

COLLEGE OF ENGINEERING  
COURSE AND CURRICULUM CHANGES

Approved at the College faculty meeting

November 14, 2008

1107 Fiedler Auditorium

3:30 p.m.

Undergraduate/Graduate

Contact Person: Jim Goddard  
532-3569  
e-mail: [goddard@ksu.edu](mailto:goddard@ksu.edu)

**Units outside the college, which may be directly  
impacted by these changes are:**

**Management Dept  
Dept of Agronomy  
Grain Science and Industry**

Please provide the sponsors of a proposed change with any information regarding fiscal or programmatic impact on your department, program or students.

# EXPEDITED COURSE PROPOSALS

## Electrical and Computer Engineering

FROM:

TO:

<b>*Subject:</b> EECE <b>Nbr:</b> 015	<b>*Subject:</b> ECE <b>Nbr:</b> 015
<b>*Subject:</b> EECE <b>Nbr:</b> 210	<b>*Subject:</b> ECE <b>Nbr:</b> 210
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**RATIONALE:** The Electrical and Computer Engineering Department's name changed some years ago and this is to reflect the correct prefix for their courses.

**IMPACT:** None

**EFFECTIVE DATE:** Spring 2009

## **NON-EXPEDITED COURSE PROPOSALS**

### ***General Engineering***

**FROM:**           **DEN 300. Introduction to Total Quality Management (1) II** Learn about the basic philosophies of Six Sigma, Total Quality Management (TQM). Topics include leadership concepts, supplier-customer relationships, group process, SPC tools, data gatherings, and related organizational issues. One hour lec. a week. Pr.: MATH 100, sophomore standing. Cross-listed with MANGT 300.

**TO:**               **DEN 300. Introduction to Total Quality Management and Six Sigma (1) II** Learn about the basic philosophies of Six Sigma, Total Quality Management (TQM) and other continuous process improvement concepts. Topics include leadership concepts, supplier-customer relationships, ~~group process, SPC tools,~~ employee involvement, data gatherings, and related organizational issues. Class time includes opportunities for team building and hands-on application of statistical process control tools. One hour lec. a week. Pr.: MATH 100, sophomore standing. Cross-listed with MANGT 300.

**RATIONALE:**   The change reflects a change in content presented in the course.

**IMPACT:**        Management Dept

**EFFECTIVE DATE:**   Summer 2009

## Curriculum Changes – Undergraduate/Graduate (non-expedited)

### *Dept of Biological and Agricultural Engineering*

**ADD:** Concurrent B.S. Biological Systems Engineering/M.S. Biological and Agricultural Engineering Degree

A student that successfully completes this program will receive both a B.S. BSE and an M.S. BAE degree from the Biological and Agricultural Engineering Department (BAE). This program has thesis and report formats.

Admission Requirements: A student must petition Kansas State University's Graduate School to be admitted into this program. The following requirements must be met before an individual can be admitted into this program.

- The student must be seeking a B.S. BSE degree from the Department of Biological and Agricultural Engineering (BAE).
- The student must have completed at least 80 credit hours of his/her undergraduate degree.
- The student's cumulative undergraduate GPA must be at least 3.25.
- The student must have a member of KSU's Graduate Faculty in the BAE department agree to be his/her major professor (this professor can be changed in accordance to KSU's policies.)
- The student must be accepted to this program before receiving his/her B.S. BSE degree.

Program Formats and Guidelines: Since there is some overlap between undergraduate and graduate study, some graduate courses will satisfy the degree requirements for the undergraduate degree. A maximum of 9 graduate credit hours from the M.S. BAE degree can be counted toward the B.S. BSE degree. Some additional conditions are:

- The student must complete 30 graduate credit hours with a graduate GPA of at least 3.0.
- The student must complete all B.S. BSE undergraduate requirements with the exception that up to 9 credit hours taken for graduate credit can also count toward his/her undergraduate degree requirements.
- At least 18 of the graduate credit hours on the Graduate Program of Study must be in classes at the 700 level or above.
- Once a student applies for this program, he/she must be continuously enrolled to complete this program. If a student is not enrolled for a fall or spring semester, this student loses the ability to count graduate credit hours toward his/her undergraduate degree.
- A student pursuing a thesis format must complete at least 6 credit hours of Masters Thesis (BAE 899).
- A student pursuing a report format must complete 2 credit hours of Masters Report (BAE 898).

Once an individual is admitted to the concurrent B.S. BSE/M.S. BAE degree program, the student should consult the graduate handbook for policies and procedures for graduate degrees, which include: supervisory committee, final examination, thesis defense, etc. The student's supervisory committee must approve the program of study, which is a statement of that student's graduation requirements.

Once a student has completed all of the graduation requirements, he/she will graduate with both a B.S. BSE and an M.S. BAE degree in the same semester. In the event that a student begins this program, but does not wish to finish the M.S. BAE degree requirements, he/she must change the nine credit hours of his/her graduate classes to undergraduate credit and then he/she will receive a B.S. BSE degree. Once the student has completed the required 128 credit hours, the BAE Graduate Committee will evaluate whether or not the student will be allowed to continue the concurrent B.S. BSE/M.S. BAE program based upon KSU Graduate School policies. If the committee doesn't allow the student to continue with the program, then, upon completion of the B.S. BSE requirements, the student will graduate with a B.S. BSE degree. In either of these two cases, the student loses the ability to count courses toward both his/her undergraduate and graduate degree requirements.

Additional Procedures: Each semester a student in this program must enroll in either BAE 815 (Graduate Seminar) or BAE 020 (Engineering Assembly). For at least one year, the student must be enrolled in BAE 815.

KANSAS STATE UNIVERSITY  
 DEPARTMENT OF BIOLOGICAL AND AGRICULTURAL ENGINEERING  
 Concurrent Bachelor of Science BIOLOGICAL SYSTEMS ENGINEERING and Master of Science BIOLOGICAL AND AGRICULTURAL ENGINEERING  
 Program Format and Minimum Requirements\*

An entering student must be pursuing a B.S. BSE and have at least a cumulative 3.25 GPA. The student must enroll in this program after completing 80 undergraduate credit hours, but before his/her B.S. degree is awarded.

The formats for this program are as follows.\*

	Thesis	Report
BAE Courses (excluding Seminar)	9	9
Other Courses and Electives	13	17
Thesis or Report	6	2
BAE 815 (Graduate Seminar)	2	2
TOTAL GRADUATE CREDITS	30	30

Other Policies

\* Actual degree requirements will be summarized on an approved plan of study. Some general guidelines include:

- The student must complete all of the B.S. BSE undergraduate requirements with the exception that up to 9 credit hours taken for graduate credit can also count toward his/her undergraduate degree requirements.
- The student must complete at least 30 graduate credit hours
- At least 18 hours of graduate courses must be at or above the 700 level.
- Graduate courses in the BAE department must be at or above the 600 level.
- Graduate courses outside the department must be at or above the 500 level.
- Continuous enrollment required.
- Each semester a student must enroll in either BAE 020 or BAE 815 and complete at least 2 semester hours of BAE 815 for credit

## ***Dept of Chemical Engineering – Graduate (non-expedited)***

### **Proposal for a New Graduate Certificate Program in Biobased Products and Bioenergy**

#### ***Educational Objectives of the Proposed Certificate Program***

The graduate certificate being proposed will establish an interdisciplinary program of study that will:

1. ensure participating students receive a broad education in several disciplines which comprise biobased products and bioenergy,
2. increase student awareness of the potential of biobased resources as fuels and industrial raw materials,
3. provide a paradigm shift in student awareness away from petroleum-based materials to the utilization of renewable resources for fuels and chemical feedstocks,
4. identify a formal set of courses in biobased products and bioenergy for graduate students and industrial practitioners, and
5. provide a documented course of study for students preferring a freestanding certificate program.

#### **Structure of the Proposed Graduate Certificate Program in Biobased Products and Bioenergy**

The graduate certificate program proposed will consist of a minimum of fifteen (15) credit hours of coursework selected from a series of courses approved by the Biobased Products and Bioenergy Certificate Committee (BPBCC). Each student will be required to complete at least one of the courses below, each of which includes content from more than one of the designated subject areas. In the case of students pursuing a graduate degree, the course **cannot** be selected from a student's primary academic department.

- ⇒ Crop Improvement and Biotechnology (AGRON 630)
- ⇒ Novel Uses of Renewable Biopolymers (GRSC 825)
- ⇒ Biochemical Engineering (CHE 715)
- ⇒ Biological Process Engineering (BAE 545)

Each student will also be required to complete a variable (2 - 3) credit hour seminar/special topics course in which the students will be placed into multidisciplinary teams. This exercise is intended to provide a "capstone" experience. The nature of the problem will vary, including (but not limited to) design of an interdisciplinary, multi-investigator research proposition, an industrial problem taken from the "real world," development of an extensive case study, or a product/process design experience. Each team will select from a list of interdisciplinary topics provided by either participating faculty or an industrial collaborator through the BPBCC. The faculty providing the problem will serve as the team's advisor. The BPBCC will assist in finding a faculty advisor in the situation where an industrial collaborator may be involved. The faculty advisor will be responsible for determining the number of credit hours and awarding the grade. The teams will prepare a formal written report documenting their work at the end of the semester. While it is envisioned that a specific course co-listed amongst participating departments will be developed, several courses currently exist which can be utilized at this time to meet this requirement, including AGRON 600 (Crop Problems), AGRON 910 (Topics in Plant Breeding), AGRON 930 (Topics in Plant Genetics), BAE 620 (Problems in Agricultural Engineering), BAE 820 (Topics in Agricultural Engineering), CHE 802 (Selected Topics in Materials Science), CHE 805 (Selected Topics in Biochemical Engineering), GSI 790 (Grain Science Problem), and GSI 910 (Topics in Grain Science).

The remaining coursework is to be selected from at least three of the following four subject areas: plant science, plant/crop production, processing, and utilization. Sufficient courses currently exist at KSU to deliver several courses in each of these subject areas; a list of courses from which students will select

their coursework for this certificate program follows. The subject areas associated with the courses listed is given in the table at the end of this document. New courses will be added to support this program as appropriate. Courses must be taken from a minimum of three different academic departments to complete this graduate certificate program. The four courses above (AGRON 630, GRSC 825, CHE 715, and BAE 545) count towards the subject area and academic department requirements while also serving as the primary required course.

Students will submit a proposed list of courses to be used in meeting the requirements for the certificate of graduate studies to the coordinator of the biobased products and bioenergy certificate program with the program of study being formally approved by the BPBCC.

In addition, each student will participate in an exit interview with a member of the BPBCC at the completion of his or her certificate program.

***List of the Courses Associated with the Certificate***

Existing courses proposed for inclusion in the biobased products and bioenergy graduate certificate program are listed below. This approved course list will be actively reviewed by the BPBCC and will be modified as needed. The course list is expected to be dynamic due to the changing availability and content of courses, new emphases within the topic area, and new developments within the subject area.

<u>Course Title</u>	<u>Course Number</u>
1. Crop Improvement and Biotechnology	AGRON 630
2. Plant Physiology	BIOL 500
3. Advance Plant Physiology I & II	BIOL 800 & 801
4. Biotechnology	AGRON 610 PLPTH 610
5. Plant Genetics	AGRON 770
6. Recombinant DNA Laboratory I & II	BIOCH 766 & 767
7. Molecular Genetics Laboratory	BIOL 676
8. Plant Molecular Biology	PLPTH 880
9. Introduction to Genomic Bioinformatics	PLPTH 890
10. Physical Studies of Biomacromolecules	BIOCH 590
11. Biochemistry I & II	BIOCH 755 & 765
12. Materials Chemistry	CHEM 820
13. Organic Spectroscopy	CHEM 862
14. Biological Process Engineering	BAE 545
15. Cereal Science	GRSC 602
16. Starch Chemistry and Technology	GRSC 901
17. Polymer Science and Engineering	CHE 656
18. Novel Uses of Renewable Biopolymers	GRSC 825
19. Processing of Composite Materials	CHE 648

20. Physical Properties of Cereal Polymers	GRSC 830
21. Surface Phenomena	CHE 682
22. Energy & Biofuel Engineering	BAE 650
23. Biomaterials Processing	BAE 740/GRSC 740
24. Bioseparations	CHE 626
25. Biochemical Engineering	CHE 715
26. Extrusion Processing in the Food & Feed	GRSC 720

### ***Certificate Program Administration***

As with other graduate certificate programs, the proposed graduate certificate in Biobased Products and Bioenergy will be administered by the Graduate School of Kansas State University, and, as such, will be monitored on a regular basis in the same manner as other graduate and graduate certificate programs. The Graduate School, according to established procedures, must approve all changes proposed in the future for the certificate of graduate studies being proposed.

The Biobased Products and Bioenergy Certificate Committee (BPBCC) will be comprised of representatives from each participating department. Initial participants are the Departments of Agronomy, Biological and Agricultural Engineering, Chemical Engineering, and Grain Science and Industry. Representation will broaden as other departments express an interest in assisting with program coordination.

The BPBCC will review the biobased products and bioenergy certificate program annually. They will have the authority to approve modifications to the list of acceptable courses and to forward changes in the graduate certificate program to the Graduate School. This group will also approve each student's program of study for the graduate certificate program and their selection of a capstone design experience.

### ***Program Coordinator***

The program coordinator will be selected each year from among current members of the BPBCC. During the initial year following approval of the graduate certificate, Dr. John R. Schlup will serve in this capacity.

### ***Student Learning Outcomes and Assessment Plan***

The participants in the Biobased Products and Bioenergy graduate certificate program will have diverse academic backgrounds and most likely widely varying academic and career goals. Therefore, the program itself centers on designing an individualized program of study from a menu of courses. The student learning outcomes, thus, do not focus on specific topics, but rather on integration of existing course content in a manner to meet student needs in this very interdisciplinary field.

**Student Learning Outcomes:**

1. Broad education in several disciplines integral to biobased products and bioenergy.
2. Demonstrated ability to utilize biobased and other renewable resources as energy sources and industrial raw materials as opposed to petroleum-based feedstocks.
3. Demonstrated ability to integrate the subject areas identified above in their understanding and implementation of biobased products and bioenergy.

No new courses are being proposed, and, as existing courses, each is a part of the assessment process within their respective departments. Thus, learning outcomes will not be identified with each course. The selection of the courses ensures that the required subject areas are available to and accessed by the students; the structure of the program ensures exposure of the students to the necessary disciplines. Each of the choices for a student's required (foundational) course provides a basis for understanding renewable resources as feedstocks instead of petrochemicals.

**University-Wide SLOs for Graduate Programs**

<b>Graduate Certificate Program Student Learning Outcomes</b>	<b>Knowledge</b>	<b>Skills</b>	<b>Attitudes and Conduct</b>	<b>Program SLO is Conceptually Different from University SLOs</b>
Broad education in several disciplines	XX	XX		
Ability to utilize biobased and other renewable resources	XX			
Ability to integrate the subject areas	XX	XX	XX	

**Assessment Methods for Each Outcome**

Assessment will focus on the ability of the student to integrate course material and to implement that material in addressing issues related to biobased products and bioenergy.

Broad education in several disciplines integral to biobased products and bioenergy

- Completion of an approved (by BPBCC) program of study meeting subject matter criteria (direct measure).
- The BPBCC will administer an exit survey to each student at the completion of their program (indirect measure).

Demonstrated ability to utilize biobased and other renewable resources as energy sources and industrial raw materials as opposed to petroleum-based feedstocks

- Review of the student's multidisciplinary team project resulting from participation in the seminar course (direct measure).
- The BPBCC will administer an exit survey to each student at the completion of their program (indirect measure).

Demonstrated ability to integrate the subject areas identified above in their understanding and implementation of biobased products and bioenergy

- Review of the student's multidisciplinary team project resulting from participation in the seminar course (direct measure).
- The BPBCC will administer an exit survey to each student at the completion of their program (indirect measure).

It should be noted that the essence of the assessment process centers on the student's multidisciplinary team project resulting from participation in the seminar course. This provides a very direct measure, similar to that of a portfolio. These assessments will be implemented from the outset of the program. The assessed outcomes will be reviewed annually by the BPBCC. The recommendations based upon this review will be utilized for modifications of the graduate certificate including, but not limited to, the utility of the approved courses, program requirements, desired outcomes, and appropriateness of assessment tools.

## ***Dept of Civil Engineering***

### **Proposal for a New Graduate Certificate Program in Transportation Engineering**

The provision of a safe, efficient and environmentally sound transportation system is critical to the physical, environmental and economic health of the nation. A pool of highly qualified transportation professionals is required to plan, design, operate and maintain our nation's transportation infrastructure, facilities and services. There is a need for educational programs designed for transportation professionals who want to expand their knowledge and skills through a program of graduate study that is less extensive, and different from, a traditional master's program. The transportation engineering certificate program described in this proposal will provide transportation professionals with the opportunity to pursue a focused collection of courses that, when completed, allows the student to receive recognition of their continued effort in the area of transportation engineering, or would like to cumulate credit hours toward their master's degree.

#### **Educational objectives of the certificate program**

1. Prepare graduates for careers in transportation engineering.
2. Expand the pool of qualified transportation engineering professionals.

#### **List of the courses associated with the certificate**

The Graduate Certificate in Transportation Engineering requires the completion of 12 credit hours of course work as described below.

#### **Core Courses**

All students must complete two of the following Core Courses (6 credit hours):

##### [CE 774 - Pavement Design](#)

Methods of evaluating the load-carrying capacity of soil subgrade, subbase, and base courses; critical analysis of the methods of design for flexible and rigid pavements; methods of increasing the load-carrying capacity of highway and airport pavements. Two hours rec. and three hours lab a week. Pr.: CE 522. When offered: I (on sufficient demand). Credits: (3)

##### [CE 775 - Traffic Engineering](#)

Traffic operations of roads, streets, and highways; traffic engineering studies; use of signs, signals, and pavement markings as traffic control devices; highway and intersection capacity, design and operations of traffic signals; current microcomputer models and applications. Pr.: CE 572. When offered: I. Credits: (3)

##### [CE 786 - Land Development for Civil Engineers and Planners](#)

Engineering problems involved in site planning and design. The comprehensive planning process, zoning and subdivision regulations; design and location of streets and highways, water supply and sanitary facilities, drainage and public utilities. Two hours rec. and three hours lab a week. Pr.: CE 572 or consent of instructor. When offered: I. Credits: (3)

## Elective Courses

In addition to the Core Courses, students must complete a minimum of 6 additional credit hours of electives from the remaining core course and the following approved list of courses.

### [CE 680 - Economics of Design and Construction](#)

Selection of alternative engineering design and construction solutions through study of unit cost determination, cost estimating, and financing procedures. Introduction to construction scheduling. Three hours rec. a week. Pr.: Senior standing in engineering or graduate standing for non-engineering majors. When offered: II. Credits: (3)

### [CE 741 - Civil Engineering Materials II](#)

Advanced study of civil engineering materials including concrete, steel and bituminous concrete. Two hours rec. and three hours lab a week. Pr.: CE 641 or CHE 350. When offered: II. Credits: (3).

### [CE 771 - Travel Demand Modeling](#)

Historical development and current status of techniques used in urban transportation planning and travel demand forecasting; trip generation, trip distribution, mode choice, and traffic assignment. Two hours rec. and three hours lab a week. Pr.: CE 572 or consent of instructor. When offered: II. Credits: (3)

### [CE 776 - Pavement Performance and Management Systems](#)

Pavement management systems including pavement condition and structural evaluation, analysis, and optimization. Economics analysis and rehabilitation planning including computer applications. Three hours rec. a week. Pr.: CE 572. When offered: I, in alternate years. Credits: (3)

### [CE 777 - Portland Cement Concrete Pavements](#)

Portland cement concrete mix design and production. Paving operations. Saw and seal operations. Subgrade preparation. Base selection. Drainage selection, design and construction. Bonded and unbonded concrete overlays. Whitetopping and Ultra-Thin Whitetopping. Concrete pavement restoration; Quality Assurance and Quality Control in Concrete Pavement Construction. Three hours rec. a week. Pr.: CE 641. When Offered II. Credits: (3)

### [CE 816 - Selected Topics in Civil Engineering](#)

Study of intermediate level topics of interest in civil engineering. Topics announced when offered. Pr.: Graduate standing and approval of instructor. When offered: I, II, S, on sufficient demand. Credits: (Var.). *[Note: Only "selected topics" with a transportation focus can be applied to the Graduate Certificate Program in Transportation Engineering.]*

### CE 872 - Transportation Safety

Importance of transportation safety, crash data collection, common crash databases, traffic safety studies, accident data analysis, identification of high crash locations, traffic control devices as related to safety, special population group safety, traffic conflict studies, accident reconstruction, statistical methods in crash data analysis and traffic calming. Three hrs. rec. per week. Pr: CE 572 or consent from the instructor. When offered: II, in alternate years. Credits: (3)

### CE 875 - Traffic Flow Theory

Theory of traffic flow, traffic stream characteristics, car following models, shock wave analysis, queuing analysis, application of statistical methods to traffic engineering problems, traffic simulation. Two hours rec. and three hours lab a week. Pr.: CE 775. Pr. or conc.: STAT 510. When offered: II. Credits: (3)

Other Graduate level course work (maximum of 3 credit hours) in Engineering Management or Statistics as approved by the Program Coordinator.

### **Other Requirements**

In addition to the course work requirements described above, students are further required to demonstrate advanced knowledge and competency in the area of transportation engineering by completing one of the following:

- 1) A research paper prepared as part of the requirements of one of the Core or Elective Courses described above. To satisfy this requirement, the research paper must have received a minimum letter grade of "B."
- 2) Presentation of the results of a transportation engineering related study or project to the faculty of the Transportation Engineering Certificate Program. To satisfy this requirement, the study or project must have been completed under the supervision of the candidate for the Graduate Certificate in Transportation Engineering.

The required evidence of advanced knowledge and competency should be presented to the Program Coordinator prior to the beginning of the candidate's final semester of course work.

### **How the courses associated with the certificate will meet educational objectives**

The courses associated with the proposed certificate program allow students to design a program of study in general transportation engineering, or to specialize in a particular area of transportation engineering such as traffic engineering, transportation materials engineering, highway safety, traffic operations, transportation planning, and site planning. In either case, the certificate program provides the means to increase the pool of qualified transportation engineers and prepare graduates to pursue careers in transportation engineering.

### **Need for the proposed certificate**

The provision of a safe, efficient and environmentally sound transportation system is critical to the physical, environmental and economic health of the nation. A pool of highly qualified transportation professionals is required to plan, design, operate and maintain our nation's transportation infrastructure, facilities and services.

However it is generally accepted within the profession that U.S. universities are not producing sufficient numbers of engineers to meet the nation's needs. In addition, several professional engineering societies have suggested that the traditional four-year engineering curriculum is not sufficient to prepare engineers for professional practice in a technologically advanced, global market. The need for highly qualified transportation engineers is particularly acute. Federal Highway Administration (FHWA) Administrator Mary Peters has noted that:

*"I am becoming increasingly concerned about a significant shortage of qualified and experienced transportation professionals. Some estimates put the workforce shortage at 40-50% as transportation workers begin to retire in the next 5-15 years. In fact, forty percent of our current state and local workforce today is between the ages of 45-65. New and innovative programs must be considered that will increase the number of students with an interest in transportation and better prepare them to enter the transportation workforce."* <http://www.fhwa.dot.gov/pressroom/re020112.htm>

There is a need for educational programs designed for current and future transportation professionals who want to expand their knowledge and skills through a program of graduate study that is less extensive, and different from, a traditional master's program.

#### **Description of the certificate program's administration**

The Graduate Certificate Program in Transportation Engineering is coordinated by Dr. Robert W. Stokes, Professor of Civil Engineering <http://www.ce.ksu.edu/> with administrative support for the distance education component of the program provided by the Division of Continuing Education <http://www.dce.ksu.edu/courses/certificates/>.

#### **Estimated budget to support the certificate program**

The distance education component of the proposed certificate program will be funded by student fees as described in the current agreement between the College of Engineering and the Division of Continuing Education.

#### **Names of the faculty associated with the certificate program**

Dr. Sunanda Dissanayake, P.E., Associate Professor of Civil Engineering.  
Dr. Mustaque Hossain, P.E., Professor of Civil Engineering.  
Dr. Kyle Riding, Assistant Professor of Civil Engineering.  
Dr. Eugene R. Russell, P.E., Professor Emeritus of Civil Engineering.  
Dr. Robert W. Stokes, Professor of Civil Engineering.

#### **Name and address the coordinator of the program**

Robert W. Stokes, PhD  
Kansas State University  
Dept. of Civil Engineering  
2118 Fiedler Hall  
Manhattan, KS 66506-5000  
Office: 785-532-1595  
Fax: 785-532-7717  
[drbobb@ksu.edu](mailto:drbobb@ksu.edu)

### **Student learning outcomes and assessment plan for the program**

Upon completion of the program students will be able to demonstrate:

- Ability to solve advanced transportation engineering problems using discipline-appropriate math, science, computation and analysis skills.
- Ability to critically synthesize and evaluate information related to transportation engineering problems.
- Ability to communicate effectively both in written and oral forms.

The proposed Certificate Program will be assessed as described in the Department of Civil Engineering Graduate Program Assessment Plan.

### **Endorsements from those academic units impacted by the new graduate certificate**

This proposal has been reviewed and approved by the Graduate Studies Committee, faculty of the Department of Civil Engineering, and the College of Engineering.

EFFECTIVE DATE: Summer 2009