Westlake University Undergraduate Course Syllabus

1.Course Information

Course Name	Honors General Physics I		Credits	4
Class Hours	Teaching Hours	Practice Hours	Lab Hours	Total
	64	0	0	64
Prerequisite courses (Consistent with major roadmap)	This course will make use of calculus and linear algebra and provides a concise introduction to these subjects. Prior knowledge of calculus and linear algebra is not required, but having some background in these areas will be very helpful.			

2. Course Coordinator

Name	Shengchao Li	Contact Info	lishengchao@westlake.edu.cn
Office Address	E5-226	Office Hours	9:00-17:00

3. Course Instructor

Name #1	Shengchao Li	Name #2	
Contact Info	lishengchao@westlake.edu.cn	Contact Info	
Name #3		Name #4	
Contact Info		Contact Info	

4. Course Description（No more than 500 words）

This course totals 64 class hours and is divided into two main parts: Classical Mechanics and Thermodynamics. In the Classical Mechanics section, we will delve into the fundamental theories of vectors and kinematics, as well as various applications of Newton's laws of motion. Additionally, there will be a detailed discussion on the conservation laws in mechanics, such as the conservation of mechanical energy, momentum, and angular momentum.

The Thermodynamics and Statistical Mechanics section covers gas dynamics theory, temperature, and distribution theory, along with the basic laws and concepts of thermodynamics. Through the analysis of thermodynamic principles, students will gain a deep understanding of core thermodynamic concepts such as entropy, enthalpy, and free energy.

Through this course, students will not only appreciate the developmental trajectory of modern physics but also understand why physics is an essential component of contemporary culture. The course aims to cultivate the thinking modes of physicists and enhance their ability to analyze and solve problems, thereby viewing the world from a new perspective.

5. Learning Objectives

Gain a deep understanding of Galileo's principle of relativity, Newton's laws of motion, the law of universal gravitation, conservation laws and symmetry, vibrations and waves, the first and second laws of thermodynamics, Boltzmann distribution, and kinetic theory of gases. This will lay a solid foundation for subsequent courses.

6. Course Content

Part I: Classical Mechanics

Matter, Space-time scales, Perspectives of physics; Vectors, Scalar and cross products, Rotation, Linear algebra; Motion, Zeno's paradox, Displacement, Velocity, Acceleration, Calculus; Galilean relativity, Space-time symmetries; Newton's laws, Gravitation; Projectile motion, Harmonic oscillation, Differential equations; Energy conservation, Work, Potential energy; Momentum conservation, Rockets; Angular momentum conservation, Kepler's problem; Forced oscillator, Resonance, Transients; Coupled oscillators; Multi-particle systems, Momentum, Angular momentum; Fixed axis rotation, Moment of inertia, Rolling; 3D rotation, Gyroscope; Wave equation, Partial derivatives, Partial differential equations; Normal modes, Fourier analysis; Shock waves, Tsunami, Light waves; Wave interference, Diffraction.

Part II: Thermodynamics

Perspectives of thermodynamics, Emergentism; First law of thermodynamics, Perpetual motion machines of the first kind; Second law of thermodynamics, Entropy, Perpetual motion machines of the second kind; Free energy, Gibbs function, Maximal work; Applications of thermodynamics, Specific heat, Cooling, Ratchet; Phase transitions, Van der Waals theory, Clausius-Clapeyron equation; Kinetic theory, Diffusion, Drift, Conductivity; Statistical meaning of entropy, Boltzmann distribution; Information entropy.

Part III: Supplemental Materials

LC circuits, Mechanical oscillators; Fermat's principle of geometric optics, Variational methods; Maupertuis's principle, Catenary, Brachistochrone curve; Random walk, Normal distribution, Bayesian statistics, Markov vs. Martingale, Probability elements.

7. Course Schedule

Week	Session	Class Hour	Instructor(s)	Theme/Topic	Teaching activities （lecture/practical）
1st week	1	2	Shengchao Li	Physics and Natural Philosophy Theories	Lecture
1st week	2	2	Shengchao Li	Calculation and Rotation Theory of Vectors	Lecture
2nd week	1	2	Shengchao Li	Zeno's Paradox: Limits and Motion	Lecture
2nd week	2	2	Shengchao Li	Displacement, Velocity, Acceleration	Lecture
3rd week	1	2	Shengchao Li	Ballistic Motion with Resistance	Lecture
3rd week	2	2	Shengchao Li	Simple Harmonic Motion	Lecture
4th week	1	2	Shengchao Li	Damped Vibration	Lecture
4th week	2	2	Shengchao Li	Forced Vibration and Resonance	Lecture
5th week	National Day Holiday Recess (according to school calendar)				
6th week	1	2	Shengchao Li	Newton's Laws of Motion	Lecture
6th week	2	2	Shengchao Li	Inertial and Non-Inertial Systems	Lecture
7th week	1	2	Shengchao Li	The Law of Conservation: Mechanical Energy	Lecture
7th week	2	2	Shengchao Li	Mechanical Energy (2)	Lecture
8th week	1	2	Shengchao Li	Conservation Law: Momentum	Lecture
8th week	2	2	Shengchao Li	The Law of Conservation: Angular Momentum	Lecture
9th week	1	2	Shengchao Li	Kepler's Problem	Lecture
9th week	2	2	Shengchao Li	Theory of Rigid Body Fixed Axis Rotation	Lecture
10th week	1	2	Shengchao Li	Euler's Rigid Motion Theorem	Lecture
10th week	2	2	Shengchao Li	Midterm Exam	/
11th week	1	2	Shengchao Li	Gas Dynamics Theory	Lecture

11th week	2	2	Shengchao Li	Temperature and Distribution	Lecture
12th week	1	2	Shengchao Li	Maxwell-Boltzmann Distribution	Lecture
12th week	2	2	Shengchao Li	Blackbody Radiation	Lecture
13th week	1	2	Shengchao Li	The First and Second Laws of Thermodynamics	Lecture
13th week	2	2	Shengchao Li	Entropy	Lecture
14th week	1	2	Shengchao Li	State Variable	Lecture
14th week	2	2	Shengchao Li	Analytical Thermodynamics	Lecture
15th week	1	2	Shengchao Li	Statistical Thermodynamics	Lecture
15th week	2	2	Shengchao Li	The Third Law of Thermodynamics	Lecture
16th week	1	2	Shengchao Li	Applied Thermodynamics	Lecture
16th week	2	2	Shengchao Li	Lesson Summary	Lecture

8. Assessment Weight

Type of Assessment	Percentage of Final Score	Notes
Attendance	/	
Class Performance	/	
Quiz	/	
Project	/	
Assignments	**25**	
Mid-term Exam	**25**	
Final Exam	**30**	
Other	**20**	**Experiment**

9.Grading

√A. Graded

☐ B. Pass/Fail

☐ C. Hundred Point Scale

10．Textbook and Supplementary Readings

Text Book:

R. P. Feynman, Feynman lecture notes of physics (I), New Millennium edition (January 4, 2011).

Reference Books:

1. C. Kittel, W. D. Knight, & M. A. Ruderman, Mechanics: Berkeley Physics Course, McGraw-Hill Book Company; Volume 1 (January 1, 1965).
2. Heat and Thermodynamics, M. W. Zemansky, R. H. Dittman, McGraw-Hill College; Subsequent edition (November 1, 1996).