

Toyama College		Year	2020		Course Title	工業材料学 I
Course Information						
Course Code		0222		Course Category	Specialized / Compulsory	
Class Format		Lecture		Credits	School Credit: 1	
Department		Department of Maritime Technology		Student Grade	5th	
Term		First Semester		Classes per Week	2	
Textbook and/or Teaching Materials						
Instructor		Mizutani Junnosuke				
Course Objectives						
At the completion of this course, students will be able to: 1) understand eutectic diagram and calculate quantity of each component. 2) explain behavior of dislocation and plastic deformation. 3) understand the behavior of martensitic transformation of steel.						
Rubric						
		Ideal Level of Achievement (Very Good)	Standard Level of Achievement (Good)		Unacceptable Level of Achievement (Fail)	
Evaluation 1		Can calculate quantity of each component from phase diagram and understand the state of steel	Can understand eutectic diagrams and calculate the quantity of each component		Can't understand all proportional solid solution diagram and lever rule	
Evaluation 2		Can explain four strengthen methods of steel materials	Can explain transitional behavior and plastic deformation		Can't understand the types of mechanical properties of metallic material	
Evaluation 3		Can calculate ideal critical diameter of quenching	Can understand the behavior of martensitic transformation of steel		Can't understand the types and methods of thermal processing to steel	
Assigned Department Objectives						
MCCコア科目						
Teaching Method						
Outline		It is essential for engineers to understand the properties of metal materials related to daily life and industrial activities. Following the interpretation of phase diagrams, the preparation method and heat treatment of metal materials, especially steel, are taught in this course. The purpose of this course is to promote understanding of the characteristics and applications of steel materials.				
Style		Lectures and exercises by an instructor				
Notice		Students are required to submit a brief report at the end of every lecture/exercise. The contents of these reports will be reflected in the subsequent lecture/exercise. Students who earned less than 60 points may be given a chance to sit for an extra exam upon request if there is a justifiable reason. 60 points will be given to those students who are assumed to be complete the course based on the results of such extra exam. This is an obligatory course to obtain the license of Third grade maritime officer (Engine) at training schools designated by the Law of Maritime Officers as the subject on Engine Part 3 Material Engineering.				
Course Plan						
			Theme		Goals	
1st Semester	1st Quarter	1st	[Lecture] - Introduction of course - Metal materials around us - Properties of mechanical materials		Can understand the history of human-metal involvement and basic properties of metals such as melting points, densities, prices of familiar metals	
		2nd	[Lecture] - Crystal structure of metal materials		Can understand the assembly state of atoms in metals with the knowledge of body-centered cubic lattice, face-centered cubic lattice, lattice constant, density, crystal grain boundaries, etc.	
		3rd	[Lecture] - Failure of crystal structure		Can understand the concepts of mirror index, type of solid solution, the dislocation and the stacking fault.	
		4th	[Lecture] - Mechanical property of materials		Can understand the meanings of S-N curve; creep strength; strain-hardening; recrystallization; recovery, hot working and cold forming.	
		5th	[Lecture] - Plastic deformation of metal materials		Can understand the mechanism of plastic deformation by stress, in particular, the concepts of slip deformation and slip direction; process of dislocation and slip deformation; and critical shear stress.	
		6th	[Lecture] - State transition of metal material		Can understand the concepts of phase change and transformation point; nucleation of crystal and nucleus growth; grain size number; and grain boundary.	
		7th	[Lecture] - State diagram of alloy (all proportional solid solution)		Can interpret the state diagram of all proportional solid solution with the knowledge of lever rule and phase rule.	
		8th	[Lecture/Exercise] - State diagram of alloy (eutectic)		Can understand the concepts of eutectic and primary crystal; and eutectic type phase diagram. Can calculate basic elements.	
	2nd Quarter	9th	[Mid-term exam]		Can demonstrate knowledge of formation and metals; plastic deformation and behavior of dislocation; and interpretation of state diagrams.	

		10th	[Answers and explanation for mid-term exam] [Confirmation of results] [Lecture] - Strengthen method of metal materials	Can understand the concepts of strain hardening, crystal grain micronizing, alloyed, precipitation strengthening.
		11th	[Lecture] - Steel as the most common mechanical material	Can classify steels with the knowledge of transformation of pure iron, magnetic transformation, ferrite and austenite.
		12th	[Lecture] - Phase diagram of steels	Can understand Fe-Fe ₃ C phase diagram, deposition, cementite and perlite in relation to organization change upon cooling.
		13th	[Lecture] - Organization of steels and their properties - Role of carbides in steels	Can infer mechanical properties of steels from their organization and carry out relevant calculations.
		14th	[Lecture] - Heat treatment of steels - Martensitic transformation	Can understand the techniques and effects of annealing, normalizing, tempering and the process of martensitic transformation.
		15th	[Final exam]	Can demonstrate knowledge of types and applications of strengthening materials.
		16th	[Answers and explanation for final exam] [Confirmation of results] [Questionnaire (Evaluation of lectures)]	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	0	0	0	0	0	0	0
Basic Ability	0	0	0	0	0	0	0
Technical Ability	0	0	0	0	0	0	0
Interdisciplinary Ability	0	0	0	0	0	0	0