Statics

SECTION I: Course Overview

Course Code: ENGR380CDG
Subject Area: Engineering
Prerequisites: Calculus I (fundamentals of integration and derivation)
Language of Instruction: English
Contact Hours: 45
Recommended Credits: 3

COURSE DESCRIPTION

This course will guide students through statics for engineering, the branch of mechanics that analyzes the forces and torques of bodies in equilibrium. Statics defines quantities such as the moment of a force, the centroid, and moments of inertia that describe how structures and bodies can remain at rest or maintain a constant velocity.

In this course, students will learn about trusses, joints, frames, and machines. Students will understand the use of forces and moments and how these combine to achieve equilibrium. As a tool for engineering, statics will provide students with the methods to design structures capable of supporting and moving loads safely and effectively from beams to bridges.

The course includes two- and three-dimensional force systems, moments, equivalent systems; trusses, frames, machines; centroids, centers of mass, moments of inertia, friction, internal axial and shear forces, and engineering applications.

The course will also give you the opportunity to discuss and analyze complex and composite rigid systems, considering their inner structure and identifying the forces and moments required to maintain equilibrium. You will explore the challenges engineers encounter in designing ever more functional structures and machinery and how these designs introduce requirements and constraint on materials.

LEARNING OBJECTIVES

- Identify concurrent and parallel forces and moments in two and three dimensions
- Outline the conditions of equilibrium for composite bodies, liquids, and gases
- Explain friction and its role in equilibrium
- Apply equilibrium conditions to analyze the forces acting on a body

- Develop an approach to systems at equilibrium based on the evaluation of internal and external forces and moments

SECTION II: Instructor & Course Details

INSTRUCTOR DETAILS

Name:	TBA
Contact Information:	TBA
Term:	SUMMER

ATTENDANCE POLICY

All students are expected to arrive on time and prepared for the day's class session.

CEA enforces a mandatory attendance policy. You are therefore expected to attend all regularly scheduled class sessions, including any field trips, site visits, guest lectures, etc. that are assigned by the instructor. The table below shows the number of class sessions you may miss before receiving a grade penalty.

ALLOWED ABSENCES – SUMMER TERMS		
Courses Meeting X day(s) Per Week	**Allowed Absence(s)**	**Automatic Failing Grade at Xth Absence**
Courses meeting **5** day(s) per week	**1** Absence	**4th** Absence

For every additional absence beyond the allowed number, your final course grade will drop down to the subsequent letter grade (ex: A+ to A). As a student, you should understand that the grade penalties will apply if you are marked absent due to tardiness or leaving class early. In the table below, you will find the grade penalty associated with each excessive absence up to and including automatic course failure.

ATTENDANCE DOCKING PENALTIES				
Absence	**1st**	**2nd**	**3rd**	**4th**
Penalty	**No Penalty**	**0.5 Grade Docked**	**1 Grade Docked**	**Automatic Failure**
HIGHEST POSSIBLE GRADE AFTER ATTENDANCE PENALTIES				
Grade	**A+**	**A**	**A-**	**F**

CEA does not distinguish between excused and unexcused absences. As such, no documentation is required for missing class. Similarly, excessive absences, and the grade penalty associated with each, will not be excused even if you are able to provide documentation that shows the absence was beyond your control. You should therefore only miss class when truly needed as illness or other unavoidable factors may force you to miss a class session later on in the term.

GRADING & ASSESSMENT

The instructor will assess your progress towards the above-listed learning objectives by using the forms of assessment below. Each of these assessments is weighted and will count towards your final grade. The following section (Assessment Overview) will provide further details for each.

Class Participation	**10%**
Homework	**10%**
Quizzes	**15%**
Midterm Examination	**25%**
Final Examination	**40%**

The instructor will calculate your course grades using the CEA Grading Scale shown below. As a CEA student, you should understand that credit transfer decisions–including earned grades for courses taken abroad–are ultimately made by your home institution.

CEA Grading Scale			
Letter Grade	**Numerical Grade**	**Percentage Range**	**Quality Points**
A+	9.70 – 10.0	97.0 – 100%	4.00
A	9.40 – 9.69	94.0 – 96.9%	4.00
A-	9.00 – 9.39	90.0 – 93.9%	3.70
B+	8.70 – 8.99	87.0 – 89.9%	3.30
B	8.40 – 8.69	84.0 – 86.9%	3.00
B-	8.00 – 8.39	80.0 – 83.9%	2.70
C+	7.70 – 7.99	77.0 – 79.9%	2.30
C	7.40 – 7.69	74.0 – 76.9%	2.00
C-	7.00 – 7.39	70.0 – 73.9%	1.70
D	6.00 – 6.99	60.0 – 69.9%	1.00
F	0.00 – 5.99	0.00 – 59.9%	0.00
W	Withdrawal	N/A	0.00
INC	Incomplete	N/A	0.00

Assessment Overview

This section provides a brief description of each form of assessment listed above. Your course instructor will provide further details and instructions during class time.

Class Participation (10%): Student participation is mandatory for all courses taken at a CEA Study Center. The instructor will use the rubric below when determining your participation grade. All students should understand that attendance and punctuality are expected and will not count positively toward the participation grade.

Class Participation Grading Rubric	
Student Participation Level	**Grade**

You make major & original contributions that spark discussion, offering critical comments clearly based on readings, research, & theoretical course topics.	**A+** (10.0 – 9.70)
You make significant contributions that demonstrate insight as well as knowledge of required readings & independent research.	**A/A-** (9.69 – 9.00)
You participate voluntarily and make useful contributions that are usually based upon some reflection and familiarity with required readings.	**B+/B** (8.99 – 8.40)
You make voluntary but infrequent comments that generally reiterate the basic points of the required readings.	**B-/C+** (8.39 – 7.70)
You make limited comments only when prompted and do not initiate debate or show a clear awareness of the importance of the readings.	**C/C-** (7.69 – 7.00)
You very rarely make comments and resist engagement with the subject. You are not prepared for class and/or discussion of course readings.	**D** (6.99 – 6.00)
You make irrelevant and tangential comments disruptive to class discussion. You are consistently unprepared for class and/or discussion of the course readings.	**F** (5.99 – 0.00)

Homework (10%): Students will be assigned as homework a problem set on a weekly basis that addresses your understanding of the week's theme(s). Problem sets will build the skills needed for the midterm and final exams. In addition to these weekly problem sets, students will complete a final assignment in which they describe a specific engineering application.

Quizzes (15%): Quizzes are short (15-minutes long) and will be taken as in-class tests. These quizzes serve to evaluate your understanding of the course's key concepts, skills, and learning objectives.

Midterm Examination (25%): The midterm exam is a 40-minute long test that evaluates your understanding of the concepts of forces and moments and equilibrium.

Final Examination (40%): The final exam is an 80-minute long test with problems involving all topics covered in the course, including selected engineering applications.

EXPERIENTIAL LEARNING ACTIVITIES (AICAP)

CEA courses are designed to include a variety of experiential learning activities that will take you out of the classroom and allow you to explore your local, host city. These activities may include field studies, guest lectures and/or activities offered through our Academically Integrated Cultural Activities Program (AICAP). Please check the Forms of Assessment section to find out if AICAP activities are related to any specific form of assessment. The following experiential learning activities are recommended for this course:

- To be confirmed based on active learning opportunities in Paris. May include visits to local museums or historic sites relevant to engineering in Paris.

REQUIRED READINGS

Listed below are the required course textbooks and additional readings. Whether you buy your books from our locally affiliated merchants or whether you acquire these before arrival, you must have constant access to these resources for reading, highlighting and marginal note-taking. It is required that you have unrestricted access to each. Additional copies will be placed on reserve in the Academic Affairs office for short-term loans. Access to additional sources required for certain class sessions will be provided in paper or electronic format consistent

with applicable copyright legislation. In addition, the Academic Affairs Office compiles a bank of detailed information about the many libraries, documentation centers, research institutes and archival materials located in the host city and accessible to CEA students. You will be required to use these resources throughout your studies. Direct access to additional resources and databanks are available to you through the online library of the University of New Haven. The required text for this course is:

I. **Required Text(s)**: You may purchase the required text(s) prior to departure or upon program arrival. The required text(s) are listed below:

Baker, Daniel and Haynes, William. *Engineering Statics: Open and Interactive.* 2020, 321 pp.

Bedford, Anthony, and Fowler, Wallace. *Engineering Mechanics: Statics (5th Edition)*. Pearson, Upper Saddle River, 2008, 634pp.

RECOMMENDED READINGS

The recommended reading(s) and/or text(s) for this course are below. These recommended readings are not mandatory, but they will assist you with research and understanding course content.

On Statics, selected sections of Hibbeler, Russell. *Engineering Mechanics: Statics (14th Edition)*. Pearson, Upper Saddle, 2015, 704pp.

On Mechanics, selected sections of Kittel, Charles, Knight, Walter, Ruderman, Malvin, Helmholz, A. Carl, Moyer, Burton. *Mechanics (Berkeley Physics Course, Vol.1, 2nd Edition)*. McGraw Hill, New York, 1973, 426pp.

On Physics and Mechanics, selected sections of Feynman, Richard, and Leighton, Robert. *The Feynman Lectures on Physics, Vol. I: The New Millenium Edition.* Basic Books, New York, 2011, 560pp.

On Materials, selected sections of Crandall, Stephen, Dahl, Norman, Lardner, Thomas, Sivakumar, M. *An introduction to Mechanics of Solids (in SI Units 3e Edition)*. McGraw Hill, New York, 2012, 586pp.

ADDITIONAL RESOURCES

- **UNH Online Library**: As a CEA student, you will be given access to the online library of CEA's School of Record, the University of New Haven (UNH). You can use this online library to access databases and additional resources while performing research abroad. You may access the UNH online library here or through your MyCEA Account. You must comply with UNH Policies regarding library usage.

- **CEAClassroom – Moodle**: CEA instructors use Moodle, an interactive virtual learning environment. This web-based platform provides you with constant and direct access to the course syllabus, daily schedule of class lectures and assignments, non-textbook required readings, and additional resources. Moodle includes the normal array of forums, up-loadable and downloadable databases, wikis, and related academic support designed for helping you achieve the learning objectives listed in this syllabus.

  During the first week of class, CEA academic staff and/or faculty will help you navigate through the many functions and resources Moodle provides. While you may print a hard copy version of the syllabus, you should always check Moodle for the most up-to-date information regarding this course. The instructor will use Moodle to make announcements and updates to the course and/or syllabus. It is your responsibility to ensure that you have access to all Moodle materials and that you monitor Moodle on a daily basis in case there are any changes made to course assignments or scheduling.

To access Moodle: Please log-in to your MyCEA account using your normal username and password. Click on the "While You're Abroad Tab" and make sure you are under the "Academics" sub-menu. There you will see a link above your schedule that says "View Online Courses" select this link to be taken to your Moodle environment.

COURSE CALENDAR *STATICS*			
SESSION	**Topic**	**Activity**	**Student Assignments**
1	**Introduction to course, review of syllabus, & classroom policies** **Introductory concepts & definitions**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 1: 1.1, 1.2
2	**Vectors & Vector algebra**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 2: 2.1, 2.5 Baker and Haynes, Chapter 2: 2.1
3	**Forces, equilibrium, free-body diagrams**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 3: 3.1 Baker and Haynes, Chapter 3: 3.1
4	**Two and three-dimensional force systems**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 3: 3.2, 3.3 Baker and Haynes, Chapter 3: 3.4, 3.5 **Assignment:** First Assignment (Forces and equilibrium)
5	**Moments** **First quiz (Systems of forces & equilibrium)**	Discussion in class ***First quiz***	**Reading:** Bedford and Fowler, Chapter 4: 4.1, 4.2 Baker and Haynes, Chapter 4: 4.4
6	**Moment of a force**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 4: 4.3
7	**Couples and equivalent systems**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 4: 4.4, 4.5 Baker and Haynes, Chapter 4: 4.5, 4.6
8	**Equilibrium conditions and supports**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 5: 5.1, 5.2
9	**Equilibrium in three dimensions**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 5: 5.3, 5.4 **Assignment:**

The instructor reserves the right to make change or modifications to this syllabus as needed

			Second Assignment (Equilibrium equations)
10	**Structures** **Second quiz (Equilibrium)**	Discussion in class ***Second quiz***	**Reading:** Bedford and Fowler, Chapter 6: 6.1-6.4 Second quiz
11	**Frames & Machines**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 6: 6.5 Baker and Haynes, Chapter 6: 6.6
12	**Centroid & Distributed loads**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 7: 7.1-7.3 Baker and Haynes, Chapter 7: 7.4, 7.8
13	**Composite Volumes & Lines**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 7: 7.4, 7.5
14	Review for Midterm		
15	**Midterm Exam (forces, moments, equilibrium)**		
16	**Center of mass**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 7: 7.6, 7.7 Baker and Haynes, Chapter 7: 7.3
17	**Centers of mass of composite objects**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 7: 7.8
18	**Moment of inertia**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 8: 8.1-8.4 Baker and Haynes, Chapter 10: 10.1 - 10.4
19	**Moments of inertia of simple objects**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 8: 8.5-8.6 Baker and Haynes, Chapter 10: 10.5 - 10.8 **Assignment:** Third Assignment (Evaluating center of mass, moment of inertia, and friction)
20	**Friction** **Third quiz (Moment of inertia)**	Discussion in class ***Third quiz***	**Reading:** Bedford and Fowler, Chapter 9: 9.1 Third quiz
21	**Friction: applications**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 9: 9.2-9.6 (selected topics)
22	**Axial & Shear Forces**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 10: 10.1, 10.2

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23	**Shear force diagrams & bending moment diagrams**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 10: 10.3
24	**Loads on cables**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 10: 10.4-10.6 **Assignment:** Fourth Assignment (Open-ended discussion of an engineering application)
25	**Internal forces for liquids and gases** **Fourth quiz (friction and internal forces)**	Discussion in class ***Fourth quiz***	**Reading:** Bedford and Fowler, Chapter 10: 10.7 Fourth quiz
26	**Virtual work & Potential Energy**	Discussion in class	**Reading:** Bedford and Fowler, Chapter 11: selected topics
27	Review for Final		
28	**Final Exam (cumulative)**		

SECTION III: CEA Academic Policies

The policies listed in this section outline general expectations for CEA students. You should carefully review these policies to ensure success in your courses and during your time abroad. Furthermore, as a participant in the CEA program, you are expected to review and understand all CEA Student Policies, including the academic policies outlined on our website. CEA reserves the right to change, update, revise, or amend existing policies and/or procedures at any time. For the most up to date policies, please review the policies on our website.

Class & Instructor Policies can be found here
General Academic Policies can be found here