Academic Guidance and Orientation

International Program of Maritime and Urban Engineering

2016 October
(Revised Version)

Division of Global Architecture
Graduate School of Engineering
Osaka University

International Program of Maritime and Urban Engineering

Brief History

Since 2004, the Department of Naval Architecture & Ocean Engineering (NAOE) has operated an international special course (combined Master's and Doctoral program) for foreign students, in which lectures and research instruction were provided in English. Beginning from 2007, all lectures in the graduate course of NAOE for ordinary Japanese students have been conducted in English, and now it is possible for both Japanese and foreign students to receive identical top-level education, delivered in English, in the same classrooms. This tradition will be kept further in the future.

From 2006 to 2012, the MEXT (Ministry of Education, Culture, Sports, Science and Technology) provided 3 preferential slots with the Japanese government scholarship for foreign students who wish to study in the international special course at the Department of NAOE. However, very unfortunately, that scholarship was stopped by a result of decision made in 2012 by the MEXT. Then as an extension, we proposed a new International Program of Maritime and Urban Engineering, which was admitted in March 2014 after strict evaluation of application documents submitted and subsequent interview at MEXT. Thus we could start recruiting again excellent foreign students. In this special program, 6 preferential slots are provided for foreign students to receive the Japanese government scholarship.

Background

Observing natural disasters by huge earthquakes, associated big destructive tsunami, typhoon, and subsequent damage of nuclear power plants, we could recognize strongly the importance of safety and protection of local and global environments. These kinds of need from the society exist in densely-populated cities especially in Asian countries. Considering these, we realize that much effort should be made for the research and education on the following modern themes to be done in Maritime and Urban Engineering:

- Prevention and mitigation of natural disaster
- Protection of maritime and urban environment
- Development of renewable energy and energy-saving techniques
- Safety measures, risk assessment, new transportation system
- Synthesized design of space, ocean and land

Objectives in the International Special Program

What we are aiming to do in this international special program are as follows:

- Nurturing younger scientists who will be able to lead the academic society in the modern Maritime and Urban Engineering and succeed the knowledge to the next generation with relationship of mutual trust and partnership with Japan
- Establishment of international environment for both Japanese and international students for studying hard in friendly rivalry, by providing them with various opportunities of high-level and quality-emphasized academic interactions

Division of Global Architecture is in charge

Division of Global Architecture in the graduate school at Osaka University is comprised of three Departments: Naval Architecture & Ocean Engineering, Civil Engineering, and Architectural Engineering, covering research areas related to offshore, coastal, onshore and urban infrastructures, and also encompassing all kinds of mobility of ships, trains and automobiles.

Therefore we are confident in our eligibility in directing and educating students on the technologies and theories requisite in the Maritime and Urban Engineering.

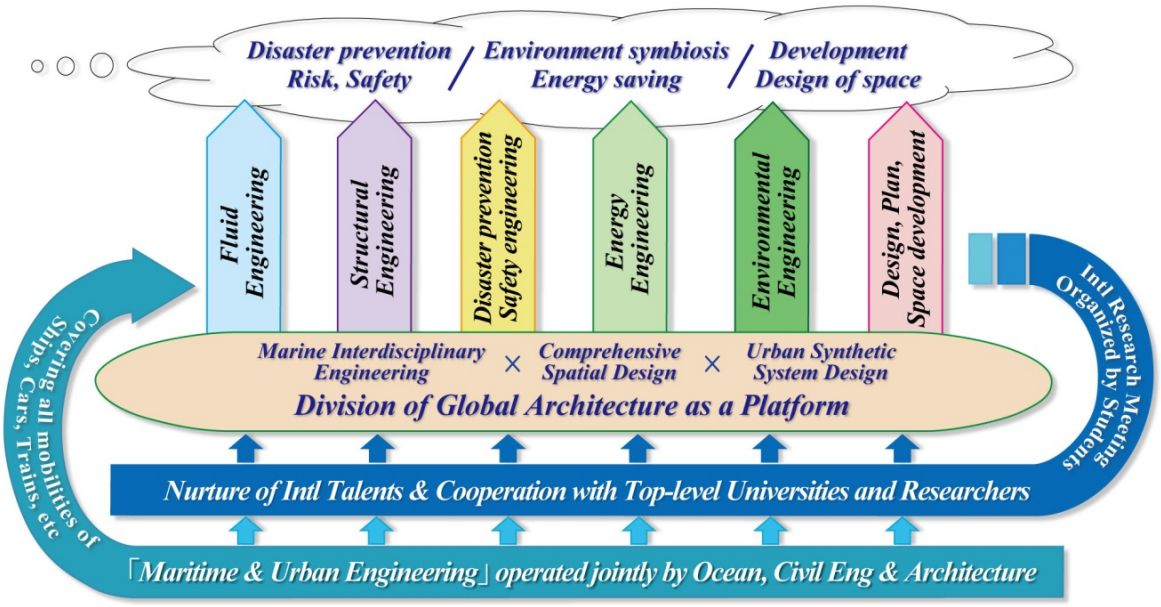

Fig. 1 Academic areas to be covered by the Division of Global Architecture

Common keywords:

Hydrodynamics, Structural strength, Disaster prevention, Safety engineering, Energy saving, Renewable energy, Transportation, Environmental symbiosis, Development and design of space, land and ocean, etc.

System in Education

An image of possible courses in taking lectures is shown next page. There are three systematic categories in elective lectures; that is, (1) Safety and Prevention of disaster, (2) Environmental symbiosis and Energy saving, and (3) Development and Design.

In addition, prerequisite (compulsory) subjects are Special Topics on Global Architecture and Exercise in Global Architecture. These are prepared to have students acquire theories and ideas for systematizing and synthesizing the three systematic categories in elective lectures to be taken. Seminars on Global Architecture I and II are also prerequisite, in which students are supposed to be directed by their supervisors to understand and perform high-level professional research.

As shown in an image of possible courses, students may combine the above-mentioned subjects specially prepared for the new program with pre-existing subjects (lectures) offered in English at basic three Departments. The students in the special program must take a total of no less than 30 units of credit for successful completion of the first stage of the program (2-year Master's program), where the student must take at least 20 credits from the lectures newly offered for the international program of Maritime and Urban Engineering.

By combining subjects in a flexible way, the students can design themselves to be professional, for example, in the following academic fields:

(A) Marine Interdisciplinary Engineering
(B) Comprehensive Spatial Design
(C) Urban Synthetic System Design

Requirements for Completion of the Program with Degrees

(1) Master's program

- Successful completion of lectures and seminars for a total of no less than 30 units of credit, among them at least 20 credits from the lectures newly offered for the international program of Maritime and Urban Engineering.
- Completion of the special research
- Submission and successful defense of the Master's thesis
- Successful passing of the final evaluation of academic achievement

Image of how to take lectures at the International Program of Maritime & Urban Engineering

English Special Course（◆: Compulsory Subjects ◇: Elective Subjects／Credit in parentheses）

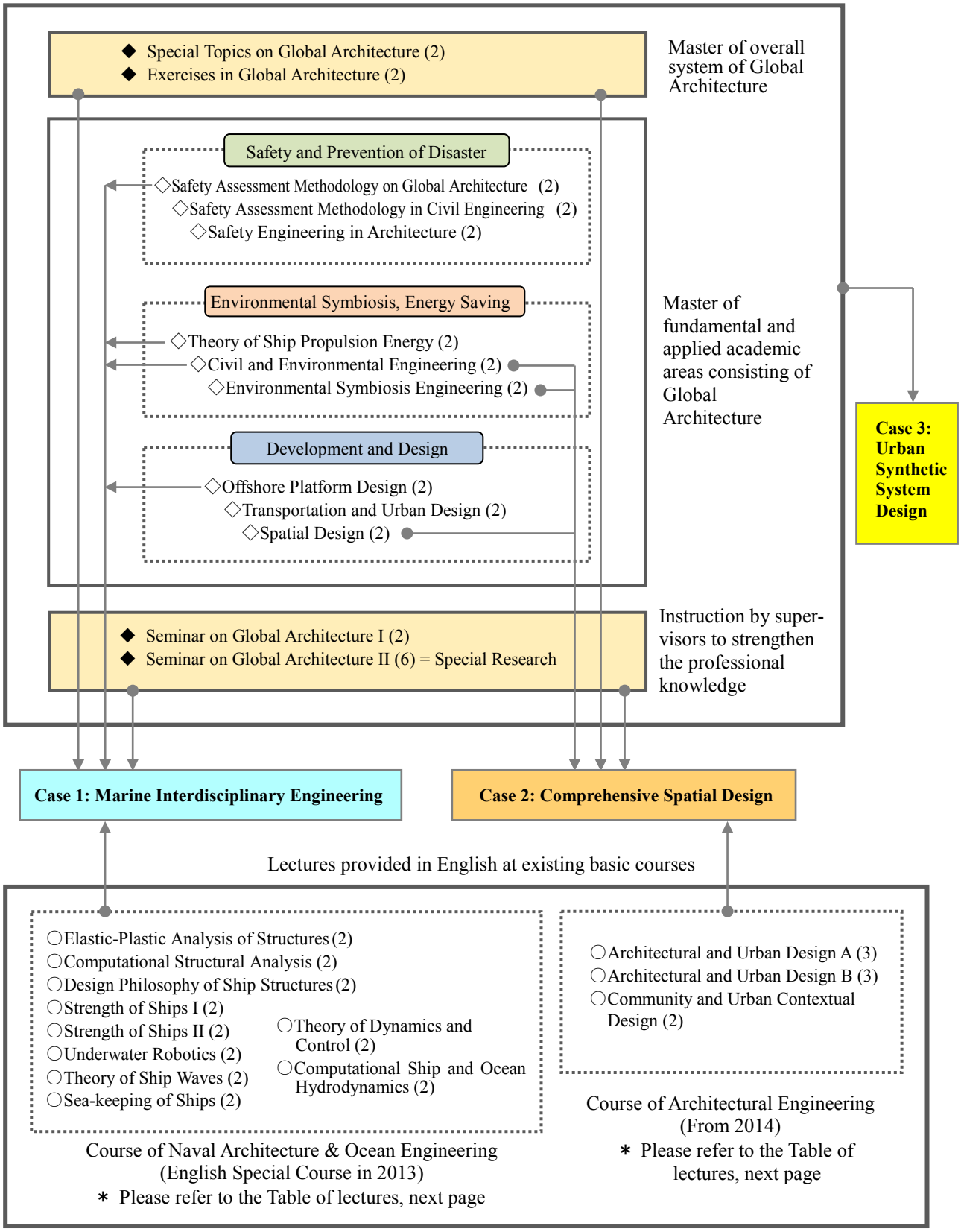

Table of Lectures for the 1st and 2nd years (Master's Course)
to be provided at International Program of Maritime and Urban Engineering

Name of Lectures	Staff in charge	Credit		Number of Subjects				Remarks (Category of System)
		Com-pulsory	Elective	First Year		Second Year		
				Autumn	Spring	Autumn	Spring	
地球総合工学特論 Special Topics on Global Architecture	All professors	2			2			
力学系の安全性評価手法論 Safety Assessment Methodology of Dynamic Systems	Umeda N.		2		2			Prevention of disaster and Safety
社会基盤安全工学 Safety Assessment Methodology in Civil Engineering	Nara S. Kamada T. Ohkura I. Tsutsumi S.		2	2				Prevention of disaster and Safety
建築安全工学 Safety Engineering of Architecture	Miyamoto Y. Kuramoto H. Tada M. Kawabe H. Sanada Y. Kuwahara S.		2	2				Prevention of disaster and Safety
船舶推進エネルギー論 Theory of Ship Propulsion Energy	Toda Y.		2	2				Environmental symbiosis and Energy saving
社会基盤環境工学 Civil and Environmental Engineering	Aoki S. Irie M.		2		2			Environmental symbiosis and Energy saving
環境共生工学 Environmental Symbiosis Engineering	Yamanaka T. Sagara K. Kotani H.		2	2				Environmental symbiosis and Energy saving
洋上プラットフォームデザイン論 Offshore Platform Design	Iijima K.		2		2			Development and Design
交通・地域デザイン学 Transportation and Urban Design	Doi K.		2		2			Development and Design
空間デザイン学 Spatial Design	Kita M. Yokota T. Abe H. Matsubara S. Iida T. Itami K.		2		2			Development and Design
地球総合工学デザイン演習 Exercise in Global Architecture	All professors	2				2		
地球総合工学ゼミナールⅠ Seminar on Global Architecture Ⅰ	All professors	2			2			
地球総合工学ゼミナールⅡ Seminar on Global Architecture Ⅱ	All professors	6					6	

[Course requirement]
The student in the international special program must take a total of no less than 30 units of credit for successful completion of the first stage of the program (2-year Master's program), where the student must take at least 20 credits from the lectures written above for the International Program of Maritime and Urban Engineering. Passing the master thesis examination is another course requirement. (Please see also the next page.)

(Important Notice)
Master course students must register for Research Training (Code: 285505) in Autumn Semester when he/she is in the second grade.

Course name	Research Training for Master's Thesis
Code number	285505
	Master course students must register "Research Training for Master's Thesis" at KOAN at the beginning of the second year. https://koan.osaka-u.ac.jp/koan/

Reference:

Table of Lectures at International Course of Naval Architecture and Ocean Engineering

Name of Lectures	Staff in charge	Credit		Number of Subjects				Remarks
		Com-pulsory	Elective	First Year		Second Year		
				Autumn	Spring	Autumn	Spring	
弾塑性学 Elastic-Plastic Analysis of Structures	Serizawa H.		2	2				
数値構造解析 Computational Structural Analysis	Murakawa E.		2	2				
構造力学 I Strength of Ships I	Hayashi S.		2		2			
構造力学 II Strength of Ships II	Fujikubo M.		2	2				
構造体強度論 Design Philosophy of Ship Structures	Sawamura J.		2	2				
水中ロボット工学 Underwater Robotics	Kato N.		2	2				
造波理論 Theory of Ship Waves	Kashiwagi M.		2		2			
船舶耐航性 Sea-keeping of Ships	Minoura M.		2	2				
運動制御学 Theory of Dynamics and Control	Hasegawa K.		2	2				
連続体力学 Continuum Mechanics	Osawa N.		2		2			
数値船舶海洋流体力学 Computational Ship and Ocean Hydrodynamics	Suzuki H.		2	2				

Reference:

Table of Lectures for Master's Course of Architectural Engineering to be offered in English

Name of Lectures	Staff in charge	Credit		Number of Subjects				Remarks
		Com-pulsory	Elective	First Year		Second Year		
				Autumn	Spring	Autumn	Spring	
建 築 ・ 都 市 デ ザ イ ン A Architectural and Urban Design A	Kita M. Yokota T. Abe H. Matsubara S. Iida T. Itami K.		3	3				
建 築 ・ 都 市 デ ザ イ ン B Architectural and Urban Design B	Kita M. Yokota T. Abe H. Matsubara S. Iida T. Itami K.		3		3			
集落・都市のコンテクスチャルデザイン Community and Urban Contextual Design	Kita M.		2		2			

Requirements for Completion of the Program with Degrees (continued)

(2) Doctor's program
- Successful completion of lectures and seminars for a total of no less than 4 units of credit
- Satisfactory performance in the Qualification Test Part I
- Publication of not less than two peer-reviewed journal papers
- Successful defense of the doctoral dissertation
- Successful passing of the Qualification Test Part II of the course

Table of Lectures from 3rd to 5th years (Doctoral Course)
to be provided at International Program of Maritime and Urban Engineering

Name of Lectures	Staff in charge	Credit		Number of Subjects						Remarks
		Com-pulsory	Elective	Third Year		Fourth Year		Fifth Year		
				Autumn	Spring	Autumn	Spring	Autumn	Spring	
防災・安全工学特論 Disaster Prevention and Safety Engineering	All professors		2	2						
環境共生・省エネルギー特論 Environmental Symbiosis and Energy Saving	All professors		2	2						
開発・デザイン特論 Development and Design of Space, Land and Ocean	All professors		2	2						
海洋総合工学ゼミナール Seminar on Marine Interdisciplinary Engineering	All professors		2		2					
空間総合デザインゼミナール Seminar on Comprehensive Spatial Design	All professors		2		2					
都市基盤システムデザインゼミナール Seminar on Urban Synthetic System Design	All professors		2		2					

[Course requirement]
A course requirement is the completion of 4 (or more) units of credit from the lectures listed above.
It is advised to take 2 credits from the first three lectures to be provided in the autumn semester and take another 2 credits from the last three lectures (seminars) to be provided in the spring semester. Regarding which lecture should be taken, please get advice from your supervisor.

Passing the doctor thesis examination (Qualification Test Part-2) is another course requirement, which may be much more important for students.

(Important Notice)
Doctor course students must register "Research Training (Code: 287524) at the beginning of each school year (when starting the Autumn Semester).

Course name	Research Training for Doctorr's Thesis
Code number	287524
	Doctor course students must register "Research Training for Doctor's Thesis" at KOAN at the beginning of each school year. https://koan.osaka-u.ac.jp/koan/

Important Features in the Special Program

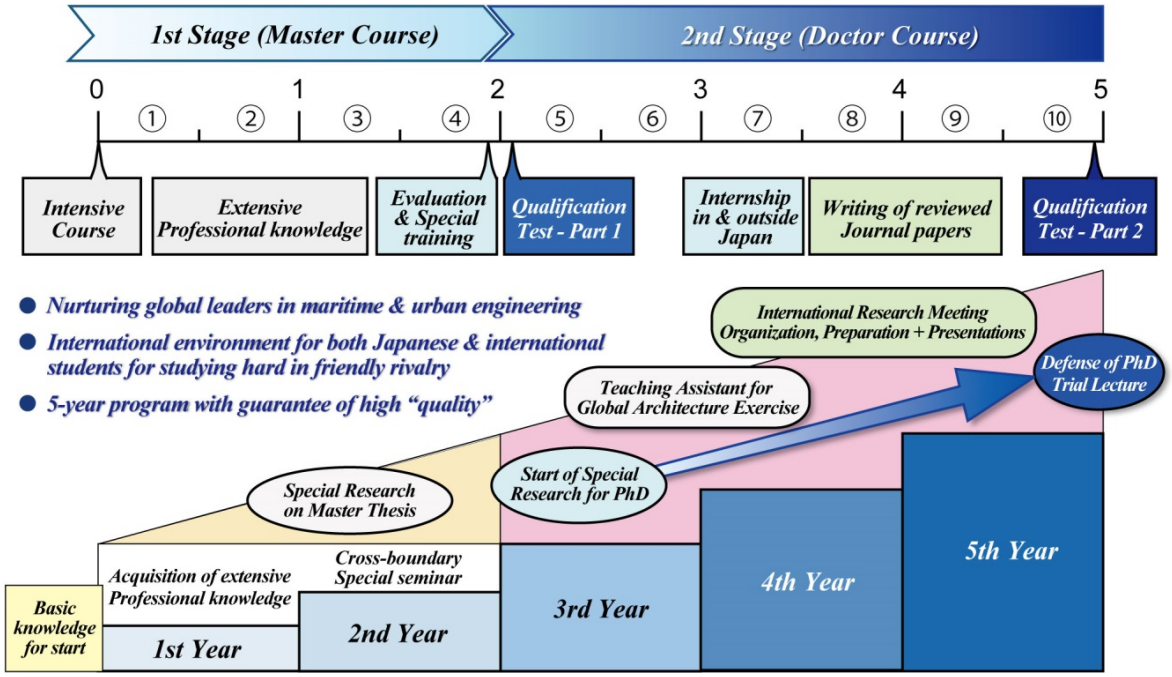

Fig. 2 Illustrative explanation of 5-year course of Maritime & Urban Engineering

1) An intensive short-term course may be organized to guarantee the fundamental knowledge for starting the course with Japanese students, if necessary.
2) Special interdisciplinary (cross-boundary) seminars will be arranged, in which all students will be required to give presentation on the progress of the special research, to learn how to make good presentation, and to widen the spectrum of professional knowledge.
3) Rigorous evaluation will be conducted on the achievement and academic level at the end of the 1st stage (Master's course). If the result is below the requirement, a short-term special training program must be taken.
4) In the Qualification Test Part I, the students will be required to write a proposal of research plan for the doctoral course, review the state-of-the-art in desired research theme, and give a presentation on the plan and review which will be followed by discussions with professors.
5) During the doctoral course, the students should be involved in the International Research Meeting through organization, preparation, and presentation on the progress of the doctoral special research.
6) Qualification Test Part II consists of the defense of dissertation and a trial lecture by the students on a research topic assigned in advance by their supervisors.

Areas for the Special Research

Students will conduct their Special Research from the third semester (the second year) of Master's course under the supervision and instruction of his/her professor or associate professor. In this scheme, each student will choose one research theme from the following categories:

- Naval Architecture
- Ocean Systems Engineering
- Structural and Geotechnical Engineering
- Civil and Social Systems Engineering
- Architectural Structures and Strength
- Environmental and Human Engineering in Architecture

Abstracts of the Lectures
to be provided at International Program of Maritime and Urban Engineering

Special Topics on Global Architecture
This prerequisite subject is the English version of the lecture that has been given in Japanese up to 2014. After the guidance and overview, various different topics will be explained by different 12 professors (one topic every week by one professor), such as (A) creation and protection of symbiotic society, (B) towards sustainable society, living and marine environments, urban transportation and environmental stress, and renewable energies, (C) consideration of safe society, prevention and mitigation of natural disaster, design of rivers for flood prevention, safety of buildings, and safety in marine traffic.

Safety Assessment Methodology of Dynamic Systems
This lecture provides students an opportunity to learn standard methodologies of nonlinear dynamics focusing on its qualitative aspects. This is because whether an accident happens or not is qualitative difference in the relevant nonlinear dynamical system. As a result, it is possible to identify all potential dangers so that we could assess safety. The contents to be learned here include local and global bifurcation analyses and nonlinear phenomena such as parametric resonance and chaos. Although the lecture mainly uses examples in naval architecture, the methodologies themselves can be applicable to mechanical vibrations, electric circuits, biology, finance and so on.

Safety Assessment Methodology in Civil Engineering
This lecture presents the following contents:
(a) Elasto-plastic deformation behavior of metallic materials and fatigue life assessment of welded structures.
(b) Plate buckling with initial imperfections and ultimate strength of corroded steel plates.
(c) Damage in previous large earthquakes, seismic performance and design methods as for steel bridges.
(d) Classification of non-destructive testing methods for concrete, basic principle and characteristics of each method, evaluation indices and targets of non-destructive inspections for diagnosis of concrete structures.

Safety Engineering of Architecture
This lecture covers structural engineering, geotechnical engineering, and seismic engineering on buildings. Five professors introduce the latest topics as well as fundamental knowledge in these fields as follows:

1st-3rd	Yuji Miyamoto	Seismic technologies for buildings in Japan
4th-6th	Hiroshi Kuramoto	Structural design methodologies for buildings in Japan
7th-9th	Yasushi Sanada	Recent natural disasters in the world which caused damage to buildings
10th-12th	Susumu Kuwahara	Excursion for introducing modern buildings in Japan
13th-15th	Motohide Tada	Recent natural disasters in Japan caused damage to buildings

Theory of Ship Propulsion Energy
The GHG reduction in ship operation is firstly discussed. The recent progress in CFD and EFD related to energy saving in ship propulsion is also discussed. Some topics in resistance and propulsion of ships based on theories of propellers, boundary layers, and wave making resistance are shown in the lecture. Applied fluid mechanics on ships such as higher order boundary layer theory, numerical invisid flow theory and viscous flow computation will be included in the topics.

Civil and Environmental Engineering
This class consists of two parts: (1) Water use issues and water quality problems in rivers, lakes, estuaries and seas. These problems which include lowering of ground water level, inflow and contamination of toxic substances, eutrophication and hypoxia are mostly caused by human activities. A review of physical, chemical, biological and ecological principles and numerical models to integrate concepts and to assess environmental impacts of human activities will be provided. (2) Coastal hydrodynamics and environments. Coastal environmental problems such as beach erosion and coastal ecosystem deterioration will be presented in relation to coastal hydrodynamics. Wave transformation in shallow waters, wave-induced currents, wave forces and sediment transport will be presented.

Environmental Symbiosis Engineering
In order to understand the environmental friendly buildings, the relationship between climate and building and the modern techniques to design sustainable buildings are lectured. Basic theory and many examples will be presented, and man-environment system will be also introduced. For example, as the basis of investigation into the environmental friendly buildings, the vernacular architectures are explained. As the modern techniques, the heating, ventilation and air-conditioning (HVAC) system and energy management in buildings are lectured on the basis of knowledge related to estimation and control of architectural and urban environment. Some visits to the real sustainable buildings are planned as well.

Offshore Platform Design
Offshore platforms are the basis for exploitation of offshore oil and gas, floating storage facility, offshore renewable energy device, and so on. This lecture outlines the design philosophy of offshore platforms. A focus is placed on the evaluation method for loads and their effects on offshore platforms while the design environmental conditions, safety assessment procedure and structural design principles are within the scope. Basic knowledge about marine hydrodynamics and structural mechanics is required.

Transportation and Urban Design
Design thinking has attracted much attention as a method of creative and interdisciplinary problem solving. This class focuses on mobility design that bridges transportation planning and regional planning. Mobility refers to how freely people and goods move, and describes a capacity for utilizing a variety of resources. The role of mobility design is to enhance the capacity for utilizing resources, that is, social usability. Raising the transportation systems now available to a level where they are easy to use both physically and physiologically, and then again to a level where people psychologically want to use them, will require comprehensive design covering transportation technologies, systems, infrastructures, institutions, and spaces.

Spatial Design
Theories and methodologies for spatial design are explained from the various academic fields, such as architectural, urban, rural, and regional planning and design. Concepts of ‘Design’, which are treated in this lecture, cover from environmental improvement by users to theoretical planning, including establishment of design guidelines and institutional systems, corresponding to physical and socio-cultural environment. Actual examples of buildings, houses, towns and areas are provided for deep understanding.

Exercise in Global Architecture
Osaka bay area, the second largest metropolitan area in Japan, is taken as the main field for this exercise. The area consists of inland sea, water and green systems, mountain systems, and polycentric structured cities networked with various transportations. Students discuss and raise urban issues by comprehending urban data in order to decide their individual theme and area. Field surveys are done in the corresponding areas, from the aspects of global architecture, which is integrated with naval, civil, and architectural engineering. Students also make a proposal of environmental improvement and give a presentation to local communities or governments.

Seminar on Global Architecture I
This is a seminar to be done at each research group for implementing the special research deserving Master’s thesis. Through discussions with professors and with support from teaching assistance, students will acquire professional knowledge of high level and understand interdisciplinary research themes and how to challenge them.

Seminar on Global Architecture II
This is an advanced seminar to be done in the last semester of the first stage of the program, in which students will deepen their understanding in the special research for Master’s degree, learn how to write an academic paper and how to make a good presentation, and as a result will enhance their research ability with which they can proceed to the second stage (doctoral course) of the program.