[Title]			[Instructor]		
Advanced Mechatronics			Nobuyuki Furuya / Kazuyoshi Ishida		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTJ501	2	Mechatronics	1st Semester	Tue.／II	Japanese

[Outline and purpose]

This course involves the principle of digital measurement and control system to understand application from the basics about control, mechanism, and signal processing. An aim in this course is to obtain an adequate knowledge of building a system using the various science and technology in mechatronics.

[Objectives]

1. To understand the system of mechatronics
2. To understand the mechanisms with articulated links
3. To understand the control elements for robot

[Requirements]

This course will be needed to understand the following fundamental knowledge: classical control, linear differential equation, Laplace transform, transfer function, stability condition of control system, hardware, programming language, and mechanism of operating machine.

[Evaluation]

1. Intermediate examination / 40%
2. Final examination / 40%
3. Quizzes in class / 20%

[Textbooks]

1. 神崎一男, 基礎メカトロニクス, 共立出版, ISBN:9784320081048 (in Japanese)

[References]

1. 土谷武士／深谷健一, メカトロニクス入門（第 2 版）, 森北出版, ISBN:9784627944220 (in Japanese)
2. 応用制御工学, 丸善, ISBN:462104477X (in Japanese)
3. 雨宮好文／高木章二, ディジタル制御入門 改訂 2 版, オーム社, ISBN:4274086704 (in Japanese)

[Schedule]

1. Introduction of mechatronics (machine, electricity, information) (Ishida)
2. Practical examples of mechatronics (Ishida)
3. Link mechanism and articulated robot (Ishida)
4. Kinematics of mechanism (Ishida)
5. Technology for machine element [1] (friction, wear, lubrication) (Ishida)
6. Technology for machine element [2] (surface modification, application to Tribology) (Ishida)
7. Outline of the first part & intermediate examination (Ishida)
8. Dynamics of mechanical systems (Furuya)
9. Outline of kinematics (Furuya)
10. Principle of electric motor (servomotor, stepping motor) (Furuya)
11. Digital circuit and interface (Furuya)
12. Components of positioning system (Furuya)
13. Application to numerical controlled machine tool (Furuya)
14. Application to robot (Furuya)
15. Outline of the last half & final examination (Furuya, Ishida)

[Title]			[Instructor]		
Advanced Robotics			Hidetsugu Terada		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTJ502	2	Mechatronics	1st Semester	Thu.／I	

[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. Kinematics of Parallel robot
6. Mechanical elements of robotics
7. Design of Mechanical elements
8. Robotics control 1 (Collision avoidance)
9. Robotics control 2 (Cooperative control)
10. Robotics control 3 (Motion planning methods)
11. Moving robotics (Gait and wheels)
12. Energies of robotics
13. Micro robotics
14. Robotics and factory automations
15. Research of foreign trends

[Title]			[Instructor]		
Ergonomics			Miyoshi Okamura / Kazuyoshi Ishida / Toshiya Kitamura		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTJ503	2	Mechatronics	1st Semester	Thu.／IV	Japanese/ English

[Outline and purpose]

Ergonomics is the practice of designing artifacts to take account of interaction between them and the people who use them. Firstly, this course provided that the fundamental knowledge of physiological, psychological and cognitive characteristics of human. Secondly, the course gives technology on designing equipment and devices that fit the human body and cognitive abilities. Thirdly, the course examines the specific design of such things as easy-to-use interfaces to machine and equipment.

[Objectives]

1. Understand physiological, psychological and cognitive characteristics of human.
2. Understand the technologies on sensor, control and man-machine interface.
3. Examine and suggest the specific design of such things as easy-to-use interfaces to machine and equipment.

[Requirements]

1. Fundamental knowledge on engineering and liberal arts
2. Critical mind and curiosity

[Evaluation]

Assignments: 70%
Presentations: 30%

[Textbooks]

Handouts will be distributed if necessary.

[References]

References will be introduced during the course.

[Schedule]

1. Orientation, History and significance of Ergonomics (Okamura)
2. Ethics in Ergonomics (Okamura)
3. Ergonomics in design of artifacts (Okamura)
4. Physiological characteristics of human (Okamura)
5. Psychological and cognitive characteristics of human (Okamura)
6. Measuring technology of sensitivity (Kitamura)
7. Measuring technology of condition (Kitamura)
8. Man-machine interface (Kitamura)
9. Universal Design (Okamura)
10. Human Centered Design (1) (Okamura)
11. Human Centered Design (2) (Okamura)
12. Human error and accidents (Kitamura)
13. Case study and presentation (1) (Ishida)
14. Case study and presentation (2) (Ishida)
15. Case study and presentation (3) (Ishida)

[Title]			[Instructor]		
Advanced Engineering Materials			Takaaki Ishii/ Shin-ichiro Hira/ Tsuyoshi Shimizu		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTJ505	2	Mechatronics	1st Semester	Mon.／III	

[Outline and purpose]

Ceramics, plastics and metals are introduced and discussed in this lecture. Fabrication methods and electric characteristics are lectured for ceramics. Characteristics and molding methods are lectured for plastics. Engineering plastics and composite plastics are included. Characteristics and processing methods are lectured for metals (aluminum alloy, stainless steel alloy and difficult-to-cut materials). Micro-processing technology is included. Understanding characteristics and processing / micro-processing methods for materials are important to design mechatronics systems.

[Objectives]

Understanding relationship between mechanical characteristics and processing methods.
Understanding how to use materials to its applications.
Understanding electric characteristics of ceramics and its applications.

[Requirements]

Fundamental knowledge of the materials.

[Evaluation]

Report : 50 %
Examination : 17 %
Attitude : 33 %

[Textbooks]

None.

[References]

None.

[Schedule]

1. Fundamentals of ceramics. (Ishii)
2. Piezoelectric / electrostrictive effects. (Ishii)
3. Fabrication of ceramics. (Ishii)
4. Electric characteristics of ceramics. (Ishii)
5. Summary of ceramics. (Ishii)
6. Kinds and characteristics of plastics. (Hira)
7. Molding method of plastics. (Hira)
8. Engineering plastics. (Hira)
9. Composite plastics. (Hira)
10. Environmental problems and safety of plastics. Summary. (Hira)
11. Aluminum alloy and its processing. (Shimizu)
12. Stainless steel alloy and its processing. (Shimizu)
13. Titanium alloy and its processing. (Shimizu)
14. High carbon materials and its processing (carbon steel, high carbon steel and cast iron). (Shimizu)
15. Summary of the metals. (Shimizu)

[Title]			[Instructor]		
Advanced Actuator Engineering			Nobuyuki Furuya / Takaaki Ishii/ Toshiya Kitamura		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTJ506	2	Mechatronics	1st Semester	Fri.／I	

[Outline and purpose]

Actuators are widely used in many kinds of mechanical systems. In this lecture, electromagnetic motors (AC / DC motors, servomotors, stepping motors, etc.), fluid actuators (hydraulic actuators, pneumatic actuators, etc.) and solid state actuators (piezoelectric / electrostrictive actuators) are introduced. Fundamental properties (driving principle, characteristics, how to use, etc.) are lectured and discussed. Understanding characteristics and selection / use of the actuators are the purposes.

[Objectives]

1. Understanding characteristics of the actuators.
2. Appropriate selection of the actuators.
3. Appropriate use of the actuators.

[Requirements]

Fundamental knowledge of physics.
Fundamental knowledge of control systems.

[Evaluation]

Report : 75 %
Attitude : 25 %

[Textbooks]

None.

[References]

None.

[Schedule]

1. The outline of the actuators. (Furuya)
2. Principles of the electric motors. (Furuya)
3. Stepping motors. (Furuya)
4. DC servomotors. (Furuya)
5. AC servomotors. (Furuya)
6. High power motors. (Kitamura)
7. The outline of the fluid actuators. (Kitamura)
8. Fundamentals of the hydraulic actuators. (Kitamura)
9. Fundamentals of the pneumatic actuators. (Kitamura)
10. Applications on fluid actuators. (Kitamura)
11. Fundamentals of the solid state actuators. (Ishii)
12. Mechanical characteristics of the solid state actuators. (Ishii)
13. Electric characteristics of the solid state actuators. (Ishii)
14. Evaluation of the solid state actuators. (Ishii)
15. Applications on solid state actuators. (Ishii)

[Title]			[Instructor]		
Computer Networks of Embedded Systems			Masayuki Morisawa / Tsutomu Tanzawa / Kazuyoshi Ishida / Hiromitsu Nishizaki		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTJ508	2	Mechatronics	1st Semester	Thu.／II	Japanese

[Outline and purpose]

The computer for control purpose and the communications between each device are vital for the embedded system used in Mechatronics. In recent years wireless and internet connections are becoming widespread on top of traditional communication methods which connect devices with cables.

In this lecture, we learn extensively about computer network based on communication technology from various methods used in embedded systems to internet. Specifically aiming at understanding methods of communication between typical PCs and embedded microcontrollers and with peripheral equipments, as well as TCP/IP protocol used in internet system.

[Objectives]

1 Enable to explain the communication interface between the computer and peripheral modules in embedded system
2. Enable to explain the basics of the digital signals and communications
3. Enable to build a small computer communication system.
4. Enable to explain the working of each layer of OSI Reference Model and its necessity.
5. Enable to explain TCP/IP protocol and to read information in packet headers.
6. Enable to explain basic matters on internet such as route control and application protocol such as DNS.

[Requirements]

Basic knowledge of computer architecture and programming is required as the premise.

[Evaluation]

The comprehension level is evaluated through several reports and mini tests.

[Textbooks]

[References]

[Schedule]

1. Introduction to the computer network to embedded system
2. The communication interface in the embedded system
3. The wireless communication interface
4. The typical Communication interface1 - RS232C(1)
5. The typical Communication interface2 - RS232C(2)
6. The typical Communication interface3 - USB (1)
7. The typical Communication interface4 - USB (2)
8. Internet Protocol, OSI reference model, packet communication, configuration of computer network
9. The first layer communication, The second layer communication
10. The third layer communication 1 （outline, IP address, Subnet）
11. The third layer communication 2 （Details of the third layer communication, ARP, router, routing）
12. Routing protocol
13. The 4th layer communication （TCP)
14. The 4th layer communication （UDP), IPv6
15. Application protocol