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CIVIL ENGINEERING CURRICULUM AT THE UNIVERSITY OF FLORIDA AND THE NATIONAL AUTONOMOUS UNIVERSITY OF HONDURAS

By
Valerie Paredes-Bonilla

Graduate Student,
And
Dr. Fazil T. Najafi

Professor
Department of Civil and Coastal Engineering
University of Florida

P.O. Box 116580, Gainesville, Florida, 32602-3394
Phone: (352) 392-9537, ext.1493 Fax: (352) 392-3394
E-mail: fnaja@ce.ufl.edu

This paper presents an overview and comparison of regular courses of study in undergraduate Civil Engineering at the University of Florida (UF) and the National Autonomous University of Honduras (UNAH). Both courses of study aim to impart a solid education in the area of civil engineering, but achieve the objective using different tools. Both curriculums provide necessary foundation courses such as mathematics, chemistry, and physics, and general sciences, which serve as a common foundation for an engineering degree. In order to obtain a Civil Engineering degree from UNAH, the student needs to complete certain number of credit hours covering major areas of the civil engineering practice. These areas include transportation, geotechnics, water resources, sanitation, materials, structures, administration, and project management. Civil Engineering education at UF is a broad engineering discipline that incorporates many different aspects of engineering. The civil engineering curriculum prepares students to select an area of concentration in preparation for practice or continuation for master and PhD degrees. The areas where both curriculums meet is aiming education towards the ever changing needs of society and strive for globalization.

Introduction

The National Autonomous University of Honduras (UNAH) is located in Tegucigalpa the capital city of Honduras and has 5 campuses over the country. The institution was founded in 1845 as a private institution and came under state control in 1847 and became an autonomous institution in 1957. UNAH currently offers undergraduate and graduate programs in over 107 fields including social sciences, engineering, health professions, agriculture, economics, administration, and math. The civil engineering undergraduate program at UNAH was created in 1904, and was the third program to be created at the university. The program is offered by the College of Engineering, Department of Civil Engineering[1].

The University of Florida (UF), as the oldest university in the state, was founded in 1853 and currently offers more than 52 undergraduate programs in a broad variety of instructional fields. The Department of Civil Engineering was created in 1910 and later merged to the Department of Coastal Engineering in 1999. The civil engineering undergraduate program is widely considered to be among the top programs in the United States[2].

In order to acquire admission to UNAH students must have completed the High School grade. Admission at UF is based on the students high school Grade Point Average (GPA), the Scholastic Aptitude Test 1 (SAT 1) and the American Collegiate Test (ACT)[2].

Description of the undergraduate programs in both universities

The civil engineering program at UNAH is a five-year program based on two 20-week academic semesters and one 8-week summer semester per year. The curriculum is rigid in which students must take courses according to a predetermined plan of study. Elective courses are offered towards the end of the program to select between 4 specialization areas and acquire more knowledge in the selected area (e.g. transportation, structures, concrete structures, and construction).

Table 1 shows the plan of study developed in 1984 for the civil engineering undergraduate degree at UNAH. The program consists of twelve semesters, with an average of six courses per semester. The student's load is measured in Value Unit (UV). The Value Units are the measure of intensity with which a course is taught, takes into reduces to a normalized number the number of hours per week spent in lectures, laboratories, and the effort a student puts in its own time. For each semester, the student must register for the courses required by the plan of study, workload varies from 30 UV to 17 UV per semester, averaging 6 courses per semester.

The first semesters courses are common and shared with students from other colleges, with a requirement of 31 UV in "General Education" courses. These include Philosophy, Writing, English, Sociology, Algebra, Trigonometry, Physics, and Chemistry. During the second semester, the student is introduced to the first level of "Professional Education" courses with a total requirement of 210 UV plus 8 UV in the elective courses. Beginning on the third semester the student is required to take courses in drafting, topography, fluids, and others that serve as a base for the more advanced civil engineering courses.

Table 1. Plan of Study for the civil engineering undergraduate degree at UNAH.

Courses		UV	Theory hours	Practice hours	Pre requisite
General Education Courses					
SC-101	Sociology I	4	4		
FF-101	Philosophy I	4	4		
EE-101	Spanish I	4	4		
EE-102	Spanish II	4	4		EE-101
IN-101	English I (or other Foreign Language)	4	4		
IN-102	English II	4	4		IN-101
IN-103	English III	4	4		IN-102
RR-154	Drawing and Painting (Arts or Sports)	3	1	2	
Total General Education		31			
Professional Education Courses					
MM-110	Mathematics I	5	4	1	
MM-111	Geometry and Trigonometry	5	4	1	
IC-100	Introduction to Civil Engineering	2	2		
MM-211	Linear Algebra	3	2	1	MM-110, MM-111
MM-201	Calculus I	5	4	1	MM-110, MM-111
QQ-100	Fundamental Chemistry	4	3	1	IC-100, MM-110
IC-141	Drafting I	2		2	IC-100, MM-110
FS-100	Physics I	5	4	1	MM-201
MM-202	Calculus II	5	4	1	MM-201
IC-142	Drafting II	2		2	IC-141
FS-200	Physics II	5	4	1	FS-100, MM-202
MM-411	Differential Equations	3	3		MM-202
IC-121	Topography I	5	4	1	MM-201
IC-101	Analytic Geometry	3	3		MM-201
IC-241	Advanced Drafting	2		2	IC-142
IC-211	Statics	5	5		FS-100, MM-202
IC-222	Topography II	5	4	1	IC-121
IC-311	Dynamics	3	3		IC-211, MM-202
IC-310	Mechanics of Materials I	5	4	1	IC-211, MM-202
IC-340	Legislation Applied to Engineering	3	3		IC-222
IC-342	Probability in Engineering (statistics)	3	3		MM-202
IC-314	Computer Programming	3	3		IC-211
IC-410	Structural Analysis I	5	5		IC-310
IC-421	Applied Geology	4	4		FS-200
IC-411	Mechanics of Materials II	5	4	1	IC-310
IC-431	Fluids Mechanics	4	3	1	IC-311
IC-512	Structural Analysis II	5	5		IC-410, IC-411
IC-541	Construction Materials	4	3	1	IC-410, IC-421
IC-540	Soil Mechanics I	5	4	1	IC-410, IC-421
IC-531	Applied Hydraulics	5	4	1	IC-431
IC-530	Hydrology	4	4		IC-431
IC-613	Structural Analysis III	5	5		IC-512
IC-620	Transportation I	4			IC-431, IC-222, IC-540
IC-621	Soil Mechanics II	5	4	1	IC-540
IC-630	Water Engineering Resources	4	4		IC-531, IC-530
IC-631	Irrigation and Drainage	4	4		IC-531, IC-530
IC-710	Steel Structures Design	3	3		IC-613
IC-711	Concrete I	5	5		IC-613
IC-712	Wood Structures Design	2	2		IC-613
IC-731	Sanitary Sewers	4	4		IC-630, IC-631

IC-741	Numeric Analysis	3	3	IC-314
IC-721	Transportation II	4	4	IC-620
IC-812	Concrete II	5	5	IC-711
IC-811	Bridge Engineering I	5	5	IC-613, IC-711
IC-841	Construction Equipment and Procedures	3	3	IC-711
IC-821	Urban Design	3	3	IC-731, IC-620
IC-840	Electric Installations	2	2	FS-200, IC-741
IC-945	General Management	3	3	IC-821
IC-810	Prestressed Concrete	4	4	IC-711
IC-912	Bridge Engineering II	4	4	IC-811
IC-941	Organization and Methods	4	4	IC-841
IC-942	Estimating and Cost Analysis	4	4	IC-841
IC-943	Engineering Economics	4	4	IC-841
IC-944	Sanitary Engineering	2	2	IC-731
Total Professional Education		210		
Elective Courses				
IC-843	Construction Engineering	4	4	IC-741
IC-810	Prestressed Concrete	4	4	IC-711
IC-912	Bridge Engineering II	4	4	IC-811
IC-923	Transportation III	4	4	IC-721
Total Electives		16		
Total civil engineering degree		241		

The remaining three and a half years are dedicated to the civil engineering professional courses, such as: Structures, Reinforced Concrete Design, Steel Design, Water Resources, Foundation, Transportation, Management, and Geotechnics[1].

As a requisite for graduation, the curriculum at UNAH includes one semester of practical training, which must be performed by students in either private companies or government. At the end of the practical training the candidate must prepare and present to a committee a final report on the practical training.

During the senior year students are given the option of selecting two among four specialty areas as mentioned before, these courses involve real design projects for local communities. After completing the bachelor degree in civil engineering, students are eligible for license that enables them to work and practice as a civil engineer.

The current curriculum at UF consists of 131 credits made up of 51 credits of math, science, and general education courses; 11 credits of engineering fundamentals (statics, dynamics, thermo, and strength); 63 credits of required Civil Engineering courses; and 6 credits of electives[3].

The primary change in the new curriculum is a reduction in the number of required Civil Engineering credits from 63 to 54. This allows an increase in elective credits, from 6 to 15, while maintaining the overall degree requirements at 131 credits[3].
The program was based on the experiences of the committee members and on a study of material covered in the Civil Engineering Fundamentals examination[3].

Six tracks are proposed: Construction, Geotechnical, Hydrology/Water Resources, Structures, Transportation, and the broad CE track. All students are required to take the Fundamentals of Engineering Examination prior to graduation[3].

Curriculum Comparison

The first aspect taken into account in the comparison is the different definition of "credit" between both universities. UF defines the credit as the one semester hour, generally representing one hour (50-minute) per week of lecture or two or more hours per week of laboratory work. UNAH requires for both laboratories and lecture classes, a 55-minute period, but the total credit for each laboratory is only 1 UV regardless of the actual time spent. A professor teaches lectures classes, and either a professor or a technician instructor teaches the laboratories.

Table 2 presents a list of the courses offered at UF and UNAH. A comparison of course-by-course based on content is made. The left side of the Table 2 shows an example of the necessary undergraduate courses for obtaining 131 credits at UF (degree requirement). The Right side of Table 2 shows the courses that students are required to take under the plan of study at UNAH. The total at the bottom of Table 2 shows the difference in the number of credits and number of courses required to complete the civil engineering degree at both universities.

The curriculum of the civil engineering undergraduate courses at UF is more flexible than the curriculum at UNAH, offering a variety of specialization courses towards the end of the program. In fact, UNAH's curriculum is more prescriptive and offers a required specialization in several areas at once.

Laboratory classes at UNAH are always part of the activities of specific courses in either basic sciences or engineering sciences. At UF, in addition to this, the curriculum offers courses completely dedicated to lab work in the pre-engineering courses (i.e. physics and chemistry).

Table 2. Comparison between courses at UF and UNAH

Number	Course UF	Credits	Equivalent Course UNAH	Credits
Term 1				
Gen Ed -- S	Social & Behavioral Science	3	Philosophy	4
Gen Ed- H	Humanities	3	Spanish I, Foreign Language I	8
MAC 2311	Analytical Geom. & Calculus I	4	Analytical Geom., Calculus I	8
CHM 2045	General Chemistry I	3	Fundamental Chemistry	3
CHM 2045L	General Chemistry Lab	1	Fundamental Chemistry	1
			Mathematics I	5
			Geometry and Trigonometry	5
Term 2				
PHY 2048	Physics with Calculus A	3	Physics I	4
PHY 2048L	Physics Lab	1	Physics I	1
ENC2210	Technical Writing or ENC3254)	3	Spanish II	4
MAC 2312	Analytical Geom. & Calculus II	4	Calculus I	5
CHM 2046	General Chemistry II	3		
			Introduction to Civil Engineering	2
Term 3				
Gen Ed -- S	Social & Behavioral Science	3	Sociology	4
Gen Ed -- H	Humanities	3	Foreign Language II, and III	8
MAC 2313	Analytical Geom. & Calculus III	4	Calculus II, Analytical Geom.	8
PHY 2049	Physics with Calculus B	3	Physics II	4
PHY 2049L	Physics Lab	1	Physics II	1
			Drafting I	2
			Drafting II	2
			Linear Algebra	3
Term 4				
Gen Ed -- H	Humanities	3	Arts or sports	3
MAP 2302	Differential Equations	3	Differential Equations	3
EGM 2511	Static	3	Static	5
Gen Ed -- B	Statistics	3	Probability in Engineering	3
SUR 2101C	Geomatics	3	Topography I, II	10
Term 5				
EGM 3520	Strength of Materials	3	Mechanics of Materials I	5
SUR 2322C	Project Develop & Visualization	3	Advanced Drafting	2
CGN 4101	Civil Engineering Cost Analysis	3	Engineering cost analysis	4
EML 3007	Thermodynamics	3	Physics II	
Term 6				
CEG 4011	Soil Mechanics	4	Soil Mechanics I	5
EGM 3400	Dynamics	2	Dynamics	3
CGN 3421	Computer Programming for CE	4	Computer Programming	3
CGN 3501	Civil Eng. Materials	4	Construction Materials	4
CES 3102	Mechanics of Eng. Structures	4	Mechanics of Materials II	5
			Structural Analysis I	5
			Introduction to the Economic	8
			Applied Geology	4
Term 7				
CES 3510	Analysis & Design in Concrete	3	Concrete I	5
CEG 4012	Geotechnical Engineering	3	Soil Mechanics I	5
CWR 3201	Hydrodynamics	4	Fluid Mechanics	4
CGN 3710	Exper. & Instrumentation in CE	3	Numeric Analysis	3
			Structural Analysis II	5
Term 8				
	Elective	3	Transportation I	4
CWR 4202	Hydraulics	3	Applied Hydraulics	5
EGN 4034	Professional Issues in Eng.	3	Legislation in Civil Engineering	3
CCE 4204	Const. Methodology & MGT	4	Equipment and Procedures	3
			Steel Structures Design	3
			Structural Analysis III	5
			Hydrology	4
Term 9				
	Design Elective	3	Construction Engineering	4
CWR 4812	Water Resources or ENV 4514	3	Waste Resources	4
	Design Elective	3	Concrete II	5
TTE 4004	Transportation Engineering	3	Transportation II	4
	Design Elective	3		
			Wood Structures Design	2
			Bridge Design I	5
			Sanitary Sewers	4
			Irrigation and Drainage	4
Term 10-12				
			Soil Mechanics II	5
			Urban Design	3
			Electric Installations	2
			General Management	3
			Presstressed Concrete	4
			Bridge Engineering II	4
			Transportation III	4
			Organization and Methods	4
			Engineering Economics	4
			Sanitary Engineering	2
			Practical Training	
Total	42 courses	131	62 courses	241

Engineering courses that include lab classes at UF (i.e. materials and soil mechanics) have a total of 4 credits (three for lectures and one for labs) and are registered as separate courses. At UNAH, engineering courses that include lab classes consist of 4 hours for lectures and 2 or 3 hours of laboratories, laboratory hours are counted as 1 UV. At UNAH if a student fails the lab, is considered to fail the entire course.

Final Considerations

Civil Engineering students at UNAH carry a heavy workload during the week, making it necessary to attend courses 4 to 5 hours in the morning, and 3 to four hours during the afternoon or even at night. This focuses the student on the academic activities and limits the time available for extra curricular activities or for work. Students who work and attend school take considerably longer (up to 10 years) to obtain the degree than full-time students. Students at UF attend a lower number of classes per week leaving time to participate in extra curricular activities including various students' organizations.

The Civil Engineering program at UNAH does not have an area of specialization defined early in the student's academic career, this reflects the country's need for a workforce that is prepared to function in several areas during its career. The curriculum prepares students different civil engineering areas, so that students can start their professional career in any of them.

Professional training during the academic career is optional at UF trough internships, but opportunities fro interning in a local civil engineering firm are limited due to the city's size. Students wishing to do an internship often look at major nearby cities like Orlando, Tampa, or Jacksonville and make the commute to class or take a semester off.

Tuition fees are considerably lower at UNAH, being a public university and the major higher education source in the country the cost per semester is $10. Comparing this to the cost per semester at UF of $800 on average can reflect the larger enrollment at UNAH, but also the lower graduation rates due to low cost to reenroll. However, once a student fails a course for the third time at UNAH, can no longer enroll for it.

It is recommended that UNAH expand its areas of specialization and offer more graduate degrees in civil engineering to locally specialize the workforce. Currently, graduates wishing to pursue graduate degrees must go out of the country at a prohibitive cost for many.

Conclusions

In this paper, we compare the curriculum of the civil engineering undergraduate courses at the University of Florida and the Universidad Nacional Autonoma de Honduras. An analysis and description of both curriculums was performed to establish similarities and differences. The major aspects taken into account in the comparison were the duration of the programs, special courses or activities of each curriculum, the differences in the student academic load and the curriculum flexibility.

At UNAH the civil engineering degree is obtained over a period of over 5 years following a predetermined plan of study, whereas at UF, the degree can be obtained in 4 years (9 semesters). Considering the total number of courses taken by the students in the entire undergraduate program, the number of class-hours received by students at UNAH is more than the double of UF students.
The UF undergraduate curriculum is more flexible than that of UNAH; this may be because the greater availability of graduate degrees in the country.

Bibliography

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Biographical Information

VALERIE PAREDES is a doctorial student at the University of Florida majoring in Civil Engineering with an emphasis in Public Works. She earned her BS degree in Civil Engineering at UNAH worked for 5 years in the public and private sector in Honduras and later earned her ME degree in Environmental Engineering from the University of Florida.

Dr. NAJAFI a professor of Civil and Coastal Engineering at the University of Florida earned his BSAE, MS, and PhD degrees in Civil Engineering from Virginia Polytechnic Institute and State University. He has 35 years of experience with government, industry, and education. He has more than 300 research papers published and presented to international, national and local organizations.