

Tsuyama College		Year	2021		Course Title	Introduction to Design of Machine System Elements
Course Information						
Course Code	0088		Course Category	Specialized / Elective		
Class Format	Lecture		Credits	Academic Credit: 2		
Department	Department of Integrated Science and Technology Advanced Science Program		Student Grade	4th		
Term	Second Semester		Classes per Week	2		
Textbook and/or Teaching Materials	Textbook : Use the same textbook used in Design of Machine Elements I (3rd year)and II (4th year)., Since the textbook describes only the minimum necessary items, students are encouraged to refer to other reference books to deepen their knowledge of related items. Reference books : Many reference books are held in libraries such as the JIS Handbook "Machine Elements" (Japanese Standards Association).					
Instructor	KONISHI Daijiro					
Course Objectives						
Learning purposes : Acquire basic design skills by understanding the basic concept of mechanical design. In addition, acquire the ability to apply knowledge of mechanics and strength of materials to machine element design.						
Course Objectives : 1. From the standpoint of machine element design, explain the basic idea of mechanical design. 2. To explain the types, functions, standards and design methods of the main machine elements. 3. Utilizing knowledge of mechanical materials, strength of materials, mechanics, etc., machine elements can be designed rationally and safely. 4. To explain how tribology technology is used in design to control and utilize the "moving" parts of machines.						
Rubric						
	Excellent	Good	Acceptable	Not acceptable		
Achievement 1	Students can combine knowledge to clarify issues while making logical judgments on the impact of knowledge and technology on society, and the results can be taken into consideration in design.	Students can clarify design requirements and problems by fusing their knowledge. Students can understand the essence of its function by modeling the design target.	Students can point out requirements and problems with design issues.	Students can not point out requirements and problems with design issues.		
Achievement 2	Students can understand the essence of its function by modeling the product, and design the product considering quality, cost and delivery.	Students can design the product considering quality, cost and delivery.	Students can reasonably design the product.	Students can not reasonably design the product.		
Achievement 3	Students can understand and utilize the necessary design formulas from their knowledge of mechanics and technology.	Students can use their knowledge of mechanics as a means of finding design solutions.	Students can generally use their knowledge of mechanics as a means of finding design solutions.	Students can not use their knowledge of mechanics as a means of finding design solutions.		
Achievement 4	Students can associate the relationship between the design formula with the conditions that can satisfy the function and performance of the machine or machine element.	Students can consider how to control the performance of machines and machine elements.	Students can generally consider how to control the performance of machines and machine elements.	Students can not consider how to control the performance of machines and machine elements.		
Assigned Department Objectives						
Teaching Method						
Outline	General or Specialized : Specialized Field of learning : Design and production / management Foundational academic disciplines : Engineering / Mechanical Engineering / Design Engineering / Machine Elements and Tribology-related Relationship with Educational Objectives : This class is equivalent to "(3) Acquire deep foundation knowledge of the major subject area". Relationship with JABEE programs : The main goal of learning / education in this class is "(A) A-2". Course outline : Mechanical design is an intellectual work process that embodies the function required by humans into a mechanical system, and at the same time, it is a technology that integrates a wide range of knowledge with a flexible way of thinking. The subject of the lecture is to think about "what is machine design", and the basic ideas and methods for designing machines are explained. In particular, in the items of bearings and gears, the relationship with tribology (technology for handling friction, wear, and lubrication) will be explained.					

Style	<p>Course method : The class will be conducted using board writing and PowerPoint, paying attention to the relationship with the mechanics required for design. In addition, exercises will be provided according to the progress of learning so that students can deepen their understanding. There is a exercise every lesson. There are assignments that must be submitted.</p> <p>Grade evaluation method : Exams (70%) + Exercises(30%). Regular exams will be totally conducted 2 times, and the evaluation ratios will be the same. Only a calculator is allowed for the test. In addition, students with grades of less than 60 may be retested.</p>
Notice	<p>Precautions on the enrollment : Students must take this class (no more than one-third of the required number of class hours missed) in order to complete the 4th year course. 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 your instructor for these studies.</p> <p>Course advice : Use the same textbook used in Design of Machine Elements I (3rd year)and II (4th year). In order to design a specific machine, not to mention the learning outcomes of the subjects related to design drawing, experimental training, and mechanics, the learning outcomes of the subjects related to social science and the knowledge gained from many years of experience and customs are required. Therefore, as a preparatory study to be conducted in advance, it is recommended to review these related subjects and read the Nikkan Kogyo Shimbun, Nihon Keizai Shimbun, etc. to know the current situation and trends in Japan and overseas regarding mechanical systems. Knowledge of mechanics and strength of materials is required for understanding. Students who are not in the mechanical system system are required to review mechanics and self-learn the contents of study in mechanical design method I and strength of materials.</p> <p>Foundational subjects : Introduction to Science and Technology (1st year), Materials Technology (2nd), Introduction to CAD (2nd), Machine Design and Drawing I-II (2nd-3rd), Mechanics I-III (3rd), Strength of Materials I (3rd), Mechanism (3rd), Design of Machine Elements I (3rd), Design of Machine Elements II (4th) etc.</p> <p>Related subjects : Machine Design Creative Practice (4th year), Strength of Materials II (4th), Mechanical System Engineering Experiments (4th), Applied Machine Design (5th), Applied Design Engineering (1st year advanced course) etc.</p> <p>Attendance advice : Students should fully prepare and review each week's lessons. Originally, mechanical design is a field that emphasizes "comprehensive", so try to learn in relation to the knowledge learned in other subjects. Students are allowed up to 25 minutes late, but attendance beyond this time limit is considered absent.</p>

Characteristics of Class / Division in Learning

<input type="checkbox"/> Active Learning	<input type="checkbox"/> Aided by ICT	<input checked="" type="checkbox"/> Applicable to Remote Class	<input type="checkbox"/> Instructor Professionally Experienced
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E l e c t i v e m u s t c o m p l e t e s u b j e c t s

Course Plan

			Theme	Goals
2nd Semester	3rd Quarter	1st	<p>Guidance, Transmission by Belt and Chain 1 [Design of Flat Belt Transmission Device]</p> <p>Learning contents outside class hours [Items] (Instructions): • Rotational movement and power, • Selection criteria from the characteristics of the driving mechanism with wrapping connector, • Flat belt length and transmission power</p>	<p>Circular motion can be described using concepts such as angular velocity. Can calculate mechanical work, power, and energy. Explain the means of power transmission using the frictional force generated between the pulley and the connector.</p>
		2nd	<p>Transmission by Belt and Chain 2 [Design of Flat Belt Transmission Device]</p> <p>Learning contents outside class hours [Items] (Instructions): • Combined moment, • Basics of power transmission by belt transmission device, • Dimensions of flat belt</p>	<p>Be able to calculate the equilibrium of basic rotational force and the combined moment. Understand the means of power transmission using the frictional force generated between the pulley and the connector, and be able to calculate the tension and transmission power of the belt. Know the Eytelwein formula. Be able to design the strength of flat belts.</p>
		3rd	<p>Transmission by Belt and Chain 3 [Transmission by V-belt]</p> <p>Learning contents outside class hours [Items] (Instructions): • Basics of power transmission by V-belt transmission device, • How to use the V-belt</p>	<p>Explain the principle of V-belt wedges using mechanics.</p>
		4th	<p>Transmission by Belt and Chain 4 [Design of V-belt Transmission Device]</p> <p>Learning content outside class hours [Items] (Instructions): • Selection of a narrow V-belt (pulley) that meets the specifications</p>	<p>From the given specifications, a transmission device using a narrow V-belt can be designed.</p>
		5th	<p>Transmission by Belt and Chain 5 [Transmission by Synchronous Belt, Transmission by Chain]</p> <p>Learning content outside class hours [Items] (Instructions): • Chain and sprocket, • Links of roller chain</p>	<p>Roller chain and sprocket can be selected.</p>

4th Quarter	6th	Transmission by Belt and Chain 6 [Design of Chain Transmission Device, Continuously Variable Transmission by Belt] Learning content outside class hours [Items] (Instructions): • Transmission power with a roller chain	Chains and sprockets can be reasonably selected from the given specifications and standards.
	7th	Clutch, Brake and Claw Wheel 1 [Function and Structure of Power Control Element, Design of Friction Clutch] Learning contents outside class hours [Items] (Instructions): • Clutch engagement / disengagement method, classification from operating method, • Determining disk clutch dimensions, • Clutch design constraints	Explain the classification of IExplain the function of the power control element and its structure. Explain the effect of friction on the friction clutch on performance. The transmission torque capacity of the disk clutch can be calculated.
	8th	2nd semester mid-term exam	
	9th	Return and commentary of exam answers, Clutch, Brake and Claw Wheel 2 [Function and Structure of Power Control Element] Learning content outside class hours [Items] (Instructions): • Brake effectiveness factor, • Friction material	Explain the effect of brake friction on performance.
	10th	Clutch, Brake and Claw Wheel 3 [Brake Design, Claw Wheel] Learning contents outside class hours [Items] (Instructions): • Block brake braking force, • Drum brake braking force	Understand the types of block brakes and drum brakes, and calculate brake torque. Understand the type of band brake and calculate the brake torque.
	11th	Spring 1 [Functions of Energy Storage Element / Buffer Element, Type of Spring, Torsion Bar Spring, Strength Design of Cylindrical Coiled Spring] Learning contents outside class hours [Items] (Instructions): • Characteristics of various springs, • Spring as an energy storage element, • Spring characteristics of torsion bar spring, • Spring strength design	Explain the function, type, and characteristics of springs. Explain the role of shock absorbers and dampers. Explain the role of spring types and uses. Design a spring with the understanding that it is an element that stores and restores energy to itself. Explain the acting force and stress of the compression cylindrical coiled spring from the viewpoint of strength of materials.
	12th	Spring 2 [Spring Characteristics of Cylindrical Coiled Springs, laminated leaf springs and other springs] Learning content outside class hours [Items] (Instructions): • Spring characteristics	The amount of deflection when a tensile or compressive load is applied to a coil spring of any material, wire diameter, and number of turns can be obtained.
	13th	Spring 3 [Laminated Leaf Springs and Other Springs] Learning content outside class hours [Items] (Instructions): • Relationship between load and deflection / stress	A beam of uniform strength can be designed (leaf spring).
	14th	Pipes, Pipe Joints, Valves [Types and Uses of Pipes, Selection Methods of Pipes, Pipe Joints,, Types and Uses of Valves] Learning contents outside class hours [Items] (Instructions): • Average flow velocity of pipes, • Selection of pipe dimensions, • Pipe screws, • Pipe line design	Explain the types and characteristics of pipelines, pipe joints and valves. Pipes used for pipelines such as fluid transportation can be selected. Safety, maintenance, operability, etc. can be considered when designing the pipeline.
	15th	(2nd semester final exam)	
	16th	Return and commentary of exam answers	

Evaluation Method and Weight (%)

	Examination	Exercises	Mutual Evaluations between students	Behavior	Portfolio	Mini test	Total
Subtotal	70	30	0	0	0	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	70	30	0	0	0	0	100
Cross Area Proficiency	0	0	0	0	0	0	0