Engineering Dynamics
PHYS/ENGR 3421.001 Syllabus (Lecture and Lab)
Spring 2024

(Follows Template for Spring 2023)

GENERAL COURSE INFORMATION
Name and Department: Dr. Harry D. Downing, Professor of Physics and Regents Scholar, Department of Physics, Engineering and Astronomy
Instructor Homepage: http://faculty.sfasu.edu/downingharry/downing.htm
Office: Room 207M, Cole STEM Building
Student/Office Hours: 2-3 M, 12-1 T, 3-4 W&F,
or by appointment/207M Cole STEM Bldg (Make an Appointment)
Phone/Fax/E-mail: 468-2290 or 468-3001/Fax: 468-4448/hdowning@sfasu.edu
Class Meeting Times and Place/Modality: 12-12:50 MWF, 2-4:50 T STEM 201/TRSFA(F2F)
Physics Homepage: http://www.sfasu.edu/academics/colleges/sciences-math/physics-engineering-
astronomy/academics/physics

Text and Materials:

*Vector Mech. for Engineers: Statics/Dynamics*
Authors: Beer, Johnston, Mazurek, Cornwell, Self

It is necessary that you acquire this edition of the text. Homework and reading will be assigned assuming the student has this text. Hard copies of homework assignments will not be handed out to the student.

Other materials needed in the course:
Engineering paper that is grid ruled (assignment submission)
Scientific calculator or better (for homework)
Ruler, compass, any other drafting tools for FBD sketches

COURSE DESCRIPTION
Basic theory of engineering mechanics, using calculus, involving the motion of particles, rigid bodies, and systems of particles; Newton's Laws; work and energy relationships; principles of impulse and momentum; application of kinetics and kinematics to the solution of engineering problems. Hamiltonian and Lagrangian mechanics. Four semester hours, three hours lecture, three hours lab per week. Prerequisite: ENGR 2401 for ENPH majors. PHYS 3421 and ENGR 3421 are cross-listed.

This is the intermediate level course in dynamics that employs various problem-solving methods and the laws of mechanics to analyze and obtain solutions to fundamental problems in engineering and physics. The material covered and the associated laboratory exercises warrant this lecture and lab as being worthy of 4 semester hours credit.

PROGRAM LEARNING OUTCOMES
- Knowledge: The student will demonstrate knowledge and comprehension of the basic and applied fields of physics.
- Problem Solving: The student will develop independent problem solving skills.
Written Communications: The student will develop effective written communication skills by clear and concise problem solving, well-structured laboratory reports, and accepted formatting of research papers.

Oral Communications: The student will develop effective oral communication skills in oral presentations of problem solution, seminars, and oral presentations at scientific meetings.

PROGRAM LEARNING OUTCOMES (for ENGR Majors)
See “Course Learning Outcomes” in the ABET syllabus at the end of this document.

GENERAL EDUCATION CORE CURRICULUM OBJECTIVES/OUTCOMES
This course is not included in the general education core curriculum.

STUDENT LEARNING OUTCOMES
By the end of the course, successful students will be able to:

- Demonstrate an advanced level knowledge and understanding of the laws of classical mechanics to include representing these laws in mathematical expressions with appropriate units for physical quantities.
- Show quantitative and analytical skills necessary to solving physics/engineering problems.
- Exhibit effective written communication skills in presentations of physics/engineering homework problems.
- Exhibit effective oral communication skills in presentations of physics/engineering problems to one’s peers.

COURSE OBJECTIVES
The main objective of this course in mechanics is to develop in the engineering/physics student the ability to analyze any problem in a simple and logical manner and to apply to its solution a few, well-understood, basic principles. A cooperative problem solving approach is taken where students develop time management skills and teaming skills.

COURSE REQUIREMENTS/GRADING POLICY
- Poor performance on any test might result in a personal visit to the instructor’s office or via Zoom.
- The tests will be done in symbolic form; therefore, no calculators will be allowed.
- All students must do one conference with the course instructor (poor performance visit can count as this conference) during the semester regardless of what their test scores are. This conference will be part of your lab grade. It will be done F2F or via Zoom (if necessary) toward the beginning of the semester.
- Homework will be worth 1/8th of your overall grade.
- Oral presentations, attendance, and performance during the problem sessions (PHYS/ENGR lab) will be 1/8th of your overall grade.

EXAMS
- There will be four to maybe six exams during the lab this semester. Each problem on an exam will be regarded as an individual test. For example, if the exam has three problems, then there will be three test scores entered in the grade sheet.
- Test dates and what the tests will cover will be announced in class at least a week in advance. These tests (individual problems) will comprise the bulk of your grade in this course. The final examination period will consist of three to four problems and it will not be comprehensive. It will cover Lagrangian and Hamiltonian formulations plus one problem from Chapter 17.
- The tentative dates of exams are listed in the course outline shown in this document. Students will have one week after each exam to review the exams and discuss the grades. No make-up exams will be given except in the case of an excused absence. An official written notice is required for an excused absence within three days of the exam. Any makeup exam must be taken within three days of the missed exam.
The style of exam as well as allowed materials for the exams will be communicated to the student in class.

- Make-up points for exams will come from finishing problems that didn’t get completed in class and pop quizzes during the first 5 minutes of class. Don’t be tardy.

**Pre-Lecture Assignments**
Students will be tasked to complete reading assignments from their text and to view videos from D2L. Each reading assignment and video viewing will be posted well before the lecture in which the material is covered. It is the responsibility of the student to complete these reading assignments and videos **BEFORE** the appropriate class or the deadline shown. The grades for these assignments will be based on in class short quizzes, primarily multiple choice.

**In Class Presentations**
All in class assignments during lab must be completed by the end of the class period by the teams involved. The grade for these assignments and participation will be averaged with the homework to give 25% of your final grade. It is the discretion of the instructor to grant additional time if deemed necessary.

**Grading Policy**

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam 1</td>
<td>16%</td>
</tr>
<tr>
<td>Exam 2</td>
<td>16%</td>
</tr>
<tr>
<td>Exam 3</td>
<td>16%</td>
</tr>
<tr>
<td>Homework, assignments, in-class activities</td>
<td>25%</td>
</tr>
<tr>
<td>Pre-Lecture assignments</td>
<td>11%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>16%</td>
</tr>
</tbody>
</table>

Letter grades are based on the following ranges:

A  90.0 – 100%  B  80.0 - 89.9%  C  70.0 - 79.9%  D  60.0 - 69.9%  F  < 60.0%

**HINTS FOR SUCCESS IN PHYS/ENGR 3421**
You will benefit much more from lecture if you **read the text** material before coming to class. Attend classes (Face to face, livestream, etc.) and take notes. Don’t try to copy everything I say, write on the “board,” or show in slides or video. Leave enough space in your notes to complement them through a thorough **reading of the text** material. I generally present material in class in the same order as the text. This makes it easier for you to augment your notes. **Read** the “Solving Problems on Your Own” sections preceding the problems and the “Review and Summary” section at the end of each chapter. If you have problems trying to comprehend this material, please do not hesitate to come and visit with me. I have truly enjoyed working with students, and often I have found that I am most effective with them when they have brought their questions and problems to me in my office.

**The most important things you can do are read the book, attend class and be attentive, and do the homework!!!**

**Format for PHY/EGR 3421 Homework**
Your homework problems will be of professional quality and professionally presented. The problems will be complete in themselves to the extent that any competent person, without reference to any material other than what you present, can determine the following: (a) the problem you are solving, (b) your method of solution, and (c) your answer. To assure these things you **must** adhere to the following rules:
1. Use engineering pad paper.
2. Before submitting homework problems for review, check for the following:
   - Problems neat and in correct order
   - Organized steps in the solution
   - Sufficient space for grader comments
   - No more than one problem per page
   - Homework left flat (not folded)
   - Pencil used instead of ink
   - Always restate the problem sufficiently so the grader is aware of what you are solving, and draw a diagram on every problem – make sure to label appropriately
   - Make sure to outline what values are given and the values you are trying to solve for
   - Use only one side of the paper (typically the side facing you on the pad)
   - Include your name and problem number on each page
   - Use a ruler to set up your diagrams or in drawing elements, or appropriate electronic equivalent
   - Show the progression of your solution, clearly identify appropriate units when necessary
   - Indicate final answers by placing a surrounding box, don’t forget the units!!
3. Include the following when appropriate while working a problem:
   - Sketch
   - Definition of variables used
   - Units and vector arrows
   - Numbering of equations for clarity
   - Needed graphs at the back of the problem (the side with a graphing grid)

Treat this as if I am your client and you need to impress me with your engineering calculations. Homework due dates and times will be communicated to the student in class. No late homework will be accepted unless you have an excused absence.

Homework Rules
The homework will be divided into two (not equal parts). There will be about 1/2 graded by me and about 1/2 graded by you (integrity homework) after seeing my solutions. Homework that I grade will count 10 points each, and integrity homework will count 5 point each.

During the semester you may have one homework problem that will be required to have a formal submission. Advance notice will be given. The submission must be a Word document using some form of a math editor and must have the look of a paper being submitted for publication. It will be graded and returned for corrections. It will be resubmitted for a second grading. The two grades will be averaged together and will count as 20% of your homework grade. You might be required to give an oral presentation of this problem as part of this 20%.

Miscellaneous Information
Students will have one week after the return of their graded exams/quizzes to discuss any possible errors made in the grading. Thereafter, no changes will be made concerning the grades for that exam. Keys to each exam will be posted online.

This syllabus is just a guide. If you miss an exam with a reasonable excuse, you will be allowed to take a make-up exam part of which might be oral. Reasonable excuses must be written and from the proper authority. Each problem given in an exam period will be considered to be a separate exam. For example if the first exam period has three problems, they will be considered to be exams 1, 2, and 3 and so on. Test dates and what the tests will cover will be announced in class.
ATTENDANCE
Absences from lab must be made up through extra homework. The first absence incurs one extra homework problem. Any further absences will incur three extra homework problems for each absence occurrence. Each of these extra homework problems must be submitted until each is completely correct. A deadline will be set for the completion of each extra problem. Failure to meet this deadline will increase the number of problems required. Failure to complete all extra homework by the end of the semester will result in a one letter grade reduction in your final grade in this course. Every four absences from lecture will count as if it were one lab absence, and lab absence rules will apply. Every four tardies (five minutes or more late) to lecture or lab will count as one lecture absence. Five unexcused absences from lecture and/or lab will result in a grade reduction of one letter grade. Seven will result in an F for the course. Absences from classes before and after breaks will count as double absences. (They will count as single absences toward letter grade reductions.) Failing to confirm the watching of a video lecture will count as a lecture absence. To get presentation points you must be present in class when the problem is presented to the rest of the class. Students should become familiar with the policies on cheating and plagiarism.

CLASSROOM POLICIES (when face-to-face)
Masks (cloth face coverings), when required, must be worn over the nose and mouth at all times in this class and appropriate physical distancing must be observed (again when required). Students not wearing a mask and/or not observing appropriate physical distancing will be asked to leave the class. All incidents of not wearing a mask and/or not observing appropriate physical distancing will be reported to the Office of Student Rights and Responsibilities. Students who are reported for multiple infractions of not wearing a mask and/or not observing appropriate physical distancing may be subject to disciplinary actions.
For the benefit of your fellow students and your instructor, you are expected to practice common courtesy with regard to all course interactions.
For example:
- Be considerate toward your classmates and instructor and arrive to class on time.
- Do not leave class early and do not rustle papers in preparation to leave before class is dismissed.
- Avoid classroom distractions. Be attentive in class, stay awake, and do not read newspapers, etc.
- If you are late to class or must leave early, please inform your instructor in advance (enter or leave quietly, don’t walk across the front of the classroom (use the side aisles) and don’t walk in front of the projector).
- Cell phones, pagers and other communication devices must be turned off during class. Failure to do so could result in confiscation and loss of bonus points.
- Be kind and respectful to your fellow students and your teachers.

EMAIL COMMUNICATIONS
Make sure you always use your SFA e-mail account for network correspondence. Messages from your instructor will be sent to your SFA email account periodically. You may forward e-mail from your SFA e-mail address to another address of your choice. To do this, use this link:
http://www.sfasu.edu/mysfa/o365/forwarding-email/

Academic Integrity (4.1)
Academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways, including instruction on the components of academic honesty and abiding by university policy on penalties for cheating and plagiarism.
Collaboration on examinations, in class assignments, and homework assignments is forbidden except where specifically specified as "Team" activities. For example, homework assignments can be worked on as a team but must be completed separately. In general, one team may not collaborate with another team on "Team" activities. Students violating this policy will be subject to procedures described in the Stephen F. Austin State University Policies and Procedures Manual.

Definition of Academic Dishonesty
Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit. Please read the complete policy at http://www.sfasu.edu/policies/student-academic-dishonesty-4.1.pdf.

Withheld Grades Semester Grades Policy (5.5)
Ordinarily, at the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future terms the WH will automatically become an F and will be counted as a repeated course to compute the grade point average. For additional information, go to https://www.sfasu.edu/policies/course-grades-5.5.pdf.

Students with Disabilities
*Please copy and paste the following statement and place it in your course syllabus.*

To obtain disability-related accommodations, alternate formats, and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services promptly may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

Mental Health and Wellness
*Please copy and paste the following information into your course syllabus.*

SFA values students’ mental health and the role it plays in academic and overall student success. SFA provides a variety of resources to support students' mental health and wellness. Many of these resources are free, and all of them are confidential.
**On-campus Resources:**
SFA Counseling Service  
www.sfasu.edu/counselingservices  
Health and Wellness Hub (corner of E. College and Raguet)  
936.468.2401

**SFA Human Services Counseling Clinic**  
www.sfasu.edu/humanservices/139.a  
sp Human Services, Room 202  
936.468.1041

**Crisis Resources:**  
Burke 24-hour crisis line: 1.800.392.8343S  
National Suicide Crisis Prevention: 9-8-8  
Suicide Prevention Lifeline: 1.800.273.TALK  
(8255) Crisis Text Line: Text HELLO to 741-741

Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program. Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This policy applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the iCare: Early Alert Program at SFA. Information regarding the iCare program is found at http://www.sfasu.edu/judicial/earlyalert.asp or call the office at 936-468-2703.

**Course Contact Hours and Study Hours**
The class meets 3 hrs/wk for 15 weeks, and it also meets for a 2-hour final examination. This is a problem-oriented class and lab with homework problems. The lecture and lab combine for 6 hours of contact time each week and the work outside of classes each week for the combined courses averages much more than 12 hours in working homework problems, reading the book to understand the theories used in lecture and in homework problems and exams, reading the lab manual to prepare for the lab experiments done each week, writing up the lab experiments, and studying for exams which include major exams and possibly short lecture quizzes.
# PHYS/ENGR 3421.001 and 3021.021
## Course Lecture and Lab Outline and Calendar
### Spring 2024

<table>
<thead>
<tr>
<th>MON</th>
<th>TUE</th>
<th>WED</th>
<th>THU</th>
<th>FRI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ch. 11</td>
<td>Ch. 11</td>
<td>Ch. 11</td>
<td>Ch. 11</td>
<td>Ch. 11</td>
</tr>
</tbody>
</table>

### Ch. 11 Kinematics of Particles
- Motions - rectilinear, relative, curvilinear and non-rectangular

### Ch. 12 Kinetics of Particles: Newton’s Second Law
- Newton’s second law, linear and angular momentum, central force, and orbital motion

### Ch. 13 Kinetics of Particles: Energy and Momentum Methods
- Work and energy, impulse and momentum, conservation of energy and momentum

### Ch. 14 Systems of Particles
- Newton’s laws, energy and momentum

### Ch. 15 Kinematics of Rigid Bodies
- Translation and fixed axis rotations, general plane motion, rotating reference frames.

### Ch. 16 Plane Motion of Rigid Bodies: Forces and Acceleration
- Kinetics of rigid bodies, forces & accelerations

### Ch. 17 Plane Motion of Rigid Bodies: Energy and Momentum Methods
- Energy and momentum methods for a rigid body

### Lagrangian Mechanics (LM) → Hamiltonian Mechanics (HM) →

### Final Exams
<table>
<thead>
<tr>
<th>Final</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 6</td>
<td>May 7</td>
</tr>
<tr>
<td>May 8</td>
<td>May 9</td>
</tr>
<tr>
<td>May 10</td>
<td>May 10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final 1:00 pm - 3:00 pm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Comprehensive Lab Time</td>
</tr>
<tr>
<td>Not Comprehensive Lec Time</td>
</tr>
</tbody>
</table>
Course Description:
Basic theory of engineering mechanics, using calculus, involving the motion of particles, rigid bodies, and systems of particles; Newton's Laws; work and energy relationships; principles of impulse and momentum; application of kinetics and kinematics to the solution of engineering problems. Hamiltonian and Lagrangian mechanics.

Prerequisites: PHYS 2450 or ENGR 2450  Co-Requisites: None

Credits: 4 Hours (Lecture: 3 Hours, Laboratory: 3 Hours)

Instructor: Harry D. Downing, Ph.D.

Textbook: Vector Mechanics for Engineers: Statics and Dynamics, 12 edition, Beer, Johnston, Mazurek, Cornwell, Self

Supplemental Materials: None

Topics Covered:

Course Learning Outcomes
By the end of the course, a successful student will be able to:
1. Demonstrate an advanced level knowledge and understanding of the laws of classical mechanics to include representing these laws in mathematical expressions with appropriate units for physical quantities.
2. Show quantitative and analytical skills necessary to solving physics/engineering problems.
3. Exhibit effective written communication skills in presentations of physics/engineering homework problems.
4. Exhibit effective oral communication skills in presentations of physics/engineering problems to one’s peers.