Applied Physics 1

Basic Course Information

Course Number	0100502S	**Subject Category**	Compulsory (M)
Class Format	Lecture	**Credit Type and Number of Credits**	1
Department	Mechatronics	**Student Category**	Year 4
Period of Study	Semester 1	**Classes per Week**	2
Required Materials	Handout materials based on "Applied physics of Kosen", ISBN978-4-627-15102		
Instructor	Takeshi TOSHIMA		

Course Objective

It is aimed not only to express the following physical phenomena using mathematical expressions but also to understand that they are mathematically interlocked and are analyzable events.
　Mechanics (equation of motion, work and force, energy, rigid body, momentum conservation law, angular momentum, moment of inertia, elastic body)
Specifically, each item of the following rubric will be the target.

Evaluation(Rubric)	Ideal Level of Achievement (Very Good)	Standard Level of Achievement (Good)	Unacceptable Level of Achievement (Fail)
It is possible to derive the equation of motion	Ability to solve not only basic problems but also applied problems on midterm and/ or final exams about this category.	It is possible to derive the equation of motions required from the problem sentence and obtain the answer.	Can not derive the equation of motions required from the problem sentence and obtain the answer.
It is possible to explain the relationship between work and force, and solve with differentiation and integration.	Ability to solve not only basic problems but also applied problems on midterm and/ or final exams about this category.	It is possible to explain the relationship between work and force, and solve with differentiation and integration.	Can not explain the relationship between work and force, and solve with differentiation and integration.
It is possible to divide the shape of the rigid body into small parts and derive its center of gravity and moment of inertia.	Ability to solve not only basic problems but also applied problems on midterm and/ or final exams about this category.	It is possible to divide the shape of the rigid body into small parts and derive its center of gravity and moment of inertia.	Can not divide the shape of the rigid body into small parts and derive its center of gravity and moment of inertia.
It is possible to explain conservation law of momentum and describe behavior before and after a collision of an object at two or three-dimensional system.	Ability to solve not only basic problems but also applied problems on midterm and/ or final exams about this category.	It is possible to explain conservation law of momentum and describe behavior before and after a collision of an object at two or three-dimensional system.	Can not explain conservation law of momentum and describe behavior before and after a collision of an object at two or three-dimensional system.
It is possible to explain the correspondence relationship between momentum and angular momentum and mechanical energy in translational motion and rotational motion.	Ability to solve not only basic problems but also applied problems on midterm and/ or final exams about this category.	It is possible to explain the correspondence relationship between momentum and angular momentum and mechanical energy in translational motion and rotational motion.	Can not explain the correspondence relationship between momentum and angular momentum and mechanical energy in translational motion and rotational motion.
Can describe and calculate the equations of motion for translation and rotation.	Ability to solve not only basic problems but also applied problems on midterm and/ or final exams about this category.	Can describe and calculate the equations of motion for translation and rotation.	Can not describe and calculate the equations of motion for translation and rotation.
It is possible to explain the difference between a rigid body and an elastic body and understand the mechanical properties of materials.	Ability to solve not only basic problems but also applied problems on midterm and/ or final exams about this category.	It is possible to explain the difference between a rigid body and an elastic body and understand the mechanical properties of materials.	Can not explain the difference between a rigid body and an elastic body and understand the mechanical properties of materials.

Relationship with Learning Outcomes

G(1) Wide knowledge on Science and Engineering and practical ability to apply them to solve problems in the society.

M(1) Ability to design, propose and develop robotic/ mechatronic systems to solve specific problems

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Teaching Method

Outline:	Expression of physical phenomena in dynamics, hydrodynamics using mathematical expressions. (Newton's law of motion, mass point system, conservation laws (mechanism energy, momentum, angular momentum), rigid body motion) In addition, the goal is set to be able to explain that physical quantities can
Class Format:	Lecture and exercise
Please Note :	All materials will be posted on the Google classroom. The student is requested to keep photo copies or files of all submitted material to ensure further study by

Course Plan

Semester 1	Contents and Method of Course	Goals	Related MCC		
1st week	Guidance: Review of the relationship between position and velocity and acceleration	Review basic equations of mechanics learned in physics	V-A 3 32 / V-A 3 33 / V-A 3 34 / V-A 3 39 / V-A 3 40 / V-A 3 51		
2nd week	Review of Newton's law of motion, force of inertia	It is possible to explain Newton's 1st, 2nd and 3rd law of motion and explain physical phenomena with differentiation and integration.	V-A 3 41 / V-A 3 42 / V-A 3 43 / I-A 1 6 / I-A 1 17 / I-A 1 18		
3rd week	Review of work, power, kinetic energy, potential energy, conservative force, mechanical energy and law of conservation of mechanical energy	It is possible to explain the relationship between the conservative force, kinetic energy and potential energy. Can derive various physical quantities using the law of conservation of	V-A 3 46 / V-A 3 47 / V-A 3 48 / V-A 3 49 / I-A 1 33 / I-A 1 34		
4th week	Review of center of mass and momentum	Understand that the overall physical quantity can be derived by dividing a figure into microsegments and taking the sum of the microsegments.	V-A 3 38 / V-A 3 52		
5th week	Review of law of conservation of momentum	It is possible to solve differential equations in the law of conservation of momentum.	I-A 1 27 / I-A 1 28 / I-A 1 29		
6th week	Review of moment of force, angular momentum and law of conservation of angular momentum	Understand the relationship between moments of force and angular momentum and be able to derive the law of conservation of angular momentum	V-A 3 35 / V-A 3 36 / V-A 3 37 / V-A 3 44 / V-A 3 45 / I-A 1 35		
7th week	Perform calculations using knowledge of Newton's law of motion and conservation laws.	Mock examination	I-A 1 30 / I-A 1 31 / I-A 1 32 / I-A 1 38 / I-A 1 39		
8th week	Wrap-up of 1st half of semester (Review)	Review and summarize learning			
9th week	Midterm Examination	For week 1-8			
10th week	Return Midterm Exam Papers and Feedback	Review learning			
11th week	Review of rigid body and its kinetic energy	Understand that a rigid body is a collection of points of mass with conditions imposed on their relative coordinates.	I-A 1 38 / I-A 1 39 / I-A 1 40 / I-A 1 41		
12th week	Derivation of moment of inertia of rigid body by using differentiation and integration.	It is possible to derive the moment of inertia of a rigid body with a typical shape.	V-A 3 53		
13th week	Derivation of moment of inertia of rigid body by using parallel axis theorem and perpendicular axis theorem	It is possible to derive the moment of inertia of a rigid body by using parallel and perpendicular axis theorem.	V-A 3 54		
14th week	Equation of motion of a rigid body in rotational motion	It is possible to solve equations of motion in rotational motion.			
15th week	Deformation of material under load	It is possible to explain the difference between rigid body and elastic body.	V-A 3 55 / V-A 3 56 / I-A 1 13		
16th week	Relationship between stress, strain, Young's modulus, shear modulus, Poisson's ratio(coefficient) and Hooke's law	It is possible to explain the difference between Young's modulus and shear modulus.	V-A 3 57 / V-A 3 58 / V-A 3 59		
17th week	Perform calculations using knowledge of rigid and elastic body.	Mock examination			
18th week	Wrap-up of 1st half of semester (Review)	Review and summarize learning			
19th week	Final Examination	For week 11-18			
20th week	Return Exam Papers and Feedback, and special sessions	Review and summarize learning			

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	Examination	Quiz	Mutual Evaluations between students	Resort	Portfolio	Other
Basic Ability	60	0	0	40	0	0
Technical Ability	0	0	0	0	0	0
Interdisciplinary Ability	0	0	0	0	0	0