

## © Courses for Unmanned Vehicle Engineering

### **Mechatronics programming / 3hours, 3credits**

Students learn an essential engineering program (i.e., MATLAB) in using the field of Mechatronics. Students also learn the basic process of machine learning using MATLAB.

### **Design of Machine Elements / 3hours, 3credits**

It is a subject that acquires knowledge for machine element design and cultivates knowledge that can be used for actual product design. In the field of mechanical element design, the theory of preventing breakage due to stress, deformation, structural rigidity, static load and variable load, screw, fastener, welding part, etc., and design theory such as spring, bearing, etc. are lectured.

### **Machine Learning / 3hours, 3credits**

Machine learning, a field of artificial intelligence, is covered in general. Students analyze the pros and cons of supervised learning and unsupervised learning methods, and learn how to choose an appropriate method for each example.

### **Digital System / 3hours, 3credits**

Students study techniques for designing logic circuits (combinational circuits, sequential circuits) and Boolean algebra, which are the basics of digital hardware, and practice accordingly. Students do the design and practice of digital systems using basic elements of logic circuits (gates, multiplexers, counters, etc.).

### **Digital Signal Processing / 3hours, 3credits**

Sampling theory, which is the basis of digital signal processing, characteristics of discrete signals, system theory in discrete hours, and Z-transform and DFT theories are studied.

### **Digital Communications / 3hours, 3credits**

The purpose of this class is to examine the operating principles, performance evaluation, and comparative study of various digital communication systems. Performance analysis of digital modulation methods, such as baseband communication, amplitude shift keying (ASK), phase shift keying (PSK), frequency shift keying (FSK), and quadrature amplitude modulation (QAM), channel equalization method, and basic information theory are studied.

### **Digital Circuits Design / 3hours, 3credits**

This class aims to learn basic techniques for the latest digital circuit design. Basic logic design, design using VHDL, and techniques for high-speed digital circuit design are studied.

### **Database / 3hours, 3credits**

Students learn about the basic concept of database, database design method, database language, database stability and completeness, etc.

### **Linear Algebra with programming / 3hours, 3credits**

Students Learn how to calculate vectors and matrices, and diagonalize matrices. Students learn LDU decomposition using Gaussian elimination, diagonalization using high-yield vectors, QR decomposition using orthogonal vectors, and also learn how to deal with linear equations with impossible and indefinite solutions.

### **Numerical Analysis / 3hours, 3credits**

Students learn the basic concepts of approximation and error. The basic theories and algorithms of equations, interpolation, numerical differentiation and integration, and analyze their errors are included.

### **Dynamics / 3hours, 3credits**

Students learn the dynamic properties of mass, rigid, and deformable bodies in terms of the relative motion and the routine between objects. Also, students Learn the transformation of impact phenomena and momentum during impact.

### **Dynamic System Modeling / 3hours, 3credits**

This course is about modeling multi-domain engineering systems. This includes state-space models, Legendre transforms, nonlinear mechanics, transformation theory. The application examples may include electro-mechanical transducers, mechanisms, electronics.

### **Deep Learning System / 3hours, 3credits**

Understand deep learning systems, a field of machine learning that teaches people's mindsets to computers, and learn about various techniques such as deep neural networks, convolutional deep neural networks, and deep self networks.

### **Robotics / 3hours, 3credits**

Students learn about analysis and design of robot manipulator in this class. This class includes robot kinematics (homogeneous transformation, inverse kinematics, and velocity kinematics), statics, kinetics (forward dynamics, and inverse dynamics), trajectory planning and generation, offline programming, actuators and sensors of industrial robot, and robot control.

### **Machine Vision System / 3hours, 3credits**

This class handles analysis of image characteristic (image formation, object recognition, image retrieval) to apply machine vision.

### **Unmanned Vehicle Design Project / 3hours, 3credits**

Based on the theory of unmanned aerial vehicles, the process of manufacturing unmanned aerial vehicles is learned through the experiment.

### **Unmanned Vehicle Control / 3hours, 3credits**

This class handles the various control theories for safe flight of the aircraft and causing the desired dynamic manoeuvre, and apply them to practical problems.

### **Unmanned Vehicle Control Lab / 3hours, 3credits**

Based on the theory of unmanned aerial vehicle control, the control design process of unmanned aerial vehicles is learned.

### **Sensors and Mapping Algorithms / 3hours, 3credits**

This class introduces a sensor-based mapping algorithm used for an accurate understanding of the space where an unmanned vehicles moves.

### **Smart Vehicle Control / 3hours, 3credits**

Students learn to control the smart car by focusing on sensors, electronic controllers (ECUs), and actuators, which are the core elements of the smart car's electronic devices.

**Smart Vehicle Control Practice / 3hours, 3credits**

Students conduct in-depth practice on smart vehicle operating and control based on smart vehicle control theory and methods.

**Signals and Systems / 3hours, 3credits**

Students learn about LTI system, Fourier Transform, and Laplace Transform to understand the characteristics of analog signals and systems.

**Algorithms and lab / 4hours, 3credits**

Students learn basic algorithms to process data and solve problems, and learn how to apply the basic algorithms to various problems. Students also learn algorithm design techniques through existing algorithms.

**App Programming / 3hours, 3credits**

In this course, students learn how to write codes for a smart device application and how to use multimedia for the application. The app development plan, system design, and UI/UX design will also be studied.

**Image Processing / 3hours, 3credits**

Students learn basic image processing methods and image compression methods. Virtual reality and video communication will also be studied.

**Web Programming / 3hours, 3credits**

This course is an introduction to programming for the World Wide Web. Students learn the relationship between clients and servers, how web pages are constructed using several technologies such as HTML, CSS, JavaScript, Dynamic HTML.

**Artificial Intelligence / 3hours, 3credits**

This course provides representations and algorithms used to build artificial intelligence systems in robotics and computer vision. The course mainly includes deep learning methods with application to computer vision system, natural language processing.

**Internship / 6hours, 3credits**

This course provides internship experiences to students during the summer and winter vacations. Students work with industries to improve practical skills and collaboration & communication skills.

**Embedded System / 3hours, 3credits**

The Embedded System course aims to provide that makes students understand the structure and the principle of the embedded system. This course teaches the practice and the basic theory, the structure, and the system programming of the embedded system.

**Automatic Control / 3hours, 3credits**

The Automatic Control course supplies the foundation of the classic feedback control. In this course, students could understand state-equation, control input and corresponding responses. After taking this course, students can perceive the root locus, the stability of the system and the frequency domain response method. This course also provides the practice of the system and controller modeling by Matlab.

**Data Structures and Lab / 5hours, 4credits**

This course provides a primary method that stores data for programming. Furthermore, this course teaches the fundamental framework of a data structure and a calculation for concept realization.

### **Autonomous Car Simulation / 3hours, 3credits**

Students learn the performance and characteristic analysis of all unmanned mobile systems through practice of visualization of motor characteristics and simulators that integrate dynamic characteristics modeling of unmanned vehicles such as smart cars and drones.

### **Basic Electrical Circuit Theory / 3hours, 3credits**

This course builds basic knowledge for the analysis and design of electric and electronic systems by dealing with the properties of basic passive elements constituting electric circuits, solving circuit equations, and analyzing signals in circuits. It is a basic subject for all electronic engineering.

### **Electrical Circuits and Lab / 3hours, 3credits**

This course lectures the basic properties of electric circuits necessary for actual circuit construction and studies problems that occur during circuit construction through experiments. In the subject, we examine the properties of RLC circuits, conduct experiments to construct basic passive element circuits, and learn how to use the measuring equipment and how to operate the latest electronic equipment.

### **Electronic Circuits / 3hours, 3credits**

This course studies the basic knowledge to understand the characteristics of active elements and to learn how to analyze and design electronic circuits composed of these active elements.

### **Industry Seminar Series / 1hour, 1credit**

In this course, experts in the field of ICT convergence are invited to give lectures on industries, technologies, and job expertise. In addition, students strengthen their job competencies such as communication skills and analytical thinking via a discussion-type class with experts.

### **Computer architecture and operating systems / 3hours, 3credits**

Students learn the functionalities, implementation, and controls of computer hardware components such as processors, memories, and input/output devices. In addition, students also learn the basic theory of computer operating systems.

### **Computer Network / 3hours, 3credits**

Students learn computer networks focusing on the Internet architecture and protocols. In particular, students learn topics including layered network topology architectures, packet communications, and network protocols related to network operations such as addressing, naming, forwarding, and routing.

### **Communication Systems / 3hours, 3credits**

Students learn basic communication theories including signal analysis and spectrum analysis techniques. Students also learn theories related to actual communication methods (i.e., AM and FM) and their applications.

### **Probability and Statistics Programming / 3hours, 3credits**

Students learn the basic theory of probability theory, which is the basis of engineering, and the basic theory of the probabilistic model of communication signals, which is the basis of communication. Students also learn probability theory, which is the basics of the Internet, and probabilistic models of signals, which are the basis

of communication and signal processing, such as irregular variables and irregular processes.

**JAVA programming / 3hours, 3credits**

Understanding the grammar and object-oriented concepts of the JAVA program and acquiring basic JAVA program skills.

**Capstone Design / 6hours, 6credits**

Students form converged teams to design and develop prototypes to cultivate practical and collaborative skills.