

Blending the Old With the New: The Surveying Program at Michigan Technological University

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ABSTRACT. The Surveying Program at Michigan Technological University was instituted in 1978 in response to the state legislature's mandate that licensed surveyors possess a college degree. From the outset, the surveying curriculum was designed to provide an education to those who wish to become licensed surveyors. The curriculum was approved by the Michigan State Board of Licensing as fulfilling the requirements of professional surveyors. The program is accredited by the Accreditation Board for Engineering and Technology under the Related Accreditation Commission. It has all the ingredients of a modern surveying curriculum, and the practical nature of its course offerings is well suited for the practicing surveyor.

Background

The bachelor of science (B.S.) degree program in surveying at Michigan Technological University has been developed around the philosophy of providing solid education to those whose primary goal is to become licensed surveyors. This fact has been recognized and acknowledged as the major strength of the program by both graduates and employers. The University's long tradition and resources for producing excellent engineering undergraduates has helped to achieve this goal.

The Michigan Technological University, or Michigan Tech as it is usually called, was founded in 1885 as the Michigan College of Mines, in response to a growing demand for metallurgical and mining engineers. Over the years, the College grew into a premier engineering institution and received university status in 1964. Michigan Tech is currently accredited by the North Central Accreditation Commission on Institutions of Higher Education. Of the approximately 6,500 undergraduate students, almost 80 percent are enrolled in the College of Engineering. All engineering and engineering-related programs are accredited by the Accreditation Board for Engineering and Technology (ABET).

Surveying was an integral part of many engineering curriculums and the B.S. in forestry

curriculum in the School of Forestry and Wood Products. Even before the B.S. degree program in surveying began, forestry graduates had the option of specializing in surveying. The bachelor's surveying program was initiated as a result of an initiative taken in October 1974 by the Surveying faculty in the School of Forestry and Wood Products and the Michigan Department of Licensing and Regulation. A new surveying curriculum leading to a B.S. degree, which would become the mandated minimum educational requirement for surveyors in 1978, was developed and adopted in the fall of that year. In 1984, the administration of the Surveying Program was transferred to the School of Technology which offered several engineering technology degrees. Along with this transition, the surveying courses taught in all of the disciplines taught at the University were consolidated and brought under the control of the surveying faculty. The affected curriculums were civil and environmental engineering, civil engineering technology, mining engineering, forestry and forest technology. Students in the above disciplines require mostly one or two courses in introductory surveying; total enrollment in these introductory courses exceeds 400 per year. In 1987, the Surveying Program was accredited by the Related Accreditation Commission of the Accreditation Board for Engineering and Technology (RAC/ABET).

Surveying Curriculum

Since the surveying curriculum was initially developed to meet the requirements of the State Board of Licensing, it was strong in traditional surveying courses. The curriculum emphasized the practical

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FIRST YEAR				MAT144	Structured Computer Programming	3	
Fall				PH202	Elements of Physics II	4	
CH101	General Chemistry I	4				Total 14	
CH111	General Chemistry Laboratory I	1	Spring				
FW201	Dendrology	3	EC201	Principles of Microeconomics	3		
HU101	First-year English I	3	EMT130	Statics	4		
MA150	Calculus and Analytic Geometry I	5	LS250	Survey Mapping	3		
		Total 16	LS301	Mathematical Astronomy	3		
Winter				PH203	Elements of Physics III	4	
HU102	First-year English II	3				Total 17	
LS101	Orientation for Surveying	1	Summer				
MA151	Calculus and Analytic Geometry II	5	LS351	Surveying Field Techniques	9		
ME104	Engineering Spatial Analysis	3	LS352	Advanced Surveying Field Techniques	9		
MET121	Land Mapping Techniques	3	PE110	Individual Athletics	1		
PE	Physical Education	1				Total 19	
		Total 16	THIRD YEAR				
Spring				Fall			
HU	Humanities Elective	3	BA254	Business Law I	4		
HU209	Verbal and Nonverbal Communication	3		Elective - HU, SS	3		
MA152	Calculus and Analytic Geometry III	5		Elective - HU, SS	3		
SS210	Amer. Government from a Hist. Perspective <i>OR</i>		LS440	Analysis and Adjustment of Surveying Measurements	4		
SS230	American Government and Politics	3	PE	Physical Education	1		
PE	Physical Education	1				Total 15	
		Total 15	Winter				
SECOND YEAR				CET251	Soil Technology	4	
Fall				CET252	Water and Wastewater Technology	4	
CET167	Computer-aided Drafting and Design	3	LS325	Real Estate Law	3		
GE201	Physical Geology I: Earth Materials	3	LS416	Photogrammetry	4		
LS249	Introduction to Surveying	3				Total 15	
MAT140	Computer Applications	2	Spring				
PH201	Elements of Physics I	4	LS443	Introduction to Geodesy	3		
		Total 15	LS447	Construction Surveying	3		
Winter					Elective - Surveying	3	
EC200	Principles of Microeconomics	3		Elective - HU, SS	3		
MA207	Principles of Statistical Methods	4		Elective - HU, SS	3		
						Total 15	
FOURTH YEAR				Winter			
Fall				CET253	Highway Technology (w)	3	
LS426	Boundary Surveying Principles	3	LS438	Subdivision Planning and Design	3		
LS437	Survey Research and Evidence	3	LS446	Land Information Systems	3		
LS444	GPS Satellite Surveying	3					

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FOURTH YEAR				
	Elective - Technical	3	Elective - HU, SS	3
	Elective - Thematic	3	Elective - Thematic	3
	Total	15	Total	15
Spring				
CET265	Construction Estimating, Planning, and Scheduling	3	Elective - Thematic	3
LS439	Survey Office Practices	3	Elective - Thematic	3
			Total	15

Figure 1. Michigan Technological University's Bachelor of Science in Surveying. (Minimum hours required for graduation = 202).

side of surveying rather than theory. This may be attributed to the fact that three members of the surveying faculty at that time were practicing licensed land surveyors. The present version of the curriculum has a good balance between theory and practice, providing a well-rounded surveying education. An Advisory Council made up of practicing surveyors advises the faculty on the relevance of the course offerings.

The curriculum, with its minimum course requirement of 202 quarter credits for graduation, is shown in Figure 1. The courses are designed to meet general education as well as ABET requirements. The basic education requirements are applicable to all bachelor degree programs and include a minimum number of credits in science, mathematics, communication, humanities, social sciences, physical education, and upper-division thematic studies. The latter studies are designed to give in-depth knowledge of a subject matter outside the student's major.

The practical nature of the surveying curriculum is strengthened by a 10-week summer program that is required for graduation. This program is designed to teach the students the skills necessary in operating surveying instruments and understanding the different surveying procedures used in the field. The students work in crews, plan their projects, and complete them to the specifications developed by the instructors. The landscape of rural Houghton county, with its rolling topography, provides ample opportunity for field exercises.

The summer program is scheduled at the end of the sophomore year, but some students may take it in the junior year. Unlike regular labs, these field exercises have real-world nature about them. They enable students to learn team work, make decisions independently, and develop their leadership qualities. Students who have completed the summer program find it easier to get summer jobs such as crew chiefs.

Although computer usage is vital to surveying, it is the view of the faculty that surveying graduates need not necessarily become computer programmers but, they should be able to use computers effectively. They should be able to use different program applications and be familiar with Internet and other modern communication modes. If a student so desires, sufficient flexibility is provided in the curriculum to learn programming skills. Michigan Tech students are exposed to such major softwares as Eagle Point and AutoCAD, both of which they use for COGO calculations, drafting, and plotting. Verbal and written communication skills are emphasized as well; good communication skills are needed in dealing with clients and to share ideas with fellow professionals. The University's Modern Language Lab, operated by the Humanities Department, is open to any student needing help to develop his or her writing and communication skills.

Distance Education Program

Michigan Tech has been involved in distance education for quite some time. Engineering and business courses are delivered, either via satellite broadcast or video taping, to off-campus sites such as the National Technical University and General Motors. The Surveying Program began delivering surveying courses to off-campus sites in the fall of 1994. This was the result of numerous requests received from industry personnel, backed by the Michigan Society of Professional Surveyors. The distance education courses are targeted to individuals who are already employed by surveying firms but do not have the necessary educational qualifications to be licensed. Most of these individuals are older employees who have families to support.

The program has grown tremendously since its establishment. Almost all the upper-division sur-

veying courses are available through our distance education program. Most students take classes toward a degree in surveying, but there are also graduates of another discipline who need to complete the surveying credit requirement of the Board of Licensing. One individual has already obtained a B.S. degree in surveying through this program, and there are several who are about to complete their degrees.

The students accepted into the distance education program are expected to fulfill the basis prerequisites of the courses they wish to enroll in, basic surveying, mathematics, statistics, and computer skills. They also need to have completed other general education requirements at another institution. The courses transferred from other institutions must be approved by the University's transfer admission counselors and surveying distance education advisor. In some courses, credits can be given for work experience in lieu of laboratory exercises.

Currently, the classes that are being taught on campus are videotaped live and delivered to the remote sites, where the students view the tapes in the evenings. This format has worked well with most of our students as they do not have to take time off from work. Delivering instruction via a videotape is also useful in that students can view the tapes when they wish to review the material. Each site is being monitored by a site coordinator who facilitates tape viewing, distribution of handouts and assignments, and proctoring the exams. Students interact with the course instructor by telephone, fax, electronic mail, and video conferencing. The surveying faculty are working on creating courses to be delivered via the Internet. This would provide the student more direct communication with the course instructor and quick feedback. The problem, however, is that currently very few distance learning students have access to the Internet.

Surveying Students

Student recruitment, a major hurdle for any surveying program in the U.S., is vital to the success of the Surveying Program at Michigan Tech. The University's distance from major population centers makes it difficult to attract students. The present student body consists of almost 50 percent transfer students who come from other programs in the University or from other colleges and universities. The program has also seen older graduates from such fields as forestry and civil engineering returning to pursue a second degree in surveying. A dual-degree option with other B.S. degree programs in the University, as well as a direct-transfer option for associate degree students in Civil Engineering Technology, is already in place.

The University offers in-state' tuition rates to all non-Michigan residents of the U.S. and Canada who rank in the top 15 percent of their high school graduating class. This helps the Surveying Program at Michigan Tech draw students from neighboring states such as Wisconsin, Illinois and Minnesota. Non-resident transfer students get the same concession if they transfer from a post-secondary institution with a minimum cumulative grade point average of 3.25 (4.0 scale). The University has an attractive financial aid program in addition to several scholarships available only to surveying students.

The surveying students are active in the Douglass Houghton Student Chapter of the American Congress on Surveying and Mapping, and the Michigan Society of Professional Surveyors. They regularly provide suggestions to improve the curriculum and teaching, participate in various University activities, and work closely with the Upper Peninsula Chapter of the Michigan Society of Professional Surveyors. They also arrange demonstrations of the latest surveying instruments and invite external speakers.

Conclusion

The Surveying Program at the Michigan Technological University is one of the early bachelor degree programs in surveying in the United States. The faculty of Michigan Tech's Surveying Program believe that surveying education should give the practicing surveyor a solid background in traditional land surveying techniques, including legal research. This does not preclude embracing new technologies and expanding the role of the surveyor into new areas of professional practice. A balance between theory and practice, which students as well as prospective employers seem to appreciate, needs to be maintained.

While surveying programs must find ways to attract more high school students to the profession, those who are already part of it should not be neglected. There is a considerable number of individuals working in the field of surveying without the necessary credentials for registration. The MTU distance education program is an attempt to pave the way for these individuals. It also serves as a platform for introducing the practicing professionals to new technologies.

FURTHER READING

Wijayratne, Indrajith D., 1995, A Baccalaureate Degree Program for the Traditional Surveyor. *Surveying and Land Information Systems* 55(3):115-24. ■