Module Handbook

Module name	Quantum Physics
Module level, if applicable	Bachelor of Science
Code, if applicable	18H02120703
Subtitle, if applicable	-
Course, if applicable	-
Semester(s) in which the module is taught	3rd (Odd)
Person responsible for the module	Azwar Sutiono, S.Si.,M.Si.
Lecturer	Prof. Dr. Tasrief Surungan, M.Sc., Prof. Dr. rer. nat. Wira Bahari Nurdin
Language	Indonesian Language [Bahasa Indonesia]
Relation to Curriculum	This course is a mandatory course and is offered in the 3rd semester.
Type of teaching, contact hours	Teaching methods: [group discussion], [~~simulation~~], [case study], [collaborative learning], [~~project-based learning~~], [problem-based learning]. Teaching forms: [lecture], [tutorial], [seminar], [~~practicum~~], [~~research~~], [~~internship~~], [~~community service~~] CH : 08.00 - 16.00
Workload	For this course, students are required to meet a minimum of 136 hours in one semester, which consists of: - 40 hours for lectures, - 48 hours for structured assignments, - 48 hours for private study
Credit points	3 credit points (equivalent to 5.1 ECTS)
Requirements according to the examination regulations	A student must have attended at least 80% of the lectures to sit on the final examination.
Recommended prerequisites	Mathematical Physics 2 and Analytical Mechanics
Module objectives/intended learning outcomes	After completing this module, **Intended Learning Outcomes** ● **ILO 1**: Students will have relatively deep understood in classical and basic quantum physics. ● **ILO 3**: Students will be able to use the basic principles of physics in technology application. **Course Learning Objectives:**

	After completing this course, students are expected to be able to analyze the Schrödinger equation for various types of potentials and explain quantum phenomena related to its solutions.
	Sub-CLO **ILO 1 ⇒ CLO 1:** Students are able to explain the physical phenomena that form the basis of quantum physics. **ILO 1 ⇒ CLO 2**: Students are able to explain the quantum operators of fundamental quantities in classical mechanics. **ILO 1 ⇒ CLO 3**: Students are able to solve the Schrödinger equation for a free particle and explain the physical properties of the solution. **ILO 1 ⇒ CLO 4**: Students are able to solve the Schrödinger equation for one-dimensional potential and explain their physical properties. **ILO 1 ⇒ CLO 5**: Students are able to solve the Schrödinger equation for harmonic potentials and explain their physical properties. **ILO 1 ⇒ CLO 6**: Students are able to solve the creation and annihilation operator problems on functions from harmonic potential solutions. **ILO 1 ⇒ CLO 7**: Students are able to solve the Eigenvalue equation for angular momentum operators and explain their physical properties. **ILO 3 ⇒ CLO 8**: Students are able to solve the Schrödinger equation for the Hydrogen atom and explain its physical properties.
Content	Students will learn about: 1. Review of classical mechanics 2. Background of quantum physics formulation (postulates in quantum physics), 3. Quantum operators and eigenvalue equations 4. Schrödinger equation for free particles 5. Schrödinger equation for one-dimensional potentials (WKB Method) 6. Harmonic oscillator 7. Creation and annihilation operators for the harmonic oscillator 8. Spherical harmonics 9. Hydrogen atom
Forms of Assessment	Assessment techniques: [~~observation~~], [participation], [performance], [written test], [~~oral test~~] Assessment forms: [quiz], [midterm exam], [final term exam], [assignment], [~~report~~], [~~presentation~~] Quiz = 15%, Assignment = 15%, Mid exam = 35%; Final exam = 35% CO 1 => ILO 1: 10% (Assignment, mid exam) CO 2 => ILO 1: 10% (Assignment, mid exam) CO 3 => ILO 1: 10% (Assignment, mid exam) CO 4 => ILO 1: 20% (Mid exam) CO 5 => ILO 1: 10% (Assignment) CO 6 => ILO 4: 10% (Assignment, Final exam) CO 7 => ILO 1: 10% (Final exam)

	CO 8 => ILO 4: 20% (Final exam)
Study and examination requirements and forms of examination	**Study and examination requirements:** ● Students must attend 15 minutes before the class starts. ● Students must switch off all electronic devices. ● Students must inform the lecturer if they will not attend the class due to sickness, etc. ● Students must submit all class assignments before the deadline. ● Students must attend the exam to get the final grade. **Form of examination:** Written Exam
Media employed	LED, Whiteboard, Textbook, Learning Management System (SIKOLA)
Reading list	1. David J. Griffiths, *Introduction to Quatum Mechanics*, 2nd Ed., Pearson Prentice Hall, New York, (2005). 2. Steven Weinberg, *Lectures on Quantum Mechanics*, Cambridge Univ. Press., (2013). 3. Ricahrd L. Liboff, *Introductory Quantum Mechanics*, Addison-Wesley, New York, (2004) 4. T. Surungan, *Pengantar Fisika Kuantum*, Diktat Kuliah, Departemen Fisika, (2015). 5. Purwanto, A. Fisika Kuantum