

Tsuyama College		Year	2021	Course Title	Quantum Science
Course Information					
Course Code	0172		Course Category	Specialized / Elective	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Department of Integrated Science and Technology Communication and Informations System Program		Student Grade	5th	
Term	Year-round		Classes per Week	1	
Textbook and/or Teaching Materials	Textbook : Yasuo Hara and Makoto Okazaki, "Modern Physics for Engineering" (Shokabo)				
Instructor	SASAI Yuji				
Course Objectives					
<p>Learning purposes :</p> <p>Quantum mechanics governs the properties of the atoms and molecules that make up the materials of devices that are used daily in modern life. In this subject, students will learn the duality of wave nature and particle nature and the old quantum theory. Then, understand the basics of quantum mechanics as wave mechanics and the quantum number of atoms.</p> <p>Course Objective :</p> <p>1. Understand the old quantum theory and solve related problems.</p> <p>2. Understand the basics of quantum mechanics as wave mechanics and quantum numbers, and solve related problems.</p>					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Can create answers to most of the problems dealt with in class about the old quantum theory.		Can create answers to the problems dealt with in class about the old quantum theory.		Has not reached the left.
Achievement 2	Can create answers to most of the problems dealt with in class about the quantum mechanics.		Can create answers to the problems dealt with in class about the quantum mechanics.		Has not reached the left.
Assigned Department Objectives					
Teaching Method					
Outline	<p>General or Specialized : Specialized</p> <p>Field of learning : Physics</p> <p>Required, Elective, etc. : Must complete subjects</p> <p>Basic disciplines: Mathematical science / physics / general physics</p> <p>Relationship with Educational Objectives : This subject corresponds to the learning objective of each engineering department, "(1) Acquire knowledge about natural science subjects centered on mathematics and physics, and acquire the ability to apply it as basic knowledge about each engineering."</p> <p>Relationship with JABEE programs : The main goal of learning or education in this subject is "(A) Deepening of basic knowledge about technology, A-1: Acquiring knowledge in a wide range of natural sciences as basic knowledge about engineering, and can be explained. "</p> <p>Class outline : Quantum mechanics is important as a basic principle of chemistry and electronic engineering. In this course, student will understand the basics of quantum mechanics as wave mechanics.</p>				
Style	<p>Course method: Lecture-style lessons will be conducted and exercises will be conducted as appropriate. In the exercise, students will be asked to write a board and explain the answers. Impose an assignment report and proceed with the lesson while confirming the degree of understanding of the students.</p> <p>Grade evaluation method: Exams (60%) + Exercises (40%) . Supplementary classes and re-taking exams will be imposed on those with poor grades, and the results of the regular exam will be replaced with a maximum of 60 points.</p>				
Notice	<p>Precautions on the enrollment : This subject is a "subject that requires study outside of class hours". Classes are offered for 15 credit hours per credit, but 30 credit hours are required in addition to this. Follow the instructions of teacher for these studies.</p> <p>Course advice : Read the textbook well. Also, be sure to submit the assignment report by the deadline.</p> <p>Basic subjects : General Physics (3rd year), Differential and Integral I (2), Differential and Integral II (3), Fundamental Differential Equations (3)</p> <p>Related subjects : Electromagnetism (4), Modern Physics (4), Analytical Mechanics(4), Condensed Matter Physics (4), Mathematics subject</p> <p>Attendance advice : Calculate and understand the mathematical formulas. If students are operating e-mail etc. during class, may be asked to leave the room. If student join the class starts within 25 minutes, it will be lateness, and 3 times lateness will result in 1 absence.</p>				
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class	
				<input type="checkbox"/> Instructor Professionally Experienced	

Course Plan							
			Theme	Goals			
1st Semester r	1st Quarter	1st	<ul style="list-style-type: none"><li>• Other than math and physics programs: Guidance</li><li>• Mathematics and Physics Program: Guidance</li></ul>	Guidance			
		2nd	Duality of light	Understand the photoelectric effect and Compton scattering.			
		3rd	Duality of electron	Understand wavefunction, probability density, de Broglie wavelength, and uncertainty principle.			
		4th	Schrödinger equation	Understand the derivation of the Schrödinger equation.			
		5th	Stable state I	Infinitely deep well-shaped potential			
		6th	Stable state II	General potential, harmonic oscillator potential			
		7th	Tunnel effect	Tunnel effect and laser			
		8th	1st term midterm exam (above content)	Requires a score of 60 points or higher.			
	2nd Quarter	9th	Return of answers for the 1st term midterm exam. exam commentary.	Review.			
		10th	Angular momentum in quantum mechanics	Qualitative understanding of angular momentum and three-dimensional Schrodinger equation			
		11th	Hydrogen atom	Hydrogen atom and spin			
		12th	Quantum mechanics of multi-particle system	Schrödinger equation of two-particle system, wave function of identical particles			
		13th	Periodic law of atoms	Atomic shell model and periodic law of atoms			
		14th	Fermi distribution and Bose distribution	Fermions and bosons, Pauli principle, chemical potential			
		15th	1st term final exam (contents after the first term mid-term exam)	Requires a score of 60 points or higher.			
		16th	Return of answers for the 1st term final exam. exam commentary.	Review.			
Evaluation Method and Weight (%)							
	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	60	0	0	0	40	0	100
Basic Proficiency	30	0	0	0	20	0	50
Specialized Proficiency	30	0	0	0	20	0	50