CE 2200 Statics

Spring 2018
School of Engineering, Vanderbilt University

Instructor: Prof. Ravindra Duddu
Email : ravindra.duddu@vanderbilt.edu
Office : 288 Jacobs Hall
Tel : (615) 343-4891
Office Hours: TBA
. Email for appointment

Teaching Assistants: TBA
Email :
Venue : JH 273 (or FGH 200)

Class Hours: Mondays, Wednesdays and Fridays, 9:10 AM – 10 AM

Class Venue: 244 Featheringill Hall

Textbook: *Engineering Mechanics: Statics with Mastering Engineering (14th Ed.) by R.C. Hibbeler, Pearson Prentice Hall, 2016.* Either a hard copy or an e-texbook can be purchased at the bookstore or online. If you are using a used textbook you must purchase Mastering Engineering separately. After you have purchased a code for Mastering Engineering, log in at `www.masteringengineering.com` and register for the course, CE2200SPRING2018.

Co-requisites: MATH 1301, PHYS 1601

Required Course For CE and ME majors; Elective for other majors

Course Overview: Statics is a branch of Engineering Mechanics that deals with the analysis of external loads (i.e., force and torque or moment) acting on structural or mechanical systems that are in static equilibrium with their environment (i.e., when the acceleration of the system is zero). The concepts are "Statics" are heavily used in understanding the mechanics of materials, the mechanics of fluids at rest, and provide the mathematical basis for structural analysis and design and machine design.

Course Description (from Course Catalog): Vector analysis of two- and three-dimensional equilibrium of particles, rigid bodies, trusses, frames, and machines. Introduction to internal forces, shear and moment diagrams, cables, centroids, moments of inertia, and friction. Credit offered for only one of CE 2200 or BME 2100. Corequisites: MATH 1301, PHYS 1601. FALL, SPRING, SUMMER [3]

Course Goals: In this course, I have set the following specific goals in terms of knowledge acquisition (content) and skills development.

Content: The goal is to introduce students to the theory and methods of engineering mechanics and prepare them for advanced courses in structural analysis and design. At the end of the course, you will be able to:

- Describe basic quantities and idealizations of mechanics
- Add, resolve or project vectors (e.g., force and position) using the Parallelogram law and the Cartesian vector form
- Draw the free-body diagram and solve particle equilibrium problems using Newton's laws of motion
- Define the moment of a force and calculate it in two and three dimensions

- Determine the resultant force due to a system of external forces
- Draw the free-body diagram and solve rigid-body equilibrium problems
- Determine the internal forces in pin-connected members of a truss or a frame using the method of joints and the method of sections
- Determine the internal shear and moment in a member and describe them graphically in the form of shear and moment diagrams
- Analyze the equilibrium of rigid bodies subjected to dry friction and rolling resistance
- Determine the center of gravity, center of mass and centroid of arbitrary shapes and composite parts using the principles of Calculus
- Determine the force resultant of a general distributed loading or pressure loading caused by a fluid
- Determine the moment of inertia for an area of arbitrary shapes and composite sections

Skills: The goal is to enhance to enhance the students' engineering problem-solving, critical thinking and quantitative skills.

- Apply calculus and geometry principles to calculate resultant force and position vectors
- Develop or use computer algorithms for solving practical engineering problems
- Write project reports and/or prepare presentations using word and powerpoint
- Engaging and supporting critical discussions and thought experiments

Methods of Assessment: There will be four modes of assessment in this course:

1. ***Assigments***: A total of 13 homework and 38 daily tutorial assignments will be assigned on the MasteringEngineering module. Check the "course calendar" on your homepage as soon as you log into MasteringEngineering for the due dates of these assignments. Typically, assignments are due at 9:10 am on the due date. You are also required to submit handwritten paper copies of homework assignments *in class at 9:10 am on the due date* (See Table 1: Course Schedule for more details).

2. ***Exams***: There will be *3 midterms and final exam.* The dates of the exams and topics covered in each midterm are given in the course schedule. The final exam is comprehensive in that it covers all topics. A study guide will posted on blackboard and practice problems (no credit) will be assigned on Mastering Engineering at least a week before each exam. Makeup exam will be permitted with proof of medical or personal emergency only.

3. ***Projects***: A couple of team projects will be assigned soon after Spring break. Typically, projects involve solving open-ended problems based on real world examples. Students will be required to assemble into teams consisting of 2-4 students. Each team will *prepare either a project report that they will submit on a specified due date.* While the project report counts for 10% of the grade, exceptional work can earn bonus points.

4. ***In class-quiz***: There will be occasional in-class quizzes, sometimes within the first few minutes of some of the classes. *Be on time or you will not make it to the quiz.* In class quizzes test the student's grasp on fundamental concepts (i.e., critical thinking rather than their quantitative skills).

Grading (breakdown):

Assignments	30% (10% each for tutorial, online and paper homework assignments)
Midterm Exams	30% (10% for each midterm)

Final Exam	25%
Project	10%
In-class quiz	5%

Note: If you fail the final exam then you fail the course.

Policy and Guidelines:

1. ***MasteringEngineering***: While you may buy/rent/borrow a paper copy of the required textbook (preferably the 14th), you should definitely buy the Mastering Engineering access code, preferably before our first class on Monday, January 8, 2018. For more details, refer to Get_Started_Flyer_Handout _MasteringEngineering.pdf posted in the Syllabus folder on Blackboard.

2. ***Hand-written homework***: Your homework must be hand-written in a *neat* and *orderly* manner. Include a sketch (free body diagrams, etc.) with each problem when needed. Answers must be *clearly marked* with appropriate *units* indicated. It is strongly recommended that you use 8.5 x 11 plain white sheets or engineering graph paper. You may write on both sides of the paper so long as the text is readable.

3. ***Late assigments***: On MasteringEngineering, late assignments will be awarded reduced credit @ -20% per day late after the due date. However, you will always get a minimum credit of 40% of your score, so make sure to submit the homework online. On the other hand, paper copies of homework assignments submitted with 48 hours of the due date will be given 50% credit and those turned in after 48 hours from due date will be graded, but no credit will be given. In case you have an health issue or personal emergency or ASCE trip, please let the TA or instructor know about this before time, so that they can make an exception on late homework.

4. ***Exams***: All exams are closed book. A two-sided equation sheet is permitted during midterms and final. The equation sheet can contain all relevant materials (e.g. concepts, equations) except worked-out example problems. Only calculators are allowed. Tablets, smart phones or laptops will not be allowed for use as calculators.

Expectations:

What you can expect from the instructor and TAs?

- Respect each of you as individual and unique learners
- Maintain a free and open class environment where you can share your ideas and concerns
- Plan the course well and provide necessary background that is missing in the textbook
- Be on time and prepared for each class
- Solve problems everyday in class and work with you individually, if required
- Provide you guidance on homework assignments out-of-class during office hours
- Provide you assistance in preparing your poster presentations
- Respond to your email queries within 24 hours
- Return graded assignments and exams promptly, and provide feedback
- Maintain a record of grades securely and accurately

What I expect from the students?

- Respect your classmates and the TAs

- Be on time for each class
- Silence or turn off your phone, no emailing or texting during class
- Participate in the discussions in class by answering or asking questions
- Complete assigned textbook readings
- Adhere to Vanderbilt Honor Code in all your work

Honor Code: Honor code is in effect during all exams and homework. Anyone suspected of cheating (i.e., copying off someone else's test/quiz, bringing unauthorized notes to tests, etc.) will be reported to the honor council. For tests students may store equations on calculators, but not solutions to example problems. Access to the previous year's homework and examinations and their solutions (not posted on blackboard) is not allowed. Group discussions in general are permitted, yet all homework must be prepared individually.

Disabilities: Vanderbilt is committed to equal opportunity for students with disabilities. If you have a physical or learning disability, you should contact the Opportunity Development Center to assist you in identifying yourself to your instructors as having a disability, so that appropriate accommodation may be provided.

Relationship of Course to Program Outcomes: Contributes to ABET outcomes a, e and k.

Outcome a: Graduates will demonstrate an ability to apply knowledge of mathematics, science and engineering.

Mathematics, physics, and engineering concepts are all integral to the solution of problems in Statics. Students set up and solve systems of equilibrium equations in up to three dimensions using mathematics and mechanics principals, such as recognizing two- and three- force members, zero force members, and breaking objects down into core components. Centroids, center of gravity, and moments of inertia are derived for objects using principals learned from basic calculus. Shear and moment diagrams are developed using equilibrium equations (shear) and integral calculus (bending moment). Basic problems solving skills are a major component of the course, and applied in future mechanics and analysis courses.

Outcome e: Graduates will demonstrate an ability to identify, formulate and solve engineering problems.

The ability of the students to identify, formulate and solve engineering problems is demonstrated and assessed through homework assignments, in-class discussions and problem solving sessions, and performance during examinations.

Emergency Evacuation Plan: In the event of a fire or other emergency, the occupants of this class should take coats and personal belongings and leave the building through the nearest exit. The class should collect in the Stevenson Center Courtyard or the lawn in front of or behind McTyeire Hall according to the evacuation plan. Please review the general evacuation plan and first floor map at
http://engineering.vanderbilt.edu/about/evacuationplans.php.

The assembly point must be at least 50 feet from the building. The assembly point must be at least 50 feet from the building. In the event of an evacuation, students should note who is near them and alert the instructor if anyone is missing on the outside. Do not congregate near response units and activities. VANDERBILT POLICY FORBIDS REENTRY TO A BUILDING IN WHICH AN ALARM HAS OCCURRED WITHOUT AUTHORIZATION BY VANDERBILT SECURITY. If, in consequence of a disability, you anticipate the need for assistance, please discuss that need with the instructor/professor.

Disclaimer: The class schedule, homework assignments and above policies of this course are subject to change by the professor. All students will be notified of any change that might occur during the semester.

Table 1: **Tentative Course Schedule**

Check the MasteringEngineering course calendar for any updates on assignment due dates

Class	Date	Topic	Book Chapter	Assignment Due
1	1/8	Introduction	1.1–1.6	
2	1/10	Force Vectors	2.1–2.9	
3	1/12			
	1/15	*MLK Day*		
4	1/17	Equilibrium of a Particle	3.1–3.4	HW1
5	1/19	Force System Resultants	4.1–4.9	
6	1/22			HW2
7	1/24			
8	1/26			HW3
9	1/29	Review		
	1/31	Midterm #1	1, 2, 3, 4	
10	2/2	Equilibrium of a Rigid Body	5.1–5.7	HW4
11	2/5			
12	2/7			
13	2/9			
14	2/12			
15	2/14	Structural Analysis	6.1–6.4, 6.6	HW5
16	2/16			
17	2/19			HW6
18	2/21			
19	2/23	Project 1: Truss Me!	Bring smart phones/tablets	HW7
20	2/26	Review		
	2/28	Midterm #2	5, 6	
21	3/2	Internal Forces	7.1	
	3/3 – 3/11	*Spring Break*		
23	3/12	Internal Forces	7.2–7.4	
24	3/14			
25	3/16			HW8
26	3/19			Project 1 Report
27	3/21	Center of Gravity and Centroid	9.1–9.4	HW9
28	3/23			
29	3/26			
30	3/28	Project 2: Snow Loads	Bring computer	
31	3/30	Moments of Inertia	10.1–10.4	HW10
32	4/2			
33	4/4			
34	4/6	Review		HW11
	4/9	Midterm #3	7, 9, 10	
35	4/11	Friction	8.1–8.5	
36	4/13			Project 2 Report
37	4/16			HW12
38	4/18			
39	4/20	Review and Wrap-up		HW13
40	4/23			
	4/30	Final Exam	Comprehensive	