[Title]			[Instructor]		
Control of Vibration and Noise			Toshiya Kitamura		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321020	2	Mechanical Systems Engineering	2nd Semester	Thu.／I	Japanese

[Outline and purpose]

Vibration worsens mechanical working efficiency. Noise has a bad effect on human physiologically and psychologically. It is important that to learn measuring, controlling, and evaluating techniques of vibration and noise. You will learn physical characteristics of vibration and noise, sensoria and sensitivity of human body, measurement methods, digital signal processing methods and advanced applications.

[Objectives]

To understand physical characteristics of vibration and noise.
To understand sensitivity of human body on vibration and noise.
To understand measurement methods and signal processing methods for vibration and noise.
To learn applications to control vibration or noise.

[Requirements]

Understanding mechanical dynamics, system control engineering.

[Evaluation]

Reports：30%
Attitude：30%
Presentation：40%

[Textbooks]

Nothing

[References]

Nothing

[Schedule]

[Lecture]
What are vibration and noise.
Sensoria and sensitivity of human body on vibration and noise.
Characteristics of sound (frequency, wave length, wave acoustics and propagation of sound and vibration).
Signal processing of sound and vibration.
Fast Fourier Transform (FFT) and the applications.
Basic methods to control vibration and noise.
Absorption, Control, Proof of vibration and noise.
[Presentation]
Applications.

[Title]			[Instructor]		
Advanced Biomechanics			Yasumi Ito		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321041	2	Mechanical Systems Engineering	2nd Semester	Mon.／III	Japanese

[Outline and purpose]

A lecture is carried out about biomechanics, medical engineering, welfare engineering, various kinds of biomedical measurement methods and rehabilitation.

[Objectives]

1. to bring up the mechanical engineer who is able to do the fundamental research on biomechanics and medical engineering.

[Requirements]

Students must have basic knowledge about mechanics of materials.

[Evaluation]

Reports：30%
Attitude：30%
Oral presentation：40%

[Textbooks]

The document will be distributed appropriately

[References]

Reference books will be announced during a lecture as needed

[Schedule]

1 Foundation of biomechanics, arthrosis, mechanics of bone
2 History of biomechanics
3 Bone
4 Biomechanics of skin
5 Cartilage, ligament
6 Biomechanics of blood vessel
7 Arteriosclerosis
8 Research of biomechanics study
9 Remodeling of tissue
10 Application to medical engineering of biomechanics
11 Application to welfare engineering of biomechanics
12 Impact biomechanics
13 Application to safety evaluation of biomechanics
14 Application of biomechanics to forensic science
15 Summary

[Title]			[Instructor]		
Advanced Course on Heat Transfer Engineering			Koji Toriyama		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321050	2	Mechanical Systems Engineering	1st Semester	Tue.／III	Japanese

[Outline and purpose]

In various industrial fields, the apparatus using heat transfer and heat exchangers are widely used. It is important that the structure of these apparatus is understood sufficiently for the thermal design. In addition to these, at this course, the measuring method of the heat and the fluid flow phenomenon required for measurement of actual apparatus, and the foundation of a numerical simulation is discussed.

[Objectives]

The structure and thermal design of the heat transfer apparatus and the heat exchangers can be understood.
The measuring method of the temperature and velocity distributions can be understood.
The modeling and thermal design of the heat transfer problem can be understood.
The foundation of a numerical simulation can be understood.

[Requirements]

Thermodynamics, Hydrodynamics, Thermal engineering, Fluid engineering

[Evaluation]

Report & examination：100%

[Textbooks]

JSME, JSME Textbook Series Heat Transfer, Maruzen, ISBN:978-4888981200 (in Japanese)

[References]

Introduce or distribute it, if necessary

[Schedule]

1 Introduction
2 Foundation of the Heat Transfer
3 Foundation and design of heat exchangers
4 Cooling technology of apparatus / Insulation technology
5 Heat pipe / Peltier element
6 Measurement method of the heat and fluid velocity
7 Dimensionless number / dimensional analysis
8 Modeling of the heat transfer problem (temperature and radiation amount estimation)
9 Modeling of the heat transfer problem (heat exchanger, etc.)
10 Government equations of the thermic fluid
11 Method of solving a system of ordinary differential equation / accuracy of the solution
12 Steady heat transfer problem
13 Unsteady heat transfer problem / Method of solving a matrix
14 Advection equation / accuracy of the solution
15 Method of thermo-fluid analysis

[Title]			[Instructor]		
Thermal Energy Engineering Theory			Tetsuaki Takeda		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321055	2	Mechanical Systems Engineering	2nd Semester	Tue.／III	Japanese

[Outline and purpose]

Improving the utilization efficiency of thermal energy when thinking about energy problems with the world will contribute to not only effective use for the energy resource but also the exhaust reduction of carbon dioxide. Especially, it is a technologically important problem to increase the conversion efficiency of the thermal energy. Transport, storage, and conversion of the thermal energy in consideration of a present energy situation is explained. In addition, effective utilization of thermal energy in the practical system is described.

[Objectives]

The energy situation not only of Japan, but also the world can be understood.
Energy problems in the future can be considered.
Generation, conversion, and use of the thermal energy can be understood.
The utilization efficiency of the thermal energy can be evaluated.

[Requirements]

Thermodynamics, Hydrodynamics, Thermal engineering, Fluid engineering

[Evaluation]

Report & examination：60%
Presentation skill：40%

[Textbooks]

Not specify

[References]

Introduce or distribute it, if necessary

[Schedule]

1 Introduction
2 Energy situation of Japan and the world
3 Thermal properties and thermal energy
4 Evaluation of thermal energy system by theoretical approach
5 Evaluation of thermal energy system by numerical analysis
6 Heat transport by thermal conduction
7 Heat transport by forced convection
8 Heat transport by natural convection
9 Heat transport by thermal radiation
10 Conversion system of thermal energy
11 Thermal efficiency
12 Nuclear energy system
13 Solar thermal energy system
14 Geothermal energy system
15 Heat utilization systems such as thermoelectric conversion element, ground source heat pump system, etc.

[Title]			[Instructor]		
Advanced Course on Viscous Fluid Mechanics			Hiroyuki Tsunoda		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321080	2	Mechanical Systems Engineering	1st Semester	Mon.／III	Japanese

[Outline and purpose]

This course discusses the motion of viscous fluid. As a starting point for analyzing viscous fluid motion, the Navier-Stokes equation is introduced based on first principles in dynamics after studying mathematical descriptions of fluid motion and an empirical relation between viscous stresses and rate of deformation of a fluid element. Exact solutions of the N.S. equation are presented for several simple flows while approximated equations are derived for limiting flows with very small and large Reynolds numbers. Special emphasis is put on the boundary layer theory for the case of very large Reynolds number so that students can understand its physical importance and apply it to the practical problems. The course also includes several subjects on turbulent flows with up-to-date research topics.

[Objectives]

The objectives of the course are to understand the motion of viscous flow. Especially, students should have a good understanding on the following subjects:

1. the rule of Cartesian-tensor suffix notation and the fundamental vector calculus,
2. the relation between viscous stresses and rate of deformation,
3. the derivation of the Navier-Stokes equation and the physical meaning of each term,
4. the idea of the boundary layer theory, and
5. properties of turbulent flow and its statistical description.

[Requirements]

Students are expected to have a good understanding on mathematics (especially calculus and linear algebra) and physics (especially dynamics) as well as fundamental fluid engineering.

[Evaluation]

homework：50% (no late homework will be accepted without clear reason)
final examination：50%

[Textbooks]

[References]

1. Schlichting,H. and Gersten, K.：Boundary-Layer Theory, Springer, ISBN:3540662707.
2. Tennekes, H. and Lumley, J.L.：A First Course in Turbulence, The MIT press, 1972, ISBN 0262200198.
3. White, F.M.：Viscous Fluid Flow, McGraw-Hill 3rd International Edition, 2006, ISBN 007124493X.

[Schedule]

1. Course guidance, Introduction of viscous fluid flow
2. Tensor suffix notation and fundamental vector calculus
3. Basic equations of flow #1 (description of fluid motion, deformation of fluid element and viscous stresses)
4. Basic equations of flow #2 (the Navier-Stokes equation)
5. Exact solutions of the Navier-Stokes equation #1
6. Exact solutions of the Navier-Stokes equation #2
7. Similarity laws and Re-limiting solutions #1 (Stokes approximation)
8. Similarity laws and Re-limiting solutions #2 (boundary layer equation)
9. Solutions of the boundary layer equation #1 (Blasius's solution)
10. Solutions of the boundary layer equation #2 (momentum integral equations)
11. Flow instability and transition from laminar to turbulent flows
12. Properties of turbulent flow and its statistical description
13. Turbulence analysis based on Reynolds averaging #1 (Reynolds decomposition , Reynolds equation)
14. Turbulence analysis based on Reynolds averaging #2 (Closure problems, Turbulence models)
15. Final exam and review

[Title]			[Instructor]		
Advanced Computational Fluid Dynamics			Yoshinobu Yamamoto		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321081	2	Mechanical Systems Engineering	2nd Semester	Fri.／II	Japanese

[Outline and purpose]

With the advent of faster computers, Computational Fluid Dynamics (CFD) is becoming a significant part of the design process with fluid phenomena in various engineering systems.

This course provides the discretization and numerical techniques in fluid dynamics equations: when to use them, how to implement them, and what can be learned from their rigorous theory.

[Objectives]

1. to understand the fundamental spatial discretization and time integration schemes
2. to understand the numerical accuracy and stability analysis
3. to understand the numerical algorithm for various fluid phenomena
4. to figure out the validation and verification of the numerical analysis in various fluid science and fluid engineering fields

[Requirements]

Overall knowledge on fluid engineering and fluid dynamics studied in the under-graduate and graduate courses

[Evaluation]

homework：80%
presentation：20%

[Textbooks]

[References]

1. C. Canuto et al., Spectral Methods in Fluid Dynamics, Springer-Verlag
2. 梶島岳夫, 乱流の数値シミュレーション, 養賢堂(in Japanese)
3. 木田重雄, 柳瀬真一郎, 乱流力学, 朝倉書店(in Japanese)

[Schedule]

1. The Equations of Fluid Dynamics
2. Spatial Discretization #1
3. Spatial Discretization #2
4. Time Integration
5. Partial Differential Equations(PDEs) #1
6. Partial Differential Equations(PDEs) #2
7. Numerical Accuracy and Stability Analysis
8. Incompressible Flow #1
9. Incompressible Flow #2
10. Compressible Flow
11. Turbulent Flows #1
12. Turbulent Flows #2
13. Parallel Computing
14. Student Presentation #1
15. Student Presentation #2 and Summary
15. Summary

[Title]			[Instructor]		
Spacecraft Systems Engineering			Junichiro Aoyagi		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321082	2	Mechanical Systems Engineering	2nd Semester	Tue.／II	Japanese

[Outline and purpose]

Design and construction of a spacecraft requires a lot of engineering components, which is specialized for space environment. This lecture learns subsystem of a spacecraft, and principle of rocket propulsion.

[Objectives]

The following subjects should be well understood:
* Environmental characteristic of space and ground,
* Principle of rocket propulsion and orbit transfer,
* Spacecraft subsystems and its required specification, and
* Outline of lifecycle of a spacecraft project.

[Requirements]

Knowledge of dynamics, mathematics and basic mechanical engineering.

[Evaluation]

Attendance and Report 40%
Presentation 60%

[Textbooks]

Charles D. Brown, Elements of Spacecraft Design, AIAA, 1563475243
茂原正道, 宇宙システム概論, 培風館, 456303505X (in Japanese)

[References]

Peter Fortescue, Graham Swinerd and John Stark, Spacecraft Systems Engineering, Wiley, 9780470750124

[Schedule]

1. Introduction: Space environment, Rocket, and Spacecraft
2. System Engineering of a Spacecraft
3. Orbital Mechanics
4. Principle of Rocket Propulsion
5. Nozzle Theory
6. Chemical Propulsion
7. Flight Performance of a Rocket
8. Electric Propulsion
9. Spacecraft Components
10. Structures
11. Thermal Control
12. Power System
13. Attitude Control
14. Telecommunication, Command and Data System
15. Conclusion

[Title]			[Instructor]		
Surface Modification			Keiji Sonoya		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321090	2	Mechanical Systems Engineering	1st Semester	Wed.／III	Japanese

[Outline and purpose]

Surface modification such as heat treatment, plating and thermal spraying is applied to the surface of components to improve the environment-resistance. We deal with representative surface modification techniques and you study the content, mechanism and application examples.

[Objectives]

You understand the contents, mechanism of the surface modification methods and can apply the technique to the producing of components.
(1)heat treatment, quenching, nitriding, carburizing
(2)thermal spraying, plating　(3)CVD, PVD

[Requirements]

Chemistry and Physics of high school

[Evaluation]

Final examination:60%
Midterm examination:20%
Rreport:20%

[Textbooks]

Instructions are at a lecture

[References]

Instructions are at a lecture

[Schedule]

1.Abstruct of surface modification
2.Classification of surface modification
3.surface quenching
4.carburizing
5.nitriding
6.chemical plating
7.electroplating
8.chemical conversion treatment
9.anodic oxidation
10.PVD
11.CVD
12.ion-beam sputtering
13.ion implantation
14.thermal spraying
15.new surface modification technique

[Title]			[Instructor]		
Advanced Optical Systems Engineering			Lianhua Jin		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321095	2	Mechanical System Engineering	1st Semester	Tue.／II	Japanese

[Outline and purpose]

This course introduces the common and different parts between mechanical waves and light waves, and application of light wave theory to design of optical systems. Emphasis is placed on development of the thinking way to apply basic physics knowledge to explain optical phenomena in the nature and to develop practical optical measurement systems.

[Objectives]

1. This course will help students to understand the basic concepts of waves and wave equations.
2. The course will help to give students a background to understand many optical phenomena.
3. Students will learn how to apply the basic knowledge to design of an optical system.

[Requirements]

Vibrations and waves
Electricity and Magnetism

[Evaluation]

Attendance: 20%
Homework: 80%

[Textbooks]

[References]

E. Hecht, OPITICS, Assison Wesley, ISBN-10: 0805385665
A. Yariv, Optical Electronics in Modern Communications, Oxford University Press, USA, ISBN-10: 0195106261

[Schedule]

The course will cover the following topics:

Part I. Mechanical vibrations and waves
1. Course Overview and Introduction
2. Simple harmonic motion and Forced vibrations
3. Couples oscillations and Normal modes
4. Boundary conditions, reflection and refraction

Part II. Light wave
5. Maxwell's equations
6. Polarization and scattering
7. Boundary conditions and Fresnel equations
8. Fraunhofer diffraction and gratings

Part III. Applied Optics
9. Traditional optical systems
10. Currently developed hybrid optical systems for different purposes

[Title]			[Instructor]		
Application of Solid State Physics			Katsuyoshi Watanabe		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321102	2	Mechanical Systems Engineering	2nd Semester	Mon.／II	Japanese

[Outline and purpose]

Materials have intrinsic properties. They are mainly thermal, electrical, optical and magnetic properties. While those properties are various, they could be interpreted by lows of physics. Those properties are studied on the levels of atoms and electrons in solid state physics. This lecture is intended to provide an introduction to solid state physics.

[Objectives]

The objective is to understand physical models and concepts for solid state physics shown in the schedule.

[Requirements]

It is advisable to know basics of dynamics of particles and systems, electromagnetism, quantum mechanics and materials science to understand this lecture.

[Evaluation]

1. Reports at the end of a semester (50%)
2. Usual exercises (50%)

[Textbooks]

黒沢達美,物性論,裳華房,ISBN:4785321385

[References]

1. Charles Kittel, Introduction to Solid State Physics, John Wiley and Sons, ISBN: 0471680575
邦訳：チャールズ キッテル, 固体物理学入門〈上〉〈下〉, 丸善, ISBN:〈上〉4621044230,〈下〉462107654X
2. 岡崎 誠, 固体物理学―工学のために, 裳華房, ISBN0: 4785322144

[Schedule]

1. Cohesion Mechanism of materials
2. Crystal structures and of wavenumber space
3. Lattice vibrations
4. Lattice specific heat
5. Thermal conductivity
6. Free electron theory
7. Electrical conductivity and Thermal conductivity in metals
8. Polarization and dielectric dispersion
9. Magnetism
10. Introduction to energy band
11. Intrinsic and extrinsic semiconductors
12. Electrical conductivity of semiconductors
13. Lattice defect
14. Dislocations
15. Summary

[Title]			[Instructor]		
Advanced Materials Engineering			Yoshihiro Nakayama		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321110	2	Mechanical Systems Engineering	2nd Semester	Mon.／I	Japanese

[Outline and purpose]

Industrial materials contributing to the modern society will be introduced first. Then, the attendance student must give a presentation on a given problem and argue about announced contents mutually.

[Objectives]

1. to understand the importance of industrial materials contributing to the modern society.
2. to understand the reason why the industrial materials are used in a specific use.
3. to understand the characteristic and meaning of the metallic materials in industrial materials
4. to understand the concept that is important to utilize metallic materials effectively.

[Requirements]

Students must have basic knowledge about metallic materials.

[Evaluation]

1. Oral presentation and discussion: 70%
2. Final examination: 30%

[Textbooks]

-

[References]

Reference books will be announced during a lecture as needed.

[Schedule]

1. Introduction
2. Analysis using an electron beam and X-rays
3. Steel and Cast iron
4. Stainless steel
5. Copper alloys and aluminum alloys
6. Titanium alloys and magnesium alloys
7. Nominal stress, nominal strain, true stress, and true strain
8. Crystal structure and plastic deformation in metallic materials
9. Shape memory materials and hydrogen storage materials
10. Super plastic alloys
11. Strengthening mechanism of metallic materials
12. Thermoplastic resins and thermosetting resins
13. Recycle of industrial materials
14. Advanced materials
15. Global assessment and commentary

[Title]			[Instructor]		
Advanced Course Plastic Working of Metals			Shoichiro Yoshihara		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321120	2	Mechanical Systems Engineering	1st Semester	Mon.／II	Japanese

[Outline and purpose]

Mechanical Processing focuses on the design, manufacture and operation of products that have moving parts. Aircraft, automobiles, more fuel efficient systems and cheaper electricity all come to mind. Manufacturing Engineering meanwhile concentrates on converting materials from one form to another.
This course also prepares you for the traditional challenges of mechanical processing using the most sophisticated computer tools.

[Objectives]

To know plasticity theory to evaluate fracture of materials..
To obtain knowledge of FEM simulation.

[Requirements]

Strength of material
Material
Metal forming

[Evaluation]

final examination：100%

[Textbooks]

N.A.

[References]

N.A.

[Schedule]

1. General Introduction
2. Structure of Metals
3. Mechanical Behavior
4. Physical Properties of Materials
5. Stress and Strain
6.Constant Volume Law
7. Yield Criterion
8. Metal Forging Processes
9. Metal Extrusion Processes
10. Sheet Metal Forming Processes
11. FEM Simulation, Modeling
12. FEM Simulation, Boundary Conditions
13. FEM Simulation, Constraints
14. FEM Simulation, Solution
15. Final examination

[Title]			[Instructor]		
Advanced Precision Machining Processes			Shinsaku Hagiwara		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321150	2	Mechanical Systems Engineering	2nd Semester	Fri.／I	Japanese

[Outline and purpose]

Grinding is a cutting processes, just like the cutting process done by lathes or milling machines and principal use of the lapping process is to obtain surfaces which are truly flat and smooth. It is hoped that in studying this lecture, students will appreciate the importance of precision processes.

[Objectives]

to understand grinding theory
to consider relationship experiment and theory
to study special processes

[Requirements]

A grounding in cutting and machine tool

[Evaluation]

attendance:30%,repots:20%, examination:50%

[Textbooks]

Kalpakjian Serope:Manufacturing processes for engineering materials,1991

[References]

切削・研削加工学（ ）臼井英治　著、　共立出版（日本語）

[Schedule]

1. Introduction
2. Generating motions of machine tools
3. Machining accuracy and its evaluation
4. What machined surfaced really look line
5. Creation of surfaces
6. Mechanical processes
7. Abrasives and grinding wheel (1)
8. Abrasives and grinding wheel (2)
9. Lapping
10. Abrasive jet cutting
11. Electro chemical machining
12. Electro chemical grinding
13. Electron and ion beam machining
14. Laser beam machining
15. Examination

[Title]			[Instructor]		
Digital Control Systems			Nobuyuki Furuya		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321181	2	Mechanical Systems Engineering Embedded and Integrated System Development	2nd Semester	Wed.／II	Japanese

[Outline and purpose]

It is necessary to understand about modern control theory which is based on a state variables to learn about the underlying robots and NC controls. The classical control theory is based on Laplace transform and transfer functions and there are many differences between classical and modern control methods.

The goal is to understand the concept of digital control in moderrn control system.

[Objectives]

1. to understand the representation of the system by state variable.
2. to understand the concrete application of modern control.
3. to understand the digital control system using pulse transfer function and Z-transform.

[Requirements]

Knowledge of classical control system, Laplace and l inear differential equations.

[Evaluation]

Routine test 40%
Presentation 20%
Report 40%

[Textbooks]

Textbook is not used and Materials will be provided.

[References]

1. Control system design, McGRAW-HILL, ISBN:0486442780
2. SIGNALS AND LINEAR SYSTEMS,Jhon Wiley & Sons,ISBN:0471838217
3. 現代制御理論入門, コロナ社, ISBN:4339031615

[Schedule]

1. Linear differential equation and control system
2. State space representation of dynamic system
3. Lagrange's equation
4. Rigid body dynamics
5. Examples of aerodynamics
6. Chemical and energy process
7. Dynamics of linear systems
8. Controllability and observability
9. Discrete time systems
10. Digital control system
11. Z-transform and difference equations
12. Inverse z-Transform
13. Pulse transfer functions
14. Digital control system example 1
15. Digital control system example 2

[Title]			[Instructor]		
Advanced Robotics			Hidetsugu Terada		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321200	2	Mechanical Systems Engineering Embedded and Integrated System Development	1st Semester	Thu.／I	Japanese

[Outline and purpose]

At this lecture, the background and outlines of robotics and the current trends of the robot technology will be taught. Especially, a structure of an industrial robot, an analytical solution of a robot motion, a control algorithm and a fundamental service robot application will be studied.

[Objectives]

(1) Various kinds of robot structures can be understood.
(2) Fundamental robotics control technologies can be understood.
(3) The trend of robot technologies can be understood.

[Requirements]

The fundamental knowledge of calculus, algebra, kinematics, machine elements design and mechanics of materials are needed. Also, you need English to read the reference papers.

[Evaluation]

Reports :40%
Presentation: 60%

[Textbooks]

We will distribute reference papers if necessary.

[References]

1. Mark E. Rosheim, Robot Evolution -The Development of Authrobotics-, John Wiley & Sons, Inc., ISBN:0471026220
2. 則次俊郎ほか, 学生のための機械工学シリーズ 6　ロボット工学, 朝倉書店, ISBN:4254237367 (In Japanese)

[Schedule]

1. Introductions of the robotics
2. Mechanical and electric structures of robot
3. Serial robot
4. Parallel robot
5. Mechanical elements of robotics
6. Robotics control 1(Collision avoidance)
7. Robotics control 2(Cooperative control)
8. Robotics control 3(Motion planning methods)
9. Moving robotics (Gait and wheels)
10. Energies of robotics
11. Micro robotics
12. Robotics and factory automations
13. Research of foreign trends
14. Colloquium
15. Problem description

[Title]			[Instructor]		
Lectures on Instrumentation			Tsuyoshi Shimizu		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321221	2	Mechanical Systems Engineering Embedded and Integrated System Development	2nd Semester	Thu.／II	Japanese

[Outline and purpose]

The field of Mechanical Systems Engineering employs a broad set of measurement techniques and instruments, and students studying the discipline must develop a strong understanding to use them effectively.

[Objectives]

(1)to understand the relationship between mathematics and instrumentation.
(2)to understand the signal processing principal.
(3)to understand the recent interest by researching case study.

[Requirements]

Students have to have basic knowledge of mathematics (ESP, differentiation, integration, probability and statistics).

[Evaluation]

1. Midterm examination 50%
2. Oral presentation and discussion 50%

[Textbooks]

[References]

1.前田良昭，木村一郎，押田至啓：計測工学，コロナ社(2001)，ISBN 4-330-04458-X (in Japanese).
2.林茂雄，馬場凉(訳) : JOHN R. TAYLOR　計測における誤差解析入門，東京化学同人(2000)，ISBN 4-8079-0521-X (in Japanese).
3.金谷健一：これならわかる応用数学教室，共立出版(2003)，ISBN 4-320-01738-2 (in Japanese).

[Schedule]

1. Introduction
2. Basic study of instrumentation
3. Data processing
4. Error estimation
5. Least square method
6. Fourier transformation
7. Wavelet transformation
8. Midterm examination
9. Student presentation I
10. Student presentation II
11. Student presentation III
12. Student presentation IV
13. Student presentation V
14. Student presentation VI
15. Student presentation VII

[Title]			[Instructor]		
Robust Control Theory			Atsushi Fujimori		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321256	2	Mechanical Systems Engineering	1st Semester	Thu.／II	Japanese

[Outline and purpose]

A linear model used in the model-based control approaches only represents a partial behavior of the real system. The model includes uncertainties such as varying parameters, unmodeled elements and nonlinear characteristics. Robust control is one of approaches to stabilize and compensate the system against the uncertainties. The concept of the robust control is first explained and some useful design techniques such as H infinity control method are given in this lecture.

[Objectives]

1. To understand the concept of robust control
2. To learn robust control design techniques such as H infinity control and μ analysis/design

[Requirements]

``Vibration Engineering" and ``Control Engineering" which have been open in Mechanical Design Course of Mechanical Systems Engineering Department are needed for taking this class.

[Evaluation]

Homework: 30%
Examination: 70%

[Textbooks]

Atsushi Fujimori: *Robust Control*, Corona Publishing, Tokyo, 2001, ISBN: 4-339-03180-1 (in Japanese).

[References]

K. Kogoh and T. Mita: *Introduction to System Control Theory*, Jikkyo Publishing, Tokyo, 1979, ISBN: 4-407-02205-1 (in Japanese).

[Schedule]

1. Introduction
2. Review of linear system control theory I
3. Review of linear system control theory II
4. Review of linear system control theory III
5. Review of linear system control theory IV
6. Introduction to robust control
7. Mathematical preliminaries I
8. Mathematical preliminaries II
9. Uncertainties
10. Linear fractional transformation
11. Robust stability analysis
12. H infinity control
13. μ analysis and design
14. Exercise on robust control
15. Final examination

[Title]			[Instructor]		
Modelling of Dynamical System			Yoshiyuki Noda		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321258	2	Mechanical Systems Engineering	1st Semester	Wed.／I	Japanese

[Outline and purpose]

Mathematical modeling to dynamical systems is necessary to analysis complicated systems with thermal, fluid, mechanical, electrical systems and so on. In this lecture, students will learn modeling techniques to dynamical systems such as mechanical, electrical, magnetic, fluid and thermal systems.

[Objectives]

1. To improve the modeling skill to dynamical properties in mechanical systems.
2. To represent dynamics by state space equations.
3. To analysis dynamical systems

[Requirements]

Material mechanics, thermodynamics, hydrodynamics, mechanical dynamics, electromagnetic, mathematics should be learnt for taking this lecture.

[Evaluation]

Report I: 40%
Report II: 40%
Mini- examination: 20%

[Textbooks]

There is no textbook assigned to this lecture.

[References]

M. Masubuchi, S. Kawata: System Modeling and Nonlinear Control, Corona Publishing, Tokyo, Japan, 1996 (in Japanese).
N. Macia, George J. Thaler: Modeling and Control of Dynamic Systems, Thomson Delmar Learning, New York, USA, 2005.

[Schedule]

1. Basis of dynamical systems
2. Analysis of dynamical systems by phase plane analysis I
3. Analysis of dynamical systems by phase plane analysis II
4. Modeling of mechanical systems by vector analysis I
5. Modeling of mechanical systems by vector analysis II
6. Modeling of mechanical systems by Euler's equation of motion I
7. Modeling of mechanical systems by Euler's equation of motion II
8. Modeling of mechanical systems by Lagrange equation I
9. Modeling of mechanical systems by Lagrange equation II
10. Modeling of mechanical systems (summary)
11. Modeling of electrical system
12. Analogy between electrical system and mechanical system
13. Modeling of fluid system I
14. Modeling of fluid system II
15. Modeling of thermo system

[Title]			[Instructor]		
Advanced Vehicle Dynamics			Shigenobu Okazawa		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321259	2	Mechanical Systems Engineering	2nd Semester	Tue.／II	Japanese

[Outline and purpose]

The background and basic vehicle dynamical theory is discussed. We will employ simple vehicle dynamical model as an example to understand the control theory.

[Objectives]

(1) Bicycle model of vehicle can be understood.
(2) Fundamental vehicle control technologies can be understood.

[Requirements]

The fundamental knowledge of calculus, algebra, kinematics, control theories are needed.

[Evaluation]

Several Reports :20%
Examinations :80%

[Textbooks]

Also, we will distribute reference papers if necessary.

[References]

1. Masato Abe, Warren Manning -Vehicle Handling Dynamics: Theory and Application, Butterworth-Heinemann, 2009., ISBN: 1856177491, 9781856177498

[Schedule]

1. Introductions of Vehicle Dynamics and Control
2. Tire Mechanics
3. Tire Mechanics
4. Fundamentals of Vehicle Dynamics
5. Fundamentals of Vehicle Dynamics
6. Fundamentals of Vehicle Dynamics
7. Vehicle Motion by Disturbances
8. Vehicle Motion by Disturbances
9. Steering System and Vehicle Dynamics
10. Steering System and Vehicle Dynamics
11. Vehicle Body Roll and Vehicle Dynamics
12. Vehicle Motion with Traction and Braking
13. Vehicle Dynamics with Active Motion Controls
14. Vehicle Motion with Human Driver
15. Vehicle Handling Quality

[Title]			[Instructor]		
Internship			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321271	2	Mechanical Systems Engineering	Intensive	／	／

[Outline and purpose]

The purpose of this internship is to gain a better understanding of the knowledge that the student has acquired at this graduate school through the training of specialized skills in public offices and private companies. There are two types of internship program: the program recommended by an academic supervisor and the program provided by the internship host.

[Objectives]

1. To conduct internship program for more than two weeks.
2. To understand how knowledge learned in the course is useful in society.
3. To enhance your motivation of learning of specialized education and help your career after completion of the course.

[Requirements]

Having fundamental knowledge on the field of study, common sense and proper mental attitude as a member of the university.

[Evaluation]

Others(Training period, the evaluation from the internship host, internship report and presentation and so on): 100%

[Textbooks]

[References]

[Schedule]

1. Application process

There are two types of internship program: the program recommended by an academic supervisor and the program provided by the internship host.

- The program recommended by an academic supervisor

  Students should arrange an internship host and project with their academic supervisor. Then, they should communicate name of company and proposed period to the internship instructor. The internship instructor will apply for the host in cooperation with their academic supervisor.
- The program provided by the internship host

  Students should collect the information about internship programs from the guidance of internship and the career center homepage and find an internship program in consultation with their academic supervisor. Then, they should apply to the educational affairs section.

2. During the internship program

Students should do their internship under the host.

3. Report and presentation

We will explain about the internship report and presentation in detail at the time of the guidance.

[Title]			[Instructor]		
Presentation I			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321272	2	Mechanical Systems Engineering		／	English／Japanese

[Outline and purpose]

Students need to present the research achievements in conferences.
The ability to write proceedings or papers is very important for independent researchers or engineers.
In this subject, academic supervisors teach students about calculation methods, how to summarize the experimental results, how to write proceedings and papers, how to present the contents.

[Objectives]

The purpose of this subject is to obtain the ability to present the research achievements in conferences and to write the proceedings or papers independently.

[Requirements]

Students need the knowledge related to the research theme and the usage of presentation software.

[Evaluation]

Academic supervisors check the achievements and state of progress in writing proceedings or papers.

[Textbooks]

[References]

[Schedule]

Academic supervisors teach students about following.
- How to summarize the calculation or experimental results.
- How to write the proceedings or papers.
- How to present the research achievements (including how to create the presentation files, how to talk, how to response in discussion.

1) Students need to obey the instructions of the professors in order to take this subject.
2) If students wish to obtain the credit of this subject, you need to fulfill the application form of the credit of Presentation I and submit it to the professor in charge of curricular and educational affairs.
3) The score of this subject should be registered after the professor, in charge of curricular and educational affairs, confirms whether the student meet the requirements of credit application form which is submitted before the deadline of score registration (If students wish to confirm the requirements, make a contact with academic supervisors or the professor in charge of curricular and educational affairs).
If the application form is submitted after the deadline, it will be registered in next term.

Students should not rely on the credit of this subject for completion of master course.

[Title]			[Instructor]		
Presentation II			all academic supervisors		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321273	2	Mechanical Systems Engineering		／	English／Japanese

[Outline and purpose]

Students need to present the research achievements in conferences.
The ability to write proceedings or papers is very important for independent researchers or engineers.
In this subject, academic supervisors teach students about calculation methods, how to summarize the experimental results, how to write proceedings and papers, how to present the contents.

[Objectives]

The purpose of this subject is to obtain the ability to present the research achivements in conferences and to write the proceedings or papers independently.

[Requirements]

Students need the knowledge related to the research theme and the usage of presentation software.

[Evaluation]

Academic supervisors check the achievements and state of progress in writing proceedings or papers.

[Textbooks]

[References]

[Schedule]

Academic supervisors teach students about following.
- How to summarize the calculation or experimental results.
- How to write the proceedings or papers.
- How to present the research achievements (including how to create the presentation files, how to talk, how to response in discussion.

1) Students need to obey the instructions of the professors in order to take this subject.
2) If students wish to obtain the credit of this subject, you need to fulfill the application form of the credit of Presentation II and submit it to the professor in charge of curricular and educational affairs.
3) The score of this subject should be registered after the professor, in charge of curricular and educational affairs, confirms whether the student meet the requirements of credit application form which is submitted before the deadline of score registration (If students wish to confirm the requirements, make a contact with academic supervisors or the professor in charge of curricular and educational affairs).
If the application form is submitted after the deadline, it will be registered in next term.

Students should not rely on the credit of this subject for completion of master course.

[Title]			[Instructor]		
Seminar in Mechanical System Engineering IA			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321281	1	Mechanical Systems Engineering	1st Semester		English／Japanese

[Outline and purpose]

Register at the same semester as Research Work in Mechanical System Engineering IA. This is a lecture-style class by the graduate advisor directing your research work. In order to acquire extensive technical knowledge, assignments is not necessarily directly related to the details of your research work.

[Objectives]

To gain the results by an investigation, a design, consideration, the experiment.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Comprehensive evaluation from progress of the problem solution, reports and an answer to a question : 100%

[Textbooks]

[References]

Depending on the case.

[Schedule]

The lectures by an instructor on the specific assignments.
Student chooses a vice-graduate advisor besides the chief-advisor, and can ask for advice about presentation skills and plan of the research work.

[Title]			[Instructor]		
Seminar in Mechanical System Engineering IB			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321282	1	Mechanical Systems Engineering	2nd Semester		English／Japanese

[Outline and purpose]

Register at the same semester as Research Work in Mechanical System Engineering IB. This is a lecture-style class by the graduate advisor directing your research work. In order to acquire extensive technical knowledge, assignments is not necessarily directly related to the details of your research work.

[Objectives]

To gain the results by an investigation, a design, consideration, the experiment.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Comprehensive evaluation from progress of the problem solution, reports and an answer to a question : 100%

[Textbooks]

[References]

Depending on the case.

[Schedule]

The lectures by an instructor on the specific assignments.
Student chooses a vice-graduate advisor besides the chief-advisor, and can ask for advice about extensive technical knowledge around the research work.

[Title]			[Instructor]		
Seminar in Mechanical System Engineering IIA			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321291	1	Mechanical Systems Engineering	1st Semester		English／Japanese

[Outline and purpose]

Register at the same semester as Research Work in Mechanical System Engineering IIA. This is a lecture-style class by the graduate advisor directing your research work.

[Objectives]

To gain the results by an investigation, a design, consideration, the experiment.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Comprehensive evaluation from progress of the problem solution, reports and an answer to a question : 100%

[Textbooks]

[References]

Depending on the case.

[Schedule]

The lectures by an instructor on the specific assignments.
Student can take counsel with his/her chief-graduate advisor and vice-advisor.

[Title]			[Instructor]		
Seminar in Mechanical System Engineering IIB			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321292	1	Mechanical Systems Engineering	2nd Semester		English／Japanese

[Outline and purpose]

Register at the same semester as Research Work in Mechanical System Engineering IIB. This is a lecture-style class by the graduate advisor directing your research work.

[Objectives]

To gain the results by an investigation, a design, consideration, the experiment.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Comprehensive evaluation from progress of the problem solution, reports and an answer to a question : 100%

[Textbooks]

[References]

Depending on the case.

[Schedule]

The lectures by an instructor on the specific assignments.
Student can take counsel with his/her chief-graduate advisor and vice-advisor.

[Title]			[Instructor]		
Research Work in Mechanical System Engineering IA			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321301	2	Mechanical Systems Engineering	1st Semester	／	English／Japanese

[Outline and purpose]

The purpose of this research work is to gain fundamental knowledge and technology of selected subject of research under the tuition of supervisor. Comprehension of background and purpose of research, planning of research schedule and accomplishment of research with initiative are required. Comprehension of research subject is promoted with report and discussion.

[Objectives]

Comprehension of social demand about engineering and technology and findings of subject and ability of problem solving is acquired. Ability of accomplishing study and research with initiative is acquired. Ability of presentation and communication on the presentation and discussion of research work is cultivated.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Others(Evaluate the appropriateness of answer to questions): 100%

[Textbooks]

[References]

Instruct if required

[Schedule]

Accomplish the selected subject of research under the tuition of supervisor.

[Title]			[Instructor]		
Research Work in Mechanical System Engineering IB			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321302	2	Mechanical Systems Engineering	2nd Semester	／	English／Japanese

[Outline and purpose]

The purpose of this research work is to gain fundamental knowledge and technology of selected subject of research under the tuition of supervisor. Comprehension of background and purpose of research, planning of research schedule and accomplishment of research with initiative are required. Comprehension of research subject is promoted with report and discussion.

[Objectives]

Comprehension of social demand about engineering and technology and findings of subject and ability of problem solving is acquired. Ability of accomplishing study and research with initiative is acquired. Ability of presentation and communication on the presentation and discussion of research work is cultivated.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Others(Evaluate the appropriateness of answer to questions): 100%

[Textbooks]

[References]

Instruct if required

[Schedule]

Accomplish the selected subject of research under the tuition of supervisor.

[Title]			[Instructor]		
Research Work in Mechanical System Engineering IIA			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321311	3	Mechanical Systems Engineering	1st Semester	／	English／Japanese

[Outline and purpose]

The purpose of this research work is to gain knowledge and technology of selected subject of research and progress the research under the tuition of supervisor. Comprehension of research subject is promoted with report and discussion.

[Objectives]

Comprehension of social demand about engineering and technology and findings of subject and ability of problem solving is acquired. Ability of accomplishing study and research with initiative is acquired. Ability of presentation and communication on the presentation and discussion of research work is cultivated.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Others(Evaluate the appropriateness of answer to questions): 100%

[Textbooks]

[References]

Instruct if required

[Schedule]

Accomplish the selected subject of research under the tuition of supervisor.

[Title]			[Instructor]		
Research Work in Mechanical System Engineering IIB			each academic supervisor		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
321312	3	Mechanical Systems Engineering	2nd Semester	／	English／Japanese

[Outline and purpose]

The purpose of this research work is to gain knowledge and technology of selected subject of research and progress the research under the tuition of supervisor. Comprehension of research subject is promoted with report and discussion.

[Objectives]

Comprehension of social demand about engineering and technology and findings of subject and ability of problem solving is acquired. Ability of accomplishing study and research with initiative is acquired. Ability of presentation and communication on the presentation and discussion of research work is cultivated.

[Requirements]

Fundamental knowledge of mechanical engineering of undergraduate level.

[Evaluation]

Others(Evaluate the appropriateness of answer to questions): 100%

[Textbooks]

[References]

Instruct if required

[Schedule]

Accomplish the selected subject of research under the tuition of supervisor.