THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Aerospace Engineering and Engineering Mechanics

EM 311M DYNAMICS
Summer 2020

SYLLABUS

Unique Number:	74830
Instructor:	Chad M. Landis Office Hours: By Zoom appointment if necessary Phone: (512) 471-4273 E-mail: landis@utexas.edu
Time:	MTWThF 1:00 pm – 2:30 pm TTh 10:00 am - 12:00 noon
Location:	Online
Teaching Assistants:	Hongrui Yu, yuhongrui@utexas.edu Amin Anvari, anvari@utexas.edu Yu-Sheng Lo, yushenglo@utexas.edu
Web Page:	Available on Canvas

Catalog Description:
Dynamics. Two- and three-dimensional kinematics and dynamics, applied to a broad class of engineering problems. Prerequisite: EM 306, M 408D (or M 308M), and PHY 303K with a grade of at least C- in each.

Course Objectives:
This course provides a solid foundation in dynamics needed by aerospace engineering and other engineering majors. It covers two- and three-dimensional particle and rigid body dynamics, energy and momentum methods, and an introduction to vibrations (structural dynamics).

Prerequisites:
Credit with a grade of at least *C-* for EM 306, M 408D (or M 308M), and PHY 303K.

Knowledge, Skills, and Abilities Students Should Have Before Entering This Course:
Prerequisites include basic trigonometry, physics, calculus, vector analysis, construction of free-body diagrams, and application of Newton's Laws.

Knowledge, Skills, and Abilities Students Gain from this Course (Learning Outcomes):
Students will acquire familiarity with the kinematics of particles and rigid bodies, gain the ability to solve two- and three-dimensional problems in particle and rigid-body dynamics, and develop a foundation for the future study of linear systems analysis, control theory, and vibrations.

Impact On Subsequent Courses In Curriculum:
The knowledge and abilities taught in this course are an essential prerequisite for subsequent courses involving dynamics; in particular: ASE 365, 366K, 367K, 167M, and 370L.

Relationship of Course to Program Outcomes:
This course contributes to the following ABET Criterion 3 outcomes and those specific to the EAC accredited program.

AEROSPACE ENGINEERING PROGRAM OUTCOMES

√	a. An ability to apply knowledge of mathematics, science, and engineering.
	b. An ability to design and conduct experiments, as well as to analyze and interpret data.
	c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
	d. An ability to function on multidisciplinary teams.
√	e. An ability to identify, formulate, and solve engineering problems.
	f. An understanding of professional and ethical responsibility.
	g. An ability to communicate effectively.
	h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
	i. Recognition of the need for and an ability to engage in life-long learning.
	j. Knowledge of contemporary issues.
√	k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

ABET Program Criteria Achieved:
Program criteria are unique to each degree program and are to be compiled from the program criteria given for each degree program and listed in table format below. The faculty should check which of the program criteria are achieved in the course.

Criterion	√	Criterion	√	Criterion	√
A. Aerodynamics		G. Orbital Mechanics	√	M. Preliminary/Conceptual Design	
B. Aerospace Materials		H. Space Environment		N. Other Design Content	
C. Structures	√	I. Attitude Determination and Control		O. Professionalism	
D. Propulsion		J. Telecommunications		P. Computer Usage	
E. Flight Mechanics	√	K. Space Structures	√		
F. Stability and Control		L. Rocket Propulsion			

Topics:
Motion of point (~6 lecture hours)
Force, mass and acceleration (3)
Energy methods (6)
Momentum methods (4)
Rigid-body kinematics (6)
Two-dimensional rigid body dynamics (3)
Energy and momentum methods in rigid body dynamics (3)
Three dimensional rigid body dynamics (4)
Vibrations (4)

Professionalism Topics:
During lectures, the instructor stresses the importance of discipline, ethics and organization in the success of engineering students in their careers.

Design Assignments:
There are no design assignments for this course.

Laboratory Assignments:
There are no laboratory assignments for this course.

Computer:
There is no required use of any computer hardware or software for this course.

Text:
Anthony Bedford and Wallace Fowler, *Engineering Mechanics – Dynamics*, Pearson, 5th Edition (but any edition should serve your purposes)

Class Format:
Each week there will be three lectures (3 hours total) and one discussion session (2 hours). The lectures formally present the topics covered in this course and will be recorded prior to discussions. The scheduled lecture hours will be live discussions and problem solving. The 2-hour discussion sessions will include bi-weekly quizzes.

Discussions
- Discussions are regular classes and they must be treated accordingly.
- You must attend only the discussion session for which you are registered.
- Discussion sessions can be changed only through regular registration processes.
- Discussions are the best place to ask questions about homework problems.

***Note that these are regular semester weeks, and over the summer session we will cover 2.5 semester weeks per summer session week. Weeks 13-15 will be modified to according to time constraints.

Class Schedule and Outline:

Week 1 Introduction, Review of prior concepts, Kinematics: rectilinear motion, Ch. 13
Week 2 Kinematics: path coordinates, polar coordinates, Ch. 13
Week 3 Kinetics, Ch. 14
Week 4 Work and energy, Ch. 15
Week 5 Impulse and momentum, Ch. 16
Week 6 Single particle dynamics analysis, Chs. 13-16
Week 7 Particle system dynamics, impacts, Ch. 16 **(Test 1, Tuesday June 23, 10am -12 noon)**
Week 8 Planar kinematics of rigid bodies, Ch. 17
Week 9 Planar kinematics of rigid bodies, planar rigid body dynamics, Chs. 17, 18
Week 10 Rigid body work and energy, momentum, Ch. 18
Week 11 Rigid body impacts, Ch. 19
Week 12 Rigid body dynamics analysis, Chs. 17-19 **(Test 2, Tuesday July 7, 10am - 12 noon)**
Week 13 Three-dimensional kinematics and dynamics, Ch. 20
Week 14 3D dynamics, Vibrations, Chs. 20,21
Week 15 Vibrations, Ch. 20, Review

Friday, July 10, Final Exam 9:00 am – 12:00 noon
Do not schedule travel that will conflict with this time. No make-up or early exams will be given.

Grading:
Weekly Quizzes (15% total, includes attendance quizzes)
2 Midterm exams (nominally each midterm is 25% of your grade)
1 Final Exam (nominally the final is worth 35% of your grade)
The weighting will be adjusted based on your performance. 5% of the weighting will be taken from your weakest performance (including the final) and given to your best performance.
+/- grades will be given at the instructor's discretion based on attendance and/or exceptional performance on the final exam

Homework Policy:
- Homework problems will be assigned weekly on Canvas.
- It is your responsibility to do the homework problems regularly.
- Homework will not be collected or graded.
- Some of the homework problems will appear in the weekly quizzes.
- Solving the homework problems and studying for quizzes is the best way to prepare for the midterms and final examination.

Examinations:
- There will be two and one final examination in addition to the weekly quizzes. All of them are closed books and notes and will be administered with Proctorio.
- Use of calculators is allowed.
- No make-up quizzes or exams will be given.
- The two lowest scores on the quizzes (that includes zero for absentia) will be dropped.
- The final exam will be conducted in accordance with the university schedule.

Attendance:
Regular attendance is expected.

Important Dates:
6/9 – Last day to drop a course for a possible refund
7/9 – Last day to drop a course (with required approvals)
7/10 – Final Exam, Friday, July 10, 9:00 am – 12:00 noon

Special Notes:
The University of Texas at Austin provides upon request appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TDD or the Cockrell School of Engineering Director of Students with Disabilities at 471-4321.

Evaluation:
The Measurement and Evaluation Center forms for the Cockrell School of Engineering will be used during the last week of class to evaluate the course and the instructor.

Prepared by: Chad M. Landis Date: 5/18/2020