Akashi College	Year	2023	Course Title	Dynamics of Machinery

Course Information

Course Code	5436	Course Category	Specialized / Compulsory
Class Format	Lecture	Credits	Academic Credit: 2
Department	Mechanical Engineering	Student Grade	4th
Term	First Semester	Classes per Week	2
Textbook and/or Teaching Materials			
Instructor	SEKIMORI Daisuke		

Course Objectives

(1) Can consider the vibratory system of one and two degrees of freedom based on the equations of motion.
(2) Can find the equations of motion (linear second-level differential equations) against the basic vibration model and understand what kind of physical phenomena the solution represents.
(3) Learn the modeling methods and sensibility, or the analysis process, which are essential for the analysis process.
(4) Can acquire the ability to apply the knowledge they have learned to reduce and prevent vibration and about measurement and instrumentation of vibration, and respond appropriately.

Rubric

	Ideal Level	Standard Level	Unacceptable Level
Achievement 1	Can accurately examine the vibration system with one and two degrees of freedom based on the equations of motion.	Can examine the vibration system with one and two degrees of freedom based on the equations of motion.	Cannot examine the vibration system with one and two degrees of freedom based on the equations of motion.
Achievement 2	Can find the equations of motion (linear second-level differential equations) against the basic vibration model and fully understand what kind of physical phenomena the solution represents.	Can find the equations of motion (linear second-level differential equations) against the basic vibration model and fully understand what kind of physical phenomena the solution represents.	Cannot find what kind of physical phenomena the solution is represented by leading the equations of motion (linear second-level differential equations) to the basic vibration model.
Achievement 3	Accurately learn the modeling techniques, the sense of modeling, or the analysis process that are essential for the analysis process.	Learn the modeling techniques, the sense of modeling, or the analysis process that are essential for the analysis process.	Do not learn the modeling methods and sense of analysis, or the process of analysis, which is essential to the progress of analysis.
	Can acquire the ability to apply the knowledge they have learned to reduce and prevent vibration and about measurement and instrumentation of vibration, and respond appropriately.	Can acquire the ability to apply the knowledge they have learned to reduce and prevent vibration and about measurement and instrumentation of vibration, and respond appropriately.	Cannot acquire the ability to apply the knowledge they have learned to reduce and prevent vibration and about measurement and instrumentation of vibration, and respond appropriately.

Assigned Department Objectives

Teaching Method

Outline	Identifying the dynamic behavior (vibration) of a machine is essential in the design of a machine. In this lesson, to study the basics of mechanical vibration analysis, students will examine the vibration system with one and two degrees of freedom based on the motion equation. Derive the equations of motion (linear second-level differential equations) against the basic vibration model and consider what kind of physical phenomena the solution represents.
Style	Lectures will be given in line with the textbook, and practice problems will be assigned.
Notice	This course's content will amount to 90 hours of study in total. These hours include the learning time guaranteed in classes and the standard self-study time required for pre-study / review, and completing assignment reports. Since this is one of the few courses in mechanical engineering on dynamics, students are requested to fully learn the basic idea. It is also important to review the knowledge gained in basic subjects such as Maths III A, Maths III B, and Industrial Dynamics I. Students who miss 1/3 or more of classes will not be eligible for evaluation.

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	Basics of vibration	Learn basic knowledge of mechanics and mathematics necessary for the analysis of vibration phenomena.
		2nd	Degrees of freedom and equations of motion	Understand the concept of degrees of freedom. Understand the basics of how to derive the equations of motion based on the Newton's second law.
		3rd	Non-damping free vibration of one degree of freedom (1)	Learn how to derive equations of motion for non-damping free-vibration systems such as linear and rotational vibration can be studied. Also, understand how to derive the equations of motion in systems that contain multiple springs, plate springs, etc.

		4th	Non-damping free oscillation with one degree of freedom (2)	Can standardize the equations of motion of the non-damping free-vibration system and learn the solutions. Understand the behavior of the system and its natural frequencies.
		5th	Damped free oscillation with one degree of freedom (1)	Understand the principle of dash pot, the damping element . Learn how to derive the equations of motion for damping free-vibration systems such as linear and rotational vibrations can be studied.
		6th	Damped free oscillation with one degree of freedom (2)	Can standardize the equations of motion for the damping free-vibration system and learn the solutions. Understand the relationship between damping ratio and system behavior.
		7th	Transient vibration	Understand the transient response of the oscillation system, which is subjected to step-function and impulse-function forces from the outside.
		8th	Midterm exam	
	2nd Quarter	9th	One degree of freedom damping force vibration (1)	Learn how to derive the equations of motions for damping force vibration systems such as linear and rotational vibrations.
		10th	One degree of freedom for damping force vibration (2)	Can standardize the equations of motion of the damping force vibration system and learn the solutions. Understand the frequency response of the system and the forces transmitted to the foundation.
		11th	One degree of freedom for damping force vibration (3)	Learn how to derive and solve the motion equation of the damping force vibration system by enforced displacement. Understand the principle of a vibration meter, which is an application of the system.
		12th	2 degrees of freedom vibration (1)	Understand the concept of coupled vibration by finding the equations of simultaneous motion in models with two degrees of freedom, such as linear and rotational vibration.
		13th	2 degrees of freedom vibration (2)	Learn how to solve the equations of motion of coupled free vibration. Understand the reference frequencies and modes that obtained from the frequency equations.
		14th	Force vibration of two degrees of freedom	Learn how to derive and solve for the equations of motion for coupled forced vibration. Understand the frequency response of a system.
		15th	Vibration isolation and vibration control	Learn the principle of a dynamic damper consisting of mass and spring, and can examine the reduction and prevention of vibration.
		16th	Final exam	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Exercises	Total
Subtotal	90	0	0	0	0	10	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	90	0	0	0	0	10	100
Cross Area Proficiency	0	0	0	0	0	0	0