FI560 Quantum Physics

Module name:	Quantum Physics	
Module level, if applicable:	Undergraduate	
Code:	FI-560	
Sub-heading, if applicable:	-	
Classes, if applicable:	-	
Semester:	5th	
Module coordinator:	Mohammad Arifin	
Lecturer(s):	Mohammad Arifin and Yuyu Rahmat Tayubi	
Language:	Bahasa Indonesia	
Classification within the curriculum:	Compulsory course	
Type of teaching	Contact hours per week during the semester	Class Size
1. Lecture (conceptual, contextual and problem-solving approaches through expository, discussions and exercises). 2. Structured activities (assignments based on conceptual, contextual and problem-solving approaches) 3. Self-study (reading literature)	3 hour 20 menit	45
Workload:	The total workload is 181 hour 20 minutes (6.4 ECTS) per semester, consisting of 46 hour 20 minutes /2800 minutes lectures (1.65 ECTS), 56 hours/3360 minutes structured activities (1.98 ECTS) and 56 hours/3360 minutes self-study (1.98 ECTS) per week for 14 weeks, 22 hour 23 minutes for two exams (0.79 ECTS)	
Credit points:	6.4 ECTS	
Pre-requisites course(s):	FI222 Mathematical Physics I, FI240 Mathematical Physics II, FI360 Modern Physics	
Course Learning Outcomes (CLO):	After taking this course the students have ability to: CLO1. Describe the basic concepts of quantization of physical quantities, general representations and formal operations of the basic laws of physics in quantum mechanics both physically-phenomenologically and mathematically. CLO2. Apply it to solve problems: stationary quantum systems for simple cases, the basic characteristics of many-body systems: atoms, molecules, atomic nuclei and particles, and materials in general.	

<table>
<tr><td></td><td>CLO3. Participate in developing it in the breadth of standard physics disciplines and science and technology in general in the global literature.</td></tr>
<tr><td>Content:</td><td>Quantization of physical quantities, black body radiation and quantization of electromagnetic wave energy, the limits of the applicability of Newtonian classical mechanics and the necessity of modern physics, de Broglie's concept of wave-particle dualism, description and representation of wave packets (scalar and vector space): states stationary and time dependent, Heisenberg uncertainty principle, physical interpretation of Max Born wave packet functions, concepts of Dirac notation (Hilbert spaces, bra-kets, observables, and operators), representation and transformation of coordinates (orthogonal and canonical), characteristics and properties of operators , postulates in quantum mechanics, the Schrödinger equation and examples of its solution in cases of stationary states for simple 1, 2 and 3 dimensional potentials, application of the postulates to simple non-relativistic states: spin 1/2 and two-level systems, states- discrete states of single and degenerated quantum systems and Hamiltonian characteristics, methods and approaches of pe solving problems in quantum physics: perturbation theory, WKB (Wentzel-Kramers-Brillouin), and numerical (tentative); general concepts and properties of angular momentum, characteristics of angular momentum operators, one-dimensional harmonic oscillator systems, particles in central potential: quantum theory of the hydrogen atom, state functions of the hydrogen atom: spherical, radial, spin harmonic functions, single electron orbitals and atomic, molecular, solid-body and many-body systems in general</td></tr>
<tr><td>Study/exam achievements:</td><td>The final mark will be weight as follow
<table>
<tr><th>No</th><th>CLO</th><th>Assessment Object</th><th>Assessment Techniques</th><th>Weight</th></tr>
<tr><td>1</td><td>CLO1, CLO2, CLO3</td><td>Subject specific competences:
a. Assignments
b. Quiz
c. Exam:
- Mid Exam
- Final Exam</td><td>

Written
Written test

Written test
Written test</td><td>

20 %
10 %

30 %
40%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Forms of media:</td><td>Board, LCD Projector, Laptop/Computer</td></tr>
<tr><td>Literature:</td><td>1. Cohen-Tannoudji, Claud, Diu, Bernard, Laloë, (2019), Quantum Mechanics, Vol. I, 2nd edition, John Wiley & Sons, New York, USA.
2. Dirac, P.A.M., (2013), The Principles of Quantum Mechanics, www.snowballpublishing.com
3. Gasiorowicz, Stephen, (2003), Quantum Physics, 3rd edition, John Wiley & Sons, Inc., Singapore.
4. Griffiths, David J., (2005), Introduction to Quantum Mechanics, Second Edition, Pearson Prentice Hall, Upper Saddle River, New Jersey, USA.
5. Sakurai, J. J. and Napolitano, Jim, (2011), Modern Quantum Mechanics, Second Edition, Pearson Education, Inc., Publishing as Addison-Wesley, 1301, Sansome Street, San Francisco, CA 94111.</td></tr>
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PLO and CLO mapping

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
CLO1		√										
CLO2		√										
CLO3		√										