

Akashi College		Year	2023	Course Title	Tribology
Course Information					
Course Code	5023		Course Category	Specialized / Elective	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Mechanical and Electronic System Engineering		Student Grade	Adv. 1st	
Term	Second Semester		Classes per Week	2	
Textbook and/or Teaching Materials					
Instructor	ABO Masayoshi				
Course Objectives					
(1) Can deepen understanding of the complex friction and wear phenomena that occur on relative motion surfaces, and establish a method for evaluating them in an appropriate manner. (2) Can establish effective use of friction and methods to control friction and wear such as lubrication. (3) Can establish various guidelines and specific methods for designing frictional parts of equipment.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Can deepen understanding of the complex friction and wear phenomena that occur on relative motion surfaces, and establish a method for evaluating them in an appropriate manner.		Can deepen understanding of the complex friction and wear phenomena that occur on relative motion surfaces and understand how to evaluate them in an appropriate manner.		Cannot deepen understanding of the complex friction and wear phenomena that occur on relative motion surfaces and do not understand how to evaluate them in an appropriate manner.
Achievement 2	Can establish effective use of friction and friction wear controls such as lubrication.		Understand the effective use of friction and methods to control friction and wear such as lubrication.		Do not understand the effective use of friction and methods to control friction and wear such as lubrication.
Achievement 3	Can establish various guidelines and specific methods for designing frictional parts of equipment.		Understand the various guidelines and specific methods for designing frictional parts of equipment.		Do not understand the various guidelines and specific methods for designing frictional parts of equipment.
Assigned Department Objectives					
Teaching Method					
Outline	The aim of this course is to deepen the understanding of tribological problems—i.e., the complex friction and wear phenomena that occur on relative motion surfaces—and to explain how to evaluate them in an appropriate manner, and also explain the effective use of friction and methods to control friction and wear such as lubrication. Students will also learn the various guidelines and specific methods for designing frictional parts of equipment.				
Style	Classes will focus on a lecture style format and have exercises, assignments, and group work as appropriate. The contents of the report will be instructed according to the progress of the class and the students' levels of understanding. The report assignments are as follows: 1) An exercise about the contact condition between two objects. 2) An exercise for friction coefficients which take into account interface shear strength. 3) A survey and summary of various types of wear. 4) A study on tribology application technologies. 5) The derivation of the double integral part of the Reynolds equation. 6) A survey on solid lubricants and greases. 7) An exercise on bearing design methods. 8) A study on hard and soft thin layers. 9) An exercise on the amount of wear. 10) Literature research on tribology This course is based on and assumes students have a basic knowledge of the following subjects: Strength of Materials I (compulsory in year 3), Fluid Mechanics I (compulsory in year 4), and Engineering Design II (compulsory in year 4).				
Notice	Before taking the course, read the text, familiarize yourself with the content, and be prepared to ask questions during the course. 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. Students who miss 1/3 or more of classes, miss 5-10 minutes of a student's presentation, or fail to submit a report 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	
2nd Semester	3rd Quarter	1st	What is tribology? Explain an outline of tribology, lubrication methods, and lubrication by oil.	Learn an outline of tribology, lubrication methods, and about lubrication by oil.	
		2nd	Solid surface contact I Explain the properties of solid surfaces and the structure and properties of surface layers in order to properly understand tribology phenomena.	Learn about the nature of solid surfaces and the structure and properties of surface layers	
		3rd	Solid surface contact II Explain the mechanisms for two-surface contact and true contact area wear with exercise problems.	Learn about the mechanisms for two-surface contact and true contact area wear.	

		4th	Friction between solid surfaces I Explain dry friction and lubricated friction, Amonton-Coulomb's laws, the causes of friction, adhesion theory of friction, and the formula for friction theory.	Learn about friction causes and friction theory.
		5th	Friction between solid surfaces II Explain the temperature rises of friction surfaces, the speed characteristics of friction and stick-slip, friction properties in a vacuum, the effects of temperature on friction, and methods for testing friction.	Learn about friction characteristics and how to test friction.
		6th	Wear on solid surfaces I Define and classify wear and explain the theoretical handling of each of the important abrasives.	Learn about the definition and classification of wear.
		7th	Solid surface wear II Explain the concept of wear maps, and discuss testing methods of wear.	Learn about wear maps and wear testing methods.
		8th	Fluid lubrication I Explain the physical significance of fluid lubrication and its principles.	Learn about the physical significance of fluid lubrication.
	4th Quarter	9th	Fluid lubrication II Explain Reynolds' fluid lubrication theory and the pressure distribution analysis of bearings.	Learn about Reynolds' fluid lubrication theory and the pressure distribution analysis of bearings.
		10th	Boundary and mixed lubrication I Explain the concept of boundary and mixed lubrication, and boundary membrane's lubricating properties.	Learn about boundary and mixed lubrication.
		11th	Boundary and mixed lubrication II Explain the types, properties, and applications of grease and solid lubricants that are used for lubrication in situations where oil cannot.	Learn about the types, properties, and applications of grease and solid lubricants.
		12th	Surface reforming technology Explain the physical significance of surface reforming technology, its method, and examples of friction wear improvement and future prospects.	Learn about the physical significance of surface reforming technology, its methods, and examples of friction wear improvement.
		13th	Bearings design Explain the basic aspects of design using journal bearings as an example.	Learn about the basic aspects of bearing design using journal bearings as an example.
		14th	Applications of tribology in current technologies Introduce a case from the many current technologies where tribology plays an important role and explain the relationship using basic knowledge.	Learn about the current application of tribology in current technologies.
		15th	Presentation Introduce videos or research related to tribology.	Learn about research related to tribology.
		16th	No final exam	

Evaluation Method and Weight (%)

	Short Tests	Report	Presentation	Behavior	Other	Total
Subtotal	30	40	10	20	0	100
Basic Proficiency	0	0	0	0	0	0
Specialized Proficiency	30	40	10	20	0	100
Cross Area Proficiency	0	0	0	0	0	0