departments to cover this expense.

This is not a new fee, but rather a modification of an existing fee in light of reduced section I budgets. Magnitude of fee is based on recent expenditure history: \$230,000/yr – or - \$127/student/yr.

- 3) **Engineering Fund for Enrichment Fee** provides funding for student professional societies, student travel to conferences, staffing of engineering tutoring center, and special projects as requested and designated by student representatives to the Engineering Enrichment Fund Council.

This is not a new, but rather an existing fee. No change to existing fee: \$72,000/yr – or - \$40/student/yr.

- 4) **Staff Engineering Fee** supports employment of 4 engineering professionals who provide laboratory maintenance and instruction, with particular contributions to engineering design education. All students will encounter these individuals during their coursework and benefit directly from the services they provide.

Salary and benefits: \$135,000/FTE or \$540,000/yr - or - \$300/student/yr

- 5) **Computing Professionals Administration Fee** will support employment of 3 positions that support instructional laboratories and computer facilities, both essential to daily operation of our educational programs.

Salary and benefits: \$135,000/FTE or \$405,000/yr - or - \$225/student/yr

- 6) **Technical Communications Fee** supports hiring of 1.5 FTE communications professionals who will work with CEAS students at all levels to refine; (a) writing skills on technical laboratory reports, (b) computer-based (PowerPoint) presentations, and (c) oral communications skills for technical presentations. The communications staff is to operate on a drop-in basis or by appointment, readily available to all CEAS students.

Salary and benefits: \$67,500/FTE or \$101,000/yr or \$56/student/yr

- 7) **Professional Academic Advising Staff Fee** supports hiring of 6 FTE staff who will work directly with students to provide academic advising. Students will continue to have access to faculty for career advising. Advising staff will free faculty to address increased teaching loads specified by President Nichols and provide students professional, full-time, competent and consistent advising pertaining to their individual degree programs. The CEAS advising center model is not a UW precedent, but will emulate the successful models that have been in place within other UW colleges for many years.

Salary and benefits: \$67,500/FTE, or \$405,000/yr - or - \$225/student/yr

- 8) **Internship/Career Professional Fee** supports one full time professional to interface between students, employers, and UW Career Services office. This individual works with students on both summer internship placements and full time employment opportunities by editing individual resumes, hosting various informational and interview-skills workshops for students, managing numerous employer requests for prospective student contacts, etc.

Salary and benefits: \$87,000/yr – or - \$48/student/yr

- 9) **Machine Shop Fee** provides partial support for staffing, supplies, and upgraded machine tools in the CEAS machine shop. The shop's services include construction of senior design prototypes, potential patentable prototypes, construction of equipment for instructional laboratories, and prototype apparatus for student contests in which CEAS students represent the College on a national stage.

Partial staffing, supplies, and equipment upgrades: \$200,000/yr – or - \$111/student/yr