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

EM 311M - DYNAMICS
Spring 2012

SYLLABUS

UNIQUE NUMBERS: 13815, 13820, 13825, 13830

INSTRUCTOR: Dr. Pablo Seleson <seleson@ices.utexas.edu>
ACES 6.328, (512) 232-7777

TIME: MWF 1:00 - 2:00 p.m.

LOCATION: PAI 3.02

TEACHING ASSISTANTS: To be announced

EXERCISE SESSIONS:

13815 M 4:00-6:00 pm RLM 6.124
13820 T 4:00-6:00 pm CPE 2.216
13825 M 6:00 8:00 pm RLM 5.118
13830 T 6:00 8:00 pm RLM 5.124

WEB PAGE: http://users.ices.utexas.edu/∼seleson/courses.html

CATALOG DESCRIPTION: http://registrar.utexas.edu/catalogs/ug10-12/

COURSE OBJECTIVES: Learn two- and three-dimensional particle and rigid body dynamics, applied to a broad class of engineering problems.

PREREQUISITIES: EM306 (or EM306S), M408D (or M308L), **with a grade of at least C**

KNOWLEDGE, SKILLS AND ABILITIES, STUDENTS SHOULD HAVE BEFORE ENTERING THIS COURSE: Prerequisites include basic trigonometry, physics, calculus, vector analysis, and the use of free-body diagrams.

EM 311M Course Syllabus — Spring Semester
Unique No. 13815, 13820, 13825, 13830 — 2012

KNOWLEDGE, SKILLS AND ABILITIES, STUDENTS GAIN FROM THIS COURSE (Learning Outcomes): Students should acquire familiarity with the kinematics of particles and rigid bodies, and gain the ability to solve two- and three-dimensional problems in particle and rigid-body dynamics. They should become familiar with the basic equations of motion necessary for their subsequent study of flight mechanics and attitude dynamics.

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, ASE365, 366K, 367K, 167M, and 370L.

RELATION OF COURSE TO PROGRAM OUTCOMES: This course contributes to the following ABET Criterion 3 outcomes and those specific to the EAC accredited program.

Outcome		Outcome	
a. An ability to apply knowledge of mathematics, science, and engineering	x	g. An ability to communicate effectively	
b. An ability to design and conduct experiments, as well as to analyze and interpret data		h. The broad education necessary to understand the impact of engineering solutions in a global/societal context	
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	x	i. A recognition of the need for and an ability to engage in life-long learning	
d. An ability to function on multi-disciplinary teams		j. A knowledge of contemporary issues	
e. An ability to identify, formulate, and solve engineering problems	x	k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	x
f. An understanding of professional and ethical responsibility			

ABET PROGRAM CRITERIA OUTCOMES ACHIEVED:

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

TOPICS:

1. Motion of a Point (6) (a,e,k,E,G)
2. Force, Mass and Acceleration (3) (a,c,e,k,E,G,M)
3. Energy Methods (6) (a,e,k,E,G)
4. Momentum Methods (4) (a,e,k,E,G,L)
5. Rigid-Body Kinematics (6) (a,e,k,E,I)
6. Two-Dimensional Rigid Body Dynamics (3) (a,c,e,k,E,I)
7. Energy and Momentum Methods in Rigid Body Dynamics (3) (a,e,k,E,I)
8. Three Dimensional Rigid Body Dynamics (6) (a,c,e,k,E,I)
9. Vibrations (3) (a,E,I)

PROFESSIONALISM TOPICS: None

DESIGN ASSIGNMENTS: There are no explicit design projects. However, there will be lectures on how dynamics influences engineering hardware design.

LABORATORY ASSIGNMENTS: None

COMPUTER: No specific software has been assigned for the homework assignments in this class. Solution of a few problems assigned for homework may be facilitated by using a computer and students are free to use scientific calculators.

TEXT: A. Bedford and W. Fowler, *Engineering Mechanics: Dynamics*, fifth edition, Prentice Hall, Upper Saddle River, New Jersey 07458, 2008.

CLASS FORMAT: This is a lecture class and meets 3 times a week. Discussion sections related to the material taught in lecture meet once a week.

CLASS SCHEDULE:

Jan 18	- Jan 27	: Kinematics of a point, velocity, acceleration, straight line motion, curvilinear motion
Jan 30	- Feb 6	: Equations of motion for a particle
Feb 8	- Feb 13	: Principle of work and energy, conservation
Feb 15		: **Exam 1 (Chapters 13 and 14)**
Feb 17	- Feb 24	: Principle of impulse and momentum, principle of angular impulse and momentum, impacts
Feb 27	- Mar 9	: Kinematics of 2D rigid bodies
Mar 7		: **Exam 2 (Chapters 15, 16)**
Mar 12	- **Mar 16**	: **Spring Break**
Mar 19	- Mar 21	: Dynamics of 2D rigid bodies
Mar 23	- Mar 26	: Equations of motion for 2D rigid body dynamics
Mar 28	- Apr 6	: Energy and momentum principles for 2D rigid bodies
Apr 9	- Apr 16	: 3D kinematics and dynamics of rigid bodies, Euler equations
Apr 18		: **Exam 3 (Chapters 17, 18, and 19)**
Apr 20		: Euler angles
Apr 23	- May 4	: Vibrations
May 11		: **Final Exam 9:00-12:00 noon**

CLASS OUTLINE:

Chapter 13.1 - 13.7 : Position, velocity, acceleration, straight-line motion, curvilinear motion.
Chapter 14.1 - 14.4 : Newtons 2nd Law, equations of motion for the center of mass, inertial reference frames, applications.
Chapter 15.1 - 15.4 : Principle of work and energy, work done by particular forces, work and potential energy, conservative forces.
Chapter 16.1 - 16.3 : Principle of impulse and momentum, conservation of linear momentum, impacts, angular momentum.
Chapter 17.1 - 17.7 : Rigid bodies and planar kinematics, rotation about a fixed axis, accelerations, sliding contacts, moving reference frames.
Chapter 18.1 - 18.2 : Equations of motion, momentum principles for rigid bodies, applications.
Chapter 19.1 - 19.3 : Principle of work and energy, kinetic energy, work and potential energy, principle of impulse and momentum, impacts.
Chapter 20.1 - 20.3: Three-dimensional rigid bodies, kinematics and equations of motion, Euler angles.
Chapter 21.1 - 21.3: Vibrations.

GRADING: Grades will be based on the following:

Exam 1 : 15%
Exam 2 : 20%
Exam 3 : 25%
Final exam : 35%
Attendance : 5 %

The plus/minus grading system will be used.

Quizzes will be given each week in discussion sections based on the homework assignments. The average of your top 8 quiz grades can be used to substitute for one exam grade (excluding the final).

NO MAKEUP EXAMS OR MAKEUP QUIZZES WILL BE GIVEN UNDER ANY CIRCUMSTANCES.

ATTENDANCE WILL BE TAKEN APPROXIMATELY 13 TIMES IN CLASS AND THE ATTENDANCE AVERAGE IS BEST OF 10.

HOMEWORK POLICY: Homework will be assigned weekly on the Web but not graded. Quizzes based on the homework will be given in discussion sections.

EXAMINATIONS: There will be three closed book exams held during the semester, and a final exam. The exam dates are as follows:

Exam 1 : February 15
Exam 2 : March 7
Exam 3 : April 18
Final Exam : May 11, 9:00-12:00 noon

The exams will be problem-based. Scientific calculators are allowed during the exams.
CELL PHONES AND OTHER ELECTRONICS MUST BE TURNED OFF DURING EXAMS.

ATTENDANCE: Regular attendance is expected. Attendance will be taken approximately 13 times during the semester. Attendance will count as 1 point. Your top 10 attendance grades will be used to calculate your attendance average. No absences will be excused under any circumstances.

OFFICE HOURS:

Monday 10:30 - 11:30 am ACES 6.382
Wednesday 2:30 - 3:30 pm ACES 6.382
You may also send me email or call to set up an appointment.

IMPORTANT DATES:

January 20 Last day of the official add/drop period.

April 2 Last day an undergraduate student may, with the dean's approval, withdraw from the University or drop a class except for urgent and substantiated, nonacademic reasons. Last day an undergraduate student may change registration in a class to or from the pass/fail basis.

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.

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. You may also want to note any other methods of evaluation you plan to employ.

PREPARED BY: Pablo Seleson Date: January 13, 2012.