



OKLAHOMA CHRISTIAN UNIVERSITY
— *School of Engineering* —



OC SCHOOL OF
ENGINEERING
CHANGING LIVES. CHANGING LIFE.

A NATIONAL MODEL FOR ENGINEERING MATHEMATICS EDUCATION

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OKLAHOMA CHRISTIAN UNIVERSITY

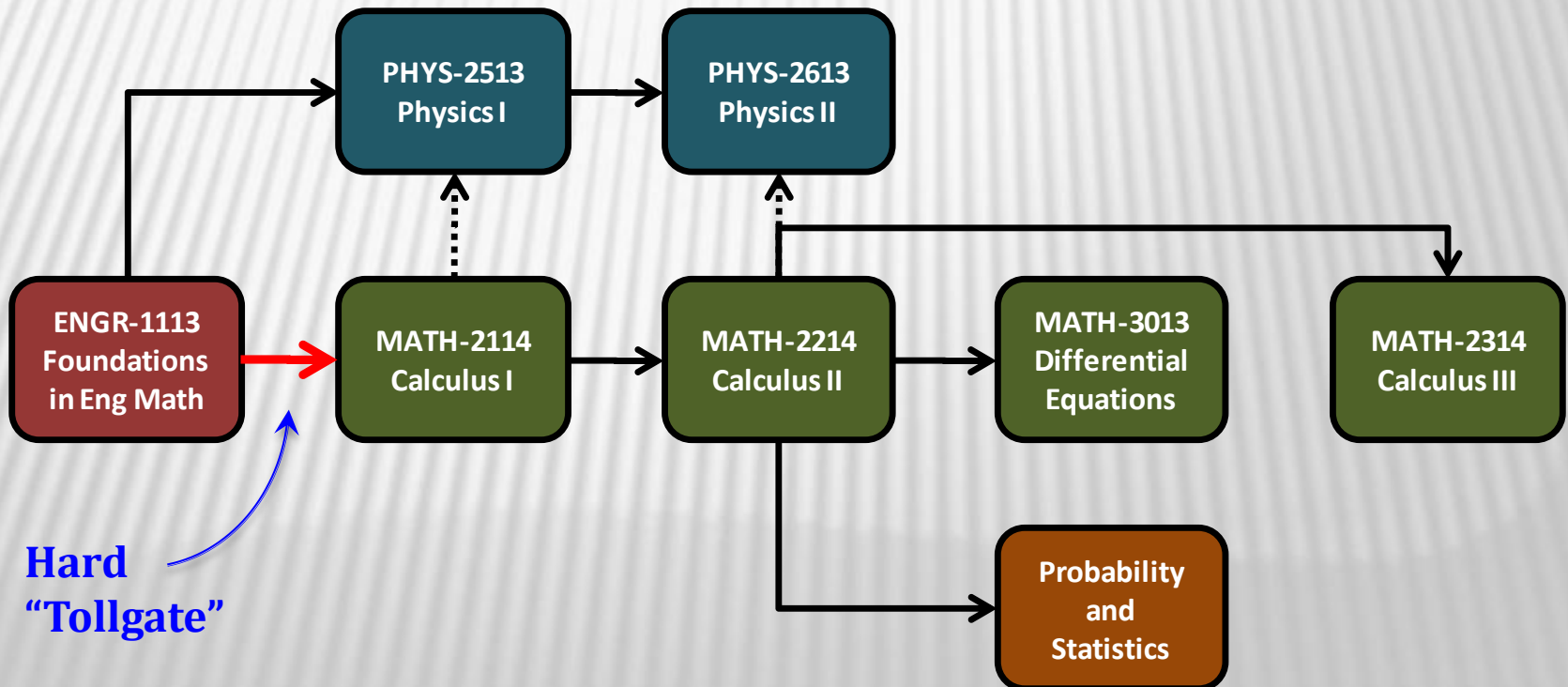
- ✖ Private faith-based university located in Oklahoma City
- ✖ 1900 undergraduate students including 213 engineering students.
- ✖ Three ABET accredited engineering programs: Electrical, Mechanical, and Computer
- ✖ Four-year 128 semester credit hour degree programs in engineering

MOTIVATION FOR JOINING

- ✖ Large range of student abilities & backgrounds
- ✖ Retention issues & student success are priorities
 - + 1/3 leave engineering after one year
 - + 1/3 graduate in engineering within six years
 - + 1/3 transfer to other disciplines (and half of these graduate from OC)
- ✖ OC participated in the 2008 NSF Academic Pathways of People Learning Engineering Survey (APPLES) led by Stanford University.
 - + Our students' perceived importance of mathematics was higher than the national average,
 - + Their intended academic persistence was lower than the national average, however.

IMPLEMENTATION: MATH/SCIENCE FLOW

During 2008-09 the engineering curricula at OC were redesigned to begin with ENGR-1113 Foundations of Engineering Math for ALL engineering freshmen. This changed the flow of the physics sequence and the subsequent mathematics courses.



IMPLEMENTATION: **FALL 2009 START**

- ✖ The redesigned curricula has been approved by the OC Academic Affairs Committee and will be implemented starting fall 2009.
- ✖ The ENGR-1113 Foundations of Engineering Math course will consist of two 1-hr lectures each week combined with a 3-hr lab. Four lab sections have been scheduled to manage class sizes.
- ✖ **ALL** freshman engineering students will be required to take the class; even those with AP or college credit for Calculus I. The class has replaced our Introduction to Engineering and also includes needed computer training (Matlab).

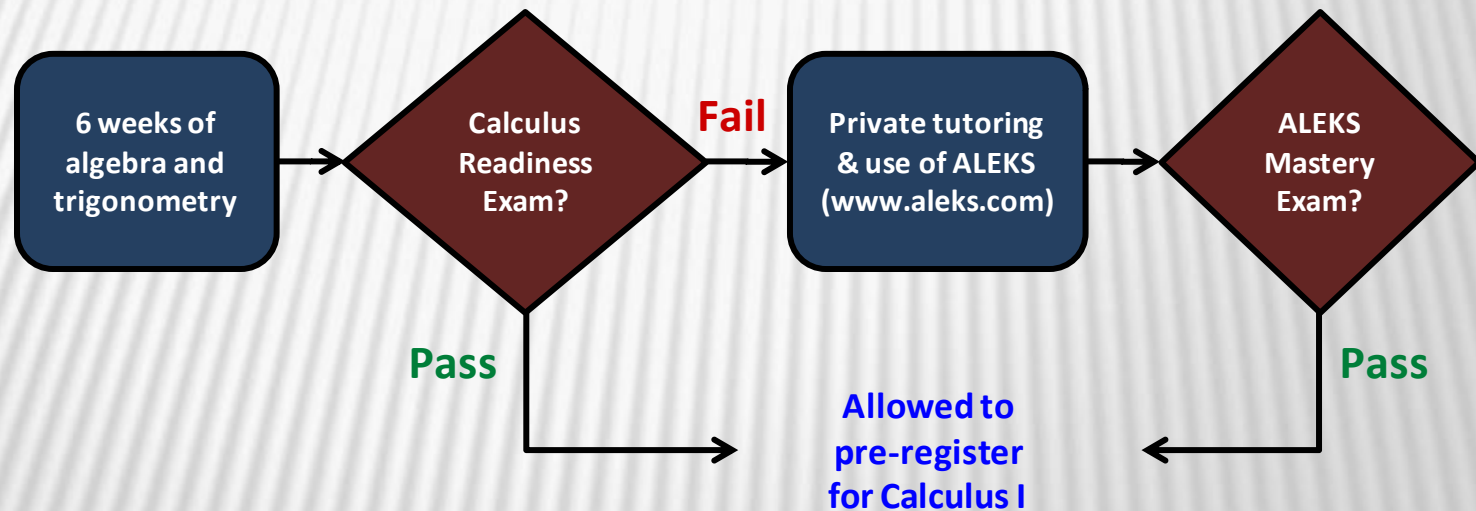
IMPLEMENTATION: INSTRUCTION MODEL

- ✖ An inductive learning model will be introduced within the laboratory component of ENGR-1113
 - + At the end of each lab, the topic of the next lab will be introduced using an application case study and an internet assignment will be given
 - + This introduction will occur prior to delivering the lectures needed for successful completion of the lab
 - + The goal is to connect students with the topic early so as to encourage self-learning

- ✖ This instructional model is consistent with recent research findings in student learning (*Educating Engineers: Designing for the Future of the Field*, Carnegie Foundation Report, 2008).

IMPLEMENTATION: “TOLLGATE” DESIGN

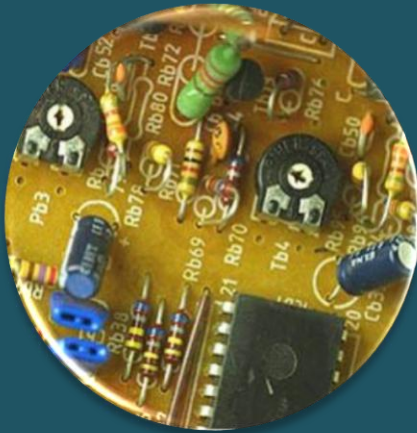
- ✖ The ENGR-1113 course will serve, by design, as a hard “tollgate” to the calculus sequence.
- ✖ The intent is to enable students, but with honesty.



- ✖ Students failing the ALEKS Mastery exam will be required to take the traditional College Algebra and Trigonometry classes.

IMPLEMENTATION: LAB TOPICS

ECE Focused



R-Circuit & **Digital Logic**

RC-Circuit Phase Shift

Multi-Loop Circuit

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RC-Circuit Response

RCL-Circuit Response

Lectures



Critical Algebra Skills

Critical Trigonometry Skills

Matrix Algebra

Fundamentals of Calculus

1st Order Diff Eqn's

2nd Order Diff Eqn's

ME Focused



-

Robot Arm Geometry

-

Freefall & Spring Force

Newtonian Cooling

Spring Mass Oscillation

IMPLEMENTATION: LAB MODIFICATIONS

- ✖ Computer data acquisition will be introduced to the students. OC is a laptop campus with all freshman receiving a fully equipped Macbook as part of tuition.
- ✖ The Vernier Go!Motion device will be incorporated into three of the ME labs.



IMPLEMENTATION: ASSESSMENT (1/2)

- ✖ Our intention is for all freshmen who meet minimum requirements (ACT Math of 23+) to take this course.
- ✖ A control group has been formed consisting of all engineering freshmen for academic year 2008-09. This control group has taken ...
 - + A survey of their perceptions of mathematics in engineering and their intentions of remaining in engineering.
 - + Both a mathematics skills basic diagnostic test and a calculus readiness test provided by mathematics researchers at Polytechnic Institute of NYU. These tests will be used as pre-tests and post-tests for all the early participants (beginning Fall 2009).

IMPLEMENTATION: **ASSESSMENT (2/2)**

- ✖ In total, three assessment studies are planned to determine the impact of ENGR-1113 Foundations of Engineering Math
 - + The performance of students taking the new course will be compared to the control group (2008-09 freshmen)
 - + The pre- and post-test scores for the students taking the course will be interpreted to determine student improvement internal to the class
 - + Student retention trends will be compared to historic numbers (several years of data available)

SUMMARY & CONCLUSIONS

× Tasks Completed

- + The curricula have been redesigned to include ENGR-1113 Foundations in Engineering Math for all freshman engineers.
- + Approval of the new curricula has been obtained for fall 2009 implementation.
- + Control group data has been collected from the 2008-09 class to serve as a baseline for assessment.

× Tasks In Progress

- + All laboratories are being designed during summer 2009 to provide balanced ECE and ME coverage.
- + Finalization of the “tollgate” flow is being designed to insure students are ready for Calculus I before proceeding.

QUESTIONS?

I will be happy to answer questions related to the implementation of *Foundations in Engineering Math* in our curricula. Feel free to contact me.

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