Akashi College	Year	2023	Course Title	Advanced Strength of Structures

Course Information

Course Code	5016	Course Category	Specialized / Elective
Class Format	Lecture	Credits	Academic Credit: 2
Department	Architecture and Civil Engineering	Student Grade	Adv. 1st
Term	First Semester	Classes per Week	2
Textbook and/or Teaching Materials	handouts, Japan Society of Civil Engineers (ed.), F. Nishino and A. Hasegawa : Civil engineering of New system, (7) Elastic analysis for structures, Gihodo shuppan (as a reference)		
Instructor	MIYOSHI Takao,NAKAGAWA Hajime		

Course Objectives

(1) Can introduce these contents related to structural mechanics in English based on the knowledge obtained so far in the Architecture and Civil Engineering departments (H) (Nakagawa).
(2) Can solve problems concerning solids based on the theory of elasticity (Miyoshi).

Rubric

	Ideal Level	Standard Level	Unacceptable Level
Achievement 1	Can properly explain content related to structural mechanics in English	Can explain content related to structural mechanics in English	Cannot explain content related to structural mechanics in English
Achievement 2	Can solve and explain problems concerning solids based on the theory of elasticity	Can solve problems concerning solids based on the theory of elasticity	Cannot solve problems concerning solids based on the theory of elasticity

Assigned Department Objectives

Teaching Method

Outline	1. Introduce in English structural mechanics studied in the Regular Course. Group learning will be conducted using active learning education (AL education). (Taught by Nakagawa: 7 weeks) 2. Lectures will be conducted concerning the theory of elasticity, which is indispensable for the analysis of solids and structures that are difficult to model as frame structures. (Taught by Miyoshi: 8 weeks) This course will be taught by an instructor (Nakagawa) who was involved in structural design of buildings at a company by making use of his experience, so that students can present in English structural mechanics that they studied in the Regular Course. In addition, an instructor (Miyoshi), who has experience as an engineer of bridge fabricator and has engaged in the design of steel bridges and steel structures, will conduct a lecture-style class on the fundamental theory of elasticity, by using his experiences.
Style	The lectures will be divided into two halves: Nakagawa will teach the first, and Miyoshi the second. 1. The exercises to introduce structural mechanics in English will be done in groups. Students will mingle together and discuss various details to create content in English regardless of whether they are from the Architecture or Civil Engineering department. The teacher in charge (Nakagawa) will provide supplementary lessons on structural mechanics as appropriate during the classes, and will provide instructions for creating English presentations. 2. Studies concerning the fundamental theory of elasticity will be mainly explained on the board
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. Before taking the course, carefully pre-study the handouts distributed in advance to fully understand the content to attend classes. Studies concerning the fundamental theory of elasticity will proceed on the premise that students have learned fundamental knowledge of mathematics such as linear algebra. Students should write on the board in class and should not miss the review of the lecture. Students who miss 1/3 or more of classes will not be eligible for evaluation. The minimum score for a pass will be 60% based on the following performance evaluation methods. The overall evaluation will be calculated with the following ratio of each teacher in charge: Nakagawa 1/2 and Miyoshi 1/2. Nakagawa: Assignment presentation for 1 (60%), and a report for (2) (40%). Miyoshi: Evaluations will be based on : 1. Exams (35%) 2. Reports (15%) The report assignments are as follows: Nakagawa: Evaluations will be based on the assignment presentation (30%) and the graduation research introduction in English (20%).

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	Class plans and guidance Explain the class plans and content of this course. Explain the outline of structural mechanics (statically determinate and indeterminate mechanics) studied in the Regular Course using the slide.	Can understand the class plans and the content of this course.
		2nd	Content creation for the presentations on statically determinate mechanics (1) Discuss in groups and think specifically about what content to create.	Can discuss in group to work on the assignment and create content.
		3rd	Content creation for the presentations on statically determinate mechanics (2) Discuss in groups and think specifically about what content to create. Create presentation data.	Can discuss in group to work on the assignment and create content.

		4th	English presentations on statically determinate mechanics Each group will present their English summary on statically determinate mechanics using slides. Afterwards, discuss among the teacher and students.	Can make presentations in groups and ask questions to other groups.
		5th	Content creation for the presentations on statically indeterminate mechanics (1) Discuss in groups and think specifically about what content to create.	Can discuss in group to work on the assignment and create content.
		6th	Content creation for the presentations on statically indeterminate mechanics (2) Discuss in groups and think specifically about what content to create.	Can discuss in group to work on the assignment and create content.
		7th	English presentations on statically indeterminate mechanics Each group will present their English summary on statically indeterminate mechanics using slides. Afterwards, discuss among the teacher and students.	Can make presentations in groups and ask questions to other groups.
		8th	Mathematical foundations of elasticity theory (1) Learn scalar product, vector product, tensor product, and summation convention.	Can calculate scalar product, vector product, and tensor product and explain summation convention.
	2nd Quarter	9th	Mathematical foundations of elasticity theory (2) Learn coordinate transformation of the vector and tensor, and. physical quantity in the theory of elasticity.	Can conduct the coordinate transformation of the vector and tensor, and explain and sort out the physical quantity in elasticity theory
		10th	Stress (1) Learn stress tensor, equilibrium of stress, and Cauchy's formula.	Can explain stress tensor, equilibrium of stress, and Cauchy's formula.
		11th	Stress (2) Learn principal stress and principal axis of stress under 3-dimensional stress state, and stress invariant.	Can calculate principal stress, principal axis of stress, and stress invariant under 3-dimensional stress state.
		12th	Strain (1) Learn displacement gradient, strain tensor, and spin tensor.	Can explain displacement gradient, strain tensor, and spin tensor
		13th	Strain (2) Learn compatibility condition, principal strain, and strain invariant.	Can explain compatibility condition and calculate principal strain and strain invariant.
		14th	Constitutive equation (1) Learn constitutive equation of 3-dimensional isotropic linear elastic body	Can explain the constitutive equation of 3-dimensional isotropic linear elastic body and calculate stress from strain using the equation
		15th	Constitutive equation (2) Learn constitutive equation of 3-dimensional isotropic linear elastic body in 2-dimensional problems	Can derive the constitutive equation of 2-dimensional isotropic linear elastic body from that of 3-dimensional one and calculate stress from stain in 2-dimensional problems
		16th	Final exam	

Evaluation Method and Weight (%)

	Examination	Reports	Presentation	Introduction	Portfolio	Other	Total
Subtotal	35	15	30	20	0	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	35	15	30	20	0	0	100
Cross Area Proficiency	0	0	0	0	0	0	0