Akashi College	Year	2023	Course Title	Strength of Materials I

Course Information

Course Code	5334	Course Category	Specialized / Compulsory
Class Format	Lecture	Credits	Academic Credit: 2
Department	Mechanical Engineering	Student Grade	3rd
Term	First Semester	Classes per Week	2
Textbook and/or Teaching Materials	Strength of Materials I, Tomohiro MORISHITA, Masahiko HIRAO, Morikita Publishing Co.		
Instructor	MORISHITA Tomohiro		

Course Objectives

1) Can calculate loads and reaction forces acting on static members of mechanical structures.
2) Can calculate the stress value and the resulting deformation amount when one-dimensional stress acts on the static member of a mechanical structure.
3) Can design static parts of mechanical structures in a reasonable and safe manner.
4) Can discuss material dynamics issues with others based on logical thinking.

Rubric

	Ideal Level	Standard Level	Unacceptable Level
(1) Calculation of load and reaction force	Understand the support conditions of static members of a mechanical structure correctly, and can create force and moment contact formulas, and calculate reaction forces.	Can calculate the loads and reaction forces acting on static members of a mechanical structure.	Cannot calculate loads and reaction forces acting on static members of a mechanical structure.
(2) Calculation of stress and strain	Understand the state of stress and the deformation of a one-dimensional stress acting on a static component of a mechanical structure correctly, and can calculate the stress values and deformation quantities.	Can calculate the stress value and the resulting deformation when one-dimensional stress is acting on the static member of a mechanical structure.	Cannot calculate the stress value and the resulting deformation when one-dimensional stress is acting on the static member of a mechanical structure.
(3) Strength design and evaluation	Understand the rational and safe method of calculating dimensions for static parts of mechanical structures, and can devise optimum shapes and dimensions.	Can design static parts of mechanical structures in a reasonable and safe manner.	Cannot design static parts of mechanical structures in a reasonable and safe manner.
(4) Logical thinking and interactive communication	Can discuss material dynamics issues with others based on logical thinking and summarize opinions of the group .	Can discuss material dynamics issues with others based on logical thinking.	Cannot discuss material dynamics issues with others based on logical thinking.

Assigned Department Objectives

Teaching Method

Outline	The aim is to be able to calculate the strength of structural and mechanical components and to evaluate the strength of these components, as well as to be able to independently and continuously learn related matters, and to conduct logical thinking and technical discussions.
Style	Pre-study the textbook and example problems before classs. After the instructor explains the key points of the study material at the beginning of the class, students will have a group discussion. They are also expected to raise questions and unclear points to the instructor for explanation. Work in groups on the exercise assignments prepared by the instructor.
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 study time required for pre-study / review, and completing assignment reports. Try to think and understand yourself. Actively work on the exercise assignments. Actively participate in group discussions and contribute to the group's learning activities during class hours. 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	Tensile and compressive (1) Normal stress and axial force	Can explain the types of loads and how the material deforms due to the loads. Understand the internal forces and stresses that occur in the virtual cross section of the bar under axial load, and can calculate their magnitude.
		2nd	Tension and compression (2) Deformation of the rod due to axial force, and the mechanical properties of the material	Understand the deformation of the bar on which the axial force acts, and can calculate its magnitude. Can explain stress-strain diagrams for various materials. Can understand Hook's law and explain the modulus of elasticity.

		3rd	Tensile and compressive (3) Thermal expansion and stress, allowable stress and factor of safety, and simple truss	Understand the meaning of the linear expansion coefficient and can calculate thermal stresses for simple thermal stress problems. Can explain the allowable stress and factor of safety, and can calculate safe workpiece dimensions for the bar under axial load. Can calculate the stresses that occur on members of a static truss, and can calculate the nodal displacements.
		4th	Tensile and compression (4) Bars with varying cross-sectional area, stress concentration	Can calculate the stress and elongation of the bars with varying cross sections. Can explain the meaning of stress concentration, and can calculate the maximum stress using diagrams and other diagrams.
		5th	Tension and compression (5) Bars with varying axial force	Can calculate the stresses, strains and deformations caused by axial loads, self-weights, and centrifugal forces acting on intermediate points.
		6th	Shear and torsion (1) Shear stress, shear strain, and couples	Can calculate the stresses and deformations of the members affected by the shear load. Understand Hook's law in shear, and can explain the modulus of elasticity. Can explain the couples and the moments.
		7th	Shear and torsion (2) Axis torsion, power axis	Can calculate the shear strain and shear stress of the torsional round bar. Can calculate the section quadratic polar moment and polar section factor for round and hollow round axes. Understand the meaning of the torsional rigidity of an axis, and can calculate the torsion angle of an axis. Can calculate the stresses and torsion angles that occur on the power axis.
		8th	Bending of the beam (1) Type of beam and reaction force of the support point	Can explain the definition and type of beam and the type of load applied to the beam. Can calculate the reaction forces that occur at the support point.
	2nd Quarter	9th	Beam bending (2) Shear force diagram and bending moment diagram	Can calculate the shear forces and bending moments that occur in a virtual section of a beam subjected to various loads, and you can create a shear force diagram and a bending moment diagram.
		10th	Beam bending (3) Regularity in shear and bending moment diagrams, inflection beams and arc beams, and beams subject to moving loads	Understand the relationships between loads, shear forces, and bending moments, and can calculate loads, shear forces, and bending moments by using the relationships. Understand the regularity of shear and bending moment diagrams, and can create shear and bending moment diagrams without relying on calculations. Can create shapes internal and internal idol forces in inflection beams, arc beams, and beams subject to moving loads.
		11th	Bending of the beam (4) Bending stress of the beam	Can calculate the bending stress and its distribution caused by bending moment.
		12th	Beam bending (5) Beam cross-sectional shape and bending strength and bending stiffness	Can explain the meaning of the centroid, the second moment of section, and the section coefficient, and can calculate them for the various section shapes. Can devise the cross-section shape of the beam by considering the bending strength and bending stiffness.
		13th	Beam bending (6) Beam deflection	Can calculate the deflection angle and deflection for various beams by using the differential equation of the deflection curve.
		14th	Bending of the beam (7) Equal strength beam	Can explain stress and deformation for equal strength beams, and can calculate them. Can calculate the shape and dimensions to achieve equal strength beams. Can explain the use examples of plate springs, lap plate springs, and vehicle springs.
		15th	Total Review	Understand the essentials of mechanics of solids.
		16th	Final exam	

Evaluation Method and Weight (%)

	Examination	Exercises	Group work	Total
Subtotal	80	10	10	100
Basic Proficiency	0	0	0	0
Specialized Proficiency	80	5	5	90
Cross Area Proficiency	0	5	5	10