[Title]			[Instructor]		
Advanced Multidiscipline Engineering			Yukiyo Suzuki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTT501 D	1	Departmental Common Courses	Intensive	／	English

[Outline and purpose]

The purposes of this lecture are to develop comprehensive knowledge of engineering, panoramic views, International perspectives, and an ability to properly and efficiently use engineering technology.

[Objectives]

The achievement is to understand the comprehensive knowledge of engineering and its environment. Active discussion and group work is necessarily by using some engineering categories that you are interested in.

[Requirements]

It is desirable that you have a basic knowledge of engineering, international environment and culture.
English and Japanese (JLPT N5 equivalent or more)

[Evaluation]

50% To evaluate understanding of basic knowledge and requirements
50% Active communication and discussion

[Textbooks]

To be informed if it's necessary.

[References]

To be informed if it's necessary.

[Schedule]

This lecture is planning on "Online Lecture". You will learn the following topics by learning materials and discussion.

1. History, background and current situation of engineering technology.
2. International contribution and agendas of engineering technology.
3. Directions of engineering technology for an even better future.
4. How you implement your engineering technology skills in the society.

※ Some group work and discussion may occur.

[Title]			[Instructor]		
Design of Experiment and Data Analysis			Yoshimichi Watanabe		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTT502	1	Departmental Common Courses	1st Semester	Wed. / I	Japanese

[Outline and purpose]

It is important fundamental ability in all fields of science and engineering that scientist and engineers properly plan the experiments, investigation, and simulation and interpret the results correctly. In this class, the students learn the basic concept of the design of experiments and appropriate data analysis methods required for all of the engineering system highly specialized professionals, through learning the handling of error that cannot be avoided in the experiments and measurements theoretically. In order to obtain as much information as possible, it is necessary to sufficiently plan the process of the experiment. In this class, students learn the practices and methods of analysis of the experimental plan, which is widely used in such as a production site.

[Objectives]

To understand the following topics:
(1) The purpose and the significance of the design of experiments
(2) The efficient planning of experiments and the statistical analysis of the experimental results, by using the techniques of the design of experiments

[Requirements]

Students are advised to know basics one or more of the following subjects; statistical methods, and quality management, but not required.

[Evaluation]

Reports: 100%

[Textbooks]

Yatsu, S.: Design and analysis of Experiments that can be used immediately (basic version), JSA, ISBN 4-542-50208-2 (In Japanese)

[References]

(1) Montgomery, Douglas C.: Design and Analysis of Experiments, 10th Edition, ISBN: 978-1-119-49244-3

[Schedule]

(1) Quality improvement and the design of experiments
(2) Statistical data analysis
(3) Analysis of the experimental data
(4) One-way layout experiment and two-way layout experiment without repetition
(5) Two-way layout experiment with repetition and multi-way layout experiment
(6) Orthogonal array experiments (the case the number of levels is 2)
(7) Orthogonal array experiments (the case the number of levels is 3)
(8) Exercises

The course contents might change by the degree of understanding of the students.

[Title]			[Instructor]		
Exercises in Applied Mathematics			Kota Yamaura/Masashi Kosuda		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTT505	1	Departmental Common Courses	1st Semester	Wed.／I	Japanese

[Outline and purpose]

Linear algebra is available in various area of engineering. In particular, vectors and transformation in 3-D space are useful. The purpose of this course is to introduce linear algebra and its applications. The students will learn elementary concepts of linear algebra and usage of them through small examples.

[Objectives]

By the end of the course, the students should be able to do the following:
(1) describe basic knowledge about vector spaces and eigenvectors of matrices,
(2) apply (1) to studies of linear transformations,
(3) calculate Jordan normal forms of 2×2 matrices,
(4) solve systems of first-order linear differential equations.

[Requirements]

Basic knowledge of linear algebra (matrices and their multiplications, systems of linear equations and the Gauss-Jordan elimination, invertible matrices, determinants)

[Evaluation]

Exercise 40%
Examination 60%

[Textbooks]

[References]

Serge Lang, Linear Algebra, Springer, ISBN:978-1441930811

[Schedule]

1. Linear transformations
2. Exercises in linear transformations
3. Vector spaces
4. Exercises in vector spaces
5. Eigenvalues and eigenvectors
6. Exercises in eigenvalues and eigenvectors
7. Diagonalization of matrices
8. Exercises in diagonalization
9. Jordan normal form
10. Exercises in Jordan normal form
11. Application to systems of linear differential equations I (introduction)
12. Application to systems of linear differential equations II (matrix exponential)
13. Application to systems of linear differential equations III (solution)
14. Exercises in linear differential equations
15. Examinations and summarization

[Title]			[Instructor]		
Practical Data Science			Hiroyasu Toyoki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTT510	1	Departmental Common Courses	1st Semester	Wed.／II	Japanese

[Outline and purpose]

The purpose of this course is to acquire the skills to use some machine learning methods for students who analyze data of experiments and observations. Machine learning is typically classified into classification and regression methods. In this course, we focus on the regression including multiple and non-linear regressions, support vector machines, random forests and some other methods. Students study them by computer-based exercises with python and its scikit-learn module.

[Objectives]

1. To understand the concepts of multiple, non-linear, support-vector and random-forest regressions
2. To be able to make python scripts to analyze data with scikit-learn modules
3. To be able to use cross-validation and typical accuracy evaluation indexes

[Requirements]

Programming skills in at least one of languages, Java, C, Fortran and/or python are required. To be willing to acquire python programming skills.

[Evaluation]

Some exercises using data analysis methods will be given. Individual reports on these problems are evaluated.

[Textbooks]

[References]

[Schedule]

1. Introduction
   Data sciences as a powerful tool in natural sciences and engineering
   Exercise of using python
2. Function approximation and regression
   Nonlinear Fitting and Over-learning
3. Bayesian Approach to Statistics
4. Support Vector Machine Method for Regression
5. Neural Network and Random Forest Methods for Regression
6. Mixture model and Hierarchy models
7. Error Evaluation and Cross-Validation
8. Summary and discussion

Examples of program codes are provided by python and its scikit-learn module.