Reflection on Course Redesign Activity

Professor Thomas Roskop, Jr.
Department of Engineering Science / Engineering Technology

Background

I had chosen to utilize the services and guidance of the Center for Teaching and Learning in order to improve an existing course which I oversee, MEC104 – Statics, which is a core program course taken in the second semester. Currently, the course is taught by myself and a collection of rotating adjuncts, depending on availability and during the evening. One of my primary goals with this activity to establish a standard barometer for the instruction of the course, independent of the instructor, and to improve the pedagogical delivery and implementation of resources to keep the course current, experiential, and effective.

The course, MEC104 – Statics, is a second semester course in the Mechanical Engineering Technology AAS Program. It is an algebra-based course covering the same range of topics as ENR223 – Mechanics, which is a calculus based statics course for our AS in Engineering Science students. The course is intended to focus more on application, rather than theoretical derivation. It covers mechanics of rigid bodies coincident with traditional topics such as Newtonian Mechanics in Physics (force systems and bodies) and Mathematics (systems of equations and trigonometry). It has, as its prerequisite courses, ENR124 – Instrumentation and Measurements, ENR119 – Technical Computer Applications, and MAT110 – College Algebra. With this in mind, there is an implication of need for skills in measurement, report writing/data analysis, and mathematical calculation. However, the implementation of these implied skill sets was lacking as it was traditionally taught through problem sets and without connection to experience and/or application. Though applicable and relevant in a theoretical context, as this is an applied course in statics there was a disservice being done with an absence of experiential learning opportunities and interdisciplinary exposure.

Goals

The project was undertaken with **five (5)** specific goals in mind:

1. **Improve communication with students in areas of learning outcomes, expectations and requirements, and workload/timing**

   Communication for students is paramount for our mechanical engineering technology students, who rely on our dissemination of jobs, events, and news from our industry partners. As this program supports non-traditional students and those looking for a quicker pathway to employment, even while concurrently studying, we need to ensure a supported platform to disseminate this information.

   There is a department initiative for the program to utilize Blackboard to disseminate information for academic, as well as administrative and accreditation purposes. Using Blackboard, we can also share Learning objectives, policies, and advisement information.

2. **Foster and provide for an Active Learning Environment (ALE)**

   The course was redesigned with the idea of active and experiential techniques being incorporated. In order to do so, students would be required to work in groups, collaborate, use discussion boards, and close the feedback loop from the traditional lecture methods. Additionally, through inter-program assignments, projects, and outside assignments which will be required outside of the assigned meeting times, the students require a platform to support their work.

3. **Interdisciplinary and Inter-program involvement as this course is a core requirement**

   This course is a core course for the Mechanical Engineering program, but more importantly its concepts are fundamental to the other higher-level courses that follows. Additionally, it is the first real "mechanical engineering" course that the students take, outside of the mechanical prototyping lab. As such, the course should continue to promote experiential learning activities. To improve upon this, projects and collaboration with the other students in the higher-level courses allow for "scaffolding" of the knowledge – or at least develop a foundation to do so – to connect the concepts to the reason why they are taught. My goal is not to teach the topic in the confines of a bubble, both in the overall program outcomes and the engineering discipline as a whole.

4. **Improve flow of topics in order to "Scaffold" ideas and lessons to develop mastery with emphasis on application**

   With a new textbook being used, I wanted the opportunity to progress the topics using a skills-centered approach, as opposed to the typical topical method that is used in this course. Typically, various topics such as force systems, moments and trusses are taught at a fundamental level but then expanded upon in that order. This causes the student to have to have to recall previous topics and involves a slight learning curve to recall those skills. My approach with the redesign is to take the topic at hand from fundamental to intermediate, from simple recalling to synthesizing. I wanted them to master the "concept" as it applies to the topic, rather than the topic itself since it will very rarely be presented in isolation. For example, when discussing force system, the flow would be: forces and vectors, resultants and components, force systems in 2D (concurrent-coplanar, non-concurrent-coplanar), how to resolve and combine systems, force systems in 3D (spatial systems). This flow will bring student to through the full gamut of force system analysis. Then we could continue to an extensive application of the topic in truss analysis (2D) using method of joints and method of section, frames, and machines. Peppered in with this are projects and activities to connect the topics to their applications.

5. **Provide a true online support presence for the course using Blackboard, rather than a repository for documents**

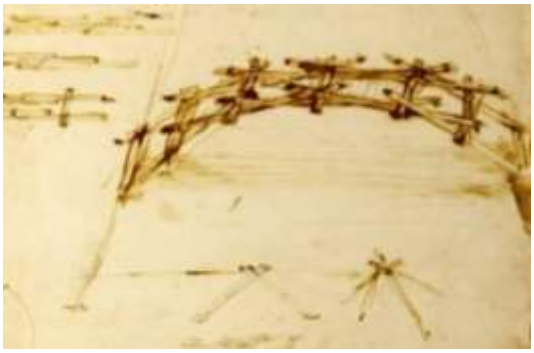
   Often the course material is just placed in Blackboard for review as a repository. My goal was to use Blackboard more proactively, to force students to utilize technology readiness skills. The additional benefit is that students can have everything they need at their fingertips – from course materials, to contacts for advisement, to even college support services.

Experiential Activities for Course

There are a variety of activities that were created to create a more involved, experiential and active learning environment for the course. For this reflection, four (4) examples will be introduced and discussed. The help to connect the concepts learned in the book and lecture to actual applied situations. Students already have shop experience in the first semester; therefore their ability to synthesize and apply is put to test. They are as follows:

1. **Leonardo Da Vinci's Military Bridge Design**

   One of the only indigenous bridges design by Leonardo, it's structure is due to only two forces – friction and gravity. He called it the "Bridge of Safety" and it is constructed without fasters, glue, or any other method of positive fixation. It is entirely passive. Students have to analyze a model then build their own. Students work on creating and analyzing the design and offer suggestions on improvements.



2. **Boonton Modified Pratt Truss Bridge**

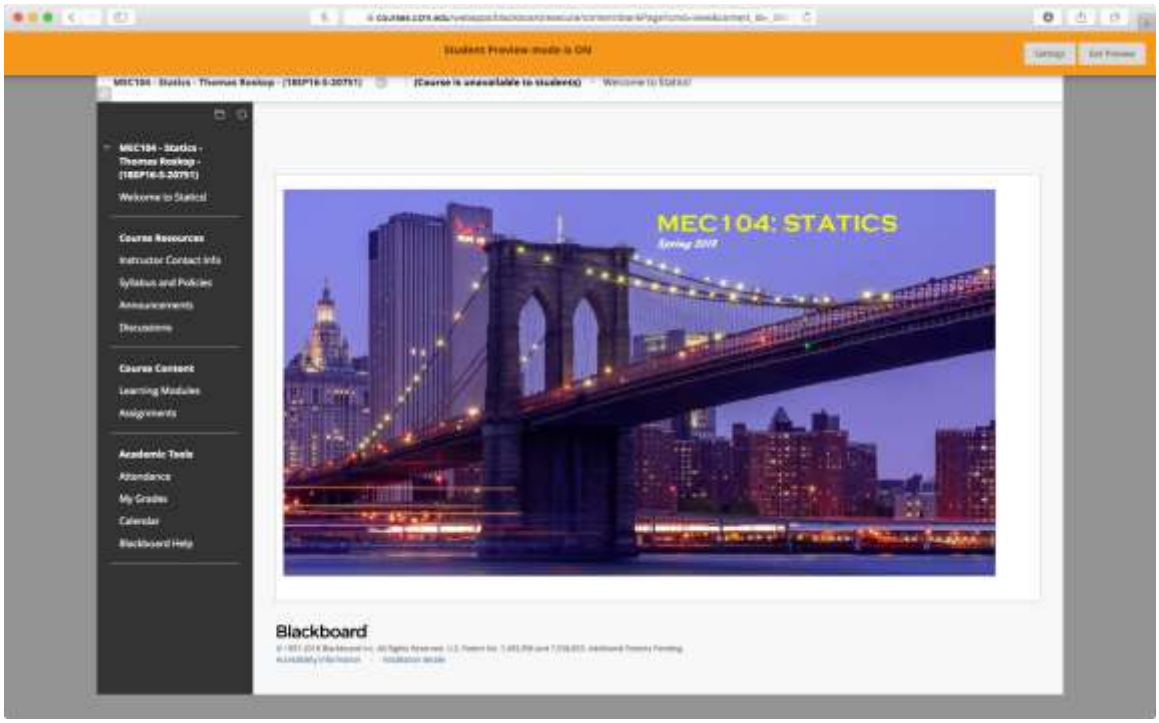
   This historical bridge built during the turn of the century has unique traits of design – such as additional roller joints at supports – to provide a unique analysis challenge to students. Students travel there, take a photo, and do a truss analysis using a load given by the instructor. A future expansion for this is to bring the CTL iPads on a field trip and use the Force Analysis software on the iPads.

3. **Truss Design Project**

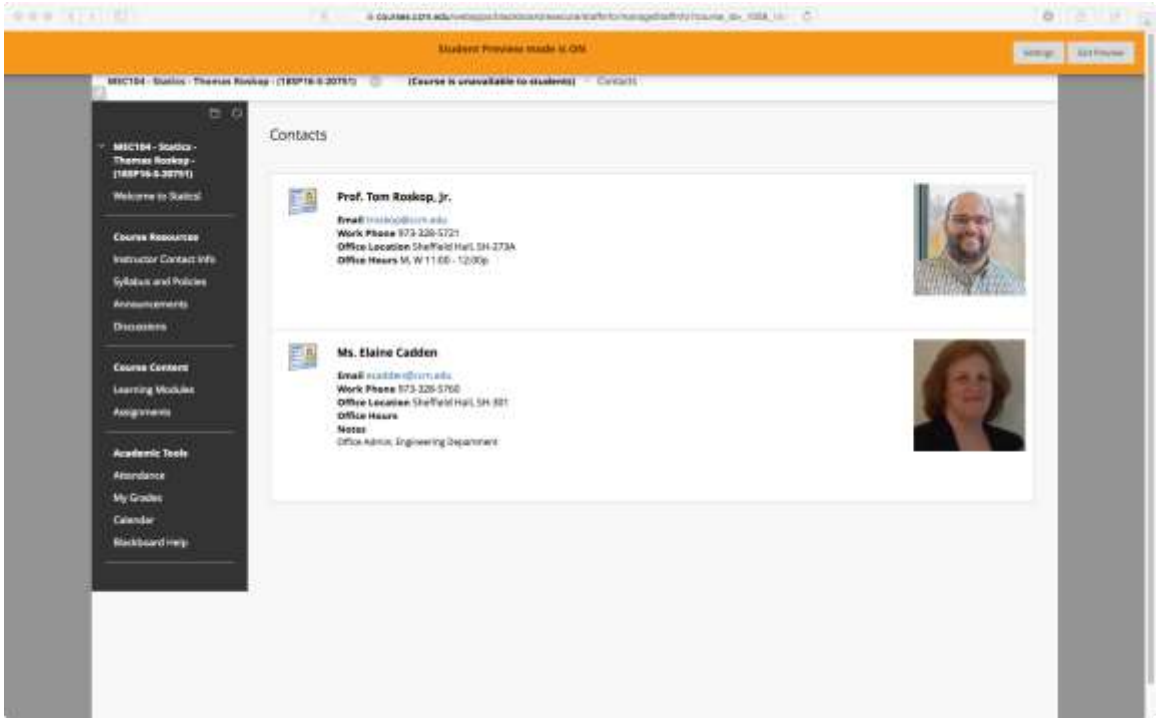
4. Cantilever Beam Analysis with ENR-240 Engineering Technology Projects

For two-classes, students in the MEC104 course are paired with the Engineering Technology Projects Capstone course (ENR240) as they worked on a cantilevered beam project. The purpose was to have the Projects students explain the underlying science to the students and show case how they used statics for their analysis. My students talked with the design students, went over their designed and watched the testing and destruction during the competition. After, we paired up and tried to do the basic analysis using photographs taken in the lab. First they do their observed beam, and then through jigsaw share the different analyses that were performed.

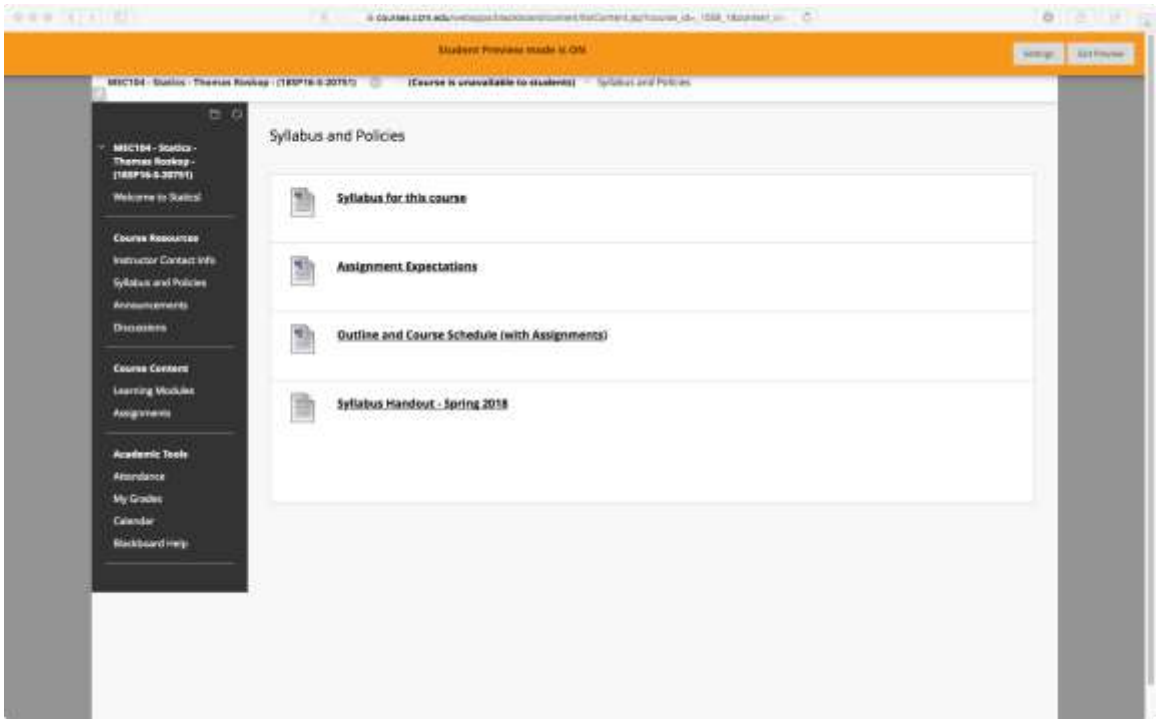
Course Blackboard



Landing Page – visually interesting and easily identifies the course

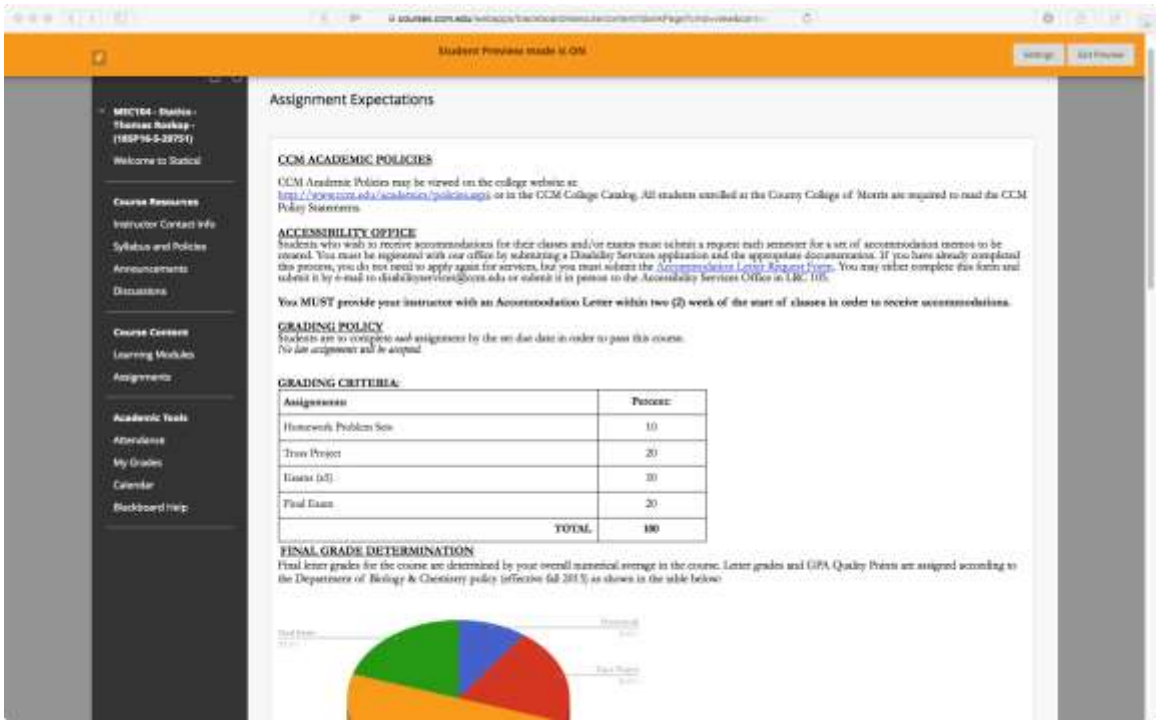


Contact Information for Instructor and Department Admin – for advisement and to schedule time with chair as necessary



Course syllabus and policies – including assignment breakdown and expectations, and outline of topics with schedule, and a copy of the syllabus handout for reference

Course Schedule Page with topics by module, assignments, readings and to-do



Assignment expectations with grading breakdown and information and links to the support services which are in place to support student performance.

MEC104: 20751 – STATICS

SPRING 2018

DEPARTMENT OF ENGINEERING SCIENCE / ENGINEERING TECHNOLOGY

COURSE INFORMATION

Instructor:	Prof. Tom Roskop	**Office:**	Sheffield Hall, SH273A
Phone:	(973) 328-5721	**Office Hours:**	M, Th, 11:00 – 12:00p
Email:	troskop@ccm.edu		T, 3:00 – 4:00p

All Email communication between students and faculty should be accomplished using CCM Faculty and CCM Student Email accounts. All CCM Faculty Email Addresses are listed in the Directory at the bottom of the CCM Web Site Home page at www.ccm.edu. Students can access their CCM Email accounts by clicking on the Student Email link at the center of the CCM Web Site Home page. Students, check your CCM Email regularly.

Credits: 3

Pre-requisite: *MAT 110 – College Algebra*
ENR 119 – Technical Computer Applications
ENR 124 – Instrumentation and Measurements

Lectures: M, Th 9:30am – 10:45am, Sheffield Hall Room 155 (SH155)

Lab: Section 80758 – T, 8:00am – 10:45am, Sheffield Hall Room 162 (SH162)
Section 80757 – R, 8:00am – 10:45am, Sheffield Hall Room 162 (SH151)

Textbook: Burns, *Applied Statics and Strength of Materials*, 2e, Cengage

DESCRIPTION

This course provides an analysis of force systems acting on particles and rigid bodies; equilibrium in two and three dimensions; trusses, frames, and machines; Friction, centroids and moment of inertia areas. ***This course is intended for Engineering Technology students.***

LEARNING OUTCOMES

The goal is to develop a mastery of the fundamental physical principles of statics, on which courses in Strength of Materials and Mechanical Design are built. Students will be able to:

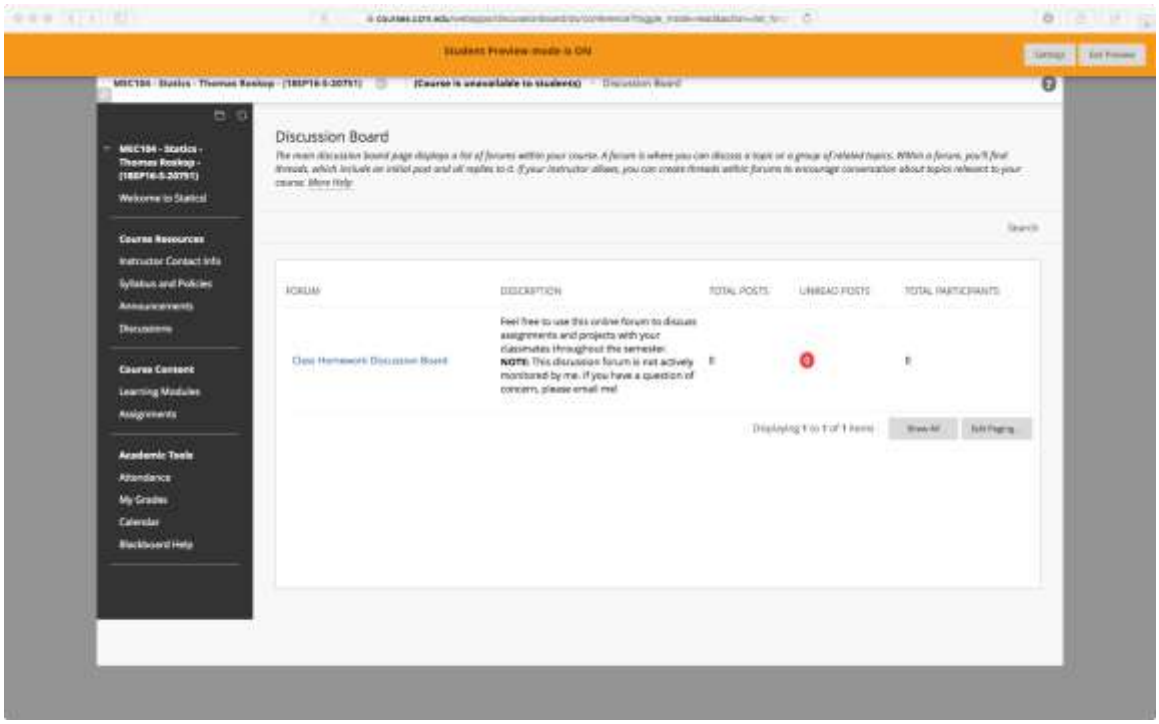
- *Solve for unknown forces and moments in concurrent and non-concurrent coplanar static force systems*
- *Draw free body diagrams*
- *Determine the magnitude and sense of all forces carried by*

Homework will be assigned every week. *Please complete the assignment and bring any questions that you may have to class. Every lab day, we will have a short quiz, which is based on the previous week's topics. Calculators and notes will be permitted for quizzes and tests. If you miss a test, make-ups will only be permitted in the case of emergency or medical reasons, as long as a note is supplied and permissions have been given* ***BEFORE*** *the test. If you will be absent for a test, contact me* ***immediately!*** *No make-ups will be given without prior notice.*

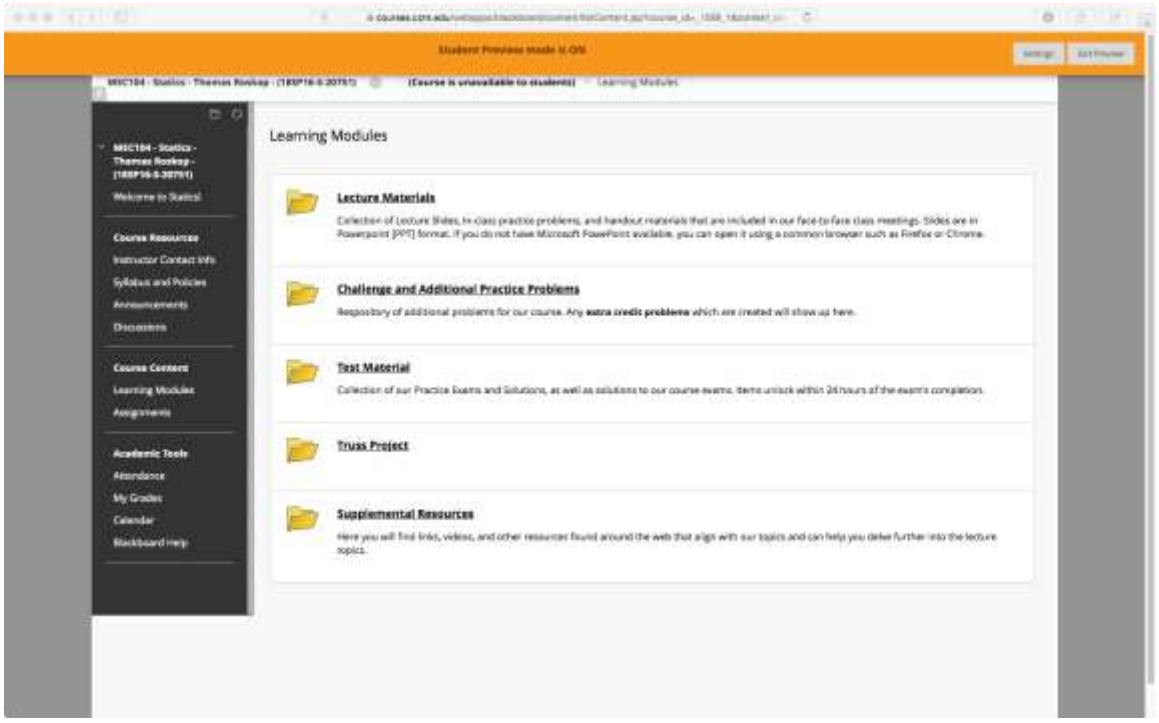
ACCESSING THIS COURSE IN BLACKBOARD

Go to ***www.ccm.edu*** *and click on "****Blackboard****" which is located on home page. Follow the instructions on how to login found on the CCM website. These instructions are also found under the Login*

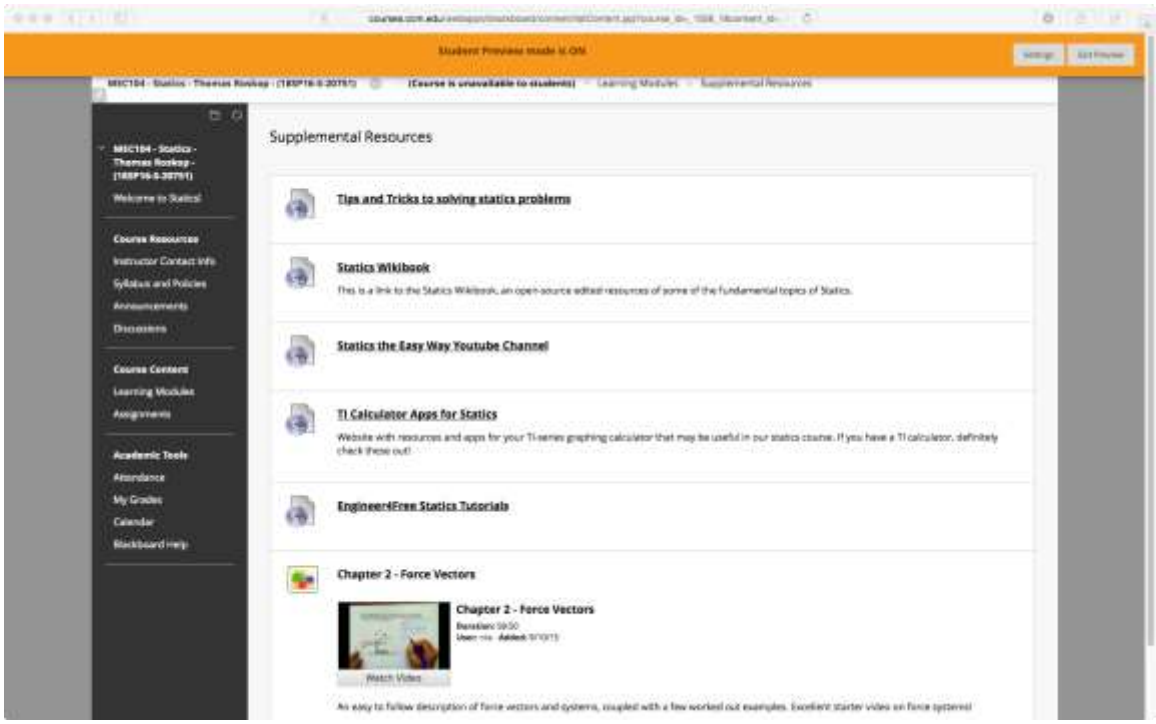
Condensed student syllabus handout contains all necessary information on a double-sided sheet. Material is expanded upon online but the handout alone can hold it's own.



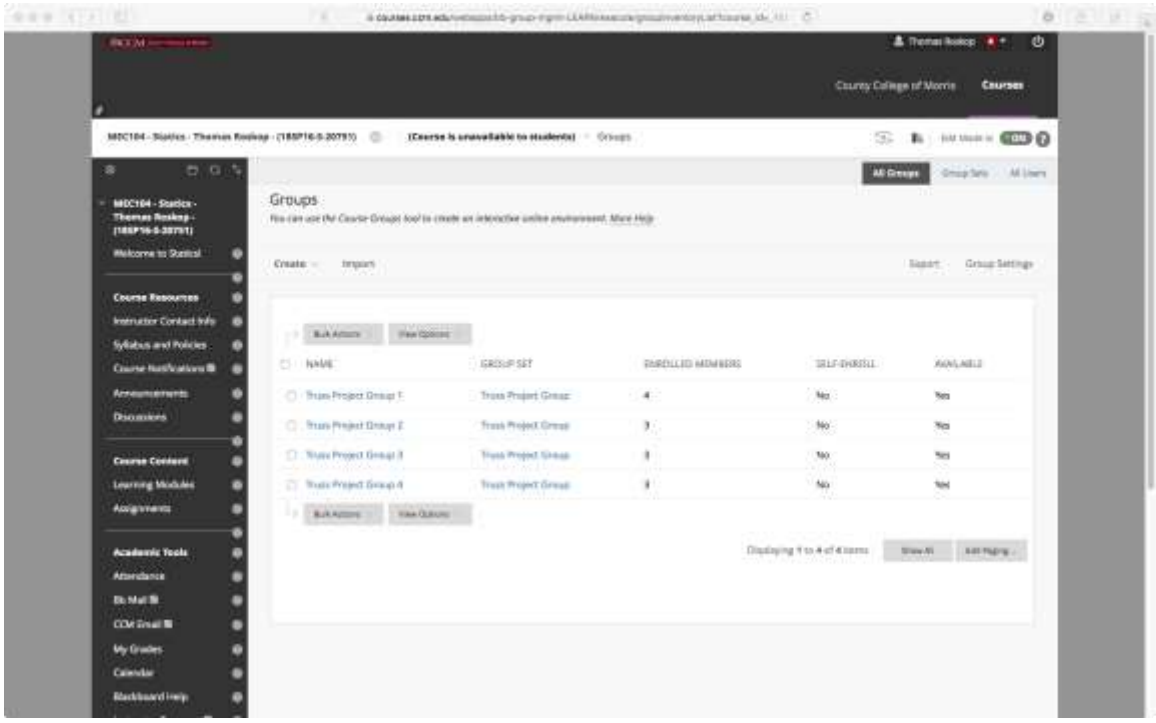
Discuss board for students to use outside of class time for homework discuss, general questions.



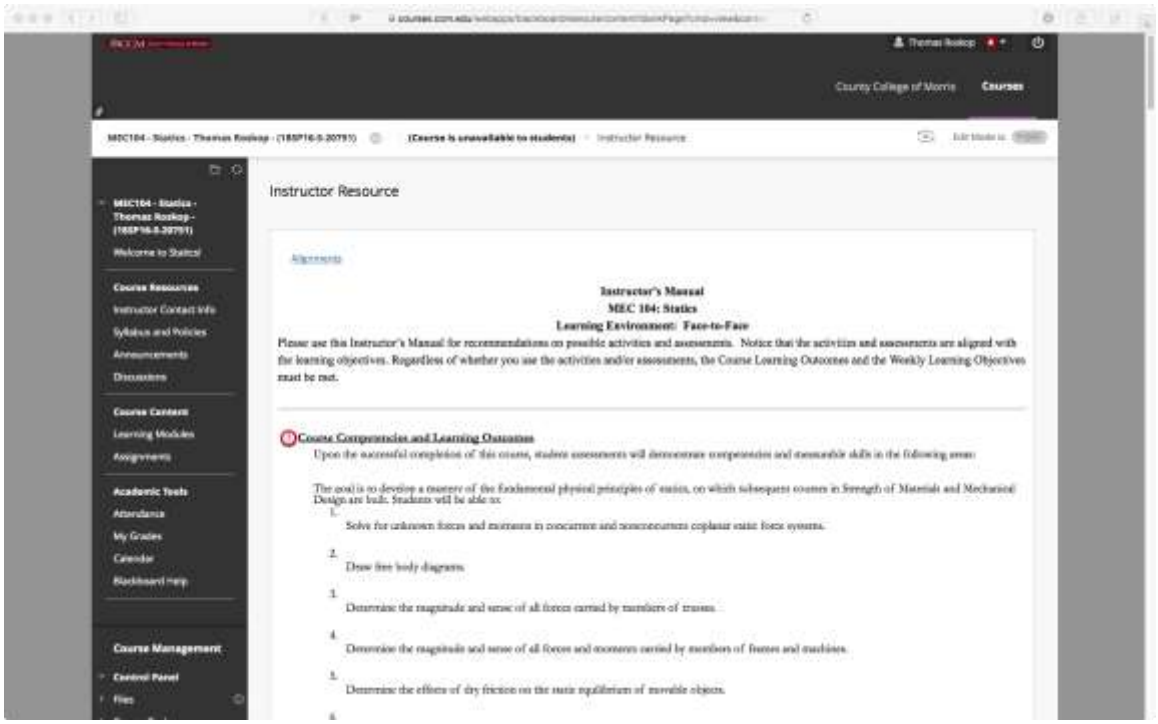
Course content organized under “Learning Modules” and containing supplemental resources for students.



Supplemental resource page is a collection of websites, tutorials, videos, and other sourced material that allow the student to further delve into the topic.



Group Assignments and pages for each group to use for their projects. The utilization of the group features is factored into their organization/participation grade.



An instructor-only manual page, hidden from students, provides guidance to adjunct instructors on course outcomes, active learning techniques, and how to utilize the material effectively to promote experiential learning.

Summary

This project allowed me to break down the course into its essence and build it up from topic to experience. With our departments goals, accreditation objectives, and student opinion in our crosshairs, these efforts melded these criteria into a well-rounded course that not only teaches the material but supports the completion goals (by connecting students to future classes early on) and skills development (such as applied analysis, building and synthesizing) needed for the Mechanical Engineering Technology program. Through the CTL's help and experience, I've been able to create a positive academic experience for our students while maintaining the academic rigor which we value.