Dynamics

SECTION I: Course Overview

Course Code: ENGR225CDG
Subject Area(s): Engineering
Language of Instruction: English
Prerequisites: See Below
Contact Hours: 45
Recommended Credits: 3

COURSE DESCRIPTION

This course will guide students through Dynamics, the branch of Engineering Mechanics that deals with the movement of bodies subject to forces and constraints. The study of motion and its causes is developed in two stages, kinematics and kinetics. As a tool for Engineering, Dynamics will provide students with methods to analyze and use physical laws in mechanical devices. The course includes basic elements of point particle physics, Newton's First, Second, and Third Law, the behavior of systems of point particles, collisions, and rigid systems. It also makes use of conservation laws, such as energy, momentum, and angular momentum conservation to predict system behavior.

Students will have the opportunity to discuss in physical and quantitative terms the motion of projectiles, of pendulums, of bodies subject to viscous drag, the functioning of mechanical devices, levers, and gearwheels.

LEARNING OBJECTIVES

Upon successful completion of this course, students will:

- Recognize the fundamental physical laws used in kinematics and kinetics.
- Discover the causal relation between forces and motion for point particles and rigid bodies.
- Demonstrate the role of vector analysis in simple mechanical systems.
- Apply a dynamical approach to addressing problems of applicative and industrial interest that involve accelerated motion.

PREREQUISITES

This course requires you to have completed introductory coursework in Physics, Statics, and Calculus III (specifically: derivation, integration, and elements of vector calculus).

SECTION II: Instructor & Course Details

INSTRUCTOR DETAILS

Name: TBA
Contact Information: TBA
Term: SEMESTER

ATTENDANCE POLICY

This class will meet twice weekly for 90 minutes each session. All students are expected to arrive on time and be 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 – SEMESTERS		
Courses Meeting X day(s) Per Week	**Allowed Absence(s)**	**Automatic Failing Grade at Xth Absence**
Courses meeting **2** day(s) per week	**2** Absences	**8th** 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**	**5th**	**6th**	**7th**	**8th**
Penalty	**No Penalty**	**No Penalty**	**0.5 Grade Docked**	**1 Grade Docked**	**1.5 Grades Docked**	**2 Grades Docked**	**2.5 Grades Docked**	**Automatic Failure**
HIGHEST POSSIBLE GRADE AFTER ATTENDANCE PENALTIES								
Grade	**A+**	**A+**	**A**	**A-**	**B+**	**B**	**B-**	**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 Assignments	**15%**
Quizzes	**25%**
Midterm Exam	**25%**
Final Exam	**25%**

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.

CEA 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 Assignments (15%): You will be assigned homework on a weekly basis. Homework will involve solving problems on specific topics covered in the course and building the skills needed for the midterm and final exams.

Quizzes (25%): Quizzes are 30-minute, in-class tests that serve to evaluate your understanding of key concepts and skills that form the basis for the learning objectives of the course.

Midterm Exam (25%): The midterm exam is a 1 hour and 30-minute test that evaluates your understanding of the concepts of fundamental kinematics and kinetics. It will involve the kinetic analysis of point particles.

Final Exam (25%): The final exam is a 1 hour and 30-minute test with problems involving rigid bodies

Required Readings

Reading assignments for this course will come from the required text(s) and/or the selected reading(s) listed below. All required readings–whether assigned from the text or assigned as a selected reading–must be completed according to the due date assigned by the course instructor.

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:

Hibbeler, R. C. *Engineering Mechanics: Dynamics* (14th Edition). Pearson, Hoboken, 2016, 760pp.

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.

Kittel, C., Knight, W. D., Ruderman, M. A. *Berkeley Physics Course : Mechanics (2nd Edition).* McGraw-Hill, New York, 1973, 426pp.

Feynman, R., and Leighton, R. *The Feynman Lectures on Physics, Vol. I: The New Millenium Edition.* Basic Books, New York, 2011, 560pp.

ADDITIONAL RESOURCES

In order to ensure you success abroad, CEA has provided the academic resources listed below. In addition to these resources, each CEA Study Center provides students with a physical library and study areas for group work. The Academic Affairs Office at each CEA Study Center also compiles a bank of detailed information regarding libraries, documentation centers, research institutes, and archival materials located in the host city.

- **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. The ceaClassroom website is located here: https://www.ceaClassroom.com/

  During the first week of class, CEA academic staff and/or faculty will provide you with your Moodle credentials. They will also 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.

COURSE CALENDAR *Dynamics*			
SESSION	**TOPIC**	**ACTIVITY**	**STUDENT ASSIGNMENTS**
1	**Introduction to course, review of syllabus and classroom policies** **Introductory concepts: kinematics**	Class Discussion	**Reading (textbook):** Chapter 12: 12.1-12.3
2	**Curvilinear motion & motion of a projectile**	Class Discussion	**Reading (textbook):** Chapter 12: 12.4-12.6
3	**Curvilinear motion: Normal and tangential components**	Class Discussion	**Reading (textbook):** Chapter 12: 12.7
4	**Curvilinear motion: polar and cylindrical components, relative motion**	Class Discussion	**Reading (textbook):** Chapter 12: 12.8, selections of 12.9 and 12.10 **Assignment:** First Assignment (Point particle kinematics)
5	**Point particle dynamics I** **First quiz (planar motion)**	Class Discussion **First Quiz**	**Reading (textbook):** Chapter 13: 13.1-13.4
6	**Point particle dynamics II**	Class Discussion	**Reading (textbook):** Chapter 13: 13.5
7	**Work and energy I**	Class Discussion	**Reading (textbook):** Chapter 14: 14.1-14.4
8	**Energy conservation**	Class Discussion	**Reading (textbook):** Chapter 14: 14.5-14.6

9	**Impulse and momentum**	Class Discussion	**Reading (textbook):** Chapter 15 : 15.1-15.3 **Assignment:** Second Assignment (Energy conservation)
10	**Impact and collisions** **Second quiz (Point particle dynamics)**	Class Discussion **Second Quiz**	**Reading (textbook):** Chapter 15: 15.4
11	**Angular momentum and moment of a force**	Class Discussion	**Reading (textbook):** Chapter 15: 15.5-15.6
12	**Principle of angular impulse and momentum**	Class Discussion	**Reading (textbook):** Chapter 15: 15.7
13	**Rigid body kinematics**	Class Discussion	**Reading (textbook):** Chapter 16: 16.1-16.4
14	**Midterm Review**		
15	**MIDTERM EXAM** **(Kinematics, point particle dynamics, energy, collisions)**		
16	**Rigid body kinematics: relative motion I**	Class Discussion	**Reading (textbook):** Chapter 16: 16.5
17	**Rigid body kinematics: relative motion II**	Class Discussion	**Reading (textbook):** Chapter 16: 16.6
18	**Rigid body kinematics: relative motion III**	Class Discussion	**Reading (textbook):** Chapter 16: 16.7

19	**Rigid body kinematics: relative motion IV**	Class Discussion	**Reading (textbook):** Chapter 16: 16.8 **Assignment:** Third Assignment (Rigid body kinematics)
20	**Rigid body dynamics** **Third quiz (Rigid body kinematics)**	Class Discussion **Third Quiz**	**Reading (textbook):** Chapter 17: 17.1-17.3
21	**Rigid body dynamics:** **Rotation about a fixed axis**	Class Discussion	**Reading (textbook):** Chapter 17: 17.4
22	**Rigid body dynamics: planar motion**	Class Discussion	**Reading (textbook):** Chapter 17: 17.5
23	**Rigid body dynamics: energy**	Class Discussion	**Reading (textbook):** Chapter 18: 18.1-18.4
24	**Rigid body dynamics: conservation of energy**	Class Discussion	**Reading (textbook):** Chapter 18 : 18.5 **Assignment:** Fourth Assignment (Open-ended discussion of an engineering application)
25	**Rigid body dynamics: impulse and momentum** **Fourth quiz (rigid body dynamics)**	Class Discussion **Fourth Quiz**	**Reading (textbook):** Chapter 19: 19.1-19.3 (selected topics)
26	**Gyroscopic motion**	Class Discussion	**Reading (textbook):** Chapter 20-21: selected topics
27	**Final Review**		
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