29. Introduction to relativity and modern physics (PH029IU)

Module designation	*This course is introductory to all theoretically fundamental aspects of Special Relativity and Early Quantum Theory. In the first part of the course, students are brought up with some experiments that lead to the special relativity concepts of objects moving at speed close to the speed of light. From there, they can develop the formalism of special relativity in both kinematics and dynamics via the discussion of moving frames of reference, Galilean and Lorentz transformations, and electromagnetism. The second part of the course will also introduce the other pillar of modern physics, quantum theory, in its early stage. Again, students will get acquainted with some experiments that led to the thoughts of quantization, the duality characteristics of the particle-wave nature of radiation, and the principle of uncertainty; and apply these foundation physics backgrounds to the quantum theory of the atom then.*
Semester(s) in which the module is taught	1, 2
Person responsible for the module	Assoc. Prof. Phan Bảo Ngọc
Language	English
Relation to curriculum	Compulsory
Teaching methods	Lecture, lesson, assignment
Workload (incl. contact hours, self-study hours)	(Estimated) Total workload: 127.5 Contact hours (please specify whether lecture, exercise, laboratory session, etc.): lecture: 37.5 Private study including examination preparation, specified in hours: 90
Credit points/ECTS	3 credits/4.62 ECTS
Required and recommended prerequisites for joining the module	Previous course General Physics 3 (PH023IU) (or Physics 4 (PH012IU)), Calculus 2 (MA003IU)

<table>
<tr><td>Module objectives/intended learning outcomes</td><td>Upon the successful completion of this course students will be able to:
<table>
<tr><th>Competency level</th><th>Course learning outcome (CLO)</th></tr>
<tr><td>Knowledge</td><td>CLO1. Solve physics problems of objects moving at speeds comparable to the speed of light and objects having sizes comparable to the atomic scale by using basic concepts of Special Relativity and Quantum Theory.</td></tr>
<tr><td>Skill</td><td>CLO2. Express ideas by using the appropriate means of graphical communications or oral presentations</td></tr>
<tr><td>Attitude</td><td>CLO3. Recognize the need of further self-learning in Special Relativity and Quantum Theory.</td></tr>
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<tr><td>Content</td><td>The description of the contents should clearly indicate the weighting of the content and the level.
Weight: lecture session (3 hours)
Teaching levels: I (Introduce); T (Teach); U (Utilize)
<table>
<tr><th>Topic</th><th>Weight</th><th>Level</th></tr>
<tr><td>Chapter 1: Background of Special Relativity</td><td>3</td><td>I, T</td></tr>
<tr><td>Chapter 2: Relativistic Kinematics</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 3: Relativistic Dynamics</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 4: Quantization of Energy</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 5: The Particle Nature of Radiation</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 6: Wave Nature of Matter and Uncertainty Principle</td><td>2</td><td>I, T</td></tr>
<tr><td>Chapter 7: Early Quantum Theory of Atom</td><td>2</td><td>I, T</td></tr>
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<tr><td>Examination forms</td><td>Exam</td></tr>
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Study and examination requirements	Attendance: A minimum attendance of 80 percent is compulsory for the class sessions. Students will be assessed on the basis of their class participation. Questions and comments are strongly encouraged. Assignments/Examination: Students must have more than 50/100 points overall to pass this course.
Reading list	**Textbooks:** [1] Basic Concepts in Relativity and Early Quantum Theory, Resnick & Halliday – 2nd Edition. **References:** [2] Becchi, Carlo M., and Massimo D'Elia. Introduction to the Basic Concepts of Modern Physics. Springer (2007).