THE PENNSYLVANIA STATE UNIVERSITY
MONT ALTO CAMPUS
Fall 2023

EMCH 211 – Statics

Course Title: EMCH 211 "Statics"
Section: 001
Credits: 3
Class Meeting: MWF 10:10 – 11:00 AM, Sci-Tech 115
Text and Material: Materials online for this course: Textbook available at http://mechanicsmap.psu.edu, all other materials available through Canvas.

Instructor: Dr. Jacob Moore, Associate Professor of Engineering
E-mail: jmoore@psu.edu
Phone: (717) 749-6209
Office Location: 7 Bookstore Building
Office Hours: Monday 9AM – 10AM, Wednesday 9AM – 10AM, Thursdays 10AM – 12PM, or by appointment

Course Goals:
Statics provides students with the tools and guidance to allow them to master the use of equilibrium equations and free body diagrams to solve real engineering problems. They should leave this class with the ability to logically approach a variety of static engineering problems, to translate a physical situation into an analytical model, and to use various mathematical tools to solve for desired information.

Course Learning Objectives:
Upon successfully completing this course students will be able to…

- Develop a systematic problem-solving technique and consistently use these this technique to solve problems and to communicate problem solutions including any assumptions.
- Write vector equations for both 2-D and 3-D forces, determine the resultant of a set of concurrent forces in two and three-dimensional system, and determine magnitudes and/or directions of forces in a concurrent system, given the resultant force.
- Automatically and consistently start equilibrium problems by drawing a free body diagram (FBD) and apply equilibrium equations (vector or scalar) to solve 2-D and 3-D problems involving a single particle.
- Identify and recognize ‘moments’ and ‘couples’, determine the moment of a couple, determine moments of a force in 2-D and 3-D cases, determine the moment of a force about an axis using scalar analysis and vector analysis, and perform dot and cross products in order to solve applicable problems.

- Obtain the resultant of a system of forces, determine when two sets of forces and couples are equivalent, and find an equivalent force-couple or force-only system for any system of forces and couples.
- Determine an equivalent force for any 2-D distributed load and be familiar with 3-D distributed loading.
- Draw an appropriate FBD of a rigid body in equilibrium, identify the relevant equilibrium equations for a given static problem, and apply equilibrium equations to solve for unknowns in rigid body problems.
- Sketch accurate FBD's of joints/pins and truss sections and determine forces in truss members using pin and section FBDs.
- Draw an appropriate free body diagram of a frame or machine and its members, lay out a plan for using various equilibrium equations to solve for unknowns, and determine the forces acting at the joints and supports of a frame or machine by applying equilibrium equations to solve for unknowns.
- Identify and correctly model support reactions in 3-D, draw an appropriate 3-D free body diagram, and apply the equations of equilibrium to solve for unknowns in 3-D problems.
- Recognize the characteristics of dry friction for both static and steady sliding problems, include appropriate friction forces in a FBD, and solve problems involving friction by making an initial assumption and checking whether equilibrium holds.
- Define, in both words and equations, the difference between Center of Gravity and Centroid, and determine the CG and/or centroid location for a body using composite sections or integration as appropriate.
- Recognize the characteristics of moments of inertia, especially the area moment of inertia, and determine the area moment of inertia for a given shape about a given axis using composite sections with the parallel axis theorem or integration as appropriate.

Course Policies:

Pre-Class Preparation:

- The class will be run as a flipped classroom, and students will be expected to do the required reading and pre-class quiz before class starts on the assigned day.
- A short review of the reading will be presented before class by the instructor, but it will not replace the course reading. The instructor will not use class time to explain materials to students who have failed to prepare before class, you will need to do the reading on your own.
- Extensions on quizzes will only be offered in instances of illness or other extenuating circumstances.

Attendance:

- Students are expected to attend all classes except in cases of illness or other extenuating circumstances.

- Students experiencing any symptoms of COVID 19, or those who were exposed to someone testing positive or presumed positive should not attend class and should alert the instructor. If possible, these students will be encouraged to continue to participate remotely.
- Class will begin promptly at the designated time, and you are expected to be ready to go at that point.
- Each unexcused absence will result in losing one point from your attendance grade, up to a maximum of 5 points.
- Students should contact the instructor before class for any pre-scheduled absences. In the case of an illness or another unexpected reason for absence, the student should contact the instructor as soon as possible.
- It is the responsibility of the student to determine what activities and assignments were missed in the case of any missed classes or significant tardiness. This can be done by contacting the instructor. Not all assignments may be made up in the case of non-university sanctioned excuses for absence.

Homework Assignments:

- All homework assignments will be graded according to the mastery grading system. For details on this system, see the section on "Mastery Assignment Grading".
- All assignments and dues dates will be documented on Canvas (https://lmstools.ais.psu.edu/login.html). Though assignments may be introduced in class, students are expected to consult the documentation on Canvas for more complete guidance for the assignments.
- All assignments are due at the beginning of class on the listed due date. Assignments may be dropped off with the instructor in class. Late assignments will not be accepted without prior consent of the instructor.
- Students are encouraged to work in groups; however, students are expected to complete and submit their own original work.

Labs:

- Labs will be done in teams of two (three only if absolutely necessary).
- Time will be allotted to work on the labs in class, but students may need to work beyond that time to complete the assignment. All due dates and guidelines for the lab are listed in the syllabus.
- Each team will submit a single report and each student in the team will receive the same grade except in instances where it is apparent that the workload was unequally distributed.
- As much of the lab will be done in class it is essential that you attend class on lab days. Unexcused absences on lab days will result in 20 points being deducted from your grade for each lab day missed.
- Any student that has a team member that they feel is not sufficiently contributing to the project is encouraged to address the issue with the instructor.

Tests:

- Tests will be conducted during the class periods indicated on the schedule unless otherwise noted in class. Because of this the tests will be limited to the regular 50-minute time period. Time starts at the beginning of class regardless of when the student shows up.
- Tests will be closed book, but open note. Students are highly encouraged to make crib sheets of common formulas that can be quickly.
- The tests will consist of two main sections:
    - The basics section will cover the fundamentals of the topics covered in class and consist of a combination of multiple choice and open response style questions. Students will be expected to answer all the questions in this section.
    - The challenge section will cover more complex topics and may string various topics together. This section will consist entirely of open response style questions and students will be expected to choose and solve a subset of the questions.

General Conduct:

- Students are expected to act professionally during all class related activities and meetings. Inappropriate behavior or language during any class activities will not be tolerated.

Mastery Assignment Grading:

The purpose of having assignments in this class is to help students learn the material and mastery the skills covered in the course. Students are expected to show mastery of the material through complete and correct solutions to the homework assignments, though it is understood that this may not happen the first-time students attempt to solve a problem. To match this expectation, the following process will be used to grade all homework assignments unless otherwise noted.

1. Students will be given a weekly assignment with several homework problems in the class readings. Students must complete all problems to the best of their abilities, completely document all their work using the appropriate homework formatting guidelines, and turn in their work by the assigned due date.
2. Within one week, the instructor will grade and return the assignment. Each problem will have one of three marks on it, indicating whether the instructor feels the problem was mastered.
    - **M (Mastered):** Indicating that the student completely and correctly answered the problem.
    - **NM (Not Mastered):** Indicating that the student did not completely and correctly answer the problem. This will be accompanied by comments from the instructor indicating any mistakes or missing information that the instructor has identified.
    - **X (Not Attempted):** Indicating that the instructor felt that the student did not make a reasonable attempt at answering the problem.
3. All problems that were marked NM (Not Mastered) can be redone and resubmitted within one week of being returned. Problems may not be resubmitted more than one week after being returned (due dates will be printed on the assignments). All problems resubmitted will be

regraded and just as the original assignment was. The new marks for each problem will replace the previous marks the student received. Resubmissions should be written on a separate sheet and must be stapled to the front of the original assignment and any previous resubmissions. The whole problem must be written out again unless the instructor has marked a "continue from here" point in the previous submission.

4. Problems can be resubmitted as many times as needed so long as the problem is marked NM.
5. The last day of classes will be the last day to resubmit any assignment. After this date, no more resubmissions will be accepted.
6. Each student's final course homework grade will be the number of problems the student has marked as mastered over the total number of problems assigned to the class.

Services for Students with Disabilities:

In order to receive consideration for reasonable accommodations, you must contact the Disability Coordinator, Kendra Wolgast, located on the first floor of the General Studies Building in the Student Success Center. Appointments can be made at https://psu.mywconline.com/. She can also be reached at 749-6045 or kmw24@psu.edu. Students must complete an introductory meeting and provide documentation: http://equity.psu.edu/sdr/guidelines. If the documentation supports your request for reasonable accommodations, the disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. You must follow this process for every semester that you request accommodations.

Counseling and Psychological Services:

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, and crisis intervention. Mantra Health Telepsychiatry services offer evaluations and limited medication prescriptions. Penn State students receive limited sessions free of charge. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

To schedule an appointment contact:
Counseling Services
Darlene Pasi, M.S., LPC
204 Wellness House
Drp16@psu.edu
Phone: 717-749-6125

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400
Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Academic Support Center:
The Academic Support Center provides academic and skill building support for all students. If you are having difficulty in any of your classes, or with academic skills, contact the Academic Support Center.
E-mail: ASC-Helps@psu.edu
Call: (717) 749-6046
Schedule a Tutoring Appointment: http://www.psu.mywconline.com
Stop by: 1st floor of the General Studies Building

Academic Integrity:
According to Penn State policy G-9: Academic Integrity, an academic integrity violation is "an intentional, unintentional, or attempted violation of course or assessment policies to gain an academic advantage or to advantage or disadvantage another student academically." Unless your instructor tells you otherwise, you must complete all course work entirely on your own, using only sources that have been permitted by your instructor, and you may not assist other students with papers, quizzes, exams, or other assessments. If your instructor allows you to use ideas, images, or word phrases created by another person (e.g., from Course Hero or Chegg) or by generative technology, such as ChatGPT, you must identify their source. You may not submit false or fabricated information, use the same academic work for credit in multiple courses, or share instructional content. Students with questions about academic integrity should ask their instructor before submitting work.

Students facing allegations of academic misconduct may not drop/withdraw from the affected course unless they are cleared of wrongdoing (see G-9: Academic Integrity). Attempted drops will be prevented or reversed, and students will be expected to complete course work and meet course deadlines. Students who are found responsible for academic integrity violations face academic outcomes, which can be severe, and put themselves at jeopardy for other outcomes which may include ineligibility for Dean's List, pass/fail elections, and grade forgiveness. Students may also face consequences from their home/major program and/or The Schreyer Honors College.

Reporting Educational Equity Concerns:
Consistent with University Policy AD29, students who believe they have experienced or observed a hate crime, an act of intolerance, discrimination, or harassment that occurs at Penn State are urged to report these incidents as outlined on the University's Report Bias webpage (http://equity.psu.edu/reportbias/)

Grading Policy:
Grades will be distributed as follows:

- Attendance 5%
- Quizzes 10%
- Labs 10% (2 labs)
- Homework Assignments 15%
- Midterm Exams 60% (4 exams)

Final letter grade will be assigned as follows:

93 - 100	A
90 – 92.99	A-
87 – 89.99	B+
83 – 86.99	B
80 – 82.99	B-
77 – 79.99	C+
70 – 76.99	C
60 – 69.99	D
below 60	F

Tentative Schedule:

Week of	Topic	Pre-Class Reading	Assignments Due
8/21	M- Course Introduction and Equilibrium W- Vectors and Vector Addition F - Newtonian Mechanics Basics	 A 1.1 – A 1.2 1.1 – 1.9	
8/28	M – Equilibrium for Concurrent Force Systems W – Equilibrium for Concurrent Force Systems cont. F – Equilibrium for Concurrent Force Systems cont.	2.1 – 2.5	M – HW1
9/4	M – **Labor Day No Class** W – Moments, Varignon's Theorem, and Couples F – Moments via Vector Calculations	 3.1 – 3.3 3.4 – 3.5, A 1.3 – A 1.4	 W – HW 2
9/11	M – Equilibrium in Rigid Bodies W – Equilibrium in Rigid Bodies (cont.) F – Equilibrium in Rigid Bodies (cont.)	3.6	M – HW3
9/18	M – Review for Exam W – **Exam 1** F – Statically Equivalent Systems	 4.1 – 4.3	M – HW4
9/25	M – Distributed Forces and the Equivalent Point Load W – 2D Centroids via Integration F – 3D Centroids and COM via integration	4.4 – 4.5, A 2.1 A2.2 A2.3	 W – HW5
10/2	M – Centroid, COM, and EPL via Composite Parts W – Area Moments of Inertia via Integration F – Moments of Inertia via Composite Parts	A 2.4, 4.6 A 2.5 A2.7	 W – HW6
10/9	M – Moments of Inertia via Composite Parts W – Review for Exam F – **Exam 2**		 W – HW7
10/16	M – Structures, Trusses, and Method of Joints W – Method of Joints (cont.) F – Lab 1 (Large Trusses in Matlab)	5.1 – 5.3	 F – HW8
10/23	M – Lab 1 (Large Trusses in Matlab) W – Method of Sections F – Method of Sections (cont.)	 5.4	 F – Lab 1
10/30	M – Frames and Machines W – Frames and Machines (cont.) F – Lab 2 (Bottle Capper Analysis)	5.5	M – HW 9 F – HW10
11/6	M – Lab 2 (Bottle Capper Analysis) W – Review for Exam F – **Exam 3**		
11/13	M – Internal Forces W – Axial Force and Torque Diagrams F – Shear and Moment Diagrams	6.1 – 6.2 6.3 6.4	M – Lab 2
11/20	**No Class, Thanksgiving Break**		
11/27	M – Dry Friction W – Slipping vs. Tipping F - Wedges and Screws	7.1 7.2 7.3 – 7.4	M- HW11 F – HW12
12/4	M – Bearing Friction and Disc Friction W – Belt Friction F – Review for Final	7.5 – 7.6 7.7	 F – HW13
12/11	**Exam 4, Finals Week**		