SYLLABUS in 2018

for Department of Civil and Structural Engineering,
Depatment of Urban and Environmental Engineering, and
Department of Maritime Engineering,
Graduate School of Engineering,
Kyushu University

Program Requirements

International Master's Programs
Graduate School of Engineering

A student shall be required to:

- be enrolled in the program for at least two years;
- acquire at least 30 credits from "Required Specialized Courses"[*1] and "Cross-disciplinary Courses"[*2] by meeting the specific requirements listed below;
- undertake guided research; and
- pass the thesis examination.

Programs	Requirements
Civil and Structural Engineering	1. Six or more credits from "Advanced Subjects" are to be included in the total credits.
Urban and Environmental Engineering	2. Six or more credits from "Advanced Specialized Subjects" are to be included in the total credits.
Maritime Engineering	3. Two or more credits from "Professional Skill Development" are to be included in the total credits.

*1: "Required Specialized Courses" refers to the subjects offered by the Master's Program of the department in which the student is enrolled.

*2: "Cross-disciplinary Courses" refers to the subjects offered by other departments and the "Common Subjects for International Students". These subjects are to be chosen in consultation with the student's supervisor.

List of courses in Department of Civil and Structural Enginieering, Department of Urban and Enivronmental Enginieering, and Department of Maritime Enginieering, Graduate School of Engineering, Kyushu University

No.	Title	Category *	Credit	Term							
				1st year				2nd year			
				Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer
IM112	Advanced Earthquake Engineering	A	2			2	2				
IM119	Advanced Numerical Analysis	A	2			2	2				
IM131	Geo-Spatial Information Science	A	2			4					
IM141	Research Planning	A	2			4					
IM250	Field Survey Method	A	2			4					
IM251	Presentation Exercise	A	2	4							
IM252	Urban Engineering & Economics	A	2							4	
IM1677	Advanced Data Analysis	A	2			4					
IM111	Advanced Concrete Engineering	AS	2							2	2
IM113	Advanced Geotechnical Modelling and its Application	AS	2	2	2						
IM114	Advanced Geomechanics and Foundation	AS	2					2	2		
IM115	Risk Management in Natural Disaster Prevention	AS	2							2	2
IM118	Advanced Structural Analysis	AS	2							2	2
IM121	Geoenvironmental System Engineering	AS	2				4				
IM140	Mechanics of Geomaterials	AS	2			2	2				
IM211	Urban Transportation Planning	AS	2			2	2				
IM212	Advanced Steel Structure	AS	2	2	2						
IM214	River Engineering	AS	2				4				
IM216	Biological Water Quality Control Engineering	AS	2			2	2				
IM217	Advanced Ecological Engineering	AS	2					2	2		
IM218	Environmental Planning	AS	2							2	2
IM219	Groundwater Environmental Systems	AS	2							2	2
IM220	Practical Application of Aestetic Design inCivil Engineering	AS	2							2	
IM221	Material Cycles and Waste Management	AS	2					2	2		
IM222	Environmental Fluid Mechanics	AS	2					2	2		

IM223	Advanced Ocean and Coastal Engineering	AS	2	2	2						
IM224	Urban Development Project	AS	2	2	2						
IM225**	Advenced Civil and Environmental Engineering	PSD	2								
IM226**	Practice in Civil and Environmental Engineering	PSD	2								
IM227+	Practice in Environmental Studies	PSD	2								
IM1679	Problem-Solution Seminar	PSD	2		4						
IM1693	Internship Program	PSD	2								

* A: Advanced Subjects（高等専門科目）

AS: Advanced Specialized Subjects（先端科目）

PSD: Professional Skill Development（能力開発特別スクーリング科目）

** : The subject is offered by the student's supervisor. Inquire of the supervisor about the detailed information.

+ : The subject is offered by Associate Prof. Seino. Inquire of Associate Prof. Seino about the detailed information.

Code	IM112	Title	Advanced Earthquake Engineering
Category	Advanced Subjects	Activities	Lecture
Term	Spring & summer term, 1st year student	Credit	2

Instructor, Contact Information	Taiji MATSUDA	Keywords	Seismic design method
	Tel: 092-802-3377 E-mail: mazda@doc.kyushu-u.ac.jp Room#: Ito Campus, W2-1115	Course Requirements	None

Outline	Students learn the seismic design process of bridges.
Objectives	Acquisition of knowledge about the earthquake engineering through the seismic design of bridges.
Goal	To get the ability to explain the seismic method of bridges To get the ability to obtain the response spectrums of ground excitations. To get the ability to explain the base isolation techniques and the vibration control techniques.
Method	Lecture and report

Lecture topics				
	1	Basic principles for Seismic Design	9	Verification of Seismic Performance of Seismically isolated (Menshin) bridges(1)
	2	Loads to be considered in Seismic Design	10	Verification of Seismic Performance of Seismically isolated (Menshin) bridges(2)
	3	Design Earthquake Ground Motions	11	Verification of Seismic Performance of Seismically isolated (Menshin) bridges(3)
	4	Verification of Seismic Performance	12	Vibration Control Techniques (1)
	5	Verification Methods of Seismic Performance Based on Static Analysis(1)	13	Vibration Control Techniques (2)
	6	Verification Methods of Seismic Performance Based on Static Analysis(2)	14	Vibration Control Techniques (3)
	7	Verification Methods of Seismic Performance Based on Dynamic Analysis(1)	15	
	8	Verification Methods of Seismic Performance Based on Dynamic Analysis(2)	16	

Grading	Attendance, report, etc.
Textbook, Reference Book	Textbook: none. Hand made print will be prepared. Reference: Specification for highway bridges Part V Seismic design by Japan Road Association
Office Hours	A/N. Questions are accepted in office any time with previous contact by e-mail.

Code	IM119	Title	Advanced Numerical Analysis	
Category	Advanced Subjects	Activities	Lecture	
Term	Spring & summer term, 1st year student	Credit	2	
Instructor, Contact Information	Mitsuteru ASAI		Keywords	Finite element method, programming, Simulation
	Tel: 092-802-3373 E-mail: asai@doc.kyushu-u.ac.jp Room#: Ito Campus, W2-1114		Course Requirements	None
Outline	Students learn the basic background for numerical analysis, and then they acquire the application skills of these techniques and/or software.			
Objectives	Recently, there is commercial software of numerical analysis in various research fields. Some engineers and students use software as a black box. In this lecture, students learn mathematical backgrounds of numerical analysis in order to use commercial software correctly. Then, students acquire the programming skills to implement the mathematical formulations.			
Goal	To understand the formulations of numerical analysis (Finite Element Method and Finite Difference Method) To acquire the programming skill for reading the existing codes and for writing own codes.			
Method	First, instructor teaches the formulations by using printed materials. Then, students practice the programming in FORTRAN.			

Lecture topics				
	1	Introduction	8	Advances in continuum mechanics for elasticity
	2	Solver for linear equations	9	Finite element formulation for 1D problems
	3	Solving technique for nonlinear systems①	10	Finite element formulation for multi-dimensional scalar field problems
	4	Solving technique for nonlinear systems②	11	Finite element formulation for multi-dimensional scalar field problems
	5	Finite Difference Method	12	Finite element formulation for linear elasticity ①
	6	Finite Difference Method (programming)	13	Finite element formulation for linear elasticity ②
	7	Continuum mechanics for linear elasticity	14	Finite element formulation for linear elasticity ③

Grading	Attendance (30%), Reports (70%)
Textbook, Reference Book	Textbook: None (Reference materials are provided as printed papers.) Reference Book: A First Course in Finite Elements, Jacob Fish and Ted Belytschko, Wiley
Office Hours	A/N. Questions are accepeted by e-mail, also.

Code	IM131	Title	Geo-Spatial Information Science
Category	Advanced Subjects	Activities	Lecture
Term	Spring term, 1st year student	Credit	2
Instructor, Contact Information	Yasuhiro MITANI	Keywords	GIS
	Tel: 092-802-3399 E-mail: mitani@doc.kyushu-u.ac.jp Room#: Ito Campus, W2-1126	Course Requirements	
Outline	Geographic Information System (GIS) is fundamentally about workable applications. This lecture provided: How GIS affects our everyday life, How GIS applications have developed How GIS can be used to study and solve problems in Civil Engineering fields Furthermore, you study the basic technique of GIS operations.		
Objectives			
Goal			
Method			

Lecture topics				
	1		8	
	2		9	
	3		10	
	4		11	
	5		12	
	6		13	
	7		14	

Grading	
Textbook, Reference Book	
Office Hours	

Code	IM141	Title	Research Planing
Category	Advanced Subjects	Activities	Lecture
Term	Spring term, 1st year student	Credit	2
Instructor, Contact Information	All professors	Keywords	research planning
		Course Requirements	
Outline	The purpose of this course is to acquire the research planning skills required for Master of Engineering.		
Objectives	Acquire basic knowledge as a researcher such as general research (research method, information gathering, dissertation, research fund etc.), research ethics etc.		
Goal	Professors teach for each specialized field of civil engineering.		
Method			

Lecture topics				
	1	Guidance	8	Case examples of research project on environmental engineering
	2	Basic knowledge of academic research	9	
	3	Case examples of research project on structural mechanics	10	
	4	Case examples of material research project	11	
	5	Case examples of research project on geotechnical engineering	12	
	6	Case study of research project on planning studies	13	
	7	Case examples of research project on hydraulics	14	

Grading	Mid. and Final examination 80% Attendance 20% Total score of 60 is necessary for qualification
Textbook, Reference Book	
Office Hours	It depends on each professor

<table>
<tr><td>Code</td><td colspan="2">IM250</td><td>Title</td><td colspan="3">Field Survey Method</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Spring term,
1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Akira TAI</td><td>Keywords</td><td>Field Survey, RTK-GNSS, ADCP, UAV</td></tr>
<tr><td colspan="3">Tel: 092-802-3439
E-mail:tai@civil.kyushu-u.ac.jp
Room#: Ito Campus, W2-1032</td><td>Course Requirements</td><td></td></tr>
<tr><td>Outline</td><td colspan="6">The purpose of this course is to learn basic knowledge of field survey and safety management in research activities.</td></tr>
<tr><td>Objectives</td><td colspan="6">To obtain basic skills of field research (water system, biological system, ground system, structure system).</td></tr>
<tr><td>Goal</td><td colspan="6">Using skills in master's course research activities</td></tr>
<tr><td>Method</td><td colspan="6">First, Students study from basic knowledge of field survey, safety management, applied surveying, and then studied on the study of water environment, ground and structures by lecture. After that, practical training using actual measurement equipment is carried out in real field.</td></tr>
<tr><td rowspan="7">Lecture topics</td><td>1</td><td colspan="2">Guidance</td><td>8</td><td colspan="2">How to use GIS and other tools for analysis</td></tr>
<tr><td>2</td><td colspan="2">Safety management</td><td>9</td><td colspan="2"></td></tr>
<tr><td>3</td><td colspan="2">Theory of Water Area</td><td>10</td><td colspan="2"></td></tr>
<tr><td>4</td><td colspan="2">Practice of Water Area Survey</td><td>11</td><td colspan="2"></td></tr>
<tr><td>5</td><td colspan="2">Theory of Applied Surveying and Biological Survey</td><td>12</td><td colspan="2"></td></tr>
<tr><td>6</td><td colspan="2">Practice of Applied Surveying and Biological Survey</td><td>13</td><td colspan="2"></td></tr>
<tr><td>7</td><td colspan="2">Fundamentals and Practice of Survey of Ground and Structures</td><td>14</td><td colspan="2"></td></tr>
<tr><td>Grading</td><td colspan="6">Report (80%) and attendance (20%)</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6"></td></tr>
<tr><td>Office Hours</td><td colspan="6">Thursday 4:00-6:00 PM</td></tr>
</table>

Code	IM251	Title	Presentation Exercise
Category	Advanced Subjects	Activities	Lecture
Term	Spring term, 1st year student	Credit	2
Instructor, Contact Information	Akihiko HIGUCHI	Keywords	
	Tel: 092-802-3436 E-mail: higuchi@doc.kyushu-u.ac.jp Room#: Ito Campus, W3-815	Course Requirements	
Outline			
Objectives			
Goal			
Method			

Lecture topics				
	1		8	
	2		9	
	3		10	
	4		11	
	5		12	
	6		13	
	7		14	

Grading	
Textbook, Reference Book	
Office Hours	

<table>
<tr><td>Code</td><td colspan="2">IM252</td><td>Title</td><td colspan="3">Urban Engineering & Economics</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Spring term,
2nd year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Shunsuke MANAGI</td><td>Keywords</td><td>Urban engineering; urban economics</td></tr>
<tr><td colspan="3">Tel: 092-802-3405
E-mail: managi@doc.kyushu-u.ac.jp
Room#: Ito Campus, W2-1035</td><td>Course Requirements</td><td>Undergraduate level of understanding of urban engineering and microeconomics required</td></tr>
<tr><td>Outline</td><td colspan="6">Lecture on economics for the civil engineering such as urban planning, regional policy, etc.</td></tr>
<tr><td>Objectives</td><td colspan="6">This course provides a comprehensive account of the application of business analysis to public issues. We will examine how business managers and government director can reconcile the goals of maintaining and improving both shareholder value and performance for SDGs.</td></tr>
<tr><td>Goal</td><td colspan="6">This course set a goal to understand above objective and present to others. The course covers both methodological topics and recent applications. Using urban engineering and microeconomic principles, we will examine such topics as the sustainability problems, public policies, and business practices.</td></tr>
<tr><td>Method</td><td colspan="6">Presentation</td></tr>
<tr><td rowspan="7">Lecture topics</td><td>1</td><td>Urban engineering</td><td>8</td><td colspan="2">Inclusive wealth</td></tr>
<tr><td>2</td><td>Microeconomics</td><td>9</td><td colspan="2">UN and national policy</td></tr>
<tr><td>3</td><td>Urban policy</td><td>10</td><td colspan="2">Climate change</td></tr>
<tr><td>4</td><td>Utility</td><td>11</td><td colspan="2">Infrastrucutre construction</td></tr>
<tr><td>5</td><td>Measurement</td><td>12</td><td colspan="2">Cost beneft analysis</td></tr>
<tr><td>6</td><td>Sustainability</td><td>13</td><td colspan="2">Engineering with policy making</td></tr>
<tr><td>7</td><td>SDGs</td><td>14</td><td colspan="2">Presentation by students</td></tr>
<tr><td>Grading</td><td colspan="6">Grades will be assigned according to the following weighting scheme:
20 % Mid-term Exam, 40 % Final Exam, 20 % Homework, 20 % Class Participation</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Managi, S. (Eds.) 2019. "Wealth, Inclusive Growth and Sustainability." Routledge, New York, USA. (Required)
Managi, S. and P. Kumar. 2018. "Inclusive Wealth Report 2018: Measuring Progress toward Sustainability." Routledge, New York, USA.
Managi, S. (Eds.) 2015. "The Routledge Handbook of Environmental Economics in Asia." Routledge, New York, USA.</td></tr>
<tr><td>Office Hours</td><td colspan="6"></td></tr>
</table>

<table>
<tr><td>Code</td><td colspan="2">IM1677</td><td>Title</td><td colspan="3">Advanced Data Analysis</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Spring term,
1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Akira TAI</td><td>Keywords</td><td>statistics, R language</td></tr>
<tr><td colspan="3">Tel: 092-802-3439
E-mail:tai@civil.kyushu-u.ac.jp
Room#: Ito Campus, W2-1032</td><td>Course Requirements</td><td></td></tr>
<tr><td>Outline</td><td colspan="6">The purpose of this course is to learn practical data analysis which is required mainly for research on water and environment.</td></tr>
<tr><td>Objectives</td><td colspan="6">· Learn practical data analysis of water and environment data using R language
· Learn about visualization of data and representation of analysis results using R language, QGIS, GMT, etc.</td></tr>
<tr><td>Goal</td><td colspan="6">· Give total exercise tasks and conduct statistical analysis and presentation of the results.</td></tr>
<tr><td>Method</td><td colspan="6">Learn how to use basic geographical data published on the web such as national land numerical information and ETOPO</td></tr>
<tr><td rowspan="8">Lecture topics</td><td>1</td><td>Basics of statistics and R.
p value, parametric, nonparametric, basic operation of R, etc.</td><td>8</td><td colspan="3">Presentation of the results of the final exercise</td></tr>
<tr><td>2</td><td>correlation analysis, regression analysis (single correlation, multiple correlation, nonparametric correlation, GLM, AIC)</td><td>9</td><td colspan="3"></td></tr>
<tr><td>3</td><td>Variance analysis, covariance analysis</td><td>10</td><td colspan="3"></td></tr>
<tr><td>4</td><td>Multivariate analysis (multiple regression analysis, principal component analysis)</td><td>11</td><td colspan="3"></td></tr>
<tr><td>5</td><td>Basics of Machine Learning</td><td>12</td><td colspan="3"></td></tr>
<tr><td>6</td><td>visualization by GMT, mapping of terrain data</td><td>13</td><td colspan="3"></td></tr>
<tr><td>7</td><td>Setting and implementation of final exercises</td><td>14</td><td colspan="3"></td></tr>
<tr><td>Grading</td><td colspan="6"></td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Paul Teetor : R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics (O'reilly Cookbooks), 2011</td></tr>
<tr><td>Office Hours</td><td colspan="6">Thursday 4:00-6:00 PM</td></tr>
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Code	IM111	Title	Advanced Concrete Engineering
Category	Advanced Specialized Subjects	Activities	Lecture
Term	Spring & summer term, 2nd year student	Credit	2
Instructor, Contact Information	Hidenori HAMADA Yasutaka SAGAWA	Keywords	Carbonation, Chloride attack, Alkali-silica reaction.
	Tel: 092-802-3390 E-mail:h-hamada@doc.kyushu-u.ac.jp Room#: Ito Campus, W2-1118	Course Requirements	Fundamental knowledge of construction material, concrete structure, should be studied.
Outline	Over all design methods and design theories from structures' planning, structural design, to life cycle management are explained in this course.		
Objectives	Students should study design code, design method, design theory, related to 1) planning, 2) Structural design, 3) material design, 4) workability, 5) durability and 6) scenario design.		
Goal	1. To get an engineering ability to design a concrete structure. 2. To get an engineering ability to know what should be studied after graduating from school, in real project.		
Method	Lecture and report.		

Lecture topics				
	1	Introduction - what is design?	8	Material design (1) - Durability verification against carbonation
	2	Grand design of concrete structure	9	Material design (2) - Durability verification against chloride attack
	3	Design code - Performance design (1)	10	Material design (3) - Durability verification against thermal cracking
	4	Design code - Performance design (2)	11	Design for workability
	5	Reliability design theory (1)	12	Maintenance planning - Life cycle management
	6	Reliability design theory (2)	13	Special lecture (1)
	7	Structural design - Limit state design	14	Special lecture (2)

Grading	Attendance, report, etc.
Textbook, Reference Book	Textbook: none. Hand made print will be prepared. Reference: (1) Concrete Standard Specification (Design), by JSCE (Japan Society of Civil Engineers) (2) Concrete Standard Specification (Maintenance), by JSCE (Japan Society of Civil Engineers)
Office Hours	A/N. Questions are accepted in office any time.

Code	IM113	Title	Advanced Geotechnical Modelling and its Application
Category	Advanced Specialized Subjects	Activities	Lecture
Term	Fall & winter term, 1st year student	Credit	2
Instructor, Contact Information	Noriyuki YASUFUKU	Keywords	Elasto-Plastic Behaviors of Geo-technical Materials, Upper and Lower bound Analysis, Critical state soil modeling.
	Tel: 092-802-3381 E-mail: yasufuku@civil.kyushu-u.ac.jp	Course Requirements	None
Outline	To learn framefork of geotechnical elasto-plastic modeling linked with the mechanical characteristics of Geomaterials through Critical State Soil Mechanics.		
Objectives	Today, rapid progress of IT technology allows us to conduct the nonlinear stability and deformation analysis in the geomechanics. In order to use such hardware more effectively, it is essential to understand the non-linear properties of geo-materials and its modeling In this subject, the main objective of this course is to learn the fundamental idea of soil characteristics and its modeling based on the critical state framework, which is widely used as one of the representative geo-analytical concepts for all over the world. As a result, using the analytical method explained, the students learn the basic knowledge and skill to give a proper solution for boundary value problems in geomecahnics such as the softground settelements, instability of slope and bearing capacities of foundations.		
Goal	To understand the characteristics of different type of plastic failures in Geomechanics To understand and use the fundamental properties of stress and strain in one and three dimentical conditions. To learn the fundamental idea of critical state soil modeling and to explain the soil elasticity, elasto-plasticity, the characteristics of soil hardening, critical state and softening based on the critical state soil mechanics		
Method	Every lecture is based on the materials which are delivered in the beginning of the class. Exercises linked with each lectures are given as home work.		
Lecture topics	1 Introduction –Geotechnical design issues related to Geotechnical analysis	8	Shear deformation behavior of soil by Cam Clay parameters (3)
	2 Deformation and equilibrium of force in one-dimensional condition	9	Derivation of critical state model with Roscoe surface and its application (1)
	3 Stress and strain in the three-dimensional space	10	Derivation of critical state model with Roscoe surface and its application(2)
	4 Compression behavior of soils by Cam Clay parameters (1)	11	Evaluation of strength and stiffness parameters by Cambridge school
	5 Compression behavior of soils by Cam Clay parameters (2)-	12	Presentation and discussion from each student based on the special issues linked with geotechnical problem (1)
	6 Shear deformation behavior of soil by Cam Clay parameters(1)	13	Presentation and discussion from each student based on the special issues linked with geotechnical problem (2)
	7 Shear deformation behavior of soil by Cam Clay parameters (2)	14	Presentation and discussion from each student based on the special issues linked with geotechnical problem (3)
Grading	It is totally evaluated on the basis of the exercise submissions for every lecture, final report submission and oral interview.		
Text and References	A Guide to Soil Mechanics (M. Bolton, Chung Hwa Book Company, 1991), Mohr Circles, Stress Paths and Geotechnics（R.H.G. Parry：E & FN SPON, 1995）and so on. Literatures are introduced in the class.		
Office Hours	E-mail communication is recommended.		

<table>
<tr><td>Code</td><td colspan="2">IM114</td><td>Title</td><td colspan="3">Advanced Geomechanics and Foundation</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Fall & winter term, 2nd year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3" rowspan="2">Hemanta HAZARIKA

Tel: 092-802-3369
E-mail:
hazarika@civil.kyushu-u.ac.jp</td><td>Keywords</td><td colspan="2">Soil exploration, Foundation, Earth Pressure, Bearing Capacity, Settlement, Ground Improvement, Earthquake and Vibration</td></tr>
<tr><td>Course Requirements</td><td colspan="2">None</td></tr>
<tr><td>Outline</td><td colspan="6">• Understand the basic but important concepts in the analysis, design, and construction of foundations of infrastructural projects
• Acquire knowledge on various ground improvement techniques including soil reinforcement used for modifying soil characteristic for economic design of foundation
• Learn the fundamental concepts in design of foundations under earthquake and impact loading</td></tr>
<tr><td>Objectives</td><td colspan="6">Any civil engineering system has two parts: Sub-structure or Foundation, and the Superstructure. Substructure transmits load from the superstructure to the base soils (rocks) underneath. However, soils and rocks are heterogeneous in nature and thus the nature of two foundations even in adjacent sites may differ. Also, the behavior of the same foundation under earthquake, vibration and impact loading will be different. In this course, the basic but important concepts in the analysis, design, and construction of foundations of any infrastructural projects will be learnt. Learning various ground improvement techniques for improving the performance of foundation under adverse geological and loading conditions will also be a part of this lecture. The main objective of this course is to learn both the science and art of foundation engineering.</td></tr>
<tr><td>Goal</td><td colspan="6">• To be able to grasp the theoretical background in the process of investigation, design and execution of any infrastructural projects
• To be able to understand the scientific principles (engineering) and engineering judgment (art) to design a foundation
• To be able to know the ground improvement techniques and their application in various projects</td></tr>
<tr><td>Method</td><td colspan="6">Classes will be conducted using multimedia with PowerPoint and other related materials, which will be supplied in the beginning of the class. Home work exercises will also be given periodically.</td></tr>
<tr><td rowspan="8">Lecture topics</td><td>1</td><td colspan="2">Types, purpose and functions of foundations</td><td>8</td><td colspan="2">Earth Reinforcement</td></tr>
<tr><td>2</td><td colspan="2">Soil Investigations and in-situ measurements</td><td>9</td><td colspan="2">Design of foundations for vibration control</td></tr>
<tr><td>3</td><td colspan="2">Bearing Capacity and Settlements</td><td>10</td><td colspan="2">Special project and report</td></tr>
<tr><td>4</td><td colspan="2">Earth pressures and Retaining walls</td><td>11</td><td colspan="2"></td></tr>
<tr><td>5</td><td colspan="2">Pile Foundations and Caisson Foundations</td><td>12</td><td colspan="2"></td></tr>
<tr><td>6</td><td colspan="2">Foundations on Difficult Soils</td><td>13</td><td colspan="2"></td></tr>
<tr><td>7</td><td colspan="2">Soil Improvement and Ground Modification</td><td>14</td><td colspan="2"></td></tr>
<tr><td>Grading</td><td colspan="6">Attendance (20%), Reports (60%) and Special Project (20%)</td></tr>
<tr><td>Text and References</td><td colspan="6">Bowles, J.E “Foundation Analysis and Design”, McGraw Hill, USA.
Das, B. M. “Principles of Foundation Engineering.“, PWS Publishing, USA.
Ishibashi, I., and Hazarika, H. “Soil Mechanics Fundamentals”, CRC Press, USA</td></tr>
<tr><td>Office Hours</td><td colspan="6">Any time but through prior e-mail contact and appointment</td></tr>
</table>

Code	IM115	Title	Risk Management in Natural Disaster Prevantion
Category	Advanced Specialized Subjects	Activities	Lecture
Term	Spring & summer term, 2nd year student	Credit	2
Instructor, Contact Information	Guangqi CHEN	Keywords	Hazard, risk, analysis, management, disaster, slope, liquefaction
	Tel: 092-802-3386 E-mail: chen@civil.kyushu-u.ac.jp Room#: Ito Campus, W2-1127	Course Requirements	None
Outline	Introduction of disaster prevention Practical techniques for risk analysis, risk evaluation and risk management		
Objectives	There are many natural hazards such as earthquake, typhoon and heavy rain, which can result in great damages on lifelines and infrastructures. This lecture teaches the theory about both qualitative and quantitative risk analysis, risk evaluation and risk management with the goal of reducing and controlling these natural risks		
Goal	1. Master the techniques for risk analysis and risk management on natural risks 2. Understand the mechanisms of some natural disasters 3. Able to apply risk theory to practical disaster prevention plan 4. Able to make the risk communication to various societies as a consulting engineer		
Method	Lecture together with group discussion		

Lecture topics				
	1	Introduction of natural disaster prevention	9	Statistical theory used in risk analysis
	2	Basic concepts of risk in engineering	10	Numerical Monte Carlo simulation
	3	Practical technique for hazard identification	11	Fault Tree Analysis
	4	Practical technique for qualitative risk analysis	12	Event Tree Analysis
	5	Practical technique for qualitative risk management	13	Consequence analysis
	6	Practical technique for quantitative risk analysis	14	Risk curve
	7	Practical technique for quantitative risk management	15	Practical applications
	8	Probability theory used in risk analysis	16	Summary

Grading	Attendance (30%), reports (40%) and others(30%)
Textbook, Reference Book	Textbook: None. Materials and information will be sent before each lesson Reference Book: Designated in case of necessity
Office Hours	A/N. Questions are accepted by e-mail, also possible to be answered face to face in official hours

Code	IM118	Title	Advanced Structural Analysis
Category	Advanced Specialized Subjects	Activities	Lecture
Term	Spring & summer term, 2nd year student	Credit	2
Instructor, Contact Information	Yoshimi SONODA	Keywords	Finite Element Method, Structural Analysis
	Tel: 092-802-3372 E-mail: sonoda@doc.kyushu-u.ac.jp Room#: Ito Campus, W2-1113	Course Requirements	None
Outline	In this lecture, students will learn about the theoretical foundation of finite element method and its application for structural analysis.		
Objectives	To study the basis of Finite Element Method		
Goal	1) Master the physical interpretation of matrix structural analysis 2) Understand the mathematical background of FE analysis 3) Learn the analysis procedure of dynamic problem and elasto- plastic problem		
Method	Classroom Lecture		

Lecture topics				
	1	Background of Finite Element Method	9	Basic Concept of Plasticity
	2	Matrix Structural Analysis (1) Spring element	10	Various Yield Criteria
	3	Matrix Structural Analysis (2) Truss element	11	Flow rule
	4	Matrix Structural Analysis (3) Beam element	12	Constitutive model (J2 theory)
	5	2 Dimensional Problem: planar element	13	Constitutive model (Pressure dependent type)
	6	Mathematical Aspect: Shape Function, Weak Form, Gauss integration	14	Numerical Procedure (1)
	7	Dynamic Problem: Theoretical treatment	15	Numerical Procedure (2)
	8	Dynamic Problem: Explicit and Implicit time integration schemes		

Grading	Attendance (20%), final exam (80%)
Textbook, Reference Book	Reference Book: ZIENKIEWICZ, O.C.: The Finite Element Method, McGraw-Hill,
Office Hours	A/N. Questions are accepeted by e-mail, also.

Code	IM121	Title	Geoenvironmental System Engineering
Category	Advanced Specialized Subjects	Activities	Lecture
Term	Summer priod, 1st year student	Credit	2
Instructor, Contact Information	Yasuhiro MITANI	Keywords	Development and harmony of environment
	Tel: 092-802-3399 E-mail: mitani@doc.kyushu-u.ac.jp Room#: Ito Campus, W2-1126	Course Requirements	None
Outline	To think about the environment of the earth in which it aims at the natural environment of the earth and the harmony of the activity of man		
Objectives	Past ground environmental engineering aimed at environmental preservation in the construction technology like the subsidence, the slope failure, the underground water problem, and the soil contamination, etc. However, large-scale development is advanced one after another, and the approach of a new ground environment in natural environment and the social climate that surrounds not the ground environment as a mere construction technology but us is requested while clarification, the region of environmental problems that as a result, are that reach global, and correspond overall being requested. It is assumed to be the first target to know the natural environment of the earth as a first step because of becoming an engineer active in such a standpoint, and is master of the overall ground environmental system engineering that thinks about the ideal way of the geotechnical engineering how for the development activity of current man to have given the environment the impact, and to restore it secondarily.		
Goal	The natural environment of the earth and the outline of the global environment and the ground environmental problems are understood from a special standpoint. An English technical book can be comprehended. In addition, it comes to be able surely to understand the special content.		
Method	In the class, basic knowledge is studied highly and more in detail than the faculty class, and it explains the case. In addition, it advances it while taking HOT TOPIC. The announcement and the report submitting are assumed to be a principle.		
Lecture topics	1 Human activity and Environmental change (1)	8	Earth materials and Processes (2)
	2 Human activity and Environmental change (2)	9	Soil and Environment (1)
	3 Effect on Human society (1)	10	Soil and Environment (2)
	4 Effect on Human society (2)	11	Ecology and Geology (1)
	5 Fundamental concept on Geo-environment (1)	12	Ecology and Geology (2)
	6 Fundamental concept on Geo-environment (2)	13	Natural hazards (1)
	7 Earth materials and Processes (1)	14	Natural hazards (2)
Grading	The distribution of the report, the announcement 60%, and the attendance 40% is assumed to be basic.		
Textbook, Reference Book	The textbook: Digital data is distributed, print by yourself. Supplementary reader and reference book: １． Written by Davis: Natural environment, man, and introduction to physical geography-Kei study publication. ２． Keller：Environmental Geology, Prentice-Hall Int, 1996		
Office Hours	The question is accepted at any time. However, contact me in the telephone and E-mail, etc. beforehand.		

<table>
<tr><td>Code</td><td colspan="2">IM140</td><td>Title</td><td colspan="3">Mechanics of Geomaterials</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Spring & summer term,
1st year students</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3" rowspan="2">Ryohei ISHIKURA

Tel: 092-802-3399
E-mail: ishikura@civil.kyushu-u.ac.jp
Room#: Ito Campus, W2-1125</td><td>Keywords</td><td colspan="2">Geomaterials, composite materials, recycling materials</td></tr>
<tr><td>Course Requirements</td><td colspan="2">None</td></tr>
<tr><td>Outline</td><td colspan="6">All structures of civil engineering for provoding communal facilities are built upon ground. It is important to understand features of “ground as foundation” and “soil as civil engineering materials” for designing soil structures.
Geomaterials have various and diversified properties. Recently, several artificial geomaterials are developed. In this class, evaluation method of stress-deformation property of geomaterials will be learned and current of development of new geomaterials will be understood.</td></tr>
<tr><td>Objectives</td><td colspan="6">Learning evaluation method of stress-deformation property of geomaterials and understanding development of new geomaterials</td></tr>
<tr><td>Goal</td><td colspan="6">1) To understand kinds and features of geomaterial, and comfirm basic of mechanics
2) To understand influence factors on deformation and strength of geomaterials, and obtaining strength constants
3) To learn modeling fo composite geomaterials and applications in practice
4) To know new research topic of geomaterials and outlool</td></tr>
<tr><td>Method</td><td colspan="6">Printing materials (download from webste) and projector</td></tr>
<tr><td rowspan="7">Lecture topics</td><td>1</td><td>Kinds of geomateials and fundamental of mechanics</td><td>7</td><td colspan="3">Behavior of deformation on composite ground</td></tr>
<tr><td>2</td><td>Stiffness and strength of geomaterials</td><td>8</td><td colspan="3">Scale effect of geomaterials based on probabilistic model</td></tr>
<tr><td>3</td><td>Meaning of c and ϕ of geomateials</td><td>9</td><td colspan="3">Development of new geomaterials (1) : artificial soil, light-weight geomaterials</td></tr>
<tr><td>4</td><td>Estimation of average elastic moduli of composite materials</td><td>10</td><td colspan="3">Development of new geomaterials (1) : recycling materials</td></tr>
<tr><td>5</td><td>Compression and strength properties of intermediate soils</td><td>11</td><td colspan="3">Development of new geomaterials (1) : reduction of environmental load</td></tr>
<tr><td>6</td><td>Summary (1)</td><td>12</td><td colspan="3">Summary (2)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Grading</td><td colspan="6">Attendance (20%), final exam (80%)</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Textbook:
Reference Book:</td></tr>
<tr><td>Office Hours</td><td colspan="6">A/N. Questions are accepeted by e-mail, also.</td></tr>
</table>

<table>
<tr><td>Code</td><td colspan="2">IM211</td><td>Title</td><td colspan="3">Urban Transportation Planning</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Spring & summer term,
1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3" rowspan="2">Yosninao OEDA

Tel: 092-802-3406
E-mail: oeda@civil.doc.kyushu-u.ac.jp
Room#: Ito Campus, W2-1037</td><td>Keywords</td><td colspan="2">Automobile, Light rail transit, Public transpotation</td></tr>
<tr><td>Course Requirements</td><td colspan="2">None</td></tr>
<tr><td>Outline</td><td colspan="6">In this lecture, Students study some issues about transportation in urbn area and planning, Especially, traffic flow, transportation system, economics, estimation of demand, total planning and planning for each traffic facilitie.</td></tr>
<tr><td>Objectives</td><td colspan="6">Students learn some problems on urban transportation and think about solution of them.</td></tr>
<tr><td>Goal</td><td colspan="6">Students understand,
1. trafic characteristic and traffic problem, especially frafiic congestion mechanism.
2. importance of trafic demand and its method.
3. estimation of toll on auto</td></tr>
<tr><td>Method</td><td colspan="6">In most of lectures, Instructor is going to explain phenomenon and problems on urban transportation, using prints copyed from the textbook that show below.</td></tr>
<tr><td rowspan="9">Lecture topics</td><td>1</td><td>Charasteristics and problems about urban traffic (1)</td><td>9</td><td colspan="2">Topics for the recent urban transportation if any.</td></tr>
<tr><td>2</td><td>Charasteristics and problems about urban traffic (2)</td><td>10</td><td colspan="2"></td></tr>
<tr><td>3</td><td>Charasteristics and problems about urban traffic (3)</td><td>11</td><td colspan="2"></td></tr>
<tr><td>4</td><td>Research and prediction for the traffic demand (1)</td><td>12</td><td colspan="2"></td></tr>
<tr><td>5</td><td>Research and prediction for the traffic demand (2)</td><td>13</td><td colspan="2"></td></tr>
<tr><td>6</td><td>Research and prediction for the traffic demand (3)</td><td rowspan="3">(14)</td><td colspan="2" rowspan="3">Closely-packed series of lecture (2 days) on Airport (include tour to Fukuoka air contorol depatrment)</td></tr>
<tr><td>7</td><td>Principles and Planning (1)</td></tr>
<tr><td>8</td><td>Principles and Planning (2)</td></tr>
<tr><td>Grading</td><td colspan="6">Attendance (20%), final exam (80%)</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Textbook: Transportation engineering, by C.Jotin Khisty and B.Kent Lall, Prentee Hall
Reference Book:</td></tr>
<tr><td>Office Hours</td><td colspan="6">A/N. Questions are accepted by e-mail, also.any time</td></tr>
</table>

Code	IM212	Title	Advanced Steel Structure	
Category	Advanced Specialized Subjects	Activities	Lecture	
Term	Fall & windter term, 1st year student	Credit	2	
Instructor, Contact Information	Shigenobu KAINUMA		Keywords	Fatigue, corrosion, durability, maintenance, steel sturucture
	Tel: 092-802-3394 E-mail:kai@docl.kyushu-u.ac.jp Room#: Ito Campus, W2-1119		Course Requirements	"Steel Structure" "Structural Mechanics I"
Outline	This course is designed to learn specialized knowledge of time-dependent deterioration mechanism, the durability evaluation and the maintenance technique of steel structures, and to understand the durability design.			
Objectives	To learn evaluation method of newly constructed and existing steel structures.			
Goal	Through completion of this course, students will be able to: -understand time-dependent deterioration mechanism of steel structures. - learn durability evaluation of steel structures. - learn maintenance technique of steel structures. - understand the durability design of welded joints in steel structural members.			
Method	Lecture by using PowerPoint and exercise for calculation of fatigue life for welded joints used in steel structures.			
Lecture topics	1	Deterioration and collapse of steel bridges due to fatigue or corrosion		
	2	Mechanism and Cause of deterioration of steel structures		
	3	Applied fracture mechanics and evaluation method of durability		
	4	Durability design of steel structures		
	5	Non-destructive inspection of weld defects and fatigue cracks		
	6	Improvement of durability technique and reinforcements in fatigue-cracked steel bridges		
	7	Maintenance of steel structures		
Grading	Attendance (60%), Regular assignments (40%)			
Textbook, Reference Book	Reference Book: J.W. Fisher: Fatigue and Fracture in Steel Bridges - Case Studies, John Willey & Sons, 1984. D. Broek : Elementary Engineering Fracture Mechanics, Martinus Nijhoff, 1984. Japanses Society of Steel Construction : Fatigue Design Recommendations for Steel Structures, JSSC Technical Report, No.32, 1995.			
Office Hours	Questions are accepeted by e-mail, also.			

<table>
<tr><td>Code</td><td colspan="2">IM214</td><td>Title</td><td colspan="3">River Engineering</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialize Subjects</td><td>Activities</td><td colspan="3">Lecture, Presentation and Practical traning</td></tr>
<tr><td>Term</td><td colspan="2">Summer term,
1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Yukihiro SHIMATANI</td><td>Keywords</td><td>River attribution, River handling</td></tr>
<tr><td colspan="3">Tel: 092-802-3421
E-mail:shimatani@civil.kyushu-u.ac.jp
Room#: Ito Campus, W2-1024</td><td>Course Requirements</td><td>It is required to take a credit of “River Engineering”</td></tr>
<tr><td>Outline</td><td colspan="6">To understand the river charactaristic and how to handle</td></tr>
<tr><td>Objectives</td><td colspan="6">Rivers have been formed by both natural behavior and human activities. This lecture will give some knouledge about hot to grasp the river charactaristics and river handling corresponding to various charactaristics</td></tr>
<tr><td>Goal</td><td colspan="6">To understand river charactaristics and aquire the advanced skills.</td></tr>
<tr><td>Method</td><td colspan="6">Student’s Presentation and comment</td></tr>
<tr><td rowspan="9">Lecture topics</td><td>1</td><td rowspan="4">Hydraulics on movable bed:
Flow resistance and amout of sediment transport in open cannel on uniform sand. Characta. Characteristics of sandbar: Sorting process and component of sediment transport at vertical angle to shoreline by wave.</td><td>9</td><td rowspan="3">Development of alluvial landform and formation of “Segment”:
Prescript factors and that charastalistics of development alluvial landform; Amount of sediment transport to river and sediment providing in each Segment; Segment formation and that history</td></tr>
<tr><td>2</td><td>10</td></tr>
<tr><td>3</td><td>11</td></tr>
<tr><td>4</td><td>12</td><td rowspan="4">Survay method of river charactalistics and case study:
Purposes and contents of survey; River charactalistics of the Arakawa river, Japan; iver charactalistics of the Apure river, Venezuela</td></tr>
<tr><td>5</td><td rowspan="3">River characteristics and internal structure at middle scale river terrain:
Scale unit to understand river charactalistics and prescript factors.</td><td>13</td></tr>
<tr><td>6</td><td>14</td></tr>
<tr><td>7</td><td>15</td></tr>
<tr><td>8</td><td>Development of alluvial landform and formation of “Segment”</td><td></td><td></td></tr>
<tr><td>Grading</td><td colspan="6">Presentation</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Hand out will be given</td></tr>
<tr><td>Office Hours</td><td colspan="6">A/N. Questions are accepeted by e-mail, also.</td></tr>
</table>

<table>
<tr><td>Code</td><td colspan="2">IM216</td><td>Title</td><td colspan="2">Biological Water Quality Control Engineering</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="2">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Spring & summer term, 1st year student</td><td>Credit</td><td colspan="2">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Takahiro KUBA</td><td>Keywords</td><td>Biological wastewater treatment engineering, biochemistry, gene engineering</td></tr>
<tr><td colspan="3">Tel: 092-802-3426
E-mail: kuba@civil.kyushu-u.ac.jp
Room#: Ito Campus, W2-1029</td><td>Course Requirements</td><td>None</td></tr>
<tr><td>Outline</td><td colspan="5">The class focuses on water quality control engineering, especially biological water quality transformation. By understanding “Central Dogma of Molecular Biology”, the aim of this class is to learn the role and function of biological water quality transformation playing for water circulation and aquatic environmental conservation/remediation.</td></tr>
<tr><td>Objectives</td><td colspan="5">To learn the principles and knowledge concerning biological wastewater treatment engineering.</td></tr>
<tr><td>Goal</td><td colspan="5">To be able to:
(1) estimate water pollution mechanisms and the chemical/biochemical reactions,
(2) explain relationships between water quality transformation and microbiological metabolisms,
(3) explain basic principles of biotechnology based on the “Central Dogma of Molecular Biology”,
(4) apply the knowledge for the bioreactor operation and wastewater treatment processes,
(5) explain the cause and effect of eutrophication in closed water areas, and propose the prevention technology and strategy.</td></tr>
<tr><td>Method</td><td colspan="5">Lecture by using the print material distributed beforehand.</td></tr>
<tr><td rowspan="5">Lecture topics</td><td>1</td><td><u>Wastewater engineering</u> (1.1 Introduction to Wastewater treatment, 1.2 Several Topics in Wastewater Engineering)</td><td>5</td><td colspan="2"><u>Proteins and genes</u> (5.1 Outline of Gene and Protein Synthesis, 5.2 ”Workers in a Cell”: Proteins, 5.3 ”Design Specification of a Cell”: Nucleic Acids and Genes, 5.4 ”Building of a Cell”: Genes and Proteins, 5.5 Application of the Knowledge in Genetics)</td></tr>
<tr><td>2</td><td><u>Characteristics of microorganisms</u> (2.1 Classification of Microorganisms, 2.2 Environment for Microorganisms and the Growth, 2.3 Biota in Activated Sludge)</td><td>6</td><td colspan="2"><u>Basic operation in bioreactors</u> (6.1 Microbial Biocatalytic Reaction Stoichiometry, 6.2 Microbial Biocatalytic Reaction Kinetics, 6.3 Operation in Bioreactors, 6.4 Biological Sewage and Wastewater Treatment)</td></tr>
<tr><td>3</td><td><u>Metabolism of microorganism</u> (3.1 Introduction to Energy Generation, 3.2 Catabolism, 3.3 Anabolism)</td><td>7</td><td colspan="2"><u>Role of anaerobic metabolism</u> (7.1 What are Anaerobic Conditions?, 7.2 Origin of Life and the Evolution, 7.3 Catabolism under Anaerobic / Anoxic Conditions, 7.4 Anaerobes as a Geochemical Factor)</td></tr>
<tr><td>4</td><td><u>Fundamentals of chemical reactions and chemical kinetics</u> (4.1 Fundamentals of Chemical Reactions, 4.2 Chemical Kinetics)</td><td>8</td><td colspan="2"><u>Advanced wastewater treatment</u> (8.1 Need for Advanced Treatment, 8.2 Biological Nutrient Removal, 8.3 New Trends in Nutrient Removal Process)</td></tr>
<tr><td></td><td></td><td>9</td><td colspan="2"><u>Population dynamics</u></td></tr>
<tr><td>Grading</td><td colspan="5">Attendance (10%), homework (40%), quiz (30%), final report (20%)
Point for completion: over 60 points out of 100 points</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="5">Textbook: PPT materials are distributed.
Reference Book: Wastewater Engineering: Treatment and Reuse, G. Tchobanoglous et al., Metcalf & Eddy, 2002, etc.</td></tr>
<tr><td>Office Hours</td><td colspan="5">Questions are accepted at any time, and also by e-mail.</td></tr>
</table>

<table>
<tr><td>Code</td><td colspan="2">IM217</td><td>Title</td><td colspan="3">Advanced Ecological Engineering</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="3">Lecture (short field trip)</td></tr>
<tr><td>Term</td><td colspan="2">Fall & winter term, 1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Satoquo SEINO</td><td>Keywords</td><td>ecological engineering, biological diversity, nature restoration, bioresources</td></tr>
<tr><td colspan="3">Tel: +81-92-802-3425
E-mail:seino@civil.kyushu-u.ac.jp–
Room#: Ito Campus, W2-1028</td><td>Course Requirements</td><td>Basic knowledge on ecological engineering and understanding of its social aspects.</td></tr>
<tr><td>Outline</td><td colspan="6">On the basis of ecological engineering knowledge, biological diversity, nature restoration projects, habitat conservation and restoration, and bioresource industries including social aspects are illustrated and discussed.</td></tr>
<tr><td>Objectives</td><td colspan="6">Based on knowledge on ecological engineering, cases on biological diversity conservation, habitat restoration and conservation, primary industries using bioresources are discussed. Practices on environmental planning, habitat and resource management and sustainable industrial use are aimed.</td></tr>
<tr><td>Goal</td><td colspan="6">・Illustrate the significance of ecological engineering in practice
・Acquisition the viewpoints of environmental planning and social affairs related to biological diversity conservation, nature restoration, bioresources management</td></tr>
<tr><td>Method</td><td colspan="6">Lecture, reports, short field trip, discussion</td></tr>
<tr><td rowspan="8">Lecture topics</td><td>1</td><td colspan="2">Ecological engineering: Overview</td><td>8</td><td colspan="2">Nature restoration project: Coastal zone management</td></tr>
<tr><td>2</td><td colspan="2">Biological diversity: International treaty, national plan</td><td>9</td><td colspan="2">Ecological enginnering on water and material cycle</td></tr>
<tr><td>3</td><td colspan="2">Biological diversity: Local cases and projects in enterprises</td><td>10</td><td colspan="2">Fisheries</td></tr>
<tr><td>4</td><td colspan="2">Biological diversity: Problems and perspective in utilization</td><td>11</td><td colspan="2">Agriculture and forestry</td></tr>
<tr><td>5</td><td colspan="2">Nature restoration project: Rivers</td><td>12</td><td colspan="2">Bioresource industry</td></tr>
<tr><td>6</td><td colspan="2">Nature restoration project: Watershed management</td><td>13</td><td colspan="2">Ecological engineering: Problems and perspective</td></tr>
<tr><td>7</td><td colspan="2">Nature restoration project: Seacoasts</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td colspan="6"></td></tr>
<tr><td>Grading</td><td colspan="6">Report submission and oral interview</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Attendance, reports, quastionnaries</td></tr>
<tr><td>Office Hours</td><td colspan="6">Anytime, e-mail communication is also available</td></tr>
</table>

<table>
<tr><td>Code</td><td colspan="2">M218</td><td>Title</td><td colspan="3">Environmental Planning</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Spring & summer term, 1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Hirofumi NAKAYAMA</td><td>Keywords</td><td>Environmental planning, Environmental management, Environmental economics, Global environment</td></tr>
<tr><td colspan="3">Tel: 092-802-3434
E-mail: nakayama@doc.kyushu-u.ac.jp
Room#: Ito Campus, W2-1027</td><td>Course Requirements</td><td>None</td></tr>
<tr><td>Outline</td><td colspan="6">This lecture provides ideas on environmental thought, ideology, planning methods to students by theaching regulatory methods and economic approaches for environmental solution.</td></tr>
<tr><td>Objectives</td><td colspan="6">This lecture aims to convey the view of environmental planning to students and inspire them to take a positive approach toward finding and implementing good environmental solutions by using various methods.</td></tr>
<tr><td>Goal</td><td colspan="6">A goal of this lecture is to understand ideas on environmental thought, ideology and planning methods.</td></tr>
<tr><td>Method</td><td colspan="6">Lecture and group discussion</td></tr>
<tr><td rowspan="8">Lecture topics</td><td>1</td><td>Outline of environmental planning</td><td>9</td><td colspan="2">Policy methodology (2) economic instruments: charges, fees, taxes, subsidies</td></tr>
<tr><td>2</td><td>Historical transition of environmental problems and policies (1) Edo era- before WWII</td><td>10</td><td colspan="2">Policy methodology (3) economic instruments: deposit-refund schemes, emission trading</td></tr>
<tr><td>3</td><td>Historical transition of environmental problems and policies (2) after WWII</td><td>11</td><td colspan="2">Policy methodology (4) informational measures, agreement measures, supportive measures</td></tr>
<tr><td>4</td><td>Principles of environmental policy (1) prevention principle, precautionary principle, source reduction, polluter pays principle</td><td>12</td><td colspan="2">Individual environmental policy (1) towards low carbon society</td></tr>
<tr><td>5</td><td>Principles of environmental policy (2) extended producer’s responsibility, designer’s responsibility, collaboration principle, subsidiary principle</td><td>13</td><td colspan="2">Individual environmental policy (2) towards sound material-cycle society</td></tr>
<tr><td>6</td><td>Plan formulation and target setting, Policy making process</td><td>14</td><td colspan="2">Exerceise of environmental policy and planning (1)</td></tr>
<tr><td>7</td><td>Carrying capacity and environmental standards</td><td>15</td><td colspan="2">Exerceise of environmental policy and planning (2)</td></tr>
<tr><td>8</td><td>Policy methodology (1) command and control instruments</td><td></td><td colspan="2"></td></tr>
<tr><td>Grading</td><td colspan="6">Attendance (30%), Exerceise of environmental policy and planning and its report (70%)</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Textbook:
Reference Book:</td></tr>
<tr><td>Office Hours</td><td colspan="6">A/N. Questions are accepeted by e-mail, also.</td></tr>
</table>

Code	IM219	Title	Groundwater Environmental Systems
Category	Advanced Specialized Subjects	Activities	Lecture
Term	Spring & summer term, 1st year student	Credit	2
Instructor, Contact Information	Yoshinari HIROSHIRO	Keywords	Groundwater Quality, Water Resources, Geochemistry, Tracer, Groundwater Pollution
	Tel: 092-802-3430 E-mail: hirosiro@civil.kyushu-u.ac.jp Room#: Ito Campus, W2-947	Course Requirements	None
Outline	Rapid exploitation of groundwater is a threat for the environmental conservation in many places of the world. And the problem of groundwater has also been increased recently. Conservation measures of groundwater quality and quantity for long-term drought have to be needed. Specifically, the water environment is the major concerns because any living inhabitants are dependent on the quantity and quality of groundwater.		
Objectives	To learn fundamental knowledge of groundwater environmental systems.		
Goal	The aim of the course is to deepen the student's knowledge to groundwater environmental systems, including the mechanism of groundwater pollutions, problem of salt water intrusion to groundwater, solute transport of groundwater, chemical evolution processes in subsurface environment.		
Method	Lecture by using the PPT software. Every lecture is based on the materials which are delivered in the beginning of the class.		

Lecture topics				
	1	Basic of Aquatic Chemistry	9	Groundwater Pollution(3)-Saltwater
	2	Evaluation Method of Groundwater Quality	10	Solute Transport Equation(1)
	3	Chemical Reaction in Groundwater(1)	11	Solute Transport Equation(2)
	4	Chemical Reaction in Groundwater(2)	12	Submarine Groundwater Discharge
	5	Tracer-Environmental Isotopes(1)	13	Underground dam
	6	Tracer-Environmental Isotopes(2)	14	Natural Analogue-Dispose of High Level Radioactive Waste
	7	Groundwater Pollution(1)-Nitrate etc.		
	8	Groundwater Pollution(2)-Arsnic		

Grading	Attendance (50%), Assignments (50%)
Textbook, Reference Book	Textbook: Handout (as needed) Reference Book: Geochemistry, groundwater and pollution, 2nd, Appelo&Posta, Balkema
Office Hours	A/N. Questions are accepted by e-mail, also.

Code	**IM220**	**Title**	**Practical Application of Aestetic Design inCivil Engineering**	
Category	Advanced Specialized Subjects	**Activities**	Lecture	
Term	Spring & summer term, 2nd year student	**Credit**	2	
Instructor, Contact Information	Akihiko HIGUCHI		**Keywords**	Aesthetic design, landscape design, structural design
	Tel: 092-802-3395 E-mail: higuchi@civil.kyushu-u.ac.jp Room#: Ito Campus, W2-1120		**Course Requirements**	None
Outline	The course intends to provide advanced knowledge of aesthetic design theory in civil engineering. Various real projects including bridges, street, dams and public open spaces are shown as case studies of contemporary design approaches.			
Objectives	To understand contemporary design approach in the field of aesthetic design in civil engineering			
Goal	The students are expected to understand that there are many alternative ways of aesthetic design approach in designing civil engineering structures.			
Method	Lecture and discussion (This lecture will be an intensive course. check on information board)			
Lecture topics	1	Design approaches to rehabilitate environmental quality		
	2	Design approaches to enhance aesthetic quality of structures		
	3	Design approaches for enhancing local cultural contexts		
	4	Design processes with local citizens		
Grading	Attendance (50%), final report (50%)			
Textbook, Reference Book	Textbook: none Reference Book: none			
Office Hours	Upon student's request.			

<table>
<tr><td>Code</td><td colspan="2">IM221</td><td>Title</td><td colspan="3">Material Cycles and Waste Management</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Fall & winter term,
1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Takayuki SHIMAOKA</td><td>Keywords</td><td>solid waste, recycle, landfill, intermediate treatment</td></tr>
<tr><td colspan="3">Tel: +81- 92-802-3433
E-mail: shimaoka@doc.kyushu-u.ac.jp
Room#: Ito Campus, W2-1026</td><td>Course Requirements</td><td>None</td></tr>
<tr><td>Outline</td><td colspan="6">To learn the current situation of solid waste management and the contribution of solid waste management for Recycling-Based Society and Low-Carbon Society</td></tr>
<tr><td>Objectives</td><td colspan="6">Solid waste problems have been more serious in the future. In this subject, the mass balance in Japan, the current state of solid waste management, and the technology of solid waste treatment are lectured. It is also lectured that the proper waste management is very important for the establishment of Recycling-Based Society as well as the preservation of global environmental.</td></tr>
<tr><td>Goal</td><td colspan="6">・To learn the technology of solid waste management
・To learn the current situation of illegal dumping and disaster waste
・To learn the contribution of solid waste management for Recycling-Based and Low-Carbon Society</td></tr>
<tr><td>Method</td><td colspan="6">Printed materials are distributed as a text and PPT slides and photographs are often used.</td></tr>
<tr><td rowspan="9">Lecture topics</td><td>1</td><td>Mass balance in Japan</td><td>9</td><td colspan="3">Intermediate treatment of solid waste 3</td></tr>
<tr><td>2</td><td>Solid waste management and recycle</td><td>10</td><td colspan="3">Landfill of solid waste 1</td></tr>
<tr><td>3</td><td>Overview of solid waste management 1; definition of solid waste, classification of solid waste, regulations etc.</td><td>11</td><td colspan="3">Landfill of solid waste 2</td></tr>
<tr><td>4</td><td>Overview of solid waste management 2</td><td>12</td><td colspan="3">Landfill of solid waste 3</td></tr>
<tr><td>5</td><td>Overview of solid waste management 3</td><td>13</td><td colspan="3">Circulative resources of solid waste 1</td></tr>
<tr><td>6</td><td>Collection of solid waste</td><td>14</td><td colspan="3">Circulative resources of solid waste 2</td></tr>
<tr><td>7</td><td>Intermediate treatment of solid waste 1</td><td>15</td><td colspan="3">Circulative resources of solid waste 3</td></tr>
<tr><td>8</td><td>Intermediate treatment of solid waste 2</td><td>16</td><td colspan="3">Final Examination</td></tr>
<tr><td>Grading</td><td colspan="6">Attendance (20%), final exam (80%)</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="6">Textbook: Original printed materials are distributed.
Reference Book: “Waste Management Handbook”, Japan Society of Material Cycles and Waste Management</td></tr>
<tr><td>Office Hours</td><td colspan="6">Questions are accepted by e-mail.</td></tr>
</table>

<table>
<tr><td>Code</td><td colspan="2">IM222</td><td>Title</td><td colspan="2">Environmental Fluid Mechanics</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="2">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Fall & winter term,
1st year student</td><td>Credit</td><td colspan="2">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Shinichiro YANO</td><td>Keywords</td><td>Turbulence, turbulent flow, diffusion, dispersion, advection, non-linearity</td></tr>
<tr><td colspan="3">Tel: 092-802-3414
E-mail: yano@civil.kyushu-u.ac.jp
Room#: Ito Campus, W2-1033</td><td>Course Requirements</td><td>None</td></tr>
<tr><td>Outline</td><td colspan="5">This course provides fundamental knowledge in environmental fluid mechanics from basic equations to turbulence modeling.</td></tr>
<tr><td>Objectives</td><td colspan="5">In natural environment flow of water (or air) often becomes turbulent flow. Thus, in order to solve a pollution problem we have to understand not only characteristics of turbulence but also turbulence diffusion. Through this course, students will be able to understand basic theory of turbulence, which is used in environmental assessment.</td></tr>
<tr><td>Goal</td><td colspan="5">1. To understand basic theories for turbulent flow.
2. To understand fundamental theory of transport and diffusion of material in natural flows.</td></tr>
<tr><td>Method</td><td colspan="5">This course is conducted by lecture only. A few assignments are required.</td></tr>
<tr><td rowspan="9">Lecture topics</td><td>1</td><td>Introduction</td><td>9</td><td colspan="2">Basic equation for advection and diffusion</td></tr>
<tr><td>2</td><td>RANS(Reynolds Averaged Navier-Stokes) equations</td><td>10</td><td colspan="2">Turbulent diffusion (1)</td></tr>
<tr><td>3</td><td>Correlation function and power spectrum</td><td>11</td><td colspan="2">Turbulent diffusion (2)</td></tr>
<tr><td>4</td><td>Homogeneous isotropic turbulence (1)</td><td>12</td><td colspan="2">Turbulent diffusion (3)</td></tr>
<tr><td>5</td><td>Homogeneous isotropic turbulence (2)</td><td>13</td><td colspan="2">Advection dispersion (1)</td></tr>
<tr><td>6</td><td>Shear turbulence (1)</td><td>14</td><td colspan="2">Advection dispersion (2)</td></tr>
<tr><td>7</td><td>Shear turbulence (2)</td><td>*</td><td colspan="2">This schedule is tentative.</td></tr>
<tr><td>8</td><td>Shear turbulence (3)</td><td></td><td colspan="2"></td></tr>
<tr><td>Grading</td><td colspan="5">Attendance (70%), report (30%)</td></tr>
<tr><td>Textbook, Reference Book</td><td colspan="5">Textbook: Instructor will provide.
Reference Book: “Hydraulics II” Tsubaki, T., “Turbulence” Hinze, “A First Course in Turbulence” Tennekes & Lumley</td></tr>
<tr><td>Office Hours</td><td colspan="5">A/N. Questions are accepted by e-mail, also.</td></tr>
</table>

<table>
<tr><td>Code</td><td colspan="2">IM223</td><td>Title</td><td colspan="3">Advanced Ocean and Coastal Engineering</td></tr>
<tr><td>Category</td><td colspan="2">Advanced Specialized Subjects</td><td>Activities</td><td colspan="3">Lecture</td></tr>
<tr><td>Term</td><td colspan="2">Fall & winter term, 1st year student</td><td>Credit</td><td colspan="3">2</td></tr>
<tr><td rowspan="2">Instructor, Contact Information</td><td colspan="3">Noriaki HASHIMOTO</td><td>Keywords</td><td>Statistical analysis of sea waves, Extreme waves, Directional spectrum</td></tr>
<tr><td colspan="3">Tel: 092-802-3417
E-mail: hashimoto-n@civil.kyushu-u.ac.jp
Room#: Ito Campus, W2-1034</td><td>Course Requirements</td><td>Preferable to finish ‘Coastal Engineering’</td></tr>
<tr><td>Outline</td><td colspan="6">The primary aim of this lecture is to learn the fundamental theory of random sea waves in order to carry out further developments in coastal and offshore engineering, which covers all the affiliated subjects, including not only statistical theory and analysis of random sea waves but also statistical analysis of extreme waves.</td></tr>
<tr><td>Objectives</td><td colspan="6">To learn the present state of the art of statistical theories and analysis methods of random sea waves</td></tr>
<tr><td>Goal</td><td colspan="6">To gain knowledge and techniques of random wave analyses</td></tr>
<tr><td>Method</td><td colspan="6">Lecture by using the textbook listed below.</td></tr>
<tr><td rowspan="8">Lecture topics</td><td>1</td><td>Description of random sea waves</td><td>9</td><td colspan="3">Frequency spectrum of irregular waves</td></tr>
<tr><td>2</td><td>Distribution of wave height</td><td>10</td><td colspan="3">Directional spectra of random sea waves</td></tr>
<tr><td>3</td><td>Wave grouping</td><td>11</td><td colspan="3">Resolution of incident and reflected waves of irregular profiles</td></tr>
<tr><td>4</td><td>Distribution of wave periods</td><td>12</td><td colspan="3">Numerical simulation of random sea waves and numerical filters</td></tr>
<tr><td>5</td><td>Maxima of irregular wave profiles</td><td>13</td><td colspan="3">Estimation of best-fitting distribution function of extreme waves</td></tr>
<tr><td>6</td><td>Nonlinearity of sea waves</td><td>14</td><td colspan="3">Estimation of return value and its confidence interval of extreme waves</td></tr>
<tr><td>7</td><td>Sampling variability of sea waves</td><td>15</td><td colspan="3">Design waves and related problems</td></tr>
<tr><td>8</td><td>Statistical quantities of irregular wave analysis</td><td></td><td colspan="3"></td></tr>
<tr><td>Grading</td><td colspan="6">Attendance (50%), presentation (30%), reports (20%)</td></tr>
<tr><td>Textbook</td><td colspan="6">Textbook: Random Seas and Design of Maritime Structures, by Y. Goda, World Scientific Publishing Co., Ltd.</td></tr>
<tr><td>Office Hours</td><td colspan="6">A/N. Questions are accepeted by e-mail, also.</td></tr>
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Code	IM224	Title	Urban Development Project	
Category	Advanced Specialized Subjects	Activities	Lecture and Case Study	
Term	Fall & winter term,1st year student	Credit	2	
Instructor, Contact Information	Kenichi TSUKAHARA		Keywords	Urban Planning, Project Management, International Cooperation, Infrastructure Development.
	Tel: 092-802-3409 E-mail: tsukahara@doc.kyushu-u.ac.jp Room: Ito Campus W2-1039		Course Requirements	None
Outline	This course deals with urban master plans and infrastructure development projects in developing countries assisted by Japanese official development assistance, and participants should understand standard procedures of making urban master plans and implementing urban infrastructure development projects. The course may include lectures by practitioners.			
Objectives	To understand standard procedures of making urban master plans and implementing urban infrastructure development projects			
Goal	To gain basic skills of making city and urban planning and urban infrastructure development planning.			
Method	Lecture by using textbooks and materials Case studies with presentation by using already implemented projects			

Lecture topics				
	1	Orientation	8	Case Study: Urban master plan
	2	Lecture: Basic knowledge of urban planning and development 1	9	Case Study: Infrastructure projects
	3	Lecture: Basic knowledge of urban planning and development 2	10	Case Study: Post Disaster rehabilitation of urban area
	4	Lecture: Urban development laws and regulations	11	Presentation and Discussion 1
	5	Lecture: Issues in urban development in developing countries	12	Presentation and Discussion 2
	6	Lecture: Basic knowledge of infrastructure development projects 1	13	Lecture: Wrap up 1
	7	Lecture: Basic knowledge of infrastructure development projects 2	14	Lecture: Wrap up 2

Grading	Attendance (50%), Presentation (30%), Reports (20%)
Text and References	To be announced
Office Hours	Afternoon of the day of lecture

Code	IM1679	Title	Problem-Solution Seminar
Category	Professional Skill Development	Activities	Group work and presentation
Term	Winter term, 1st year student	Credit	2
Instructor, Contact Information	Masaru YAMASHIRO	Keywords	
	Tel: 092-802-3418 E-mail: yamashiro@civil.kyushu-u.ac.jp Room#: Ito Campus, W2-1035	Course Requirements	None
Outline	The purpose of this lecture is to learn group work to think about solutions to specific tasks. Each group prepares a project proposal that summarizes solutions to the problem. Furthermore, its contents will be explained in a presentation.		
Objectives	To improve the problem solving ability for practical problem related to urban planning.		
Goal	To learn the merit and difficulty of group work through this course. To learn actual projects on urban planning		
Method	Students will extract problems on Kyudai-Gakkentoshi Area from the point of view of urban planning, and make a plan to improve this area.		
Lecture topics	1	Guidance, Grouping	
	2	Group Work	
	3	Group Work	
	4	Group Work	
	5	Midterm Presentation	
	6	Group Work	
	7	Final Presentation	
Grading	Students will be evaluated on the basis of their presentation, proposal, contributions, etc.		
Textbook, Reference Book			
Office Hours			