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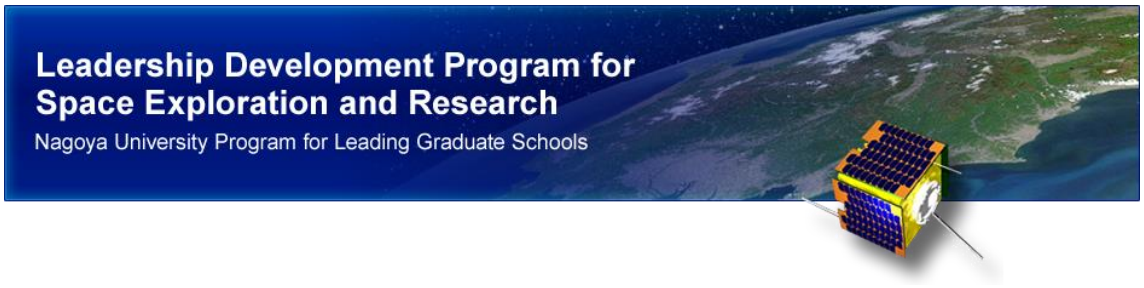

Syllabus

Table of Contents

1. Overview of Space Exploration and Research

Term(Semester): Spring Every Fri.1st lecture Class Room: 241 Lecture Room, Engineering Building 2 South Course Category: Required Credits:2.0	Contact Information Faculties in charge: Hideyo Kunieda, Hosei Nagano, Ichiro Nishimoto Phone: Office: e-mail:kunieda@u.phys.nagoya-u.ac.jp
Purpose and Aim of Course To acquire a wide-ranging, panoramic knowledge of space research and development given by omnibus of lectures from different academic field.	
Registration Qualification LGS students (Leadership Development Program for Space Exploration and Research), and holder of students qualification of A Classes (Graduate School of Science) or Applied engineering courses (Graduate School of Engineering)	Completion Deadline Before advancing to the third year (D1)
Grading GP is calculated by averaging following individual grades. A and higher=4, B=3, C=2, D and lower=0	Requirements for Credits
Related Courses	For non-LGS students ・Acceptable ・Conditions : Graduate students of Nagoya University

Course Content

Lecture Day	Lecture Title	Lecturer
April 15	Overview of Space Exploration and Research	Hideyo Kunieda (Graduate School of Science)
April 22	Foundations of Astrophysics	Takahiko Matsubara(Graduate School of Science)
April 29	Space Observation Technology	Hironori Matsumoto(Graduate School of Science)
May 6	Composite Material	Takashi Ishikawa (NCC)
May 13	Space Environment Science	Kanako Seki (University of Tokyo)
May 20	Patent Right and Standardization	Masahiro Kito (Academic Research & Industry Academia-Government Collaboration)
May 27	Introduction to Radiation Detectors	Toru Iijima (Graduate School of Science)
June 10	Satellite Development	Yasurou Kanamori (Graduate School of Engineering)
June 17	Computer Experiment	Akiko Matsuo (Keio University)
June 24	Electronic Circuit Technology	Mitsuhiro Nakamura(IMaSS)
July 1	Earth and Planetary Science	Yasushi Yamaguchi (Graduate School of Environmental Studies)
July 8	Project Management	Takanori Iwata (JAXA)
July 15	Management of Research and Development	Yoshifumi Inatani (JAXA/ISAS)
July 22	Spacecraft (HTV) Development	Koji Yamanaka (JAXA)
July 29	Space Propulsion Engineering	Akihiro Sasoh (Graduate School of Engineering)

Text Book	Reference Book

Notes

Taking DVD video lectures in English is accepted for non-Japanese students whose mother tongue is not Japanese.

2. Satellite Systems

<table>
<tr><td>Term(Semester): Spring (in English),and Autumn (in Japanese)
Class Room:
Course Category: Required electives
Credits:0.2 each, 2.4 (maximum)</td><td>Contact Information
Faculties in charge: Hosei Nagano, Yasuro Kanamori
Phone:
Office:
e-mail: nagano@mech.nagoya-u.ac.jp</td></tr>
<tr><td colspan="2">Purpose and Aim of Course
To acquire basic and advanced knowledge on satellite systems and subsystems, and cultivate a broad perspective on satellite systems and their development process.
It is also expected for students to utilize what they learn in this course in the ChubuSat Instrument Development Project.</td></tr>
<tr><td>Registration Qualification
Nothing in particular</td><td>Completion Deadline
Before advancing to the third year (D1)</td></tr>
<tr><td>Grading
GP is calculated by averaging following individual grades.
A and higher=4, B=3, C=2, D and lower=0</td><td>Requirements for Credits</td></tr>
<tr><td>Related Courses
・Overview of Space Exploration and Research
・Satellite Development and Applications
Courses below
・Satellite Communication (in Japanese)
・Micro-Satellite Development and Applications
・Thermal design and analysis
・Structural design and analysis</td><td>For non-LGS students
・Acceptable
・Conditions： Graduate students of Nagoya University</td></tr>
<tr><td colspan="2">Course Content
Courses are organized to cover the following topics. Note that they are not necessarily offered in the same order, classification, title, etc. as shown below.
1. Review of history of space exploration and solar system
2. Spacecraft configuration
3. Review of orbital mechanics
4. Space environment and its effect on spacecraft design
5. Spacecraft communication subsystem
6. Spacecraft attitude determination and control subsystem
7. Spacecraft guidance and navigation subsystem
8. Spacecraft thermal subsystem
9. Spacecraft structures and mechanisms
10. Spacecraft propulsion subsystem
11. Spacecraft power subsystem
12. Assembly, Integration and Testing</td></tr>
<tr><td>Text Book
Shown on the spot from the lecturer</td><td>Reference Book
Shown on the spot from the lecturer if necessary</td></tr>
<tr><td colspan="2">Notes
Besides faculties of LGS Frontier Space, experts and faculties from academy, industry and government (JAXA) are invited as lecturers. (for Japanese version)
Expert professors in this field are invited from the overseas university as a lecturer. (for English version)</td></tr>
</table>

3. Satellite Communications

<table>
<tr><td>Term(Semester): Autumn (in Japanese)
Class Room: Science B 3F B312
Course Category: Required electives
Credits:1.0</td><td>Contact Information
Faculties in charge: Hosei Nagano, Yasuro Kanamori, Keisuke Tamura, Daisuke Ishihara, Hidetaka Tanaka, Kikuko Miyata
Phone:
Office:
e-mail: nagano@mech.nagoya-u.ac.jp</td></tr>
<tr><td colspan="2">Purpose and Aim of Course
To understand satellite communication system and proper method for using related instrument through the part of the real small satellites' receiver and transmitter experiment.
To understand the system design flow and analysis flow.</td></tr>
<tr><td>Registration Qualification
Nothing in particular</td><td>Completion Deadline
Before advancing to the second year (M2)</td></tr>
<tr><td>Grading
GP is calculated by averaging following individual grades.
A and higher=4, B=3, C=2, D and lower=0</td><td>Requirements for Credits</td></tr>
<tr><td>Related Courses
・Satellite Systems (Lecture Courses on Space Science and Engineering)
・Micro-Satellite Development and Applications (Satellite Development and Applications Short Courses)</td><td>For non-LGS students
・Acceptable
・Conditions： Graduate students of Nagoya University</td></tr>
<tr><td colspan="2">Course Content
The main plan is shown as follows: (subject to change)
1. Design and Analysis
1.1 Understand design condition
1.2 Explanation of the link budget analysis
1.3 Summary of the results
2. Experiment
2.1 Understand receiver specification
2.2 Understand transmitter specification
2.3 Receiver and transmitter's compatibility testing with cable
2.4 Wireless compatibility testing
2.5 Summary of the results</td></tr>
<tr><td>Text Book
Shown on the spot from the lecturer</td><td>Reference Book
Shown on the spot from the lecturer if necessary</td></tr>
<tr><td colspan="2">Note
This lecture will be canceled when the number of applicants are small.</td></tr>
</table>

4. Micro-Satellite Development and Applications

<table>
<tr><td>Term(Semester): Autumn
Class Room: Science B 3F B312
Course Category: Required electives
Credits:1.0</td><td>Contact Information
Faculties in charge: Hosei Nagano, Yasuro Kanamori, Keisuke Tamura, Daisuke Ishihara, Hidetaka Tanaka, Kikuko Miyata
Phone:
Office:
e-mail: nagano@mech.nagoya-u.ac.jp</td></tr>
<tr><td colspan="2">Purpose and Aim of Course
To study small satellite technologies, development process, and the domestic and international trend of the micro-satellite development and applications.
To understand the basis of the satellite subsystem and study the micro-satellite's wide knowledge and technologies, with the help of the class room satellite kit.</td></tr>
<tr><td>Registration Qualification
Nothing in particular</td><td>Completion Deadline
Before advancing to the second year (M2)</td></tr>
<tr><td>Grading
GP is calculated by averaging following individual grades.
A and higher=4, B=3, C=2, D and lower=0</td><td>Requirements for Credits</td></tr>
<tr><td>Related Courses
・Overview of Space Exploration and Research
・Satellite Systems (Lecture Courses on Space Science and Engineering)
・Satellite Communications (in Japanese)
・Thermal design and analysis
・Structural design and analysis</td><td>For non-LGS students
・Acceptable
・Conditions： Graduate students of Nagoya University</td></tr>
<tr><td colspan="2">Course Content
The main plan is shown as follows:
1. Lecture of the whole development process of micro-satellite; planning, launch and operation
2. Lecture of the domestic and international trend of the micro-satellite
3. Understand the satellite subsystems through the classroom satellite kit</td></tr>
<tr><td>Text Book
Shown on the spot from the lecturer</td><td>Reference Book
Shown on the spot from the lecturer if necessary</td></tr>
<tr><td colspan="2">Note</td></tr>
</table>

5. Thermal Design and Analysis

Term(Semester): Autumn (in Japanese and English as a general rule) Class Room: Bldg. B Room 312 (LGS laboratory), Graduate School of Science Course Category: Required electives Credits: 1.0	Contact Information Faculties in charge: Hosei Nagano, Yasuro Kanamori, Keisuke Tamura Phone: Office: e-mail: nagano@mech.nagoya-u.ac.jp
Purpose and Aim of Course To develop the thermal control mechanism of satellites through learning the application feature of thermal control material and measuring its characteristics. To learn the thermal analysis method through practical operation of the thermal analysis tool "Thermal Desktop" which is used worldwide. By taking these courses, students are expected to acquire overview of ChubuSat thermal design, and develop a hardware-based practical ability on thermal control.	
Registration Qualification Nothing in particular	Completion Deadline Before advancing to the third year (D1)
Grading GP is calculated by averaging following individual grades. A and higher=4, B=3, C=2, D and lower=0	Requirements for Credits
Related Courses ・Overview of Space Exploration and Research ・Satellite Systems (Lecture Courses on Space Science and Engineering) ・Micro-Satellite Development and Applications (Satellite Development and Applications Short Courses)	For non-LGS students ・Acceptable ・Conditions: Graduate students of Nagoya University
Course Content 1. Confirmation of Thermal Control Material Characteristics 1.1 To confirm the effectiveness of the thermal control material (MLI and/or Thermal Filler) applied to equipment samples, comparing the temperatures between the applied and non-applied samples in the vacuum chamber. 1.2 To measure and confirm the thermo-optical characteristics of various thermal control surfaces, through which the nature of the surface for thermal control is acquired as practical knowledge; besides, to learn the meaning of the thermal parameters and the measurement principle of the characteristics. 2. Training on Thermal Analysis Tool Operation 2.1 To give lectures on the tool "Thermal Desktop" 2.2 To analyze an example problem using "Thermal Desktop"	
Text Book Shown on the spot from the lecturer	Reference Book Shown on the spot from the lecturer if necessary
Notes	

6. Structural Design and Analysis

Term(Semester): Autumn (in Japanese and English as a general rule) Class Room: Bldg. B Room 312 (LGS laboratory), Graduate School of Science Course Category: Required electives Credits: 1.0	Contact Information Faculties in charge: Hosei Nagano, Yasuro Kanamori, Daisuke Ishihara, Keisuke Tamura, Hidetaka Tanaka Phone: Office: e-mail: nagano@mech.nagoya-u.ac.jp
Purpose and Aim of Course To learn the basic concept of a structural design, an analysis method using Finite Element Method (FEM), and the vibration test technique required for developing a satellite or a payload. By taking these courses, students are expected to develop a practical ability on the structural design, which will also be useful for ChubuSat Instrument Development Project.	
Registration Qualification Nothing in particular	Completion Deadline Before advancing to the third year (D1)
Grading GP is calculated by averaging following individual grades. A and higher=4, B=3, C=2, D and lower=0	Requirements for Credits
Related Courses ・Overview of Space Exploration and Research ・Satellite Systems (Lecture Courses on Space Science and Engineering) ・Micro-Satellite Development and Applications (Satellite Development and Applications Short Courses)	For non-LGS students ・Acceptable ・Conditions: Graduate students of Nagoya University
Course Content 1. Training on the structural analysis using Finite Element Method (FEM) 1.1 Basic lecture on the structural analysis and FEM. 1.2 Hands-on FEM software training. 1.3 Model optimization to analyze a real structure. 2. Training on the vibration tests 1.4 Basic lecture on the operation of the vibration test machine. 1.5 Practice of a series of the pre-launch vibration tests.	
Text Book Shown on the spot from the lecturer	Reference Book Shown on the spot from the lecturer if necessary
Notes	

7. *Monozukuri* Lecture

("Introduction to the experimental and observational techniques for particle and astrophysics research")

This is a lecture in the curriculum of the Graduate School of Science and is given in Japanese. Lecture details are available in the Japanese version of this syllabus and in the following Japanese web page.

http://www.frontier.phys.nagoya-u.ac.jp/jp/monozukuri/lecture/index.html

Please consult K. Suzuki (kazuhito@hepl.phys.nagoya-u.ac.jp) about English support if you plan to take this lecture.

8. *Monozukuri* Laboratory Courses

The hands-on courses listed below will be available. Course details, including the date and registration, will be announced in the following web page.

http://www.frontier.phys.nagoya-u.ac.jp/en/monozukuri/lab_course/index.html

Course	Credit
Soldering and Assembling Course	1
Printed Wiring Board Production Course	1
Electronics Circuit Manufacturing Course	1
FPGA Training Course (*)	1
ASIC Training Course (*)	1
Machining Course	1
Monozukuri Practical Course: Vibration Cutting (*)	0.5
Monozukuri Practical Course: Automation Technology (*)	0.5
Monozukuri Practical Course: Thin-film Manufacturing Technology with Plasma-ion Processing and the Assessment of Tribological Property (*)	0.5

(*) These courses will be held in collaboration with the organizations outside the University and will be given in Japanese. Please consult K. Suzuki (kazuhito@hepl.phys.nagoya-u.ac.jp) about the course details and English support if you plan to take these courses.

9. Global Leadership Training

<table>
<tr><td>Term(Semester): GLT Ⅰ:Spring , Autumn
GLT Ⅱ : Autumn
Class Room:
Course Category: Required electives
Credits:2</td><td>Contact Information
Faculties in charge:
Akihiro Sasoh, Jiro Kasahara, Hidetaka Tanaka, Naoko Yamazaki, Hiroyuki Kousaka, Janet Henderson, Reiko Furuya, Emanuel Leleito, Setsuko Aoki
Phone: 4402
Office:
e-mail: sasoh@nuae.nagoya-u.ac.jp</td></tr>
<tr><td colspan="2">Purpose and Aim of Course
To cultivate the English language proficiency, international outlook and project management ability required for a global leader.
In Global Leadership Training Ⅰ(GLT Ⅰ), students strengthen their ability to communicate and discuss in English, essential in global communication.
In Global Leadership Training Ⅱ(GLT Ⅱ), students acquire qualities that can be used globally such as during joint international development and in international competition through lectures and presentations on space law, international relations and business, and project management on the course of the space industry.</td></tr>
<tr><td>Registration Qualification
English score of IELTS ≧5.5</td><td>Completion Deadline</td></tr>
<tr><td>Grading
GP is calculated by averaging following individual grades.
5 grades evaluations</td><td>Requirements for Credits</td></tr>
<tr><td>Related Courses
・Overview of Space Exploration and Research
・Satellite Systems
・Leadership Development Seminar</td><td>For non-LGS students
・Acceptable
・Conditions: Graduate students of Nagoya University</td></tr>
<tr><td colspan="2">Course Content
GLT Ⅰ(Global Communication)
Each class will include a speaking project, to be worked on in class. You must use English to do the project and to communicate with our classmates. In addition , each student will do a final project, to be presented in class.
Students must actively participate in each class.

Class 1: Unit 1 Biology
Class 2: Unit 2 Marketing
Class 3: Unit 3 Astronomy
Class 4: Unit 5 Psychology
Class 5: Unit 6 Sociology
Class 6: Unit 8 Earth Science
Class 7: Final Project

GLT Ⅱ(Program Management & Space Policy)
International Space Law, International Relations & Business, Project Simulation
1. Space Law
2.Space Business
3.Project Management Overview
4.NASA Project Management/System Engineering
5.ISS Design Training
6.SS Design Training : Case Study
7.SS Design Training : Presentation and Review</td></tr>
<tr><td>Text Book
GLT Ⅰ: Academic Connections, by David Hill
GLT Ⅱ: Shown on the spot from the lecturer</td><td>Reference Book</td></tr>
<tr><td colspan="2">Notes
Students who have already obtained an IELTS score ≧7.0 or the equivalent are not required to take GLT Ⅰ(GC), and are awarded 1 credit.</td></tr>
</table>

10. English Communication Training

<table>
<tr><td>Term(Semester): Spring and Autumn
Class Room: Science Bldg. A Room104 and others
Course Category: Electives
Credits: -</td><td>Contact Information
Faculties in charge:
Yoshitaka Itow, Hiroaki Menjo
Phone: 4319
Office: Common Building, Room 531
e-mail: Itow@isee.nagoya-u.ac.jp</td></tr>
<tr><td colspan="2">Purpose and Aim of Course
English communication skills are the basis for international communication ability. The English training are offered to students lacking English proficiency to raise their level to the required level for doing an international internship and attending the Global Leader Training. Two trainings, weekly basic English training in the campus and overseas intensive English training in Malaysia for one month, are available, especially for the students who have the English test score of less than IELTS 5.5 equivalent, to raise it to IELTS 5.5 equivalent or higher.</td></tr>
<tr><td>Registration Qualification
Highly encourage to the students with English test score of IELTS ≦ 5.0 or equivalent scores in other English tests (All applicants can take these trainings)</td><td>Completion Deadline
Take the training repeatedly until the student achieves the required level of English test score.</td></tr>
<tr><td>Grading
Evaluate achievement by a English proficiency test</td><td>Requirements for Credits
No credit is given in this training.</td></tr>
<tr><td>Related Courses
・Global Leader Training</td><td>For non-LGS students
Not acceptable</td></tr>
<tr><td colspan="2">Course Content
The practical trainings by native English teachers improve the four English skills of Reading, Listening, Writing and Speaking. Depending on the results of a computer-based English test that students take every half-year, they are classified to two courses, Course A (English score of IELTS 5.0 equivalent) and Course B (English score of IELTS 4.5 equivalent and less). In addition to the whole-year basic English training (2 hours per week in May-July and in November-January), students of Course B may participate in the one-month oversea intensive English training in Malaysia. Students are expected to take English trainings until they achieve the required English proficiency which is evaluated by English test held every half year.

1. Basic English Training: Whole year training, 2-hourlecture x 26 times. The training is divided to the two semesters, Spring and Autumn. For Course A and B
2. Oversea Intensive English Training: Learn English in English language school located in Kuala Lumpur, Malaysia and stay for one month in the full English environment. For Course B.</td></tr>
<tr><td>Text Book
Complete IELTS Bands 5-6.5 (Course A)
Complete IELTS Bands 4-5 (Course B)</td><td>Reference Book
IELTS training (Japanese)
Cambridge IELTS 7 Self-study Pack (English) etc.
These books can be borrowed in the LGS office.</td></tr>
<tr><td colspan="2">Notes
The English communication trainings is offered so that students can achieve required English communication proficiency. The GPA evaluation is not performed. A half of the estimated expense of basic English training, 30,000 yen per semester, will be deduced from the international internship allowance of the students taking the training.</td></tr>
</table>