Anan College	Year	2024	Course Title	Machine Dynamics 2

Course Information

Course Code	1214C01	Course Category	Specialized / Compulsory
Class Format	Lecture	Credits	Academic Credit: 2
Department	Course of Mechanical Engineering	Student Grade	4th
Term	Second Semester	Classes per Week	後期:2
Textbook and/or Teaching Materials	Kikai Rikigaku (CORONA)		
Instructor	Kawabata Nariyuki		

Course Objectives

1. Understand and derive equations of motion for masses and rigid bodies.
2. Able to explain the types of vibration and to analyze the free motion of mass, spring, and dashpot systems by expressing them in terms of equations of motion.
3. Able to express and analyze the forced vibration of a damped system subjected to harmonic external force and harmonic displacement by equations of motion.
4. Understand resonance phenomena and explain how to prevent vibration.

Rubric

	Ideal Level	Standard Level	Minimum Level
Achievement 1	Able to analyze the motion of complex-shaped objects, including rigid bodies, and dynamical systems composed of many objects.	Able to derive the equations of motion for simple dynamical systems at the exercise level and analyze the motion of the system.	Able to derive the equations of motion for simple dynamical systems at the example level and analyze the motion of the system.
Achievement 2	Able to derive and analyze the equations of motion for free vibration and identify the parameters of the system from experimental results.	Able to derive the equations of motion for free vibration systems and explain analytical results.	Able to derive the equations of motion for free vibration systems.
Achievement 3	Able to derive the equations of motion for forced vibration systems and correctly explain the relationship between analytical results and resonance phenomena.	Able to derive the equations of motion for forced vibration systems and analyze the motion of the system.	Able to derive the equations of motion for forced vibration systems.
Achievement 4	Able to explain the phenomenon of resonance and suggest methods of vibration prevention that are appropriate to the situation.	Understand resonance phenomena and explain various vibration prevention methods.	Able to explain the basic application of various vibration prevention methods.

Assigned Department Objectives

学習・教育到達度目標 B-3 学習・教育到達度目標 D-1

Teaching Method

Outline	Machine dynamics is one of the essential fields for designing machines, which includes a wide range of fields related to machines such as statics, dynamics, kinematics, vibration, and control. The objective of this course is to master the fundamentals of kinematics to vibration science while using the knowledge acquired in industrial mechanics.
Style	At the end of each class, exercises will be provided as self-study assignments. Each student is required to solve the exercises and submit them as a review. Online assignments via manaba will be provided in advance of the class. Each student is required to check the contents of the next lesson in advance and answer the exercises. [30 hours of class time + 60 hours of self-study]
Notice	This course is based on and further developed from the physics and industrial mechanics courses. Students are expected to review the fundamentals of mechanics thoroughly before the beginning of the course. There are plenty of exercises other than the assignments, and students are expected to master the methods of vibration analysis through independent study. The portfolio evaluation will include the evaluation of [assignment reports (self-study assignments)] and [online review tests].

Characteristics of Class / Division in Learning

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

Course Plan

			Theme	Goals
2nd Semester	3rd Quarter	1st	Fundamentals of Dynamics I and Fundamentals of Mathematics for Machine Dynamics	Understand Newton's laws of motion and be able to model systems. Able to calculate ordinary differential equations and matrices.
		2nd	Fundamentals of Dynamics II and Dynamics of Rigid Body I	Able to derive equations of motion for modeled systems and analyze simple systems. Able to calculate the moment of inertia of rigid bodies with relatively complex geometry.
		3rd	Dynamics of Rigid Body II	Able to analyze the plane motion of a rigid body considering its moment of inertia.

		4th	Vibration of single-degree-of-freedom system I	Able to analyze Maxwell's model and Voigt's model. Understand the function of springs and analyze the vibration of undamped single-degree-of-freedom systems.
		5th	Vibration of single-degree-of-freedom system II	Able to analyze the motion of a physical pendulum. Understand the phenomenon of damped vibration and classify it by damping ratio.
		6th	Vibration of single-degree-of-freedom system III	Understand the function of a dashpot and be able to analyze the vibration of a damped single-degree-of-freedom system. Understand logarithmic damping rate and be able to calculate the damping rate from damping waveforms.
		7th	Vibration of single-degree-of-freedom system IV and Forced Vibration I	Able to analyze the vibration of single-degree-of-freedom system subjected to impact force. Analyze forced vibration due to harmonic external force and explain the resonance phenomenon.
		8th	Midterm examination	
	4th Quarter	9th	Forced Vibration II	Able to analyze by the half power method. Able to analyze forced vibration due to displacement input.
		10th	Vibration of two-degree-of-freedom systems	Able to analyze free and forced vibration analysis of two-degree-of-freedom systems.
		11th	Vibration of continuous systems	Understand modeling by partial differential equations for strings and be able to analyze the vibration of a continuum.
		12th	Vibration of Rotating Body I	Understand rotational motion and be able to analyze vibrations due to critical velocity and disproportionality.
		13th	Vibration of Rotating Body II	Understand the disproportionate amount of disproportion and be able to design the balancing design of rotating parts.
		14th	Prevention of Vibration I	Able to explain the types and characteristics of vibration prevention methods.
		15th	Prevention of Vibration II	Understand vibration insulation and be able to design dynamic absorbers.
		16th	Reflection of final examination	

Evaluation Method and Weight (%)

	midterm / final exam	quiz	portfolio	presentation / attitude	other	Total
Subtotal	70	0	30	0	0	100
Basic Proficiency	10	0	0	0	0	10
Specialized Proficiency	60	0	30	0	0	90
Cross Area Proficiency	0	0	0	0	0	0