

Syllabus for SJTU International Undergraduate Entrance Examination

(Physics)

(NOV. 2021)

I. Purpose of the test

The International Undergraduate Entrance Examination (Physics) (IUEE-Physics) is to check whether the candidates have sufficient knowledge and literacy in physics for further study in SJTU.

The test focuses on the evaluation of candidates' autonomous learning ability and the ability of integrating theory with practice. This test also pays special attention to the development of science, technology, and economy relating to physics.

II. Skills assessed in the test

The test is designed to assess candidates' knowledge and scientific literacy in physics, including: 1. the basic knowledge and skills learned in high school; 2. the ability to solve the practice problems by means of physics principles and methods; 3. research ability: using physics principles and methods to analyze the problems, deduce, and finally obtain conclusion. The details are as follows:

1. *The basic knowledge and skills*

- a) Recognize the common physics phenomena. Understand the processes of their formations and developments.
- b) Understand the basic concepts and laws of physics, can use them to explain the common phenomena.
- c) Can use simple mathematical calculation to explain the problems.

2. *The basic principles and methods*

- a) Can use the methods of analysis, induction, and inference to deal with the physics problems.
- b) Can use methods of symmetry analysis, parameter controls, and mathematics, etc. to deal with the problems.
- c) Can use the data and figures to analyze the problems.

3. *The basic scientific literacy*

- a) Can model the practice problems by means of physics methods.

- b) Synthetically use the materials, motions, and energy perspectives to analyze and deal with the problems.
- c) Can understand the new knowledge and apply it to analyze and deal with the problems.
- d) Can do simple scientific research.

III. Structure of the test

The duration of the test is 60 minutes, and the total score is 100. The content and structure of the test are presented in Table below.

The content and structure of the IUEE-Physics

Knowledge and Skills	Response format	Number of items	Weight (%)	Time (minutes)
Mechanics	Multiple-choice questions	10	33.3	60
Oscillation and wave	Multiple-choice questions	3	10.0	
Thermal physics	Multiple-choice questions	5	16.6	
Electromagnetism	Multiple-choice questions	7	23.4	
Optics and atomic physics	Multiple-choice questions	5	16.7	
Total			100	

IV. Format of the test

The IUEE-Physics is a computer-based test. All prompts and questions are presented on the computer, and students are required to complete all the tasks on the computer. The prompts and questions are presented in the form of audios, videos, texts, and graphics.

V. Scoring and score reporting

Multiple choice items are automatically scored by the computer. The IUEE-Physics reports a total score of 0 to 100.

Appendix 1 : Knowledge and Skills

Chapter	Content details	Notes
Mechanics	Frame of reference, point mass, physics model	
	Distance and displacement	
	Average and instantaneous velocities	
	Average and instantaneous accelerations	
	Linear motion with constant acceleration	
	Free fall motion	
	Projectile motion	
	Relative motion	
	Interaction and force	
	Newton's first law	
	Newton's second law	It is limited to the problems associated with only a single body of constant mass and total forces.
	Newton's third law	
	The International System of Units and unit conversion	
	Circular motion	
	Linear speed, Angular Velocity, period	
	Newton's Law of Universal Gravitation	Skills to solve the problems associated with astronomical object are required.
	Satellites and weightlessness	
	Kepler's law	
	Work and power of force	
	Kinetic energy	
Potential energy		

	Relationship between work and energy	It is limited to quantitatively analysis of simple problems
	Law of conservation of mechanical energy	
	Theorem of momentum	
	Law of conservation of momentum	
	Applications of laws of conservation of mechanical energy and momentum	It is limited to the simple problems.
Oscillation and Wave	Oscillations and simple harmonic motion	
	Energy if simple harmonic motion	
	simple pendulum	
	Damped and forced vibrations	
	Production and propagation of mechanical waves	
	Transverse wave and its picture, simple harmonic wave	
	Energy of simple harmonic wave	
	Superposition of waves	
	Standing Waves	
	Doppler effect	
Thermal Physics	Molecules, Avogadro constant	
	Parameters of the Gaseous State	
	Ideal gas law	It is limited to the problems associated with a pure gas with constant mass.
	Thermodynamic temperature scale	
	Kinetic-molecular theory	
	Internal Energy of ideal gas	
	First law of thermodynamics and its applications	It is limited to the problems of simple applications.

	Second law of thermodynamics and its applications	
Electromagnetism	Quantity of electric charge (or electricity), elementary charge	
	Insulators and conductors	
	Coulomb's law	
	Electrostatic field	
	Diagrams of Electric field, Electric field strength	
	Electric potential and electric potential energy	
	The relationship between electric potential and strength of electric field	
	Motion of charges in electric field	
	Conductors in electrostatic field	
	Electric currents	
	Ohm's law	
	direct current circuits	It is limited to the problems associated with simple circuits.
	Electrical work and power	
	capacitors	
	Energy of electric field	
	Electric current and magnetic field	
	magnetic flux density (or magnetic induction), magnetic flux	
	The force of magnetic field on currents	
	The force of magnetic field on the moving charged particle	Lorentz force
	Law of electromagnetic induction	
Circuits of alternating current		
voltage transformer		
Electromagnetic field and wave	√	
Geometric optics	Propagation of light	It is limited to simple

	Laws of Reflection and refraction of light	problems.
	Spherical mirrors	
	Concave mirrors	
	Thin lens	
Microscopic structure of matters and Nuclear Energy	Electrons and atoms	
	atomic spectroscopy	
	Bohr's model of atoms	
	Structure of nuclear atom	
	Radioactivity of nucleus	
	Composition of nucleus	
	Fission of heavy nucleus, chain reaction	