2012-2013 Undergraduate Academic Assessment Plan

Civil Engineering

College of Engineering

Dr. Robert J. Thieke

rthie@ce.ufl.edu

Civil Engineering, College of Engineering
Undergraduate Academic Assessment Plan

Mission Statement

The Department of Civil and Coastal Engineering Mission Statement is as follows:

> *The mission of the Department of Civil and Coastal Engineering is to deliver undergraduate and graduate degree programs that prepare Civil and Coastal engineers for successful careers in an increasingly global and interdisciplinary world, and to perform research that results in leading scientific contributions that have a direct impact on our ability to renew, secure, and broaden the capabilities of our nation's infrastructure, environment and homeland security.*

As a service-oriented profession, the Civil Engineering mission statement above is completely consistent with the core elements of the University of Florida Mission Statement, namely, Teaching, Research and Service as shown below:

- *Teaching is a fundamental purpose of this university at both the undergraduate and graduate levels.*
- *Research and scholarship are integral to the educational process and to the expansion of our understanding of the natural world, the intellect and the senses.*
- *Service reflects the university's obligation to share the benefits of its research and knowledge for the public good. The university serves the nation's and the state's critical needs by contributing to a well-qualified and broadly diverse citizenry, leadership and workforce.*

The program mission is also aligned with the mission statement of the College of Engineering in the same three major areas:

> *The College of Engineering fosters and provides world-class programs in engineering education, research and service to enhance the economic and social well-being of the citizens of Florida, the nation and the world.*
>
> *Graduates of the College of Engineering at the University of Florida will exhibit the following in pursuit of their profession:*
>
> - *Vision, as evidenced by an ability to use creative approaches to problems.*
> - *Values, as evidenced by an understanding of the importance of employing strong professional ethics.*
> - *Leadership, as evidenced by serving as a team/project leader with solid project management and planning skills, a mentor to less experienced staff, and a volunteer in the community*

- *Professional expertise, as evidenced by making meaningful contributions to technical engineering problem solving as both an individual contributor and in team situations, continually enhancing both technical and non-technical skills, applying professional expertise to increasingly complex problems/projects, and increasingly capable communications skills, both verbal and written*
- *Knowledge about the interaction of financial, societal, legal or cultural influences with science and technology*

Student Learning Outcomes (SLOs)

The Student Learning Outcomes (SLOs) for the Civil Engineering program are as follows:

SLO #1: Apply knowledge of mathematics, science and engineering principles to civil engineering problems.

SLO #2: Conduct civil engineering experiments, analyze and interpret data.

SLO #3: Design a civil engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints.

SLO #4: Communicate technical data and design information effectively in writing and in speech to other civil engineers.

These SLOs are grouped into the three areas of:

1. Content Knowledge (SLO #1 and SLO #2)
2. Critical Thinking (SLO #3)
3. Communication (SLO #4)

Curriculum Map

Curriculum Map for:

Program: Civil Engineering College: Engineering

Key: **I**ntroduced **R**einforced **A**ssessed

Courses SLOs	EGM2511	EGM3520	ENC3254	PHY2048L	CGN3501C	CES3102	CES4702	CEG4011	CWR3201	CGN4806	CGN4910	FE Exam	Exit Survey	Employer Survey (even years only)
Content Knowledge														
#1	I	R			R	A Exam Question	A Exam Question					A	A	A
#2				I	R			A Lab Report	A Lab Report				A	A
Critical Thinking														
#3	I	R				R	A Design Problem			A Design Project	A Design Project	A	A	A
Communication														
#4			I		R				A Lab Report	A Design Presentation	A Design Presentation		A	A

Assessment Cycle

The SLOs in Civil Engineering represent a subset of 11 SLOs used in connection with Engineering Accreditation as required through the Accreditation Board for Engineering and Technology (ABET). The ABET accreditation cycle is 6-years, but the assessments are carried out every year, so the same assessment frequency is used for the assessment methods outlined in Figure 2. In accordance with the review of assessment data for ABET, the analysis and interpretation period is set for early summer, with improvement actions and implementation slated for the Fall semester in time for each new Undergraduate Catalog cycle.

Assessment Cycle Chart

Assessment Cycle for:

Program: Civil Engineering College : Engineering

Analysis and Interpretation: May - June
Improvement Actions: Completed by October 1
Dissemination: Completed by December 1

Year / SLOs	10-11	11-12	12-13	13-14	14-15	15-16
Content Knowledge						
#1	x	x	x	x	x	X
#2	x	x	x	x	x	x
Critical Thinking						
#3	x	x	x	x	x	x
Communication						
#4	x	x	x	x	x	x

Methods and Procedures

SLO Assessment Matrix

The four SLOs are assessed through the following direct and indirect methods:

Direct Methods:

1. Coursework-based assessment in Civil Engineering courses (previously outlined):
2. Fundamentals of Engineering (FE) Examination

The Fundamentals of Engineering Examination provides an objective third-party assessment which is nationally-normed. Almost all students in our program take the F.E. exam, so the sampling rate for our students approaches 100%. The FE exam cannot be used to assess all four of the SLOs; the rubric for assignment of FE exam results to the various SLOs is shown below:

SLO #1: Overall result; A.M. exam questions in: Mathematics, Probability & Statistics, Chemistry, Electricity & Magnetism, Statics, Dynamics, Mechanics of Materials, Fluid Mechanics, Thermodynamics; P.M. exam questions in Transportation, Water Resources, Geotechnical, Construction, and Materials.
SLO #2: N/A
SLO #3: P.M. Exam questions in Structural Design
SLO #4: N/A

Indirect Methods:

1. Senior Exit Survey: Student self-assessment of achievement of SLOs; performed each semester by graduating seniors.

Another assessment tool that we have found very useful is the Senior Exit Survey, which is administered online to our students in their final semester. The survey is a graduation requirement, so we are able to achieve survey rates of 100%. The students are asked to self-assess their achievement of the outcomes on a 1-5 scale as they complete their UF careers.

2. Employer Survey: Evaluation of performance of recent Civil Engineering graduates by employers; performed every 2 years (even years).

Our Employer Survey, which is administered every 2 years, also provides a quantitative third-party assessment of the abilities of our students. The employer survey asks the employers directly the rate the student achievement of the SLOs on a 1-5 Likert Scale.

These are summarized in the matrix below:

SLO Assessment Matrix for 2012-13

2012-13 Student Learning Outcome	Assessment Method	Measurement Procedure
#1: Apply knowledge of mathematics, science and engineering principles to civil engineering problems.	Course exam questions; FE Exam; Exit Survey; Employer Survey	Exam question: faculty developed rubric (see example in Appendix A); FE Exam: compare with National pass rates. Surveys: Direct Likert scale self-assessment.
#2: Conduct civil engineering experiments, analyze and interpret data.	Lab reports; Exit Survey; Employer Survey	Lab reports: faculty developed rubric (see example in Appendix A); Surveys: Direct Likert scale self-assessment.
#3: Design a civil engineering system, component or process to meet desired needs within realistic economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability constraints.	Design projects; FE Exam; Exit Survey; Employer Survey	Exam question: faculty developed rubric; FE Exam: compare with National pass rates. Surveys: Direct Likert scale self-assessment.
#4: Communicate technical data and design information effectively in writing and in speech to other civil engineers.	Lab report; Design project presentation; Exit Survey; Employer Survey	Lab report: faculty developed rubric; Design project presentation: faculty developed rubric; Surveys: Direct Likert scale self-assessment.

Assessment Method		Administered By	When Administered
Direct Assessments			
Student Performance in Courses		Civil Engineering Faculty	Every semester
Student Performance on FE Exam		NCEES	Semi-Annually (April, October)
Indirect Assessments			
Senior Exit Survey		Department (Self-Assessment)	Every semester
Employer Survey		Department (Civil Engineering Employers)	Every two years

Assessment Oversight

Oversight of the assessment process is the primary responsibility of the undergraduate coordinator/department head with the cooperation of the Civil and Coastal Engineering Faculty. The Civil and Coastal Engineering Department resides within the Engineering School of Sustainable Infrastructure and Environment (ESSIE) which is led by a Director who is also in charge of the Department of Environmental Engineering Sciences. The contact information for the Department Head/Undergraduate Coordinator of Civil and Coastal Engineering and the Director of ESSIE are provided below:

Contact Information

Department Head/Undergraduate Coordinator: Dr. Robert J. Thieke, Assistant Professor

Department of Civil and Coastal Engineering
365 Weil Hall, P.O. Box 116580
University of Florida
Gainesville, FL 32611
Phone: (352)-392-9537
FAX: (352)-392-3394
e-mail: rthie@ce.ufl.edu

ESSIE Director: Dr. Kirk Hatfield, Professor
Engineering School of Sustainable Infrastructure and Environment
Department of Civil and Coastal Engineering
365 Weil Hall, P.O. Box 116580
University of Florida
Gainesville, FL 32611
Phone: (352)-392-9537
FAX: (352)-392-3394
e-mail: khh@ce.ufl.edu

Appendix A: Sample Assessment Tools and Rubrics

Department of Civil and Coastal Engineering
SACS Student Learning Outcomes Assessment Form

SLO #1: **Apply knowledge of mathematics, science, and engineering to civil engineering problems**

Assessment Scores: Likert scale 1 to 5 according to: 5 Outstanding achievement of outcome
4 Good achievement of outcome
3 Adequate achievement of outcome
2 Inadequate achievement of outcome
1 Failure to achieve outcome

Class: CES 3102 Mechanics of Engineering Structures						
Term: Fall 2012						
Assessment Instrument (Exam, report etc.): Quiz question						
Assessment Scale: 5 = 90%-100% 4 = 80%-89% 3 = 70%-79% 2 = 60%-49% 1 = <60%						
# Students Assessed	# Scoring 5	# Scoring 4	# Scoring 3	# Scoring 2	# Scoring 1	Mean Likert Score
68	25	14	7	6	16	3.38

Problem 4 **Name:** _

Consider the two-span beam shown below. A distributed load acts on element 1 and a concentrated moment acts at node 3. Node 1 is a fixed support, node 2 is a roller and node 3 is a free end. The rotation of node 2 and the rotations and deflection of node 3 are given. *EI* is constant.

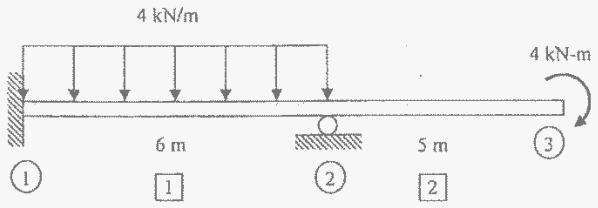
a) Determine the end forces and moments for both beam elements and show them with the correct direction on the elements provided on the following page.
b) Draw the shear and moment diagrams for the entire beam in the space provided on the following page.
c) Determine the vertical reaction at node 2.

$\frac{wL^2}{12} = 12$

$EF^{1} = \frac{wL}{2} = 12$

$\frac{-wL^2}{12} = -12$

$\frac{wL}{2} = 12$



$FEF^{12} = 0$

$$\theta_2 = \frac{12\ kN \cdot m^2}{EI} \quad \theta_3 = -\frac{8\ kN \cdot m^2}{EI} \quad \Delta_3 = \frac{10\ kN \cdot m^3}{EI}$$

$M_1^{1} = \frac{2EI}{L}\theta_2 + 12 = \frac{2EI}{6}\frac{12}{EI} + 12 = 16\ kN\cdot m = M_1^{1}$

$P_1^{1} = \frac{6EI}{L^2}\theta_2 + 12 = \frac{6EI}{36}\frac{12}{EI} + 12 = 14\ kN = P_1^{1}$

$M_2^{1} = \frac{4EI}{L}\theta_2 - 12 = \frac{4EI}{6}\frac{12}{EI} - 12 = -4\ kN\,m = M_2^{1}$

$P_2^{1} = \frac{-6EI}{L^2}\theta_2 + 12 = \frac{-6EI}{36}\frac{12}{EI} + 12 = 10\ kN = P_2^{1}$

$M_1^{2} = \frac{4EI}{5}\frac{12}{EI} + \frac{2EI}{5}\frac{-8}{EI} - \frac{6EI}{25}\frac{10}{EI} = 9.6 + -3.2 - 2.4 = 4\ kNm = M_1^{2}$

$P_1^{2} = \frac{6EI}{25}\frac{12}{EI} + \frac{6EI}{25}\frac{-8}{EI} - \frac{12EI}{125}\left(\frac{10}{EI}\right) = 2.88 - 1.92 - 0.96 = 0\ kN = P_1^{2}$

$M_2^{2} = \frac{2EI}{5}\frac{12}{EI} + \frac{4EI}{5}\frac{-8}{EI} - \frac{6EI}{25}\left(\frac{10}{EI}\right) = 4.8 - 6.4 - 2.4 = -4\ kNm = M_2^{2}$

$P_2^{2} = \frac{-6EI}{25}\left(\frac{12}{EI}\right) - \frac{6EI}{25}\left(\frac{-8}{EI}\right) + \frac{12EI}{125}\left(\frac{10}{EI}\right) = -2.88 + 1.92 + 0.96 = 0\ kN = P_2^{2}$

Department of Civil and Coastal Engineering
SACS Student Learning Outcomes Assessment Form

SLO #2: Conduct civil engineering experiments, analyze and interpret data

Assessment Scores: Likert scale 1 to 5 according to: 5 Outstanding achievement of outcome
4 Good achievement of outcome
3 Adequate achievement of outcome
2 Inadequate achievement of outcome
1 Failure to achieve outcome

Class: CWR 3201 Hydrodynamics

Term: Spring 2012

Assessment Instrument: Lab Report (Drag Measurements - Lab #8)

Assessment Scale:
5 = 90-100%
4 = 80-89%
3 = 70-79%
2 = 60-69%
1 = less than 60%

# Students Assessed	# Scoring 5	# Scoring 4	# Scoring 3	# Scoring 2	# Scoring 1	Mean Likert Score
34	13	13	7	0	1	4.09

SACS SLO #2 Lab Grading Sheet: CWR 3201 Laboratory

Data Quality/Consistency

Are the raw data presented? Are they consistent and correct, with proper units labeled where appropriate?

Overall Presentation: Inclusion of title page with required information, overall neatness

Calculations: Inclusion of sample calculations for each step. Calculation accuracy

Graphical Presentations (3@ 1 point each)

For each graph - Title or caption included, axes labeled (with units!), appropriate legend.

Three graphs required (@ 1 point each)

#1 Cp vs. Theta: Requires 2 data sets (ideal, measurement)

#2 Cpcos(Theta) vs. Theta:

#3 Fd/A vs. Dynamic Pressure: Both axes have units of Pascals (Pa).

Analysis/Questions (3 @ 1point each)

#1 Numerical integration (usually with trapezoidal rule) should produce Cd = 1.10 to 1.30

#2 Linear Regression of Cd from drag force graph: should yield Cd approximately 1.0

#3 Comparison with standard: based on Reynolds number, Chapter 9 graph gives Cd = 1.3 to 1.4

Conclusions

Are conclusions true statements?

Are conclusions well written and expressed?

Are conclusions relevant to the lab at hand?

SACS SLO #2 Lab Grading Sheet: CWR 3201 Laboratory (continued)

General (3 points total)			Graphical Presentations (3 points)			Analysis (3 points)			Conclusions (1)	TOTAL	Likert Score
Data Quality/ Consistency	Overall Presentation	Calculations	Pressure Coefficent	Cpcos theta	Drag Force	Numerical Integration	Linear Regression	Comparison w/Standard			
1	1	1	1	1	1	1	1	0	1	**9**	**5**
1	1	1	1	1	1	1	1	1	1	**10**	**5**
1	1	1	1	1	0.75	1	1	1	1	**9.75**	**5**
1	1	0.5	1	1	1	1	0.75	1	1	**9.25**	**5**
1	1	1	1	1	0.75	1	1	1	1	**9.75**	**5**
1	1	1	1	1	1	1	1	1	1	**10**	**5**
1	1	1	0.75	1	0.65	0.75	1	1	1	**9.15**	**5**
1	1	1	1	1	1	1	1	0.9	1	**9.9**	**5**
1	1	1	1	1	1	1	1	0.9	1	**9.9**	**5**
1	1	0.65	0.9	0.9	0.9	1	1	0.9	1	**9.25**	**5**
1	1	1	1	1	1	1	1	0.9	1	**9.9**	**5**
1	1	1	1	1	1	1	1	0.9	1	**9.9**	**5**
1	1	0.65	0.9	0.9	0.9	1	1	0.9	1	**9.25**	**5**
1	1	0.75	1	0.5	0.25	0.75	1	1	1	**8.25**	**4**
1	1	1	1	1	0.75	0.75	0.65	0.75	1	**8.9**	**4**
0.75	0.75	1	1	0.75	0.75	1	0.75	0.75	1	**8.5**	**4**
0.9	1	0.6	1	1	0.75	1	0.5	0.75	0.5	**8**	**4**
0.65	0.9	0.8	0.9	0.9	1	1	0.5	1	0.5	**8.15**	**4**
0.5	1	0.65	1	1	1	0.75	0.5	1	1	**8.4**	**4**
1	1	0.75	1	1	0.75	1	0.5	0.9	1	**8.9**	**4**
1	1	0.25	1	1	0.75	0.5	0.5	1	1	**8**	**4**
0.9	1	0.6	1	1	0.75	1	0.5	0.75	0.5	**8**	**4**
0.65	0.9	0.8	0.9	0.9	1	1	0.5	1	0.5	**8.15**	**4**
0.5	1	0.65	1	1	1	0.75	0.5	1	1	**8.4**	**4**
1	1	0.75	1	1	0.75	1	0.5	0.9	1	**8.9**	**4**

1	1	0.25	1	1	0.75	0.5	0.5	1	1	**8**	**4**
1	0.75	0.75	0.75	1	0.5	0.5	1	0	1	**7.25**	**3**
1	1	1	0.5	1	0.5	1	0.5	0.25	1	**7.75**	**3**
1	1	0	1	1	0.75	0.25	0.5	1	1	**7.5**	**3**
1	1	1	0.5	0.5	0.5	0.5	0	1	1	**7**	**3**
1	1	1	1	0.5	0.5	0.75	0	0.75	1	**7.5**	**3**
0.9	1	0.6	0.9	0.75	1	1	0.5	0.75	0.5	**7.9**	**3**
0.9	1	0.6	0.9	0.75	1	1	0.5	0.75	0.5	**7.9**	**3**
1	0.75	0	1	1	0.5	0	0.5	0	1	**5.75**	**1**
0.98	0.98	0.91	0.97	0.94	0.86	0.95	0.95	0.87	1.00	9.42	4.09