2/6/91

CIVIL ENGINEERING TECHNOLOGY
MISSION STATEMENT

Civil engineers apply the principles and techniques of engineering to the design and implementation of complex systems such as structural, building and transportation systems; water resources; solid and liquid waste treatment and disposal; construction management; and the building of public works. There is evidence that there will be future growth of the field of civil engineering in the State of Michigan because of expected high activity in many of these areas. As construction projects and federal and state dollars increase in the 1990's to address growing concerns over infrastructure repair and environmental issues, there will continue to be a shortage of trained civil engineers and technicians to fulfill the demand.

A comprehensive Civil Engineering Technology Program is required in southeastern Michigan because of the large infrastructure needs, the shortage of trained civil engineers and the growing importance of the engineering team with the inclusion of the engineering technologist. The ability to train civil engineering technicians at the Auburn Hills campus and the trend of the civil engineering industry to use technicians to supplement and extend the work activities of staff civil engineers is an opportunity that is expected to result in a number of strong partnerships between Oakland Community College and the industry. The partners, both public agencies and private firms, will be selected on the basis of their ability to offer cooperative programs, provide training on the latest civil engineering technology, and offer careers in the field.

The mission of the proposed Civil Engineering Technology Program at the Auburn Hills campus of Oakland Community College is to prepare civil engineering technicians for either office design work or field inspection/surveying/investigation work in the specific areas of transportation and public works design, construction, maintenance, and operations. As an offshoot of this program it is expected that upgrading of skills of practicing technicians and engineers will be offered in these same areas because of the fast changing technology.

CIVIL ENGINEERING TECHNOLOGY GOALS

1) Participants will be trained in the terminology and procedures of highway and public works surveying including topographic surveys, construction layouts, cross-sections, and as-built surveys and be able to use the most recent survey technology to perform this work under the general direction of a surveyor or engineer. They will be able to transform the data gathered into the format needed for application.

2) Participants will be able to assist civil engineers in the performance of computer-aided highway, bridge, and structure design through familiarity with the widely-used Computer-aided design (CAD) hardware/programs and the basic mathematics and standards of highway/public works construction. They will be able to produce contract drawings and construction quantity estimates for the engineer's review.

3) Participants will understand the principles of the public works bidding and construction process and be familiar with ~~the~~ standard procedures, tests, quality assurance ~~controls~~, and measurements used to insure conformance with the project specifications. They will be able to perform standard tests (using the latest technology) for, by way of example, asphalt and concrete placement, and grade compaction. They will be acquainted with procedures for assuring quality ~~control of~~ assurance of manufactured materials such as structural steel and sewer pipe.

4) Participants will understand the ~~preventive maintenance~~ concepts of systems management of highway pavements, structures, and appurtenances such as traffic control signs and pavement markings. They will be familiar with data gathering and data base management techniques for such programs. They will be able to assist engineers in designing and estimating preventive maintenance programs.

5) Participants will be acquainted with the planning and operations of highway systems including the techniques of data gathering, data reduction, and presentation. They will be familiar with the theory of

traffic flow, highway capacity, and traffic control. They will understand the terminology of traffic accident data and be able to produce accident summaries for the engineer. They will be aware of traffic safety concerns and be capable of recommending traffic controls and operations measures for specific locations following investigation.

6) Participants will be aware of construction safety measures and the principles of traffic work zone safety so that they can implement, under the direction of the engineer, appropriate measures for maintenance of traffic and work zone safety for specific sites.

7) Participants will be familiar with the design, capability, operations, and maintenance of solid-state traffic control equipment and be able to assist the traffic signal engineer in designing layouts, supervising installation, setting up operations, and maintaining the system in the field.

8) Participants will be able to express themselves clearly, both verbally and in written reports, as to the circumstances, problems, and recommendations involved in their expected work assignments. They will be able to communicate with the public, elected officials, and other lay people about both the technical and practical aspects of the jobs they will typically be assigned to undertake.

OBJECTIVES OF THE CIVIL ENGINEERING TECHNOLOGY CURRICULUM

The purpose of the curriculum in civil engineering technology is to provide the general, supportive, and technical education necessary for the student who completes the program to take a technician position in one of the following fields of civil engineering:

- o-Design of highways and other public works
- o-Construction of highways and other public works
- o-Surveying of highways and other public works
- o-Traffic and transportation engineering
- o- Environmental and solid waste planning, design, and construction
- o-Traffic signal design, construction, and maintenance

The graduate student should be able to, once he/she has become familiar with the specific practices and procedures of any employer, be able to become, in a very short time, a productive member of the civil engineering team.

ASSOCIATE IN APPLIED SCIENCE-CIVIL ENGINEERING TECHNOLOGY

Major Requirements (28 credit hours)

CET 100	Property of Engineering Materials	3	
CET 110	Engineering Plans & Specifications		3
CET 120	Surveying for Construction		4
CET 130	Nature of Soils	3	
CET 140	Highway Design	4	
CET 150	Bituminous and Concrete Materials		3
CET 160	Highway and Structure Maintenance		3
CET 170	Route Surveying	4	
CET 180	Construction Safety and Traffic Maintenance		4
CET 190	Traffic Flow and Data	3	
CET 200	Traffic Signal Control	4	
CET 210	Highway and Construction Drainage		4
CET 220	Environmental Testing and Solid Waste Disposal	3	

STATICS will have to be added

Supportive Courses (20 credit hours)

MAT 115	Intermediate Algebra	4	
MAT 156	Trigonometry	3	
DPR 103	Principles of Computer Information Process.	4	
DRT 111	Introduction to Technical Drawing	3	
CAD 110	Introduction to Computer Aided Design	3	(Design track)
CAD 120	Computer Aided Design Applications I	3	(Design track)
PHY 161	College Physics I	4	
QAT 100	Total Quality Control	3	(Inspection track)

QAT 101	Principles of Quality Assurance	3	(Inspection track)
ELT 121	Basic Electricity I	3	(Signal track)
ELT 124	Basic Electricity II	3	(Signal track)

General Education (16 credit hours)

Communications/English		3
Fine Arts/Humanities		3
Mathematics/Science	(fulfilled above)	3
Social Science		3
American Government (POL 151)		3
Written Communication		3
Physical Education		1

COURSE DESCRIPTIONS

CET 100 Property of Engineering Materials

General survey of the Pproperties, testing, and uses of construction materials, ~~with emphasis in the areas of~~ especially steel, aggregates, portland cement concrete, and bituminous concrete. The student learns standard laboratory testing and report writing procedures. Co-requisites: MAT 115 and Written Communications.

CET 110 Engineering Plans & Specifications

Introduction to construction documents for the highway/heavy construction field. Study of plans, details contracts and specifications for the design and construction of highways, bridges and appurtenant structures. Prerequisite: high school drafting or DRT 111.

CET 120 Surveying for Construction

Introductory course in plane surveying procedures emphasizing computerized surveying systems and using transit, tape and engineering levels. Topics included in construction-oriented problems are ~~differential leveling for basemark~~ establishment, ~~transit-tape~~ traverses, structure tapelay-out procedures, and profile, cross-section leveling. Prerequisite: MAT 156.

CET 130 Nature of Soils

An introductory course for the technical student in the basic physical and geological aspects, characteristics, and engineering classifications of Michigan soils as well as geo-environmental considerations such as handling hazardous waste on the construction site. Prerequisites: CET 100, MAT 156, PHY 161.

CET 140 Highway Design

A study of the theory and practical applications in highway design. Topics covered in the geometric and structural design of highways include horizontal and vertical alignment, super-elevation, sight distances, structural design, and the typical cross-section, culverts and drainage design, earth work and mass-diagram calculations. Laboratory exercises relate theory to actual highway plans, ~~and~~ involve computer-aided design applications, and introduce the AASHTO design guides. Prerequisites: CET 120, MAT 156, CET 100, Co-requisite: CAD 120.

CET 150 Construction ~~Bituminous and Concrete~~ Materials

A continuation of the study of materials of construction with emphasis on mechanical and physical properties of aggregate, portland cement concrete, and bituminous mixtures but with some discussion of timber and geo-synthetics. Laboratory exercises include aggregate blending, stress-strain testing, concrete slump and compression tests, and Marshall testing of bituminous-aggregate mixtures. Prerequisite: CET 100.

CET 160 Highway and Structure Maintenance

Basic preventive maintenance procedures for pavements, structures, and appurtenances will be presented and familiarity with standard reporting procedures acquired. Also includes an introduction to pavement management systems, structure inventories, and highway facility inventories with emphasis on methods of data collection and updating and means of preparing system reports and queries. Prerequisites CET 140 & 150.

CET 170 Route Surveying

Review of instrument adjustment, ~~stadia~~, global positioning, and ~~celestial~~ satellite observations. Advanced problems in horizontal and vertical curves and an introduction to instrument repair and road construction staking procedures. Covers U.S. government land survey system. Prerequisite: CET 120

CET 180 Construction Safety and Traffic Maintenance 4

An introduction to safe working procedures for various types of construction and surveying procedures. The student will gain an understanding of the procedures for maintaining traffic during construction and a familiarity with the ~~requirements~~ guidelines of the Michigan Manual for Uniform Traffic Control Devices. Analysis will be made of actual construction projects by review of plans and field inspection, when possible. Prerequisites: CET 140, CET 190.

CET 190 Traffic Flow and Data

A description of design elements of highway systems including driver, vehicle, and roadway. Traffic flow design elements including volume, density, and speed. Intersection design elements including delay, capacity, and accident countermeasures. Terminal design elements including inflow, outflow, and circulation. Procedures for obtaining traffic data including counts, accident records, and presenting data for analysis. Methods of traffic investigation and recommendation of traffic control measures. Prerequisites: MAT 115 and Written Communications.

CET 200 Traffic Signal Control

An introduction to the theory of traffic signal control including traffic signal warrants, traffic signal systems, actuated signals and loop detection, and the concepts of cycles, phases, splits, and intervals. The students will become familiar with the types of traffic signal controllers currently being used, their capabilities, and maintenance requirements. Prerequisites CET 190 and ELT 121

CET 210 Highway and Construction Drainage

An introduction to the concepts of hydrology, fluid mechanics, and hydraulics as they apply to the design and maintenance of highway and construction drainage facilities. Students will be exposed to the fundamental elements and characteristics of drainage systems including pumps, sumps, catch basins, storm sewers, bank and edge drains, etc. They will learn how to design drainage systems based on hydrologic storm data, run-off characteristics, and the relationship of pipe size and gradient to capacity. Prerequisites CET 130 & 140.

CET 220 Environmental Testing and Solid Waste Disposal

An introduction to the most current environmental concerns in highway and other public works construction including pertinent federal and state regulations, standard tests, and methods of mitigation. Also includes an overview of the solid waste disposal systems used in Michigan, pertinent legislation, and environmental concerns and design of sanitary landfills and waste-to-steam incinerators. Prerequisites CET 130.

ABET CRITERIA

The Accreditation Board for Engineering and Technology, Inc. (ABET) has established criteria for accrediting programs in Engineering Technology. The criteria for associate programs are as listed below:

General Criteria

- o-Minimum of 64 semester hour credits
- o-16 semester hour credits of an appropriate combination of basic sciences and mathematics of the type, level, and subject coverage specified in the applicable program criteria. The basic sciences component must include at least 4 semester hour credit in area specified under basic sciences below. The mathematics component must include at least 8 semester hour credits in areas specified under mathematics below. The remainder of the requirement may be met by appropriate course work in either basic sciences or mathematics but not in computer programming.
- o-The balance of the program should be designed to achieve an integrated and well-rounded engineering technology program with a maximum of 4 semester hours of cooperative education experience provided it meets requirements stated under that section.

Program Content and Orientation

- o-The program should provide an integrated educational experience directed toward the development of the ability to apply pertinent knowledge to the solution of practical problems in the graduate's engineering technology speciality.
- o-ABET requires a high degree of specialization for engineering technology programs, but with field orientation rather than task orientation. The engineering orientation of the technical specialization should be manifested by faculty qualification and course content.

Curriculum Elements

o-Subject matter has its roots in mathematics and basic sciences and carries knowledge further toward application.

o-Technical skills and technique courses are those where the student acquires the necessary skills and knowledge of appropriate methods, procedures, and techniques---such as graphics, problem solving, processes, construction techniques, field operations, safety and maintenance. Technology laboratory manuals, experiments, projects, and activities should clearly reflect the orientation of the program towards the education of the student in the modern techniques of applied design, construction, operation, maintenance, and testing. For courses requiring laboratory work, sufficient written documentation of that work is required to ensure that students become competent in communications with such material graded with respect to both technical content and writing skills.

o-Technical design courses are practice-oriented standard design applied to work in the field in which students acquire experience in carrying out established design procedures in their areas of specialization. The course would follow established design concepts developed by engineering would emphasis standard design procedures and practices most of which have been included in handbooks or standard computer methods.

Basic Sciences and Mathematics

o-Basic science courses should emphasize fundamental knowledge about nature and its phenomena using measurement and quantitative expression. Laboratory work is a required part of the study. Physics, chemistry and the life and earth sciences may be components of the basic sciences. The basic sciences in a Civil Engineering Technology Program also have to include, according to criteria submitted by the American Society of Civil Engineers (ASCE), topics in statics and strength of materials.

o-College algebra is the basis for the minimum mathematics credit. Program requirements should include carefully selected topics suited to the individual program from algebra through trigonometric functions to higher levels of mathematics.

According to additional criteria for Civil Engineering Technology Program submitted by ASCE, the program must ensure that a student understands and is able to use algebra, trigonometry, and analytic geometry with facility. In addition, depending upon the educational objectives of the program, the basic concepts of applied statistics, advanced trigonometry, or calculus should be included.

Communications, Humanities and Social Sciences

o-Good oral and written communications are a necessary achievement of a college graduate. Reports should be neat, grammatically correct, and lucid. Graduates must be proficient in the use of English and have developed the ability to communicate ideas and understand those of others. Course work in English composition, including both written and oral presentation, literature and especially technical writing is appropriate.

o-It is important that the student understand and appreciate our cultural heritage, the complexities of interpersonal relationships and understand the interrelationship between technology and society, and a system of values essential for intelligent and discerning judgments.

Computer Literacy

o-It is essential that students acquire a working knowledge of computer usage in the engineering technology field. Instruction must be included in one or more of the computer languages commonly used in the practice of engineering technology. Assignments should concentrate on using the computer in technical problem solving applications as contrasted to traditional data processing problems.

Cooperative Programs

o-ABET does not separately identify cooperative programs but encourages flexibility in the development of appropriate work experiences as part of an engineering technology program. credit for work experience, as described above under General Criteria, must include an appropriate academic component such as a seminar or written formal report addressing the experience and educational benefits.

Technical Currency

o-Technical currency must be assured by such means as a competent and inquisitive faculty, an active industrial advisory committee, an adequately funded budget which encourages continued faculty development, and a modern library collection.

Other Sections

There are other sections to the ABET criteria which are not relevant at this time. They include:

o-Arrangement of Baccalaureate Programs (2 + 2)

o-Faculty

o-Student Body

o-Administration

o-Satisfactory Employment

o-Industrial Advisory Committee

o-Financial Support and Facilities