Space Engineering International Course
Syllabus 2023

English XA（英語　ＸＡ）

Subject code, Lecturer, Credit

26009663, WATANABE Hiroaki, Credit 1

Course Description

To teach students how to write technical abstracts, and full research papers that meet global standards. Students will bring in content that is related to their thesis, and will learn to build up their academic writing ability. They will learn more technical terminology, and various aspects of how to best structure their academic paper and thesis. They will learn to summarize academic papers.

They will be exposed to spoken English (videos of lectures etc.) related to their research field.

Classes will be conducted with Moodle.

Course and Curriculum linkage

Intended for students of the Space Engineering International Course (SEIC).

Course Calendar/Class Topic

1 Course overview, summary and paraphrasing and avoiding plagiarism. Step-by-step introduction to characteristics of a good abstract.

2 Review of summarizing and paraphrasing; introduction to self- and peer-evaluation techniques; Abstract introduction and method. Homework as directed by the instructor: Summary of research.

3 Abstract discussion and conclusion. Turn in your study's summary.

4 Introduction to common errors

5 Presenting your research (1) (practice); Self-evaluation and goal setting; Editing.

6 Presenting your research (2); Peer-reviewing (structure, format and language conventions review).

7 Summarizing academic papers (1) Choosing an appropriate topic

8 Summarizing academic papers (2); Homework as directed by the instructor

9 Writing research introduction; Researching the topic background; Describing aims and writing good research questions; Write a summary about your study's introduction, literature, problem and research questions; Homework as directed by the instructor

10 Writing research method; Poster Session writing: Turn in summary of study's introduction.

11 Writing research results; Poster Session writing; Turn in summary of research method. Homework as directed by the instructor

12 Write the discussion and significance of your research results. How to present results; Poster writing, facts, details and delivery. Turn in summary of research results. Homework as directed by the instructor.

13 Writing research references and citations. Presenting your research (practice), as well as on student self-evaluation, goal setting, along with reviewing the fundamentals of abstract and academic writing. Turn in completed summary; Homework as directed by the instructor.

14 Presenting your research (1); Peer-editing (structure, format and language conventions review). Homework as directed by the instructor.

15 Peer-editing; Turn-in Final Paper

16 Final Exam and student survey

General Course Policies

All class sessions are conducted in English. This class has informal conversation, peer-assisted learning and writing practice. Class assignments will be conducted with Moodle.

Course Objectives

By the end of this course, students should:

1. Understand the basic conventions of an abstract

2. Understand how to concisely state research objectives, explain the research background, describe the research design and present results
3. Understand how to use appropriate register and tone for the specific genre of writing
4. Be able to write grammatically accurate sentences using appropriate vocabulary
5. Be able to write academic papers in English

Evaluation Methods and Grading Criteria

20% Summary of Student's Study
20% Research Drafts
20% Teacher Discretion
40% Final Exam

Assignment Instructions

Active participation is expected in class activities. Students are expected to prepare for class warm-up each week and assist each other.
Students are expected to set aside 0.5 hours a week as time for class preparation.

Keywords

Descriptive writing, evaluation, cooperative / autonomous learning, creative process: brainstorming, organizing, drafting, reviewing, revising, publishing

Required Textbooks

Writing Research Papers 4 (published by Macmillan)

References/Recommended Reading

Any English-English dictionary from a reputable publisher (eg. Cambridge, Oxford, Collins etc.) is recommended.

Notes

Create a free online account at https://www.grammarly.com/ (This helps you correct grammatical errors.)
dictionary.com online is useful.

Email

watanabe_hiro_kyutechST*runbox.com（Replace * with ＠）

Japanese for Beginners（日本語入門）

Subject code, Lecturer, Credit
42000809, ISHIKAWA Tomoko, Credit 1

Course Description
This class is designed to provide international students with basic structures and grammatical items to promote Japanese language proficiency.

Course and Curriculum linkage
This class is only for the international students of the Space Engineering International Course.

Course Calendar/Class Topic
1 Orientation
Basic greeting expressions and self introduction
2 Counting system and time-measuring system
3 Sentences using nouns
4 Numeral and Japanese counter words
5 Shopping conversation
6 Sentences to express existence
7 Expressions of dates and periods of time
8 Two types of adjectives and their usage
9 Sentences using adjectives
10 Introduction of basic verbs
11 Sentences using verbs
12 Conversation using basic verbs (non-past)
13 Conversation using basic verbs (past)
14 Review
15 Oral test
16 Written test

General Course Policies
We will use a romanized Japanese textbook and concentrate on developing the basic hearing and speaking abilities required in daily life.

Course Objectives
1. To master basic Japanese sentence patterns and vocabulary
2. To be able to use greeting expressions and speak simple Japanese
3. To get used to Japanese phoneme system

Evaluation Methods and Grading Criteria
Class participation, assignments, the final written and oral tests.

Assignment Instructions
Students are expected to set aside 30 minutes a week as time for class preparation.

Keywords
Elementary Japanese
Required Textbooks
Japanese for Beginners
References/Recommended Reading
To be announced as needed
Email
ishikawa-t[at]kitakyu-u.ac.jp

Space Environment Testing Workshop（宇宙環境試験ワークショップ）

Subject code, Lecturer, Credit

26000813, CHO Mengu, Credit 1

Course Description

A satellite is exposed to extreme environments such as vacuum, radiation and plasma. It is also exposed to severe vibration and shock onboard a rocket. Satellites have to operate maintenance-free and need to be tested thoroughly before the launch. The purpose of this subject is to learn the actual tests through hands-on laboratory workshop.

Course and Curriculum linkage

Space Environment Testing Workshop is a subject for the Space Engineering International Course (SEIC).

Course Calendar/Class Topic

1 Vibration - overview
2 Vibration - preparation
3 Vibration test
4 Vibration - analysis
5 Shock - overview
6 Shock - preparation
7 Shock test
8 Shock - analysis
9 Thermal vacuum - overview
10 Thermal vacuum - preparation
11 Thermal vacuum test
12 Thermal vacuum - analysis
13 Thermal cycle overview and preparation
14 Thermal cycle test
15 Thermal cycle – analysis

General Course Policies

The classes will be laboratory workshops

Course Objectives

1. Obtain hands-on experience of spacecraft testing
2. Understand the testing principle

Evaluation Methods and Grading Criteria

Report

Assignment Instructions

Download and read the lecture material before each lecture.

Keywords

Spacecraft Environment, Testing

Required Textbooks

None

References/Recommended Reading

HARRIS' SHOCK AND VIBRATION HANDBOOK, Allan G. Piersol, Thomas L Paez, Macgrawhill, Spacecraft Thermal Control Handbook, David G. Gilmore, Aerospace Press
JAXA-JERG-2-130「宇宙機一般試験標準」
SMC-S-016 “TEST REQUIREMENTS FOR LAUNCH, UPPER-STAGE AND SPACE VEHICLES”
ISO-15864 “Space systems — General test methods for space craft, subsystems and units”
ECSS-ST-10-03 “Space Engineering – Testing”

Notes

This workshop is for students who register the Space Engineering International Course only. Students are supposed to finish Space Environment Testing.

Email

cho.mengu801[at]mail.kyutech.jp (Replace [at] with @)

Space Systems PBL I（宇宙システム PBL Ⅰ）

Subject code, Lecturer，Credit
26990824, CHO Mengu, IWATA Minoru, Credit 1

Space Systems PBL Ⅱ（宇宙システム PBL Ⅱ）

Subject code, Lecturer，Credit
26990825, CHO Mengu, IWATA Minoru, Credit 1

Course Description
Space system spans a wide range of fields such as mechanical, electrical, material and other engineerings and consists of a huge number of parts and numerous softwares. It is also required to function maintenance-free for a long time in the extreme environment in space. A satellite flies over any countries regardless the border. Therefore, its usage requires a global point of view. It is not sufficient to learn via textbooks and lectures, in order to learn how to design the system elements, combine them, test and operate to bring the satellite value to the users. Students carry out a project in a group made of a few numbers to develop hypothetical space system or real nano-satellite, rocket, spacecraft and others. Students organize the user requirements and perform system conceptual design by incorporating them into the system requirements and the design requirements. This PBL will be conducted in English as a subject of Space Engineering International Course.

Course and Curriculum linkage
*Space Systems PBL I and Space Systems PBL II are subjects for the Space Engineering International Course (SEIC).

*To be announced by the project supervisors.

Course Calendar/Class Topic
To be announced by the project supervisors.

General Course Policies
To be announced by the project supervisors.

Course Objectives
1. Obtain experience of space system design
2. Obtain experience of inter-cultural communication

Evaluation Methods and Grading Criteria
To be announced for each project.

Assignment Instructions
To be announced for each project.

Keywords
To be announced for each project.

Required Textbooks
To be announced for each project.
References/Recommended Reading
To be announced for each project.

Email cho.mengu801[at]mail.kyutech.jp (Replace [at] with @)
iwata[at]ele.kyutech.ac.jp (Replace [at] with @)

Advanced Embedded Systems（組み込みシステム特論）

Subject code, Lecturer, Credit

26100001, ASAMI Kenichi, Credit 2

Course Description

This lecture provides design methodology, working principles, and organization of embedded systems. Fundamentals of computer architecture, digital circuits, and systems modeling languages will be introduced.

Course and Curriculum linkage

Intended for students of the Space Engineering International Course (SEIC).

Course Calendar/Class Topic

1 Embedded systems
2 Logic circuits (1)
3 Logic circuits (2)
4 Verilog HDL (1)
5 Verilog HDL (2)
6 FPGA (1)
7 FPGA (2)
8 ARM microprocessor (1)
9 ARM microprocessor (2)
10 UML/SysML (1)
11 UML/SysML (2)
12 SystemC (1)
13 SystemC (2)
14 Presentation (1)
15 Presentation (2)

General Course Policies

Mini-tests are imposed for the understanding of each topic.

Course Objectives

Students understand embedded systems design process.

1. Students expand understanding of embedded systems design.
2. Students enhance understanding of digital systems development.
3. Students utilize understanding of systems modeling languages.

Evaluation Methods and Grading Criteria

The grade is evaluated by mini-tests, presentation, and final report.

Assignment Instructions

Students are required to review the lecture slides.
Students are expected to set aside 4 hours a week as time for class preparation.

Keywords

Embedded systems, FPGAs, ARM microprocessor, UML/SysML, SystemC

Required Textbooks

The lecture slides will be provided on Moodle.

References/Recommended Reading

[1] Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design 2nd Edition, Morgan Kaufmann, 2008.
[2] Sarah Harris, David Harris, Digital Design and Computer Architecture ARM Edition, Morgan Kaufmann, 2015.
[3] Clive Maxfield, The Design Warrior's Guide to FPGAs, Newnes, 2004.

Email

Provided on Moodle.

Vision and Image Recognition（視覚画像認識特論）

Subject code, Lecturer, Credit

26500911, HANAZAWA Akitoshi, Credit 2

Course Description

With the progress of image recognition algorithms, image recognition technologies are utilized in many fields, e.g. robotics, vision assistance, security, car safety system, etc. To understand image reconition systems, students study about the characteristics of digital images, feature detection, reognition methods, machin learning algorithms. In the class, for the experience of practical image recognition systems, each student uses computer tools related to image processing and machine learning, which is, OpenCV, Processing, Maxima, R. By doing assignments using these tools, students learn techniques applicable for their research activities.

Course and Curriculum linkage

In this class, students will experience image feature detection and machine learning by running their own programs using image processing and machine learning tools such as Python, OpenCV, and Processing. In addition, by performing assignments using these tools, students will deepen their understanding of the content and learn techniques that can be used in graduate school research activities.

Course Calendar/Class Topic

1 Basic Knowledge
2 Bayes' Theorem
3 Image Acquisition
4 Image Encoding, Transmission
5 Local Feature Detection
6 Linear Discrimination Analysis
7 Kernel Method
8 Time Series Recognition
9 Tracking
10 Ensemble Learning
11 SVM
12 Neural Network
13 Imagege Segmentation
14 Attention & Saliency
15 Color

General Course Policies

Moodle is used for the distribution of lecture materials, task submission and examination. For doing the tasks using C langulage, Processing, Maxima, etc. and thir submission, students must bring their own PC. (Let the teacher know if it is impossible before the class starts.)

Course Objectives

1. Understand basics of digital image processing.
2. Understand statistical characteristics of digital image components.
3. Understand image recognition by machine learning.

Evaluation Methods and Grading Criteria

Task submission 60% and final exam 40%,

Assignment Instructions

Students are expected to set aside 4 hours a week as time for class preparation.

Keywords

Image Recognition, Machine Learning

Required Textbooks

Use online (moodle) materials.

References/Recommended Reading

Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition, Packt Publishing, ISBN-13 : 978-1789955750

Notes It is recommended to review C language and Maxima.

Email hanazawa.akitoshi344[at]mail.kyutech.jp (Replace [at] with @)

Advanced Mechanics of Materials（材料力学特論）

Subject code, Lecturer，Credit
26450810, YAMAGUCHI Eiki, Credit 2

Course Description
For a good prediction of structural behavior, the modeling of material behavior (stress-strain relationship) is very important. To this end, plasticity-based modeling of material behavior is studied in this course.
Course and Curriculum linkage
Prerequisite: structural mechanics

Course Calendar/Class Topic
1 Plasticity-Based Modeling of 1D
2 Plasticity-Based Modeling of 1D
3 Example Problem
4 Essentials of Stress
5 Essentials of Stress
6 Essentials of Strain
7 Essentials of Stress-Strain Relationship
8 Plasticity Theory in Multi-Dimension
9 Plasticity Theory in Multi-Dimension
10 Plasticity Theory in Multi-Dimension
11 Stress-Strain Relationship
12 Stress-Strain Relationship
13 Example Problem
14 Example Problem
15 Example Problem

General Course Policies
Plasticity-based constitutive model is studied. From the one-dimensional model, the fundamental of the plasticity theory is discussed first. The plasticity theory for multi-axial stress state is then explained. To be specific, the constitutive relationship for von Mises material is given in detail.

Course Objectives
The goal of this course is to acquire a good knowledge of the plasticity theory. It is important to evaluate the ultimate strength of a structure and required for the seismic design of a structure.

Evaluation Methods and Grading Criteria
The mid-term exam and the final exam would be given, based on which the grade would be determined.
Assignment Instructions
Students are expected to study for 4 hours a week for this course in addition to the lectures
Keywords
stress, strain
Required Textbooks
None
References/Recommended Reading
Plasticity for Structural Engineers, Wai-Fah Chen and Da-Jian Han
J. Ross Publishing
Notes
This lecture is given in English.
Email
yamaguch[at]civil.kyutech.ac.jp　(Replace [at] with @)

Advanced Analysis of Structures（構造解析特論）

Subject code, Lecturer, Credit
26600001, CHEN Pei-Shan, Credit 2

Course Description
This course will introduce you to the study of nonlinear behavior of structures, including the basic theories on buckling analysis of space frames, analysis of cable structures, and Elasto-Plastic analysis of rigid frames. Furthermore, this course will equip you with the knowledge to anchor your understanding of structural design of space structures, high-rise buildings and mechanical structures.
This is also a course of Space Engineering, and the lectures will be given in English.

Course and Curriculum linkage
It is desirable that the attendees have the basic knowledge of Structural Mechanics.

Course Calendar/Class Topic
1 Introduction, Nonlinear analysis (Part 1)
    Nonlinear Analysis of a 2-Bar system
2 Nonlinear analysis (Part 2)
    Principle of stationary potential energy
3 Nonlinear analysis (Part 3)
    Iteration and incremental analysis (Geometric stiffness)
4 Nonlinear analysis (Part 4)
    Coordinate transformation and nonlinear element stiffness matrices
5 Nonlinear analysis (Part 5)
    Nonlinear stiffness matrices by principle of virtual work
6 Nonlinear analysis (Part 6)
    Incremental analysis and convergence
7 Nonlinear analysis (Part 7)
    Nonlinear buckling analysis and bifurcation of space frames (Imperfections sensitivity)
8 Nonlinear analysis (Part 8)
    Linear buckling analysis
9 Cable structure (Part 1)
    Introduction; Suspension cables (parabolic profile)
10 Cable structure (Part 2)
    Suspension cables (catenary profile), Influence of boundary condition
11 Cable structure (Part 3)
    Prestressing analysis of tensegric structures
12 Cable structure (Part 4)
    Linear and nonlinear analysis of tensegric Structures
13 Elasto-plastic analysis (Part 1)
    Introduction, Homogeneous Beams
14 Elasto-plastic analysis (Part 2)
    Combined Bending and axial force
15 Elasto-plastic analysis (Part 3)
    Elasto-plastic analysis of structures

General Course Policies
Students may be asked to explain and/or solve questions during lesson. After the lesson, every student should complete his/her homework and review the lecture contends simultaneously for more deep understanding.

Course Objectives
1. Knowledge of nonlinear analysis of space frames and mechanical structures.
2. Knowledge of analysis of cable structures.

3. Elasto-plastic analysis of building and mechanical structures.

Evaluation Methods and Grading Criteria

The overall grade will be decided based on short reports and the attendance.

Assignment Instructions

Attendees should prepare to explain and/or solve questions in turn during lectures.

Keywords

Nonlinear analysis, Buckling analysis, Spatial Structures, Space frames, Cable structure, Elasto-plastic analysis, 非線形力学解析，座屈解析，スペースフレーム，ケーブル構造，弾塑性解析

Required Textbooks

No textbook. Reference books may be introduced during the lecture.

References/Recommended Reading

No textbook. Reference books may be introduced during the lecture.

Notes

It is desirable that the attendees have the basic knowledge of Structural Mechanics.

Email

chen[at]civil.kyutech.ac.jp (Replace [at] with @)

Computational Fluid Dynamics（数値流体力学特論）

Subject code, Lecturer, Credit

26440902, TSUBOI Nobuyuki, Credit 2

Course Description

Recent numerical methods to solve fluid dynamics have been improved remarkably. Many engineering companies use some commercial codes to design some products; however, basic knowledge must be required to use such the commercial codes. This course presents recent numerical simulation methods for compressible fluid in order to understand some basic solver and recent numerical techniques.

Course and Curriculum linkage

Basic knowledge of thermal and fluid dynamics-related subjects, especially compressible fluid dynamics, is mandatory. This course is the basis for understanding numerical methods for compressible fluids.

Course Calendar/Class Topic

1 Introduction
2 Numerical method for scalar equation
    (a)Finite difference method
3 (b)Higher-order upwind difference method
4 Numerical method for system equation
    (a)Finite difference method
5 (b)Solution method for system equation
6 (c)Approximate Riemann solver
7 (d)Various numerical fluxes
8 (e) Recent numerical fluxes
9 Transfer on general coordinate and grid generation method
10 Time integration method
    (a) Scalar equation
11 (b) System equation
12 Initial and boundary condition
13 Numerical method on unstructured grid
14 Numerical method for turbulence
15 Stability analysis and recent topics

General Course Policies

Lectures are given by the above items, and exercises and review reports are required to promote understanding of the content of the lecture.

Course Objectives

1. Understand the role of numerical analysis methods in fluids
2. Understand the difference method
3. Understand the numerical flux method
4. Understand the time integration method

Evaluation Methods and Grading Criteria

Grade is evaluated by attendance of class, reports, and final examination.

Assignment Instructions

You should read distributed materials before the lecture and investigate some technical home works. Students are expected to set aside 4 hours a week as time for class preparation.

Keywords
Compressible Flow, Numerical Simulation, Compressible Flow

Required Textbooks
K. Fujii, Numerical Methods for Computational Fluid Dynamics, University of Tokyo Press(1994), in Japanese

References/Recommended Reading
(1)C. Hirsch, Numerical Computation of Internal and External Flows(2nd Edition), Butterworth-Heinemann(2007)
(2)小林敏夫 編，数値流体力学ハンドブック，丸善(2003), in Japanese
(3) R. W. MacCormack, Numerical Computation of Compressible and Viscous Flow, AIAA Education Series(2014)

Notes
It is desirable or recommended for the students to take courses related to “Fluid Dynamics”, “Compressible Fluid Dynamics” and so on in the undergraduate course.

Email
Tsuboi[at]mech.kyutech.ac.jp (Replace [at] with @)

High-speed Gas Dynamics（高速気体力学特論）

Subject code, Lecturer, Credit

26440903, TSUBOI Nobuyuki, Credit 2

Course Description

Rockets, airplanes, and space vehicles fly under severe environments. The flight velocity changes from subsonic speed to supersonic and hypersonic speeds. The flight environment changes from a continuum regime to a low-density regime. This course presents fluid dynamics under such the flight environments of the space vehicles to understand the fundamental of the fluid dynamics.

Course and Curriculum linkage

Basic knowledge of thermal and fluid mechanics-related subjects, especially compressible fluid dynamics, is mandatory. This course is the basis for understanding high Mach number flow.

Course Calendar/Class Topic

1 Introduction
2 Fundamental theory of compressible flow
3 Hypersonic gas dynamics
  (1) What is hypersonic low?
4 (2)Experimental approach
5 (3) Various approximate solution methods
6 (4) Inviscid hypersonic flow
7 (5)Viscous hypersonic flow
8 (6)Real gas effects
9 (7)Radiation
10 (8)Wind tunnel testing for hypersonic flow
11 4. Rarefied gas dynamics
  (1)What is rarefied gas dynamics?
12 (2)Feature of gas dynamics from microscopic view
13 (3)Feature of gas under equilibrium state
14 (4)Gas-surface interaction
15 (5)Numerical simulation on rarefied gas dynamics

General Course Policies

Lectures are given by the above items, and exercises and review reports are required to promote understanding of the content of the lecture.

Course Objectives

1. Understand the concept of hypersonic flow
2. Understanding the various approximate solutions
3. Understand the real gas effect
4. Understand the rarefied gas flow

Evaluation Methods and Grading Criteria

Grade is evaluated by attendance of class, reports, and final examination.

Assignment Instructions

You should read distributed materials before the lecture and investigate some technical home works. Students are expected to set aside 4 hours a week as time for class preparation.

Keywords

Hypersonic Flow, Compressible Flow, Reentry, Rarefied Gas Flow

Required Textbooks
Distributed prints

References/Recommended Reading
(1)J.D.Andarson, Jr., Hypersonic and High Temperature Gas Dynamics, McGraw-Hill(1989)
(2)Bird, G.A., Molecular Gas Dynamics and the Direct Simulation of Gas Flow, Oxford(1994)
(3)日本機械学会 編, 原子・分子の流れ, 共立出版(1996)
(4)小林敏夫 編, 数値流体力学ハンドブック, 丸善(2003)

Notes
It is desirable or recommended for the students to take courses related to “Fluid Dynamics”, “Compressible Fluid Dynamics” and so on in the undergraduate course.

Email
tsuboi[at] mech.kyutech.ac.jp (Replace [at] with @)

Advanced Space Robotics（宇宙ロボティクス特論）

Subject code, Lecturer, Credit
26630001, NAGAOKA Kenji, Credit 2

Course Description
Currently, robotics technologies have been required for various space applications to support or replace human space activities. In particular, robotics exploration is necessary for deep space exploration. This course introduces the fundamentals and applications of space robotics. Specifically, this course expects students to learn and have a better understanding of fundamental dynamics, control technique, and autonomous technology of space robotics.

Course and Curriculum linkage
This lecture expects that students have understood the fundamentals of dynamics, control engineering, and robotics. Understanding space engineering is also preferable, but not necessarily required.

Course Calendar/Class Topic
1 Introduction of Space Robotics
2 Kinematics and Dynamics of Space Manipulator
3 Control of Space Manipulator
4 Contact Dynamics of Space Manipulator
5 Object Capture by Space Manipulator
6 Vibration Suppression Control of Flexible Space Structure
7 Tele-Operation Technology and Autonomy
8 Locomotion Mechanism of Planetary Robot
9 Terramechanics for Planetary Robotics (1)
10 Terramechanics for Planetary Robotics (2)
11 Autonomous Technology for Planetary Robotics (1)
12 Autonomous Technology for Planetary Robotics (2)
13 Robotics for Minor Body Exploration
14 Drilling Technology on Extraterrestrial Body
15 State-of-the-Art Topics in Space Robotics

General Course Policies
This lecture is provided based on Moodle and Zoom with the lecture notes according to the above topics.

Evaluation Methods and Grading Criteria
Comprehensive evaluation of attendance and reporting assignments.

Assignment Instructions
Eight-hour-a-week of self-learning for preparation based on the lecture materials and reference books.

Keywords
Robotics, Control Engineering, Space Technology, Contact Dynamics, Terramechanics

Required Textbooks N/A.

References/Recommended Reading
[1] A. Elley, An Introduction to Space Robotics, Springer.
[2] R. Vepa, Dynamics and Control of Autonomous Space Vehicles and Robotics, Cambridge University Press.
[3] J. Y. Wong, Theory of Ground Vehicles, Wiley.
[4] J. A. Pytka, Dynamics of Wheel-Soil Systems, CRC Press.

Notes This lecture the SEIC subject and thus is given in English while supplementary explanations is provided in Japanese as appropriate.

Email Kenji Nagaoka: nagaoka.kenji572[at]mail.kyutech.jp (Replace [at] with @)

Advanced High Velocity Impact Engineering（高速衝突工学特論）

Subject code, Lecturer, Credit
26440810, AKAHOSHI Yasuhiro, Credit 2

Course Description
Students will learn fundamental knowledge such as birdstrikes of airplane and space debris impact on International Space Station in this course. In particular, students learn stress wave propagation in material and fracture phenomena due to hypervelocity impacts.

Course and Curriculum linkage
Space Environment Testing Workshop is a subject for the Space Engineering International Course (SEIC).

Course Calendar/Class Topic
1 Introduction of space debris
2 Introduction of low, high, hypervelocity impact
3 Fundamental relationships(1)
4 Fundamental relationships(2)
5 Material response(1:metals and ceramics)
6 Material response(2:composites)
7 Impedance
8 Non-penetrating impacts
9 Strength Effect
10 Tate model
11 HVI: semi-infinite target
12 HVI: finite target
13 Hydrocode
14 Scale Modeling
15 Final Examination
16 Summary

General Course Policies
Short quiz will be given every class topic for confirmation.

Course Objectives
The goal of this course is to understand high-velocity deformation of material under high strain rate such as hypervelocity impact phenomena. After successfully completing this course, students will be able to demonstrate their skills/knowledge/competency that are indicated in the following course objectives.

1. the student understands stain rate effects.
2. the student understands spall fracture.
3. the student understands features of ballistic limit curves.
4. the student understands conservation of laws and simple models such as Tate model.

Evaluation Methods and Grading Criteria
Grade is evaluated by attendance of class, short quiz, and final examination.

Assignment Instructions
Students are expected to set aside 8 hours a week as time for class review.

Keywords
Hypervelocity Impact, Space Debris, Shock Wave

Required Textbooks N/A

References/Recommended Reading

(1) Zukas et al, Impact Dynamics, KRIEGER, 1982
(2) Melosh, Impact Cratering, OXFORD, 1989
(3) Horie and Sawaoka, Shock Compression Chemistry of Materials, KTK Scientific Publishers, 1993
(4) Norman Jones, Structural Impact, Cambridge University Press, 1990 (https://doi.org/10.1017/CBO9780511624285)

Notes

Students should acquire knowledge of strength of material, elasticity and plasticity at undergraduate level before they take this course.

Email

akahoshi.yasuhiro144[at]mail.kyutech.jp (Replace [at] with @)

Advanced Space Dynamics（スペースダイナミクス特論）

Subject code, Lecturer, Credit

26440819, HIRAKI Koju, Credit 2

Course Description

This course aims to promote the understandings of the basic formulations of two-body problems in three-dimensional coordinates, taking an artificial satellite and a spacecraft as examples. The lectures are given in English.

Course and Curriculum linkage

Advanced Space Dynamics is a subject for the Space Engineering International Course (SEIC).

Course Calendar/Class Topic

1 Two-body problem
2 Eccentricity and orbital energy
3 Trajectory equation and Keplerian orbit
4 Kepler's law
5 Kepler's equation
6 Orbital elements
7 Orbits of planets in solar system
8 Transformation of coordinates
9 Hohmann transfer
10 Launch window
11 Sphere of influence
12 Patched conics
13 Swing by
14 Trajectory design of planetary swingby
15 Presentations

General Course Policies

All the lectures are made completely in English. Only the fundamentals of dynamics are required.

Course Objectives

The goal of this course is to be able to design an interplanetary orbit.

1. understand orbital elements
2. predict the positions of a satellite on the orbital element
3. understand a launch window

Evaluation Methods and Grading Criteria

Several assingments will be given. Students are required to submit documents for them. For some assingments students are requested to make presentations in front of attendee.

Assignment Instructions

The basics are given in the course. The assignments are achievable based on the knowledge given in the lectures. Students are expected to set aside 8 hours a week as time for class preparation.

Keywords

planets, trajectory design, deep-space exploration

Required Textbooks

No textbook is necessary.

References/Recommended Reading

Not specified. You can refer to the internet, if necessary.

Notes

The assignments need calculations using a spreadsheet application or program language.

Email

hiraki.koju735[at]mail.kyutech.jp (Replace [at] with @)

Introduction to Satellite Engineering（衛星工学入門）

Subject code, Lecturer，Credit
26500908, CHO Mengu, Credit 2

Course Description
The purpose of this lecture is to provide an overview of satellite engineering with its emphasis on micro- and nano-satellite technologies and systems engineering approach such as verification and test.
Course and Curriculum linkage
Introduction to Satellite Engineering is a subject for the Space Engineering International Course (SEIC).

Course Calendar/Class Topic
1. Introduction
2. Propulsion Basics
3. Propulsion System
4. Orbital Mechanics
5. Mission Analysis part.1
6. Mission Analysis part.2
7. Mission Analysis (constellation)
8. Electrical Power Systems
9. Prelaunch Environment and Spacecraft Structures
10. Spacecraft Dynamics and Attitude Control part.1
11. Spacecraft Dynamics and Attitude Control part.2
12. Thermal Control
13. Communication part.1
14. Communication part.2
15. Small Satellite Engineering

General Course Policies
The lectures will be done according to the schedule above. Some of the lectures will be done remotely.
Course Objectives
1. Understand the basic of satellite system

Evaluation Methods and Grading Criteria
Home works and discussion in the class
Assignment Instructions
Download and read the lecture material before each lecture.
Students are expected to set aside 4 hours a week as time for class preparation.
Keywords
satellite engineering, Spacecraft Systems Engineering

Required Textbooks
1. Spacecraft Systems Engineering, edited by Peter Fortescue et al., Wiley
References/Recommended Reading
1. Space Mission Analysis and Design, Third Edition, edited by James Werts and Wiley Larson, Space Technology Library
2. Space Vehicle Design, second edition, Michael Griffin and Jame French, AIAA

Notes
This lecture is provided in English.
Email
cho.mengu801[at]mail.kyutech.jp　(Replace [at] with @)

Satellite Power System Ⅰ（衛星電力システム特論Ⅰ）

Subject code, Lecturer，Credit
26500928, CHO Mengu, IMAIZUMI Mitsuru, NOZAKI Yukishige, OKUMURA Teppei,
Credit 1

Course Description
Power system is one of the most important subsystems to determine the fate of satellite mission. Without power, a satellite is useless. This lecture provides introduction of satellite power system from individual elements to overall pictures, as well as future prospect.

Course and Curriculum linkage
Satellite Power System I is a subject for the Space Engineering International Course (SEIC).

Course Calendar/Class Topic
1 Architecture of electrical power system
2 Photovoltaic-Battery System
3 Power system design
4 Solar cell principle
5 Space solar cell state-of-art
6 Environmental effect
7 Environmental effect
8 Solar array system

General Course Policies
The lectures will be done according to the schedule above. Some of the lectures will be done remotely.

Course Objectives
Understand the satellite power system

Evaluation Methods and Grading Criteria
Reports and mini tests

Assignment Instructions
Read a paper listed as reference during each lecture.
Students are expected to set aside 2 hours a week as time for class preparation.

Keywords
Satellite Power, Solar Array, Battery, Power Control, Power Distribution

Required Textbooks
None

References/Recommended Reading
Reference book;
Spacecraft Power Systems by Mukun R. Patel, CRC Press, 2005

Notes
This lecture is provided in English. It is desirable for students to take Space Systems Engineering (宇宙システム工学) and/or Introduction to Satellite Engineering (衛星工学入門) as well. It is strongly recommended to take Satellite Power System Ⅱ with this subject.

Email
cho.mengu801[at]mail.kyutech.jp　(Replace [at] with @)

Satellite Power System II（衛星電力システム特論 II）

Subject code, Lecturer，Credit
26500929, CHO Mengu, NAITOU Hitoshi, KUSAWAKE Hiroaki, Credit 1

Course Description
Power system is one of the most important subsystem to determine the fate of satellite mission. Without power, a satellite is useless. This lecture provides introduction of satellite power system from individual elements to overall pictures, as well as future prospect.

Course and Curriculum linkage
Satellite Power System II is a subject for the Space Engineering International Course (SEIC).

Course Calendar/Class Topic
1 Battery
2 Space battery state-of-art
3 Battery safety
4 Power control algorithm
5 Power control hardware
6 Reliability
7 High voltage power system
8 Small satellite power system

General Course Policies
The lectures will be done according to the schedule above. Some of the lectures will be done remotely.

Course Objectives
Understand the satellite power system

Evaluation Methods and Grading Criteria
Reports and mini tests

Assignment Instructions
Read a paper listed as reference during each lecture.
Students are expected to set aside 2 hours a week as time for class preparation.

Keywords
Satellite Power, Solar Array, Battery, Power Control, Power Distribution

Required Textbooks
None

References/Recommended Reading
Spacecraft Power Systems by Mukun R. Patel, CRC Press, 2005

Notes
This lecture is provided in English. It is desirable for students to take Space Systems Engineering (宇宙システム工学) and/or Introduction to Satellite Engineering (衛星工学入門) as well. It is strongly recommended to take Satellite Power System I before taking this subject.

Email
cho.mengu801[at]mail.kyutech.jp　(Replace [at] with @)

Space Environment Testing（宇宙環境試験）

Subject code, Lecturer, Credit
26500915, CHO Mengu, Credit 2

Course Description
A satellite is exposed to extreme environments such as vacuum, radiation and plasma. It is also exposed to severe vibration and shock onboard a rocket. Satellites have to operate maintenance-free and need to be tested thoroughly before the launch. The purpose of the lectures is to understand from the basics about necessity, background of test levels and conditions, judgment criteria of each test.

Course and Curriculum linkage
Space Environment Testing is a subject for the Space Engineering International Course (SEIC).

Course Calendar/Class Topic
1 Space environment tests, why necessary?
2 Satellite development and test strategy
3 Vibration test principle
4 Vibration test methods and analysis
5 Shock test principle
6 Shock test and analysis
7 Thermal vacuum test principle
8 Thermal vacuum test method and analysis
9 Thermal vacuum or thermal cycle
10 Antenna and communication test
11 EMC test
12 Outgas test
13 Radiation test
14 Radiation test
15 Test standard

General Course Policies
The lectures will be done according to the lecture schedule above. Some of the lectures will be given remotely.

Course Objectives
1. Understand the effects of space environment on spacecraft
2. Understand spacecraft verification processes
3. Understand rationales of each testing
4. Understand testing procedures

Evaluation Methods and Grading Criteria
Reports and mini-test

Assignment Instructions
Download and read the lecture material before each lecture.
Students are expected to set aside 4 hours a week as time for class preparation.

Keywords
Space Environment, Verification, Testing

Required Textbooks
None

References/Recommended Reading
参考書: HARRIS' SHOCK AND VIBRATION HANDBOOK, Allan G. Piersol, Thomas L Paez, Macgrawhill, Spacecraft Thermal Control Handbook, David G. Gilmore, Aerospace Press
JAXA-JERG-2-130「宇宙機一般試験標準」
SMC-S-016 "TEST REQUIREMENTS FOR LAUNCH, UPPER-STAGE AND SPACE VEHICLES"
ISO-15864 " Space systems — General test methods for space

Notes
This lecture is provided in English. It is desirable for students to take space system related subjects, such as Space Systems Engineering and Introduction to Satellite Engineering. Also, laboratory workshop will be held in Space Environment Testing Workshop

Email
cho.mengu801[at]mail.kyutech.jp (Replace [at] with @)

Space Systems Engineering I（宇宙システム工学Ｉ）

Subject code, Lecturer, Credit

26500950, MIHARA Shoichiro, Credit 1

Course Description

Systems Engineering for Space Systems will be lectured based upon NASA handbook. The lectures covers Stakeholder Expectations Definition, Technical Requirements Definition, Logical Decomposition, Design Solution Definition, Product Implementation, Product Integration, Product Verification, Product Validation, Product Transition, Technical Planning, Requirements Management, Interface Management, Technical Risk Management, Configuration Management, Technical Data Management, Technical Assessment, Decision Analysis, Concurrent Engineering, Technical Margin Management and so on. The content of this course is indispensable as a common language for those who are or will be working for space project, space industry, academia around the world.

Course and Curriculum linkage

Space Systems Engineering I is a subject for the Space Engineering International Course (SEIC). Space System Project Management will be lectured by Space Systems Engineering I (3rd semester) and Space Systems Engineering II (4th semester). In Space Systems Engineering I, lectures will be focused on Systems Engineering, and in Space Systems Engineering II, lectures will be focused on program and project planning and control (PP & C) and so on. Technical areas, such as satellite orbits, space environment, technical design for satellite components or satellites, are not covered in this course.

Course Calendar/Class Topic

1 Introduction to Systems Engineering
   Fundamentals of Systems Engineering, NASA Program/Project life Cycle
2 System Design Processes
   Stakeholder Expectations Definition, Technical Requirements Definition, Logical Decomposition, Design Solution Definition
3 Product Realization
   Product Implementation, Product Integration, Product Verification, Product Validation, Product Transition
4 Crosscutting technical management 1: Technical Planning, Requirement Management
   Technical Planning, Requirements Management,
5 Crosscutting technical management 2: Interface Management, Technical Risk Management, etc.
   Interface Management, Technical Risk Management, Configuration Management, Technical Data Management
6 Crosscutting technical management 3: Technical Assessment, Decision Analysis
   Technical Assessment, Decision Analysis
7 Crosscutting topics 1: Engineering with Contract etc.
   Engineering with Contracts, Selecting Engineering Design Tools
8 Crosscutting topics 2: Fault Management, Technical Margins
   Environmental, Nuclear Safety, and Planetary Protection Policy Compliance/ Systems Engineering on Multi-Level/Multi-Phase Programs, Fault Management, Technical Margins, Human Systems Integration (HSI) in the SE Process

General Course Policies

Lecture by aural presentation. Language is English only.　Assignment for related subject shall be submitted before the next lecture. PDF file of presentation and text version of aural presentation will be uploaded. If situation allows, face to face presentation is base line of the lecture. Otherwise mp4 file will be uploaded. It is advised to read related handbook before and after the lecture.

Course Objectives

The lectures cover Space Systems Engineering Engine. Understanding of Process of System Design, Product realization and Technical Management of Systems Engineering activities are expected.

1. Understanding of System Design Process
2. Understanding of Product realization
3. Understanding of crosscutting technical management.

Evaluation Methods and Grading Criteria

Attendance of lecture and Assignment

1. Watch presentation video in case of remote lecture. In remote lecture, attendance of class is measured by history of watch/Stream the video. If you does not watch or download the whole video, unwatched contents will be regarded unattended time of the lecture.
2. Submit Assignments.

Assignment Instructions

Download and study the lecture material before each lecture.
Students are expected to set aside 2 hours a week as time for class preparation. 2 hours for each assignment.

Keywords

Systems Engineering, Space Project, System Design Process, Product Realization, Technical Management, Technical Requirement Definition, Logical Decomposition, Interface Management, Product Verification, Product Validation, Configuration management, Decision Analysis

Required Textbooks

NASA/SP-2016-6105-SUPPL Expanded Guidance for NASA Systems Engineering volume 1
NASA/SP-2016-6105-SUPPL Expanded Guidance for NASA Systems Engineering volume 2

References/Recommended Reading

NASA Systems Engineering Handbook. NASA/SP-2016-6105 Rev 2.

Notes

The lecturer has been working as project manager for Space Project in Private Space Sector and Semi Private Space Foundation.
This lecture is provided in English. It is recommended to take "Introduction to Satellite Engineering" to understand technical issue of space system. It is strongly recommended to take "Space Systems Engineering I I" after this subject. If situation allows, four lectures will be performed by face to face basis and four lectures will be performed on line.

Email

Mihara-Shoichiro*jspacesystems.or.jp, change*to@

Space Systems Engineering II（宇宙システム工学 II）

Subject code, Lecturer, Credit
26500951, MIHARA Shoichiro, Credit 1

Course Description
Program and Project Management and Control for Space System will be covered based on NASA Handbooks. The lecture covers Functions of Project Planning and Control (PP&C) and Work Breakdown Structure(WBS). Schedule Management and Fault analysis. (FTA and FMECA) Functions of PP&C covers PP&C Integration, Resource Management, Scheduling, Cost Estimation/Assessment, Acquisition and Contract Management, Risk Management, Configuration and Data Management. The contents of this course are indispensable as a common language for those who are or will be working for space project, space industry, academia around the world.

Course and Curriculum linkage
Space Systems Engineering II is a subject for the Space Engineering International Course (SEIC). Space System Project Management will be lectured by Space Systems Engineering I (3rd semester) and Space Systems Engineering II (4th semester). In Space Systems Engineering I, lectures will be focused on Systems Engineering, and in Space Systems Engineering II, lectures will be focused on program and project planning and control (PP & C) and so on. Technical areas, such as satellite orbits, space environment, technical design for satellite components or satellites, are not covered in this course.

Course Calendar/Class Topic
1 Introduction to Project Management of Space Systems, Project Planning and Control(1/3)
  Course plan, Fundamentals of project planning and control, Functions
2 Project Planning and Control(2/3)
  Resource Management Function, Scheduling Function, Cost Estimation Function
3 Project Planning and Control (3/3)
  Acquisition and Contract Management Function, Risk Management Function, configuration and Data Management Function
4 WBS and Schedule Management 1
  Work Breakdown Structure
5 WBS and Schedule Management 2
  Schedule Management
6 Fault analysis for space systems 1
  Fault Tree Analysis(FTA)
7 Fault analysis for space systems 2
  Failure Modes, Effects and criticality analysis(FMECA)
8 Conclusion of Space Systems Engineering and Project Management
  Summary of important points covered by Space Systems Engineering I and II.

General Course Policies
Lecture by aural presentation. Language is English only. Assignment for related subject shall be submitted before the next lecture. PDF file of presentation and text version of aural presentation will be uploaded. If situation allows, face to face presentation is base line of the lecture. Otherwise mp4 file will be uploaded. It is advised to read related handbook before and after the lecture.

Course Objectives
The lectures cover Project Planning and Control(PP&C). Understanding of functions of PP&C, Work Breakdown Structure, Schedule Management, and Fault analysis are expected.

1. Understanding contents of functions of Project Planning and Control.

2. Understanding how to make Work Breakdown Structure and development Schedule.
3. Understanding how to make Fault Analysis of Space Systems.

Evaluation Methods and Grading Criteria

Attendance of lecture and Assignment
1. Watch presentation video in case of remote lecture. In remote lecture, attendance of class is measured by history of watch/Stream the video. If you do not watch or download the whole video, unwatched or un downloaded contents will be regarded unattended time of the lecture.
2. Submit Assignments.

Assignment Instructions

Download and study the lecture material before each lecture.
Students are expected to set aside 2 hours a week as time for class preparation. 2 hours a week for each assignment.

Keywords

Space Project Planning and Control, WBS, Schedule Management, Fault analysis, FTA, FMECA, Resource management, Risk Management.

Required Textbooks

Presentation Material and lecture note. And following materials.
#1,#2,#3,NASA Project Planning and Control Handbook NASA/SP-2016-3424
#4: NASA/SP-3404 Work Break Down Structure Handbook
#5:NASA/SP-2010-3403 Schedule Management Handbook Ver 2010
#6: Fault Tree Handbook with Aerospace Applications Ver1.1
#7:Failure Modes, Effects and criticality analysis(FMECA) for C4ISR

References/Recommended Reading

NASA Risk Management Handbook NASA/SP-2011-3422 Version 1.0
Failure Analysis: Case Study Challenger SRB Field Join
Failure mode and effect analysis on safety critical components of space travel
Electronic Reliability design hand book. MIL-HDBK-338B
Implementation of FMEA to improve the reliability of GEO satellite payload
NASA Systems Engineering Handbook. NASA/SP-2016-6105 Rev 2.
NASA Schedule Management (version 2020. Revision 1 total 403 pages. Deferent edition from the text, ver 2010)

Notes

The lecturer has been working as project manager for Space Project in Private Space Sector and Semi Private Space Foundation.
This lecture is provided in English. It is strongly recommended to take "Space Systems Engineering I" before this subject. It is recommended to take "Introduction to Satellite Engineering" to understand technical issue of space system. If situation allows, four lectures will be performed by face to face basis and three or four lectures will be performed on line.

Email

Mihara-Shoichiro*jspacesystems.or.jp, change*to@

Spacecraft Environment Interaction Engineering（宇宙環境技術特論）

Subject code, Lecturers, Credit

26440801, CHO Mengu, AKAHOSHI Yasuhiro, TOYODA Kazuhiro, KIMOTO Yugo, KOGA Seiichi, TERAMOTO Mariko, Credit 2

Course Description

A spacecraft must withstand the severe space environment which is widely different from the ground. The purpose of this class is to understand special characteristics of space environment, and to learn the basic knowledge needed to develop technologies against space environment.

Course and Curriculum linkage

This lecture is SEIC.

Course Calendar/Class Topic

Space environment
Spacecraft charging and discharge
Space debris
Spacecraft charging analysis
Lunar charging
Space environment measurement
Contamination on spacecraft

General Course Policies

This lecture will be given by faculty members of the Department of Space Systems Engineering and invited lecturers from related fields outside the university.

Course Objectives

The purpose of this class is to understand special characteristics of space environment, and to learn the basic knowledge needed to develop technologies against space environment.

1. the student understands space environment
2. the student understands spacecraft charging and discharge
3. the student understands space debris
4. the student understands space contamination
5. the student understands space radiation

Evaluation Methods and Grading Criteria

Reports

Assignment Instructions

Lecture materials will be uploaded on Moodle page. It is recommended to read lecture materials before the class.
Students are expected to set aside 4 hours a week as time for class preparation.

Keywords

Space environment, spacecraft charging, space debris, contamination

Required Textbooks

None

References/Recommended Reading

(1) D. E. Hastings and H. Garret, Spacecraft Environment Interaction, Cambridge University Press

Notes

Students should be well informed about space engineering.

Email

toyoda[at]ele.kyutech.ac.jp (Replace [at] with @)

Energy Conversion and Plasma Physics（エネルギー工学特論）

Subject code, Lecturer，Credit
26490802, TOYODA Kazuhiro, Credit 2

Course Description
Plasma physics are introduced for understanding energy conversion from electric enegy to kinetic energy employed in electric propulsion.

Course and Curriculum linkage
This lecture is SEIC.

Course Calendar/Class Topic
What is plasma?
Various Collisions
Transport of plasma fluid equations
Waves in plasma
Plasma and magnetic field
Electrical discharge
Plasma surface interaction Various discharges
Electrical sheath
Introduction of electric propulsion
Absorption

General Course Policies
The lecture will proceed according to the class topics.

Course Objectives
To understand the application of energy convergion to new technology
1. the student understands plasma
2. the student understands collisions
3. the student understands plasma fluid equations
4. the student understands waves in plasma
5. the student understands plasma and magnetic field
6. the student understands Electrical discharge
7. the student understands Electrical sheath

Evaluation Methods and Grading Criteria
Perticipation and weekly report

Assignment Instructions
Futher understanding is needed with reference books after the lecture.
Students are expected to set aside 4 hours a week as time for class preparation.

Keywords
Plasma physics

References/Recommended Reading
(1) F. F. Chen: Introduction to Plasma Physics and Controlled Fusion. (PLENUM)
(2) 栗木、荒川: 電気推進ロケット入門（東京大学出版会）

Email
toyoda[at]ele.kyutech.ac.jp (Replace [at] with @)

Advanced Space Environment Science（宇宙環境科学特論）

Subject code, Lecturer, Credit
26650002, KITAMURA Kentaro, Credit 2

Course Description
In space near the Earth, the interaction of plasma gas (solar wind) emitted from the Sun and the Earth's magnetic field causes complex electromagnetic disturbances (space weather), which often cause failures of spacecraft and other social infrastructure. This lecture aims to provide an overview of such electromagnetic disturbances in space and to discuss their effects on spacecraft and other social infrastructure from the viewpoint of space weather.

Course and Curriculum linkage
SEIC subject

Course Calendar/Class Topic
1-5 Solar wind, Geomagentic field, Magnetosphere, Ionosphere, Radiation Belt
6-7 Environment of Electromagnetism and Plasma physics in the Magnetosphere
8 Interim presentation
9 Concept of the Space Weather
10-12 Affection of the Space Weather to the satellite Systems and social infrastructures.
13-14 Interplanetary Dust
15 Final presentation

General Course Policies
The class will be conducted in a mixture of lecture style and group exercises based on the reading of materials presented in advance, and reports and presentations of exercises will be required as appropriate.

Course Objectives
The objective of this class is to understand the overview of the near-Earth space environment from the viewpoints of plasma physics and electromagnetism inspace, and to be able to discuss its impact on satellite systems and social infrastructure as space weather.
1. to understand the structure of magnetosphere and ionosphere
2. to understand the phenomena of disturbance in the magnetosphere and ionosphere
3. to understand the impact of space weather on satellite systems and ground infrastructure

Evaluation Methods and Grading Criteria
A pass grade of 60% or higher will be given based on the evaluation of reports and student presentations given in class.
Assignment Instructions
Requires about 8 hours of self-study per week other than class time

Keywords space weather

Required Textbooks
None
References/Recommended Reading
(1) Introduction to Space Physics, Kivelson and Russell, ISBN :0521457149
(2) Space Weather, Singer et al., ISBN: 0875909841
(3) Fundamentals of Space Systems, Pisacane, ISBN: 0195162056
(4) Spacecraft-Environment Interactions, Hastings and Garret, ISBN: 0521607566
(5) The Space Environment, Alan C. Tribble, ISBN 0-691-10299-6
Notes
None
Email
kitamura.kentaro375[at]mail.kyutech.jp

Advanced Rocket Propulsion Engineering（ロケット推進工学特論）

Subject code, Lecturer，Credit
26640001, KITAGAWA Koki，Credit 2

Course Description
In order to develop a rocket, it is necessary to define the mission requiments, perform conceptual design and proceed with detailed design based on it. Setting the initial model by conceptual design is an important task because it affects the work efficiency. The purpose in this lecture is to acquire the ability to perform rocket sizing and rocket engine conceptual design for initial model setting.

Course and Curriculum linkage
This is Space Engineering International Course.
It is desirable to have completed rocket propulsion engineering, rocket/satellite system engineering, combustion engineering and thermo-fluid engineering related subjects in the faculty.

Course Calendar/Class Topic
1 Introduction
2～6 Rocket sizing
7, 8 Intermediate presentation
9～12 Rocket engine conceptual design
13, 14 Final presentation
15, 16 Feedback, Summary

General Course Policies
Lecture and group exercises.

Course Objectives
The purpose in this lecture is to acquire the ability to perform rocket sizing and rocket engine conceptual design for initial model setting.
1. Understand rocket sizing
2. Understand rocket engine conceptual design

Evaluation Methods and Grading Criteria
A total of 60% or more of evaluation of presentations and presentation materials will pass

Assignment Instructions
Read a paper listed as reference during each lecture.
Students are expected to set aside 8 hours a week as time for class preparation.

Keywords
Rocket, Sizing, Rocket engine, Conceptual design

Required Textbooks N/A
References/Recommended Reading
(1) NASA SP-125, Design of Liquid Propellant Rocket Engines (NASA)
https://ntrs.nasa.gov/citations/19710019929
(2) Ronald Humble,　Space Propulsion Analysis and Design (Learning Solutions)
(3) George P. Sutton,　Rocket Propulsion Elements (WILEY)
(4) 田辺英二：ロケットシステム（風虎通信）(in Japanese)

Notes Lecture in English only.

Email kitagawa.koki862 [at] mail.kyutech.jp (Replace [at] with @)

Solar System Planetary Physics and Environments（太陽系惑星環境特論）

Subject code, Lecturer, Credit
26640002, TERAMOTO Mariko, Credit 2

Course Description
Since the late 1950s, humanity has sent numerous spacecraft to planets in the solar system for exploration. Based on the technology and discoveries gained from these planetary missions, plans are being made for human migration to the Moon and Mars, and we are on the cusp of the era of space exploration. To prepare for this new era, we need to learn about the latest technologies for planetary exploration and the environments of the planets in the solar system.
Course and Curriculum linkage
This lecture is SEIC.

Course Calendar/Class Topic
1. Introduction to the Solar System
2. Sun
3. Mercury
4. Venus
5-6. Moon
7-8. Mars
9. Jupiter
10. Saturn
11. Uranus
12. Neptune
13. Pluto
14. exoplanet
15 feedback

General Course Policies
Proceed with the lecture according to the class topics.

Course Objectives
The purpose of this class is to understand his lecture is to understand the technology of planetary exploration satellites and planetary environments in the solar system, and the following are the achievement goals.
1. the student understands planetary environments
2. the student understands the technology of planetary exploration

Evaluation Methods and Grading Criteria
The lecture grades will be evaluated comprehensively based on the exercises during lecture hours, assignment reports, and other related content carried out.

Assignment Instructions
It is recommended to review each class and prepare the next class by lecture materials, which will be uploaded on a Moodle page.
Keywords
Space environment, Planetary environment
Required Textbooks none
References/Recommended Reading none

Notes none
Email
teramoto.mariko418[at]mail.kyutech.jp (Replace [at] with @)

Thesis Research for Degree（工学講究）

Subject code, Lecturer，Credit

26990833, Primary supervisor, Credit 2

Course Description

In the course of writing a master's thesis, students will be instructed on research plans, methods of research, and how to summarize research results regarding the master thesis subject. The course will guide students to write theis writing focusing thesis organization, research planning, problem solving methods, summarizing the results.

Special Laboratory Work（工学特別実験）

Subject code, Lecturer，Credit

26990834, Primary supervisor, Credit 1

Course Description

In the course of writing a master's thesis, students will be instructed on research plans, methods of research, and how to summarize research results regarding the master thesis subject. The course will guide students to do laboratgory works regarding data management, safety, experimental practice and other practical aspects of the research.