

# 0702P101

## Fundamentals of Physics I (With Lab)

**Instructor:** TBA

**E-mail:** TBA

**Time:** May 9, 2022-June 10, 2022

**Office Hours:** 2 hours (according to the teaching schedule)

**Contact Hours:** 60 (50 minutes each)

**Credits:** 4

### Course Description

Fundamentals of Physics I is a general education course designed as an introduction to college physics for students majoring in the biological, environmental, earth, and social sciences, as well as disciplines such as architecture, business, and the humanities. The main emphasis of the course is on the fundamentals of Newtonian mechanics and the physics of fluids. The goals of this course are to provide the student with a clear and logical presentation of the basic concepts and principles of physics, and to strengthen student's understanding of concepts through a range of interesting applications to the real world, including practical examples that demonstrate the role of physics in our universe.

### Required Textbook

#### *College Physics from OpenStax College*

Go to <https://openstax.org/subjects> and click on blue colored College Physics to download the e-book.

A laptop or desktop with Microsoft Office.

Access to a scanner or cell phone with Adobe Scan App for preparing pdf files.

A calculator with square-root, square, sine, cosine and tangent functions.

Access to reliable and high-speed internet connection.

WeChat account

## Course Structure

This course covers 5 units on the topics listed below:

**Unit 1:** Units and significant figures, one and two-dimensional kinematics, position, velocity, and acceleration vs. time graphs, free-fall, projectile motion, vectors, trigonometric analysis of vectors, coordinate systems and vector components

**Unit 2:** Newton's three laws of motion, identifying forces, Hooke's law, static and kinetic friction, drag, free-body diagrams, equilibrium, statics in two dimensions, motion on inclined planes, dynamics in two dimensions, ropes and pulleys.

**Unit 3:** Impulse, momentum, the impulse-momentum theorem in one and two dimensions, conservation of momentum, collisions, work, power output, kinetic energy, gravitational potential energy, elastic potential energy, thermal energy, the work-energy theorem, and conservation of energy

**Unit 4:** Rotational motion, equations of motion for rotational motion, centripetal forces and accelerations, center of mass, torque, gravitational torque and stability, rotational inertia, Newton's second law for rotational motion, angular momentum, conservation of angular momentum, rotational kinetic energy

**Unit 5:** Fluids, pressure, hydraulic lifts, Buoyancy, fluid dynamics and Bernoulli's principle.

## Assessment

There will be a total of 720 points which will be convert to a percentage to assign letter grade (shown in grading scale in the next page).

**Tests** - 300 points.

There will be three unit tests at the end of first three units, each worth 100 points.

Tests will be administered on Tuesdays at 8 am Beijing time.

**Homework** - 100 points.

Four weekly homework will be assigned on Mondays at 5am and will be due on Fridays at 11:59 am Beijing time.

**Labs** – 120 points.

Three lab assignments will be assigned on Wednesdays at 5am. It is due on Mondays at 11:59 am Beijing time. Three labs total; 40 points each.

**Final Exam** – 200 points.

The final is cumulative and required.

## Grading Scale

The instructor will use the grading system as applied by JNU:

Definition	Letter Grade	Score
Excellent	A	90~100
Good	B	80~89
Satisfactory	C	70~79
Poor	D	60~69
Failed	E	Below 60

## Online Submission Procedures

**In order to receive any grade for your assignments or tests, do the followings:**

If you have a printer, print the assignment and fill in the answers. If you do not have a printer, write the answers, your name and student ID clearly on paper or by using your electronic device. Then take picture on each page (note one picture per page to have the words large enough to read). Use Adobe Scan App to convert images into a pdf file. Submit this pdf file to Moodle.

Summary of due dates (based on Beijing time)

	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1					Homework 1 due
Week 2	EXP1 due		Unit Test 1 due		Homework 2 due
Week 3	EXP2 due		Unit Test 2 due		Homework 3 due
Week 4	EXP3 due		Unit Test 3 due		Homework 4 due
Week 5					Final Exam due

## Late Assignments and No Make-up Exam

Tests, lab reports and assignments cannot be made up under any circumstances. All the tests, lab reports and assignments must submit online (see “online submission procedures” for general assignment guideline). Please inform the instructor if you foresee any difficulty in meeting required item listed (see page 1) on day 1 of this class.

Late submission except the Final Exam may be accepted within 12 hour past the due time with at least 10% grade reduction. After the late submission is received, the

instructor reserves his right to give zero grade and deduct points according to his discretion for late submission.

No late submission is allowed for the final exam so plan your time accordingly.

## **Class Schedule**

### **Week 1:**

- a. Units and significant figures
- b. Motion in one dimension
  - i. Average vs. instantaneous speed
  - ii. Velocity
  - iii. Uniform Acceleration
  - iv. Free-fall
- c. Graphing motion
  - i. Position, velocity, and acceleration vs. time graphs
- d. Vectors
  - i. Trigonometric representations of vectors
  - ii. Coordinate systems and Vector components
  - iii. Projectile motion

### **Week 2:**

- a. Motion and Force
  - i. Newton's first law

- ii. Identifying forces: friction, normal, tension, etc..
- iii. Free-body diagrams
- iv. Newtons Second Law
- v. Applying Newton's Second Law in 1 and 2D
- vi. Newton's Third Law
- b. Equilibrium
  - i. Static and dynamic equilibrium
- c. Dynamics and Newton's second Law
- d. Mass vs. weight and weightlessness
- e. Inclined planes
- f. Friction and drag
- g. Pulley systems

**Week 3:**

- a. Momentum and Impulse
  - i. Conservation of momentum
  - ii. Impulse-momentum Theorem
  - iii. Inelastic collisions vs elastic collisions
- b. Work and Energy
  - i. Work and power
  - ii. Kinetic energy
  - iii. Gravitational potential energy

- iv. Elastic potential energy
- v. Work-energy theorem
- vi. Conservation of energy

**Week 4:**

- a. Rotational motion
  - i. Uniform circular motion
  - ii. Centripetal forces and accelerations
  - iii. Angular displacement, velocity, and acceleration
- b. Torque
  - i. Gravitational torque and center of gravity
- c. Rotational dynamics
  - i. Moment of inertia
  - ii. Newton's second law for rotational motion

**Week 5:**

Fluids

- i. Pressure
- ii. Buoyancy
- iii. Fluid dynamics
- iv. Pascal Principle
- v. Archimedes Principle

vi. Bernoulli Principle

### **Experiment Description**

Exp 1: Kinematics. In this experiment, students will study the effect of angle, mass, surface friction and radii on the rolling of a disk down an incline. Students will collect the velocity-time data and analyze data to see if the motion has constant acceleration.

Exp 2: Determine coefficient of friction on an inclined plane. In this experiment, students are going to perform the experiment at home and hope students can gain the experience of determining coefficient of friction of any surface. Students will increase the angle of slope until a coin starts to slip on the slope. That angle is associated with the coefficient of friction.

Exp 3: Momentum and collision. In this experiment, students will use a simulator to study two different collisions (elastic vs inelastic collision). Students are asked to answer a series of questions in differentiating two different collisions using data.

### **Academic Integrity**

As members of the Jinan University academic community, students are expected to be honest in all of their academic coursework and activities. Academic dishonesty, includes (but is not limited to) cheating on assignments or examinations; plagiarizing, i.e., misrepresenting as one's own work any work done by another; submitting the same paper, or a substantially similar paper, to meet the requirements of more than one course without the approval and consent of the instructors concerned; or sabotaging other students' work within these general definitions. Instructors, however, determine what constitutes academic misconduct in the courses they teach. Students found guilty of academic misconduct in any portion of the academic work face



penalties that range from the lowering of their course grade to receiving a failing grade (E) in the course.