

Analytical Mechanics & Vibrations
EGR 463
Spring 2021

Instructor: Kurt DeGoede (Professor of Engineering and Physics)
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Office Hours: M Tu W Th: 2:00-3:20
Or by appointment. Please feel free to stop by my office anytime, if my door is closed please leave a note.

Class Meetings: Tu & Th 11:00 - 12:20. N212. OR
<https://etown.zoom.us/j/97194860766>

Text Available on Knovel ([link](#)):

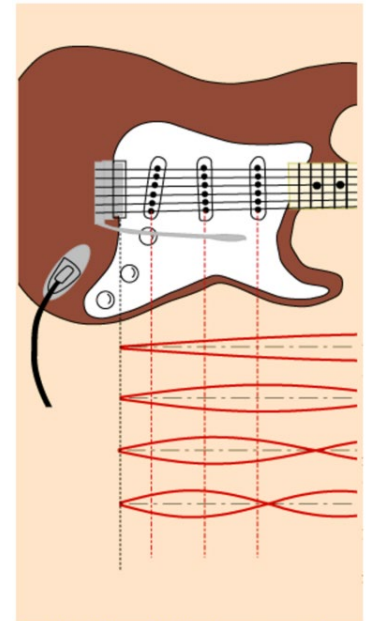
ISBN Number:	978-0-19-514246-4
Author:	Tongue
Title:	Principles of Vibration
Edition and Copyright:	2 nd , 2002
Publisher:	Oxford

Course Description: Lagrangian formulations for three-dimensional motion of particles and rigid bodies. Linear free and forced responses of one and multi degree of freedom systems and simple continuous systems. Introduction to vibration control/absorption.

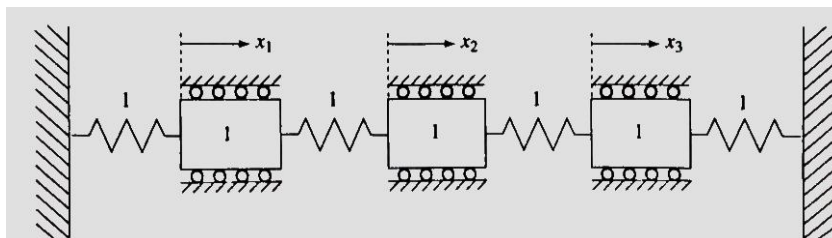
Course Objectives: The students will learn to use Lagrangian mechanics to solve advanced problems in dynamics and vibrations, and set up the wave equation (ABET outcome 1). They will learn to use MATLAB and other computational tools to solve equations of motion, the wave equation, and model complex systems (ABET 1). Emphasis is on multi degree of freedom oscillatory systems.

Students will solve realistic complex engineering problems (multi DOF vibrating systems) using modern analytical tools (MATLAB and Simscape Multibody) including a special emphasis on appropriate approximation methods (ABET 1). Students will design vibration isolators (ABET 2).

Prerequisites: EGR360, MA321



<http://hyperphysics.phy-astr.gsu.edu>



Grading:

Grading System				
Topic	Homework	Proficiency ^ψ	Mastery Exam ^δ	Mastery Project ^δ
Lagrange	*	+1/3 grade	+1/3 grade	NA
1-D	*	+1/3 grade	} → +1/3 grade [‡]	+2/3 grade
n-D	*	+1/3 grade		+2/3 grade
Continuous	*	N/A	+1/3 grade	NA
*Homework	+1/3 grade [†]			

^ψ You may re-take Proficiency Quizzes on every subsequent test date. There is no partial credit on proficiency quizzes.

^δ Mastery Exams are assessed at four levels:

- 0 – No credit
- 2 – Above Proficiency
- 5 – Good
- 7 – Excellent

^δ Mastery Projects are assessed at four levels:

- 0 – No credit
- 4 – Above Proficiency
- 10 – Good
- 14 – Excellent

[‡] On the third exam date there will be a combined discrete oscillator Mastery Quiz

^δ Partial credit on mastery assessments sums. Sum all your mastery points and divide by 7: $M = \text{Points}/7$. Your final grade is raised by $M/3$ of letter grade. Final Grades are rounded. $\geq X.5$ rounds up. For example, if you score 'Good' on all 5 Mastery assessments your final grade will be raised by $5/3$ of a letter grade, from a C- to a B+.

[†] To meet HW expectations, students must average 75% on Homework assignments (20% lowest of Homework will be dropped). HW is designed for student learning, not assessment of mastery. Author/Instructor solutions will be posted for every assigned problem for self-evaluation. You will be expected to contribute to on-line and in class discussion of these materials. Class time will be focused on the mastery of the application of course material.

There are 11 possible increases in the grade. Meet all 11 for a Grade of A (any 5 for C, any 8 for B, etc.).

Course Topics:

1. **Lagrangian Mechanics (4 sessions)**
Prof. Quiz I, Mastery Exam I
2. **1 DOF Systems + Intro to Sim Mechanics (7 sessions)**
Prof. Q II, Mastery Exam III and Project 1
3. **Multi-DOF Systems (8 sessions)**
Prof. Quiz III, Mastery Exam III and Project 2
4. **Wave Equation (6 sessions)**
Mastery Exam IV (FE)

Tue	Thu
Jan 26 R:1.5 Lagrangian	Lagrangian
Feb 2 Lagrangian	SimMechanics
9 R: Ch1.1-1.4 Intro to vibes	Lagrangian

Tue	Thu
16 Quiz & Exam I (Lagrangian)	Free Vibration
23 R: 2.1-2.4 Forced Vibration	R: 2.5-2.7 Forced Vibration
Mar 2 R: 2.8-2.12 Forced Vibration	1DoF Oscillators Review Project 1 Work
9 Quiz II (1-DOF)	Project 1 Due (1-DOF) R: 4.1-4.3 Multi-DOF Systems
16 R: 7.1-7.4 Multi-DOF Systems	R: 4.4-4.5 Multi-DOF Systems
23 R: 4.6-4.9 Multi-DOF Systems	No Class: Study Break
30 Multi-DOF Systems	R: 4.10-4.12 Multi-DOF Systems
Apr 6 R: 4.13-4.15 Multi-DOF Systems	Multi-DOF Systems Project 2 Work
13 Quiz and Exam III (n-DOF)	R: 5.1-5.2 Continuous Systems
20 SCAD – No Classes	R: 5.2 Continuous Systems
27 Continuous Systems	Project 2 Due (n-DOF) R: 5.3 Continuous Systems
May 4 R: 5.4 Continuous Systems	Continuous Systems

Final Exam: Exam IV, Tuesday May 11: 11:00 AM – 2:00 PM.

Ethics: Students are to act in accordance with the Pledge of Integrity,

I pledge to respect all members of the Elizabethtown College community, and to act as a responsible member of the College community. I pledge to respect the free exchange of ideas both inside and outside the classroom. I pledge to represent as my work only that which is indeed my own, refraining from all forms of lying, plagiarizing, cheating, and academic dishonesty.

As members of the Elizabethtown College community, we hold each other responsible in the maintaining of these values.

and the NSPE code of ethics (Cannons attached, with Etown Engineering Professional Obligations)

Students will be asked to reaffirm their commitment to the pledge and the code with their signature on each exam. Dishonest practice can result in failure of the course and possibly expulsion from the college.

All work should represent each student's individual efforts. **Students are encouraged to discuss assignments with other students and/or the instructor, however submitted assignments should reflect the student's own work and understanding.** Any solution obtained from any source should be properly referenced.

All **quizzes and exams** will be taken using only the "Just the Facts+" packet and a calculator approved for use on the FE/PE exams (<http://ncees.org/exams/calculator/>). The use of any other electronic device (graphing calculators, cell phones, smartwatches, etc.) is strictly prohibited. If a student is found using one of the prohibited devices, the item(s) will be confiscated, and the student will receive a 3-skill penalty.

Assessments are to be taken without communication, except for problem clarification from the instructor. During testing, students are not allowed to access any resources beyond those explicitly permitted by the instructor, including but not limited to online materials and books/note/study guides. Students will not be permitted to leave the classroom (or their zoom window) during assessments. Exceptions will be granted at the professor's discretion.

EMCS Remote Testing Policy: Students taking assessments remotely may be called upon to additionally present their work orally. When taking remote assessments, students must provide live video of their workspace (including full coverage of hand movement) during the session. Remote assessments will be proctored and recorded. If you need to reach off screen, use Zoom chat to obtain permission.

Re-Grading: Written requests, with full rationale, for re-grading of all course-work will be accepted the next class period after original materials are returned to the students.

[Disabilities Statement](#)

[Religious Observance](#)

Fine Print: The preceding information represents the *intent* of the course and is subject to change at the discretion of the instructor.

Elizabethtown Engineering Program Code of Ethics

- I. Hold paramount the safety, health, and welfare of fellow students.
- II. Perform project tasks and assignments only in the areas of their competence.
- III. Submit assignments only in an objective and truthful manner.
- IV. Act for team members, instructors, or employers as faithful agents or trustees.
- V. Avoid deceptive acts.
- VI. Conduct themselves responsibly, ethically, lawfully, and in line with the integrity policy so as to enhance the honor, reputation, and usefulness of the profession and college's engineering department.

Professional Obligations (Etown Engineering Students)

- 1. **Engineering students shall be guided in all their relations by the highest standards of honesty and integrity.**
 - A. Be honest about your mistakes.
 - B. Do not cheat on exams or assignments.
 - C. Do not plagiarize or falsify data.
 - D. Do not aid or abet another student in unethical behavior.
- 2. **Engineers shall at all times strive to gain the knowledge to serve the public's interest.**
 - A. Your goal in class should be to gain knowledge to justify your intended degree, not just to obtain a high grade.
 - B. Work for the advancement of society and the profession by engaging in the community, and recruiting youth to the engineering profession.
 - C. Inform professors of unethical requests from other students.
- 3. **Engineers shall avoid all conduct or practice that deceives other students, instructors, or the public.**
 - A. In lab work, be truthful with ALL data, even if it is not favorable.
 - B. All assignments should be your own original work unless otherwise noted.
 - C. Do not finish and submit team projects without the approval of ALL your other team members.
- 4. **Engineers shall not disclose confidential information concerning their own group work to any person outside of their group except for the professor.**
 - A. Do not put individual assignments in your public folder.
 - B. Do not spread the word of quiz questions or unannounced assignments to later sections of a course.
 - C. Engineering students who are or have been a TA shall not disclose information about tests and grades of other students.
 - D. Do not disclose or use information learned from the internships that have to do with processes, or techniques of production.
- 5. **Engineering students shall not be influenced in their scholastic duties by conflicting interests.**
 - A. Do not attempt to receive a favorable grade or recommendation by establishing an unprofessional relationship with a professor.
 - B. In peer assessments or as a TA, do not allow friendships or grades to sway judgment
 - C. Do not attempt to gain favor in class or for assignments through flattery of professors.

6. **Students should not attempt to gain advancement by downgrading other students' work or by other questionable methods.**
 - A. Credit should be awarded where it is deserved when submitting group work.
 - B. If another student does exceptional work, do not take credit for it if it is not your work.
 - C. If another student is performing inadequate work, calmly confront them about it before addressing it to the professor.
 - D. Students shall not sabotage the projects or advancements done by other students.
 - E. Do not blame group members for their own behavior.
 - F. Do not blame professors or staff for their grades.
7. **Engineering students should not attempt to injure the reputation of the engineering department or the reputation of professors and engineers in the department.**
 - A. If other engineering students are injuring the reputation of the department, you should inform the head of the department or the professor of their actions.
 - B. Every student in the department's actions should coincide with the integrity policy of the college to avoid degrading the department.
 - C. Students shall report malicious activities to the Head of the Engineering Department, or appropriate instructor. Yet, the student shall not tell others of the issue.
8. **Engineering students should accept personal responsibility for all of the work they do for the department and for their group.**
 - A. Students shall act truthfully when accused of misconduct.
 - B. Blame for violations of the integrity policy should not be placed on the department or professors, but rather on the individual who committed them.
 - C. Students should also accept the blame if their group submits unethical work because it is their responsibility to ensure any submission with their name on it is held to high ethical standards.
9. **Engineering students shall give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others.**
 - A. Students shall not steal programs or work from other engineers or students from the internet through illegal networks.
 - B. Students shall properly cite information in all manners of presentation such as research papers, essays, PowerPoints, etc.

*Obligations written by Etown Engineering students Class of 2021
Cannons adapted from: <https://www.nspe.org/resources/ethics/code-ethics>*