Tsuyama College	Year	2021	Course Title	Modern Physics

Course Information

Course Code	0100	Course Category	Specialized / Elective
Class Format	Lecture	Credits	Academic Credit: 2
Department	Department of Integrated Science and Technology Electrical and Electronic Systems Program	Student Grade	4th
Term	First Semester	Classes per Week	2
Textbook and/or Teaching Materials	Textbook : handouts, Reference Book : Akira Harashima , "Special Relativity" chapter of Mechanics II (Shokabo), Tatsuo Uchiyama, "Relativity Theory" (Iwanami Zensho)		
Instructor	SASAI Yuji		

Course Objectives

Learning purposes :
Understand Lorentz transformations and relativistic dynamics as the basis of special theory of relativity, and solve related problems.

Course Objective :
1. Understand Lorentz transformations and solve related problems.
2. Understand relativistic dynamics and solve related problems.

Rubric

	Ideal Level	Standard Level	Unacceptable Level
Achievement 1	Can create answers to most of the problems dealt with in class about Lorentz transformation.	Can create answers to problems dealt with in class about Lorentz transformation.	Has not reached the left.
Achievement 2	Can create answers to most of the problems dealt with in class about relativistic dynamics.	Can create answers to problems dealt with in class about relativistic dynamics.	Has not reached the left.

Assigned Department Objectives

Teaching Method

Outline	General or Specialized : Specialized Field of learning : Physics Required, Elective, etc. : Elective subjects Basic disciplines: Mathematical science / physics / general physics 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." 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. " Class outline : As modern physics, this subject deals with special relativity, which is mathematically easy to handle, among relativities that completely changed the concept of space-time.
Style	Course method: Lecture-style lessons are conducted. In the handouts exercises, the questions are assigned in advance, so the students are asked to write on the board. Requiring an home work report and proceeding with the lesson while confirming the degree of understanding of the students. 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.
Notice	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. Course advice : Read the textbook well. Also, be sure to submit the assignment report by the deadline. Basic subjects : General Physics (3rd year), Differential and Integral I (2), Differential and Integral II (3), Fundamental Differential Equations (3) Related subjects : Quantum Science (5th year), Electromagnetism (4), Analytical Mechanics (4), Condensed Matter Physics (4), Mathematics subject 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.

Characteristics of Class / Division in Learning

☐ Active Learning	☐ Aided by ICT	☐ Applicable to Remote Class	☐ Instructor Professionally Experienced

Course Plan

			Theme	Goals

1st Semester	1st Quarter	1st	・ Other than mathematics and physics science programs: Not offered ・ Mathematics and Physics Program: Guidance	Guidance
		2nd	Michelson-Morley experiment	Understand Michelson-Morley's experiments and their consequences.
		3rd	Basic principles of special relativity	Understand the event, the principle of special relativity, and the principle of the light speed invariance.
		4th	Lorentz transformation	Derivation of Lorentz transformations.
		5th	Consequence from Lorentz transformation	Understand the relativity of the same time, Lorentz contraction, and the delay of the moving clock.
		6th	Velocity synthesis	Derivation of the composite formula of velocity.
		7th	Geometric representation of Lorentz transformations	Understand the world line, light cone, Minkowski space-time.
		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	Relativistic dynamics 1	Understand the four-vectors, momentum, mass, and force.
		11th	Relativistic dynamics 2	Understand work, energy, and four-momentum.
		12th	Lorentz invariant form of the equation of motion	Understand Lorenz's invariant equation of motion and the disappearance of matter.
		13th	Application of theory of relativity	Understand what is the application of the theory of relativity to our lives.
		14th	Topics of particle physics and astrophysics	Learn about the topics of particle physics and astrophysics.
		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