

Language: English 

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## 2021 Academic Year Course Description and Syllabus

Course Name	Instructor Name
Mechanics(2credits)	Yukio Kobayashi
Physics 1(2credits) <a href="#">[BIOI111]</a>	
Physics(2credits) <a href="#">[ENES335]</a>	
Physics A (Basic Mechanics)(2credits)	
<a href="#">[SCEN121]</a>	
Physics A (Introductory Mechanics)(2credits)	
<a href="#">[SCEN121]</a>	

Course numbers are displayed in blue color after course names.

**Semester** Spring Semester

### Course Sub Title (for general course and seminars)

Basic concepts and laws of mechanical phenomena

### General Description

Online class

Can you answer the following problems on elementary mechanics correctly?

1. Why is the trajectory of a thrown ball a parabola?
2. When a horse pulls a sleigh, the sleigh also pulls the horse. Why does the sleigh move?

This course will enable you to understand the mechanisms of mechanical phenomena based on Newton's laws of motion and to understand the fundamental principles behind the equations describing such phenomena. I hope that the discovery-oriented approach of this course will stimulate your thoughts about the physical world.

We cannot necessarily predicate that physics is the only basis of natural science. Physics intuition, however, will be useful in all areas of science and engineering. If you can only perform calculations but have no understanding of the qualitative interpretation, you cannot apply the ideas of physics to other fields.

The starting point is to understand the basic theory of number and quantity as the grammar of measurement. The most important point is to understand, from spatial and temporal viewpoints, the causal relationship between the effect of a force acting on a body and the resulting change in the magnitude of the motion of that body.

### Goals and Objectives

1. Correctly performing operations with physical quantities and understanding significant figures.
2. Calculating displacement, velocity, and acceleration based on the physical meaning of the differential and the integral.
3. Correctly finding the forces acting on a body by other bodies.
4. Analyzing physical phenomena based on the causality of motion, from spatial and temporal viewpoints.
5. Correctly distinguishing inertial and accelerated reference frames.

### General Education / Faculty Courses: Most relevant Learning Outcomes for this course.

- Students are able to learn the knowledge necessary in the specialized field and utilize it.
- Students are able to have an inquiring mind/intellectual curiosity and collect the related knowledge from a wide range of information media.

- Students are able to analyze the issues/problems and solve them through critical/creative thinking.
- Students are able to communicate with each other in a group.
- Students are able to properly describe opinions and claims of their own.
- Students are able to actively take an action under their self-management and display their leadership.
- Students are able to have a sense of ethics and be aware of the social contribution and responsibility.
- Students are able to be conscious of their contribution to the international communities.

## Course Syllabus

		Content
Class 1	Lecture contents	Models in physics, Measurement of physical quantities
	Self-study Assignments	Ch. 1
Class 2	Lecture contents	Kinematics (1): Definition of velocity based on the differential
	Self-study Assignments	Secs. 2.1-2.3
Class 3	Lecture contents	Kinematics (2): Calculating displacement from acceleration and velocity based on the integral
	Self-study Assignments	Secs. 2.4-2.5
Class 4	Lecture contents	Law of inertia, Ways of finding forces acting on a body by other bodies, Diagram of forces
	Self-study Assignments	Secs. 3.1-3.4
Class 5	Lecture contents	Law of action and reaction
	Self-study Assignments	Secs. 3.5-3.6
Class 6	Lecture contents	Effect of force (1): Temporal viewpoint
	Self-study Assignments	3.7.1
Class 7	Lecture contents	Effect of force (2): Spatial viewpoint
	Self-study Assignments	3.7.2-3.7.3
Class 8	Lecture contents	Magnitude in motion (1): Linear momentum
	Self-study Assignments	4.1.1-4.1.2
Class 9	Lecture contents	Magnitude in motion (2): Kinetic energy
	Self-study Assignments	4.1.3
Class 10	Lecture contents	Conservation laws
	Self-study	Sec. 4.2

	Assignments	
Class 11	Lecture contents	Newton's laws of motion, Potential of force field
	Self-study Assignments	Appendices C, D, and E, Secs. 5.1-5.2
Class 12	Lecture contents	Examples of mechanical phenomena (1): Friction
	Self-study Assignments	Sec. 5.4
Class 13	Lecture contents	Examples of mechanical phenomena (2): Harmonic oscillator
	Self-study Assignments	5.6.1
Class 14	Lecture contents	Elementary dynamics of rigid bodies
	Self-study Assignments	Ch. 6
Class 15	Lecture contents	Frames of reference
	Self-study Assignments	Ch. 7

### Evaluation/Assessment

Assessment	Percentage	Evaluation Criteria (Explanation)
Final Exam	70%	Remarks about grading: The most important advice is to not work to memorize the formulae but to work to understand the essence of the concepts. I will evaluate your understanding of the relevant concepts in physics and their qualitative interpretation.
Midterm		
Papers		
Performance/Works		
Continuous Assessment (quizzes, assignments, etc.)	30%	Remarks about grading: The most important advice is to not work to memorize the formulae but to work to understand the essence of the concepts. I will evaluate your understanding of the relevant concepts in physics and their qualitative interpretation.
Other		
Remarks about grading		Grade breakdown: Overall grades will be computed as follows: 40% Home works + 60% Final Exam.

### Grading Method:ABC

### Course Materials

1. 小林幸夫: 『力学ステーション』(森北出版, 2002, 3150円)

### Reference Materials

1. 小林幸夫: 『新訂版 現場で出会う微積分・線型代数』(現代数学社, 2011, 3800円)  
[秋学期: 「線型数理」の教科書]

### Advice for Prospective Students

Estimated Out-of-class Study Time Per Week: 4 hr

Estimated time to prepare and to review for each class session. (incl. assignments, tests, papers, etc) : 4hrs

### Implementation of Active Learning

No

### Will you use ICT for class or to support self-learning?

No

### How to give feedback for assignments (mid-term exams, reports, etc.)

Correct and return tests or reports.

### Language used in class

Japanese

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**Link URL:** <https://plas.soka.ac.jp/csp/plas/slb.csp?nd=2021&sm=1&mk=11&lc=108503>