NIU *PHYS 253* – **Fundamentals of Physics 1**, Fall 2020

Syllabus

(The latest version of this document can be found under the course's *Content* section on *Blackboard.*)

Course Description: Physical laws governing motion, force, energy, rotation, and vibration using calculus. Primarily for majors in the physical and mathematical sciences and engineering. One three-hour laboratory a week. Not available for credit to students with credit in PHYS 210.

Prerequisite: None. However, there is a **Co-requisite**: MATH 229.

Credit hours: 3

Course objective: We'll learn

1. How to think and act like a physicist
    a. Use significant figures and orders of magnitude to make estimates of physical quantities.
    b. Apply dimensional analysis to an equation involving units of length, time and mass.
    c. Use graphs and tables to record and read data.
    d. Use addition, subtraction, and scalar multiplication of vectors.
    e. Convert vectors between "angle/magnitude" and "components" forms.

2. The Laws of Motion

    a. Find examples of Newton's three laws of motion in real-life situations.
    b. Identify weight, normal force, tension, static equilibrium, static and kinetic friction in mechanical problems.
    c. Draw a vector force diagram in two dimensions, and convert to component equations.
    d. Define position, displacement, velocity and acceleration.
    e. Set up and solve equations of motion of a body under constant acceleration.
    f. Solve equilibrium and dynamic problems with inclined planes and pulleys.
    g. Use kinematic equations in two dimensions to solve for quantities in projectile motion.

3. Conservation Laws

    a. Define angular velocity, angular acceleration & centripetal force.
    b. Solve problems of horizontal and vertical circular motion.
    c. Give examples of Kepler's laws of planetary motion.
    d. Define work, kinetic energy, potential energy, and power and their relationships.
    e. Solve equilibrium and dynamic problems with a spring.
    f. Identify conservative forces in mechanical problems and find the potential energy.
    g. Define momentum and impulse.
    h. Calculate the center of mass of a system of discrete masses or a simple symmetric object.
    i. Apply the conservation of momentum to solve problems of collisions between two objects.
    j. Define torque, moment of inertia, and angular momentum and the relationship between them.
    k. Solve problems involving wheels rolling without slipping.
    l. Apply linear and rotational equilibrium conditions to solve statics problems.

Learning outcome: At the end of the course, the students will be able to analyze simple mechanical systems under static equilibrium and those in dynamic motion, set up and solve the relevant equations. They will have an appreciation of the fundamental role of tools and concepts learned in the course in the fields of physics and engineering. They will also be ready for the next course in the Fundamentals of Physics series, which deals with Electricity and Magnetism.

Course web page: BlackBoard: https://webcourses.niu.edu/. The Blackboard page for this course will be linked to Cengage subscription to whose WebAssign service **is mandatory for this course**. Students are expected to stay up-to-date with the contents of this page throughout the semester. Students should always access Cengage/WebAssign through Blackboard (after choosing the course on BB, click on the "Tools" button in the menu bar on the left, then choose WebAssign from the menu that pops up in the main panel), instead of going directly to https://www.cengage.com/ or http://www.webassign.net/.

Class meeting times: Mon, Wed, Fri 12 noon - 12:50 pm.

Classroom location: Online. The link, posted on the course web page, may change from time to time.

Instructor: *Prof. Dhiman Chakraborty*. E-mail: dchakrab@niu.edu, dhiman.chakraborty@gmail.com

Instructor Office Hours: Mon, Wed, Fri 10:30 am - 11:30 am, online: (or by appointment).

Textbook: **Physics for Scientists and Engineers: Foundations and Connections** (Katz), 1st edition. Full version or just Volume 1. It is best to purchase **Cengage Unlimited**, which combines **WebAssign** with the e-textbook. We will cover **Chapters 1-14** this semester.

Student Performance Assessment (basis of grading, tentative, may change during the course):

- **Homework**: One assignment per chapter (roughly one for each week of class, submitted on Blackboard) – **25% of total.**

- **Lab work and reports (schedule and rules posted separately)**: **25%**

- **Quizzes:** Short online preparatory quizzes before start of lecture on each chapter: **20%**.

- **Exams**: One mid-semester (**15%**) + final (**15%**). See the semester schedule below.

Grading scheme:

90-100%	85-90%	80-85%	75-80%	70-75%	65-70%	60-65%	50-60%	<50%
A	A-	B+	B	B-	C+	C	D	F

All exams and quizzes will be given during normal lecture hours.

Course Policies, Accommodation and Advice:

- Students are encouraged to seek one-on-one consultation with the instructor for any need related to the course. The more time one spends on the course, the more fruitful those sessions will be.
- Efforts will be made to communicate all important announcements relating to the course by posting on Blackboard with e-mail notification. In addition to paying prompt attention to notifications, students should make it a habit to visit the course page on Blackboard frequently – at least once the afternoon before each class. However, some announcements may also be made verbally during lectures, and not communicated in writing. If a student is absent during any part of a lecture, it is their responsibility to follow up with the instructor to be sure that they did not miss any announcement. Ignorance of any announcement – written or verbal – shall not count as an excuse.
- Attendance may be taken at random times during each lecture and used in calculation of extra credit.
- No late submission of homework assignments will be accepted and no make-up will be offered for missed attendance, quizzes, or exams, _unless_ a valid excuse is presented in official writing by an authorized party. See details under **Attendance** below.
- To get the maximum out of each lecture, come prepared by reading in advance the textbook chapter to be covered that day. A quiz will be given at the start of each chapter to test student preparedness.
- The lecture part of each class will mainly serve to revise the key ideas that the students are already supposed to have read from the textbook.

- 30-40% of the class time will be spent working in groups on problems assigned from the textbook.
- Students should have paper, pen/pencils, and a calculator handy during each class.
- Use of electronic devices such as laptops, tablets, or smart phones without the instructor's permission is prohibited during exams. The only device exempted from this rule is a physical calculator.
- Laboratory is an integral part of this course. Details of the lab part is given in a separate lab syllabus. Note that a minimum of 60% score on the lab part is required in order to pass the entire course.
- In addition to instructor office hours, graduate teaching assistants are there you need help outside the class. Help room hours are available at the Physics Department Office. Lab TAs can help as well.
- Last, but not the least, remember that we are operating under extenuating circumstances. The grave threat posed by the COVID-19 pandemic looms large above all of us, dictating what we can or cannot do. We have yet to get fully accustomed to the adjustments it calls for - operationally, behaviorally and mentally. Also, as the situation and our understanding of it evolves, so must our response to it. Many things are new to us. In addition to forcing us to deviate from a number of time-tested standard methods/practices and to adopt use of tools that are unfamiliar to us, it puts all of us under serious psychological stress. In due recognition of that, **it is vitally important that we be patient with each other**. We should be prepared to face uncertainties, accept unanticipated changes on short notice, and expect surprises - often nasty ones - from time to time until the situation has improved. Yet, with goodwill and honest effort on everyone's part to do the best we can, we should be able to achieve the learning objective. Effective communication will play a crucial role in the process. Please don't be shy about voicing your concerns, either personal or collective. The sooner they're heard, the better we can address them.

Attendance: Those wishing to do well in the course must make every effort to attending all lectures and labs. In the case of an absence due to required attendance at a university-sponsored event such as a department trip, ROTC function, athletic competition etc, or in the case of an absence due to unforeseen causes such as an illness or other emergency, reasonable attempts shall be made to allow the student to make up missed work. Students are responsible for completing the work assigned and/or due on the days they are absent. Students are required to provide the instructor with official notification in advance of a pre-planned absence (e.g., a letter from the chair of the sponsoring department, the head of the sponsoring unit, or the coach), or within a week after an unplanned one (e.g. a doctor's note) for arrangements to be made for completing missed assignments or other required course work.

Academic Integrity: Good academic work must be based on honesty. Any attempt by a student to present as his or her own work that which he or she has not produced is regarded by the faculty and administration as a serious offense. Students are considered to have cheated if they copy the work of another during an examination or turn in a paper or an assignment written, in whole or in part, by someone else. Students are guilty of plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging those sources or if they paraphrase ideas from such sources without acknowledging them. Students guilty of, or assisting others in, either cheating or plagiarism on an assignment, quiz, or examination may receive a grade of F for the course and may even be suspended or dismissed from the university. See https://www.niu.edu/academic-integrity/ and, in particular, https://www.niu.edu/conduct/academic-misconduct/index.shtml.
Accessibility for students with disabilities: Students needing disability accommodation for this course should contact the Disability Resource Center as soon as possible. The DRC is located on the 1st floor of the Campus Life Building, Suite 180, and can be reached by phone: 815-753-1303 (V) or e-mail: drc@niu.edu.

Detailed statement on accessibility at NIU: https://www.niu.edu/accessibility/index.shtml.

Syllabus Change Policy: Every effort has been made to ensure that the syllabus posted on the first day of class is as complete and accurate as possible. However, some changes can become necessary as the semester progresses under unprecedented conditions. The most up-to-date version of this document will be available in the *Content* section of the course web page on *Blackboard* throughout the semester.

Semester Schedule:

Date	Lecture Chapter	Other events	
8/24/2020	1		
8/26/2020	1	Quiz1: WebAssign	
8/28/2020	2	Quiz Ch 2	
8/31/2020	2		
9/2/2020	2	Homework Ch 1	
9/4/2020	3	Quiz Ch 3	
9/7/2020	Labor day		
9/9/2020	3		
9/11/2020	3	Homework Ch 2	
9/14/2020	4	Quiz Ch 4	
9/16/2020	4		
9/18/2020	4	Homework Ch 3	
9/21/2020	Review Ch 1-4		
9/23/2020	5	Quiz Ch 5	
9/25/2020	5		
9/28/2020	5		
9/30/2020	6	Quiz Ch 6	
10/2/2020	6		
10/5/2020	6	Homework Ch 5	
10/7/2020	7	Quiz Ch 7	
10/9/2020	7		
10/12/2020	Review Ch 5-7		
10/14/2020	Mid-term exam		Homework Ch 7 due before class
10/16/2020	8	Quiz Ch 8	
10/19/2020	8		
10/21/2020	8	Homework Ch 7	
10/23/2020	9	Quiz Ch 9	
10/26/2020	9		
10/28/2020	9	Homework Ch 8	
10/30/2020	10	Quiz Ch 10	
11/2/2020	10		
11/4/2020	Review Ch 8-10		
11/6/2020	11	Quiz Ch 11	
11/9/2020	11	Homework Ch 10	
11/11/2020	12	Quiz Ch 12	
11/13/2020	12		
11/16/2020	12	Homework Ch 11	
11/18/2020	13	Quiz Ch 13	
11/20/2020	13		
11/23/2020	14	Quiz Ch 14	
11/25/2020	Thanksgiving break		
11/27/2020			
11/30/2020	14		
12/2/2020	Review Ch 11-14		
12/4/2020	Reserve or Final Exam		
12/7/2020	Final Exam?		