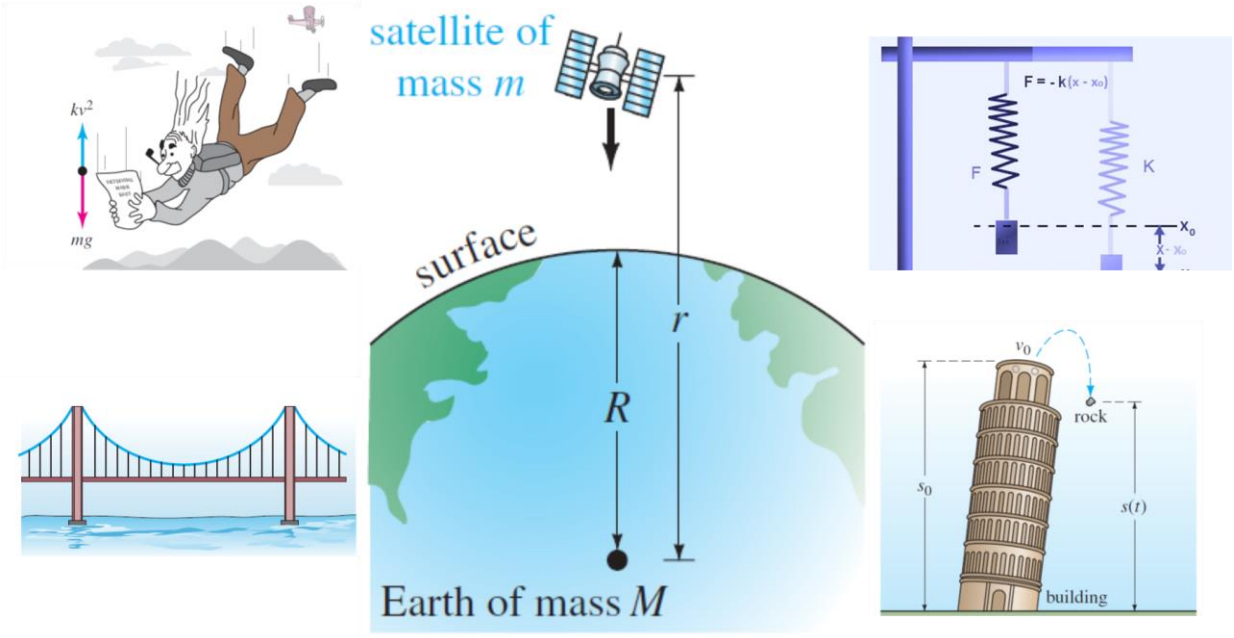
MECH 2351: Engineering Analysis I

Class Reference Number: **23594**
Class/Lab Meeting: 9:00 am - 10:20 am, TR
Class Room: **UGLC 220**
Instructor: **Ramana V. Chintalapalle, Ph.D.**
Professor
Department of Mechanical Engineering
Office: A113; E-mail: rvchintalapalle@utep.edu; Tel: **915-747-8690**
Office Hours: M: 11.00 am - 11.50 am & W9.30 am – 10.30 am
Teaching Assistant(s):

Overview

The behavior of many of the engineering as well as real-life systems or phenomenon, whether physical, sociological, or even economic, can be described in mathematical terms. The mathematical description of a system/phenomenon is called a mathematical model and is constructed with certain goals in mind. For example, we may wish to understand the mechanisms of a certain ecosystem by studying the growth of animal populations in that system, or we may wish to date fossils by analyzing the decay of a radioactive substance either in the fossil or in the stratum in which it was discovered or we may wish to estimate the time required for a satellite to get into an orbit . This course is intended and designated to prepare the mechanical engineers with a broad knowledge and skill set in modeling engineering problems via ordinary differential equations. Specifically, students will explore the fundamentals of differential equations, which governs various simple and complex real-life problems. By learning the course contents, students will be able to answer questions like differential equations for an engineering problem and solve them using Mathematica.



Course Objectives

- Introduce differential equations with a focus on the engineering applications of first and second order linear and nonlinear differential equations (ODEs) with constant coefficients, both homogeneous and inhomogeneous
- Firm understanding of the differences in the responses of the two types of ODEs
- Introduce basic linear algebra. The students need to be able to pose a large system of algebraic equations as a matrix vector system
- Develop a detailed understanding of what constitutes an over constrained and under constrained system of equations without the need to get too much into rank and span concepts. This concepts number of equations, number of unknowns, linear dependency and its manifestation and a singular system.
- A basic introduction to an advanced programing tool (e.g. Mathematica); the students at the end of the class should be comfortable solving calculus-based problems using one of those programs

Topics Covered

The topics covered in this class are

1. Introduction to differential equations (chapter 1)
2. First-order differential equations (chapter 2)
3. Modelling with first-order differential equations (chapter 3)
4. Higher-order differential equations (chapter 4)
5. Modelling with higher-order differential equations (chapter 5)
6. Linear algebra (from reference books)

**Subjected to revision during the first two weeks of the semester

Grading

Your grade for this course will be assessed based on your performance in the quizzes, home work and/or assignments, mid-term exams, group project and final exam towards the end of course. Quizzes will be given in the class, every week and throughout the semester. There will be three or four mid-term exams during the course and one final exam at the end of the semester. The following is the breakup of the grades:

Quizzes & Homework (10%)
Mid-Term Exams (55%)
Final Exam (35%)

****Instructor reserves the right to change these proportions any time during the course. However, the changes will be notified to the students.**

Your FINAL GRADE, following the letter system, will be assigned based on your overall score as per the details below.

GRADE	SCORE
A	90-100
B	80-89
C	70-79
D	60-69
F	<60

Policy on Cheating

Students are expected to be above reproach in all scholastic activities. Students who engage in scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and dismissal from the university. Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person and helping or preparing presentation/term-paper for another person. Scholastic dishonesty harms the individual, all students, and the integrity of the university, policies on scholastic dishonesty will be strictly enforced.

Text Books

Required book

1. ***Zill, Differential Equations with Boundary-Value Problems Edition: 9th edition, ISBN: 9781305965799, 2017, Cengage Learning***
2. ***Eugene Don, Schaum's Outline of Mathematica: 2nd Edition, ISBN-13: 978-0071608282***
3. Richard Bronson and Gabriel Costa, Schaum's Outline of Differential Equations, 3rd Edition, McGraw-Hill.
4. Seymour Lipschutz and Marc Lipson, Schaum's Outline of Linear Algebra, 4th Edition, McGraw-Hill.
5. Saber Elayd, An Introduction to Difference Equations (Undergraduate Texts in Mathematics), 3rd Edition, Springer
6. Gilbert Strang, Introduction to Linear Algebra, Fourth Edition, 4th Edition, Wellesley Cambridge Press

Following is the Schedule of Lectures, Quizzes, Mid-Term Exams and FINAL EXAM

Week	Date	Lecture/Quiz/Exam		Remarks
1	8/28 -8/30	***Introduction to the Course Structure, Objectives, Performance Expectations, Grading Policies and Exam Schedule*** ***L-1*** ***L-2***		
2	09/04-09/06	L-3 L-4		
3	09/11-09/13	L-5 L-6		
4	09/18 – 09/20	L-7	**EXAM-1 (Wednesday)**	

5	09/25 – 09/27	L-8 L-9		
6	10/02 – 10/04	L-10 L-11		
7	10/09 – 10/11	L-12	**EXAM-2 (Wednesday)**	★
8	10/16 – 10/18	L-13 L-14		
10	10/23 - 10/25	L-15 L-16		
10	10/30 - 11/02	L-17 L-18		
11	11/06 - 11/08	L-19 L-20		
12	11/13 - 11/15	L-21	**EXAM-3 (Wednesday)**	★
13	11/20	L-22	***Thanksgiving Holiday (No Class on 11/22)***	
14	11/27 - 11/29	L-23 L-24		
15	12/04 V 12/06	L-25 L-26	**Review Session/**	★
	★ **FINAL EXAM**	**Friday, DEC 10th**	**am – am**	★

Disabilities

If you have a disability and need classroom accommodations, please contact: The Center for Accommodations and Support Services (CASS) at 747-5148, or by email to cass@utep.edu, or visit their office located in UTEP Union East, Room 106. For additional information, please visit the CASS website at www.sa.utep.edu/cass.

Mechanical Engineering - Safety Statement

The Department of Mechanical Engineering at the University of Texas at El Paso is committed to a model of excellence in education that includes providing a safe and healthy environment for its students, staff, faculty, and the general public.

Our goal is to maximize education and research training that can only occur if you, the individual, minimize hazards and risks. This can be done by:

» providing adequate control of the health and safety risks arising from any and all activities;
» consulting with employees on matters affecting their health and safety;
» providing and maintaining safe laboratories and equipment;
» ensuring safe handling and use of substances;
» ensuring all employees are competent to do their tasks and have adequate training; and
» maintaining clean, safe and healthy working conditions;

The principal investigator or individual in charge of each laboratory is ultimately responsible for safety in that respective lab. This includes training and ultimate release of the laboratory. Within the Department, we hold every employee (staff, faculty, student) responsible for implementing our safety practices and our departmental safety policy. We hold every employee (staff, faculty, student) responsible for providing leadership within our department to establish effective environmental, safety and occupational health standards.

Prepared by:

Ramana V. Chintalapalle, Professor, Mechanical Engineering