Course Outcomes Guide (COG)

Course Title: EGR 108 Statics **Date: 5/6/13**
Course Team: Joshua Stover
Expected Learning Outcomes

1. Utilize vector addition, subtraction, dot and cross product to analyze forces and moments
    a. Vector addition and subtraction
    b. Vector components in two and three dimensions
    c. Vector dot and cross products
    d. Vector components parallel and normal to a given line
    e. Position vectors, magnitudes of vectors, and unit vectors
    f. Describe and analyze forces in two and three dimensions using vectors
    g. Analyze and describe moments in two and three dimensions using vector cross products
    h. Calculate the moments about a point or about a line
    i. Calculate and analyze moments due to a couple

2. Perform a thorough force analysis of rigid bodies and simple structures in equilibrium.
    a. Construct a free body diagram including all external and reaction forces and moments
    b. Demonstrate an understanding of equilibrium conditions
    c. Apply equilibrium equations to analyze rigid bodies/structures and solve for unknown forces and couples acting on those rigid bodies/structures
    d. Identify statically indeterminate structures

3. Draw clear and appropriate free-body diagrams.

4. Analyze trusses, beams, frames and machines.
    a. Demonstrate an understanding of two force and three force members, and the assumptions that are required for truss analysis.
    b. Demonstrate the ability to differentiate between trusses, frames, and machines
    c. Analyze trusses using the method of joints
    d. Analyze trusses using the method of sections
    e. Analyze plane trusses
    f. Analyze frames and machines

5. Determine the centroids, centers of gravity and moments of inertia of simple geometric shapes

6. Perform analysis related to distributed loads.
    a. Calculate the total force and moment of distributed loads.
    b. Replace a distributed load with a single resultant load located at the centroid.

7. Perform calculations related to friction forces in various engineering applications.
    a. Analyze and solve problems related general cases of static and kinetic friction.
    b. Demonstrate the ability to solve application of friction to cases of simple machines including wedges, threaded shafts, journal bearings, thrust bearings, and clutches.
    c. Perform analysis of application to belt friction.

8. Determine internal forces and produce shear and moment diagrams for beams subjected to various

loadings.

a. Use the method of sections to find internal axial and shear forces, and bending moments.
b. Use the graphical method to construct shear and bending moment diagrams for a given beam loading.

Assessment

The assessment is a comprehensive common final exam that is given to all sections of EGR 108. The assessment is included directly following the SLOA report for EGR 108. The common assessment was given in 2012 and 2013.

Validation

For spring 2013, the exam was scored using two different rubrics. One rubric was used to calculate the exam score for the course. The other rubric was used to calculate the total learning outcomes score for the course. The correlation factor between the two scores for Spring 2013 was found to be 0.981. This high value suggests that the final exam is a good measurement for student learning outcomes on the course level. This value will continue to be monitored as there is typically a small sample size for each course.

Results

Course EGR 108			
Semester	Spring 2012	Spring 2013	Total
Enrollment	15	20	35
Withdrawals	0	1	1
A	5	4	9
B	2	3	5
C	1	2	3
D	2	2	4
F(not including walk away F)	3	2	5
AU	0	1	1
Walk away F	2	5	7
Pass Rate % (D and above)	66.67%	57.89%	61.76%
Assessment	Final Exam		
n	13	13	26
Average	68%	72.46%	70.13%
Standard Deviation	19.10%	16.74%	17.68%
Benchmark (70%)	70	70	70
Meeting Benchmark	7	8	15
Percent Benchmark	53.80%	61.54%	57.69%

Twenty students initially enrolled in statics for the Spring 2013 semester. One student switched to audit early one and one student withdrew to pursue a different major. There were 5 walk-away Fs, two of whom were unable to continue the course due to severe disruptions in their personal lives. The pass rate for the class was 57.89%.

The final exam grades and the course grades were compared from the Spring 2012 and Spring 2013 semesters using a one tailed student-t test(assuming two samples with unequal variance). The p value for significance was $p < 0.05$. The p value for the comparison of final exam scores for Spring 2012 and Spring 2013 was $p=0.259$. The p value for comparison of final course grades between Spring 2012 and Spring 2013 is $p=0.315$. These values demonstrate there is no significant difference in final exam scores or final course grades for the two semesters.

The final exam assessment was given to 13 students. The average score on the assessment was 72.46% with a standard deviation of 16.74%. The percentage of students scoring above the desired benchmark of 70% was 61.54% (8 of 13 students). Of the 9 students receiving a C or better in the course, 2 did not score above the benchmark of 70%. Both students had good HW averages and had scored high enough on the remaining parts of the course that the final exam (worth 20% of the grade) did not significantly alter their final grade.

The most difficult question on the exam was the final question 6 which had an average exam score of 61.38% with a standard deviation of 25.96%. This question was a 3-D equilibrium problem requiring the use of unit vector notation and 3-D vector cross products. This is typically a difficult concept for students. In addition, the question is the last question at the end of a rigorous 3 hour exam so students may have been fatigued and/or ran short on time. Furthermore, the wording of the question is being changed to clear up any ambiguity about finding reaction moments. The students should know to find reaction moments, but under the stress of an exam there is the possibility of a misinterpretation that can be eliminated.

The scores for the 6 individual learning outcomes all had scores that round to 70% or higher suggesting that course learning outcomes are being met. This is the first time that individual learning outcomes have been quantified, and they will continue to be monitored in the future.

The lowest overall score was outcome 1 which covers vector mathematics with an average of 69.62% with a standard deviation of 20.55%. This result is to be expected as this is first time many students learn vector mathematics and they must have a solid foundation in vector mathematics to succeed in EGR 108 and other engineering courses.

Follow-up

Data collection will continue using the establish rubrics and common final exams for the Spring 2014. This should give an adequate sample size of three years of final exam scores and two years of learning outcome scores to analyze.

To help with improving student scores on the vector mathematics additional vector mathematics will be incorporated into EGR 103. The students who take EGR 103 before EGR 108 will benefit. In addition, more time may be allocated to the subject in EGR 108. All topics were covered in Spring 2013 despite the loss of 3 instructional days.

Beginning in Spring 2014, a database will collect incoming student course history for mathematics and physics. The co-requisite for EGR 108 is Calculus one and there is no requirement for physics. Many math concepts are covered in statics that are not covered until higher level math courses. This is unavoidable. Conducting a study looking at previous course history for mathematics and physics will determine if there is any link between taking physics and calculus before statics and success in the statics course. Ideally, a student would complete EGR 103, MAT 203, and PHY 203 in the fall of their freshman year to take EGR 108. This study would help determine if additional prerequisites should be required for EGR 108.

Budget Justification

None.