[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 pre-examine 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, but not required, to know basics one or more of the following subjects; statistical methods, and quality management.

[Evaluation]

Reports: 100%

[Textbooks]

谷津進: すぐに役立つ実験の計画と解析　基礎編, 日本規格協会, ISBN 4-542-50208-2

[References]

(1) 鷲尾泰俊: 実験計画法入門(改訂版), 奥村印刷, ISBN 4-542-50330-5
(2) 永田靖: 入門実験計画法, 日科技連出版, ISBN 4-817-10382-5
(3) 山田秀: 実験計画法-方法編-, 日科技連出版, ISBN 4-8171-0389-2
(4) 中里博明, 川崎浩二郎, 平栗昇, 大滝厚: 品質管理のための実験計画法テキスト〈改訂新版〉, 日科技連出版, ISBN 4-8171-0378-7
(5) 新藤久和編集: 2015 年改定レベル表対応 品質管理の演習問題と解説(手法編) QC 検定試験 1 級対応, 日本規格協会, ISBN 4-5425-0395-X

[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]		
Numerical Simulation Methods			Hiroyasu Toyoki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTT503	1	Departmental Common Courses	1st Semester	Wed.／II	Japanese

[Outline and purpose]

This course offers some major simulation methods used in various engineering fields and the role of simulation in the research area. The mathematical basis for making discrete models of spatially and temporally continuous phenomena and modeling method describing stochastic processes are presented.

[Objectives]

1. To understand the numerical method for differential equations and statistical method for analyzing data
2. To be able to use plotting tools and GUI of python, and understand effective way of python coding for numerical analysis
3. To be able to make some numerical models related to your major.

[Requirements]

Programming skills in at least one of languages, Java, C, Fortran and python are required.

[Evaluation]

Three problems on the numerical methods will be given. Your reports on these problems are evaluated.

[Textbooks]

[References]

An Introduction to Computer Simulation Methods 3rd Edition, (Harvey Gould, Jan Tobochnik and Wolfgang Christian, Pearson Education)

[Schedule]

1. Modeling dynamical systems with many degrees of freedom
   Exercise of using python
2. Numerical method to solve ordinary differential equations (ODE)
   Analysis method for chaotic systems
   Visualization with python
3. Numerical and analytical consideration on cooperative phenomena in ODE systems
4. Coupled nonlinear oscillators as an example of the cooperative phenomena
5. Emergence of spatiotemporal structure in continuous media: systems described by partial differential equations
6. Simulations for random processes 1: percolation problems
7. Simulations for random processes 2: programming exercise
8. Summary and discussion

Examples of program codes are provided in Java language.

[Title]			[Instructor]		
Exercises in Applied Mathematics			Masahisa Sato/ Masaki Kobayashi		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTT505	1	Departmental Common Courses	1st Semester	Wed.／I	English／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 is to improve the technique for real world. To begin with, the students will learn elementary concepts of linear algebra. After that, they will learn the technique of 3-D vectors, linear transformations and special matrices.

[Objectives]

(1) To understand the usage of 3-D vectors.
(2) To improve the ability to use adequate basis and transformation in 3-D space.
(3) To understand application of eigen values.
(4) To use orthonormal basis and special matrices.

[Requirements]

Linear algebra

[Evaluation]

Exercise 40%
Examination 60%

[Textbooks]

[References]

Ichir-O Satake, Linear Algebra, Marcel Dekker Inc, ISBN:0824715969

[Schedule]

1. Linear equations, basic deformation, rank
2. Definition, properties and theorems of determinant
3. Application of 3-D space
4. Exercises in 3-D space application
5. Vector space
6. Exercises in vector space
7. Linear maps and their applications
8. Examination and comments
9. Application of eigen values
10. Exercises in eigen values
11. Orthonormal systems and their applications
12. Exercises in orthonormal systems and their applications
13. Symmetric matrices and their applications
14. Exercises in symmetric matrices and their applications
15. Examinations and summarization