

Department of Electronic Engineering

1. Educational Goal

We teach advanced technologies in the area of electronics so that the graduates may lead the information technology society and contribute to the local community with their creative and active commitment. Also, the graduates may be able to diagnose and solve various problems in their research and development areas.

2. Educational Objective

- ① Develop adaptability to rapidly changing new technologies
- ② Build research ability in various integrated and hybrid electronic engineering areas.
- ③ Educate development capability which is required in the various fields of Daedok R&D Science Town

3. List of Full-time Faculty

Name	Position	Degree(University)	Field of Instruction	Area of Research
Lee, Kuiyon	Professor	Ph. D., Yonsei University	Electronic Engineering	Semiconductor and Microwave Circuit Design
Lee, Il-geun	Professor	Ph. D., Oregon State University	Electronic Engineering	Wireless Communication and Digital Signal Processing
Choe, Jin-gyu	Professor	Ph. D., Korea University	Computer Engineering	Computer and Microprocessor Application
Oh, Byeong-ju	Professor	Ph. D., University of New Mexico	Control and Robotics	Control, Robotics, Virtual Reality
Choi, In-sik	Professor	Ph. D., Pohang University of science and technology	Electronic Engineering	Radio wave Engineering
Um, Ji-Yong	Assistant professor	Ph. D., Pohang University of Science and Technology	Electronic and Electrical Engineering	Mixed-Signal Integrated Circuit Design

4. Course Description

• ET601 Advanced Communication Systems 3credits

This course deals with analog and digital communication system advantages and disadvantages, analog and digital communication system classification, digitization

of analog signals, and digital transmission systems, which are required in the field of analog and digital communication systems. Furthermore, for the graduate students, this course handles advanced digital communication applications such as wireless communications and satellite communications.

- **ET602 Digital Image Processing 3credits**

This course introduces the basic and advanced concepts and theories of image processing. Course topics include: image acquisition; enhancement; restoration; transformation; analysis; understanding; compression; visual C++ software and practical applications. The useful methods for the pattern recognition is neural network or fuzzy logics. Depending on the student's interest, topics will cover computer graphics and animations.

- **ET603 Selected Topics on Control Systems 3credits**

Control system has various aspects in its specifications depending on the industry requirements. So it is necessary to select various topics which is adaptable to the rapidly changing techniques, and to satisfy the demands of the industry engineers. The topics will be classical control, PID feedback control, modern control, intelligent including neural network, MATLAB, robot control, embedded system, etc. The student who take this course will be able to read and comprehend papers in their interested area.

- **ET604 Selected Topics in Computer Engineering 3credits**

The advancement of the computer engineering is very fast and proceeded widely in association with several disciplines. In this lecture, topics will be given related to the development of computer hardware and software or research projects using computer system or computer communication will be studied as well. The class consists of lectures and individual seminars on assigned topics.

- **ET605 Performance Analysis of Computer Networks 3credits**

Performance evaluation and estimation are important when we design computer networks. In this subject various performance evaluation methods and tools are introduced, which include Statistics, Queuing Theory, and Simulation techniques. Throughput and delay time characteristics are derived for random access networks and polling networks based on ring and bus topology.

- **ET606 Advanced Theory for Signals and Noise 3credits**

The main purpose of this course is to introduce the graduate students majoring in electrical and electronic engineering to the principles of random signals and to provide tools whereby they can handle systems involving such signals. To achieve the goal of this course, they will learn some advanced concepts and methods

regarding single random variables, expectation, moments, transformations of single random variables, multiple random variable, expectations of multiple random variables, Gaussian random variables, random process, stationarity, ergodicity, Independence autocorrelation, cross-correlation, Gaussian random process, power density spectrum, cross-power spectrum, estimation, and linear system analysis with random inputs.

• **ET607 Robot Engineering 3credits**

Robot includes industrial robot and service robot. Students who take this course will be able to understand the principle concept of the basic theory, design, implementation, kinematics, inverse kinematics, dynamics, control, computer interface, and sensors. The fields related to this subject is so wide, that the mechanical part will be studied in basic concept only, and control and computer interface will be handled in depth. The sensor systems in the special service robot is so important that the kinds, applications, and the mechanism of the mobile robot will be studied.

• **ET608 Advanced Microprocessor 3credits**

The advancement of microprocessor is faster and stronger than any other products. Microprocessors were utilized as one of the components of a simple microcomputer but they are now used as a core of the powerful computer system. In this lecture, the recent-developed high performance microprocessor/microcontroller will be probed and the related design of computer system will be carefully investigated.

• **ET609 Advanced Computer System 3credits**

The digital system design is enhanced by the improvement of HDL and its design tools. In this lecture, the fundamentals of digital system design will be studied. Students will work on the small scale digital system design as well as the complex digital system design. They also will design diverse digital system using VHDL and will implement on FPGA.

• **ET610 Radar Engineering 3credits**

Radar is an electromagnetic devices used for detection of targets by transmitting electromagnetic energy and examining the reflected energy. The modern wireless communication system and RFID were also originated from Radar technology. This subject will handle the topics of radar equation, transmitter and receiver, RCS (Radar Cross Section), CFAR detection, tracking radar, radar signal processing, application, etc. The students should have a programming skill using MATLAB or C language.

• **ET611 Advanced Embedded System 3credits**

Because of the growing demands of embedded system, it is required to have the microcontroller application design capability. In this lecture, the basic operation theory and detailed application design of microcontroller will be learned and the application design capability will also be raised. Practicing embedded system development tools will be used to be familiar with the software design and hardware operation. So, the learners will have the microcontroller application design capability. Design and implementation of embedded system will be achieved by lectures, laboratory works, and prototyping.

• **ET612 Advanced Digital Signal Processing 3credits**

The main objective of this course is to present an introduction to digital signal processing, a field of study created by the great interest in the design and application of numerical algorithms resulting from the change in new signal processing technologies for the graduate students majoring in electrical and electronic engineering.

• **ET613 Filter Design 3credits**

In this course we will study about the filter class and basic theory. from this basic theory, we will depth study about the Bilinear Transfer function, frequency response, cascade design of 1st order filter, Biquid circuit, Butterworth filter, chebyshev response과 Sensitivity Ladder design, Switched capacitor filter, frequency scaling, OP-AW oscillator etc.

• **ET614 Advanced Semiconductor Engineering 3credits**

Semiconductor processing technology and packing density of integrated circuits have been developing rapidly to process, store and display lots of data because of growing up of the uses of small, thin, and light personal multimedia communication devices, which are worked in low voltage. In this class, we will study about fundamentals of solid-state device theory (basses of crystallography, quantum mechanics, free electron theory, band theory, and so on.) and the standard unit device processing technique (deposition of epi-layer, oxidation, diffusion, ion-implantation, lithography, and etc.). By student interest, we will also study about the subject related to the newest processing technology and trends in packing of devices, new semiconductor materials, and device structure and modeling. The class will progress by lectures and thematic seminars.

• **ET615 Wavelet Transform 3credits**

Wavelets provide efficient localization in both time and frequency. Therefore, wavelet transform is now applied to the data compression such as image compression or speech compression, and the feature extraction for various pattern

recognitions. This class handles the concept of time-frequency analysis, Short-Time Fourier Transform (STFT), continuous wavelet transform (CWT), discrete wavelet transform (DWT), and adaptive wavelet transform (AWT). The students will be exercised in programming about various time-frequency analysis methods.

- **ET617 Selected Topics in Communication Networks 3credits**

The areas of the computer and communication networks are changing rapidly. In this subject, one of the state of the art research topic is selected and discussed. The topic may be one of the following areas including the Next Generation LANs, wireless networks, all-optical networks, Satellite networks, and New Generation network protocols.

- **ET618 Intelligent Systems 3credits**

Fundamentals and applications of intelligent systems and biologically inspired algorithms such as neural networks, evolutionary computations, swarm optimization and fuzzy systems. Solving complex engineering applications with a combination of these technologies as well as with more traditional approaches such as statistical system theories.

- **ET619 Special topics on Electromagnetics 3credits**

This class handles the advanced analysis methods on Electromagnetics based on the basic Electromagnetic theory of undergraduate level. The scope of topics are the Maxwell equation, wave equation, electrical property of matter, Green's function, wave propagation and polarization, reflection and transmission, transmission line theory, scattering, etc. Prerequisite for this course is a basic knowledge about field theory and microwave engineering. The students should have a programming skill using MATLAB or C language.

- **ET620 Selected Topics on RF Circuits 3credits**

The micro- and milli-meter band wireless communication web, which is based on mass capacity and very high speed wireless communication techniques, is building up rapidly in the world. The RF Transceiver is indispensable to building up the Wireless Communication Web. In this Class, we will study about power amplifiers, oscillators, mixers, low noise amplifier, and filters, and so on which are the core components of RF transceiver. Also, we will design the circuits with student's deep interest. The Class will progress by lectures and design of the circuit (term-project).

- **ET621 Mixed-Mode Integrated Circuit Design 3credits**

In this course, CMOS mixed-mode integrated circuit design methodology will be

covered. Circuits including a fully differential op-amp, a band-gap reference, a switched-capacitor circuit, and transistor-level CMOS digital logic circuits will be designed through SPICE and CAD tool. Also, recent design trend of integrated circuits will be dealt with by studying low-power/low-voltage integrated circuits.

- **ET622 Bioinstrumentation Integrated Circuit Design 3credits**

CMOS integrated circuit designs for bio-instrumentation such as ultrasound medical imaging applications will be covered in this course. Nature of ultrasound and transducer, an architecture of ultrasound medical imaging device, and a beamforming principle will be studied as an introduction of this class. Also, circuits including linear-in-dB variable gain amplifiers and analog-to-digital converters for medical imaging applications will be intensively studied. A lecture of mixed-mode integrated circuit design is recommended as a prerequisite subject for this lecture.

- **EO702 Advanced Filter Design 3credits**

In this course we will study about the filter specification & basic theory & we will lecture about the bilinear transferfunction, Biquad circuit, Butterworth Filter, Chebyshev Filter, SC Filter, frequency response etc. also we will study sensitivity computation & application method through the computer simulation.

- **EO703 Special Topics on Control Systems) 3credits**

This topic deals mainly with the field application of control theory. A special theory or topic on the control system will be introduced, and analyzed by computer simulation to check the feasibility of the system. This class requires reading papers and application on the system. This topic may include the structure of the telecontrol system through internet and robot control.

- **EO704 Neural Network 3credits**

This subject deals with basic theory and application on the artificial neural networks. The topics includes the structure of the various neural networks, various types of network, and the various learning methods. This lecture also includes genetic algorithms, which includes the principle of the algorithm, related theories, analysis, and combination of genetic algorithm with neural network. After that, the application on the robot control or optimization problems will be studied.

- **EO705 Special Topics on Robot Engineering 3credits**

This lecture deals with the industrial robot and service robot from a theoretical and practical angle. The robot system includes coordinate system, kinematics, inverse kinematics, dynamics, control and robot vision, software. The students

who finish this course could understand papers on robot, and apply his knowledge on the practical robot applications.

- **EO706 Advanced Microwave Circuit Design 3credits**

In the class, we will study about the fundamental theories of microwave passive and active circuits that are impedance matching, stabilization, and so on. Also, we will design the circuits with student's deep interest that are power amplifiers, low-noise amplifiers, mixers, filters, and so on which are the core components of RF transceiver.

- **EO707 Selective Topics in Semiconductor Engineering) 3credits**

In the class, we will study about behavior characteristics and nonlinear models of MESFET, HBT, HEMT, and so on after Advanced Semiconductor Engineering. And we will also study about the optimized circuit design technology using the CAD tools that are applied the models.

- **EO708 Selective Topics in Digital Signal Analysis 3credits**

The main objective of this course is to present some advanced concepts on digital signal processing, a field of study created by the great interest in the design and application of numerical algorithms resulting from the change in new signal processing technologies for the graduate students majoring in electrical and electronic engineering.

- **EO709 Selective Topics in Theory of Signal and Noise 3credits**

The goal of this course is to present some advanced principles of random signals and to provide tools whereby one can handle systems involving such signals. To achieve the goal of this course, they will learn some advanced concepts and methods regarding single random variables, expectation, moments, transformations of single random variables, multiple random variable, expectations of multiple random variables, Gaussian random variables, random process, stationarity, ergodicity, Independence autocorrelation, cross-correlation, Gaussian random process, power density spectrum, cross-power spectrum, estimation, and linear system analysis with random inputs.

- **EO710 Selective Topics in Communication Systems 3credits**

This course deals with analog and digital communication system advantages and disadvantages, analog and digital communication system classification, digitization of analog signals, and digital transmission systems, which are required in the field of analog and digital communication systems. Furthermore, for the graduate students, this course handles advanced digital communication applications such as wireless communications, optical communications, satellite communications.

- **EO711 Advanced Mobile and Satellite Communications 3credits**

This course deals with mobile and satellite communication systems advantages and disadvantages, mobile and satellite communication systems classifications. Furthermore, for the graduate students, this course handles next generation mobile satellite communication system related topics.

- **EO712 Special Topics on Image Processing 3credits**

This course introduces the advanced concepts and theories of image processing. Course topics include: image acquisition; enhancement; restoration; transformation; analysis; understanding; compression; image coding; visual C++ software and practical applications. The useful methods for the pattern recognition is neural network or fuzzy logics. Depending on the student's interest, topics will cover computer graphics and animations.

- **EO713 Advanced SOC Design 3credits**

A new digital system design method will be considered due to the development of computer system and semiconductor technology. The purpose of the class is to achieve and raise the capability of state of the art design methods for digital system and its application. UNIX system as a widely used operating system for design will be introduced. As a practical training of CAD software, the design method of digital logic circuit based on the schematic as well as VHDL will be carried out. For further understanding of VHDL, various circuit designs and simulations will be used and the verification of the circuit design can be done by composing the physical hardware. Students can design the suggested circuit by the CAD software.

- **EO714 High-Performance Microprocessor 3credits**

Microprocessors become the backbone of an information-oriented society because of widespread of personal computers and construction of networks. The purpose of this class is comprehensive understandings of hardware environment, operating system environment, software environment, and communication environment of microprocessor. The development processes of personal computer and its main components will be introduced as well as the open bus standards. The principles and differences of the Window operating system and LINUX will be discussed. Multi functions for installation and application of softwares in the operating system such as management of registry and dynamic links, DLL, OLE, and COM will be introduced and the principles, cons, and pros will be discussed. The class will prospects the communication environment of microcomputers and related programming lab will be accompanied.

- **EO715 Advanced Parallel Processing 3credits**

As an architecture of typical parallel processing computer, the architecture of multiprocessor systems which are classified shared memory multiprocessor and distributed memory multiprocessor will be studied. Also, software characteristic that fit parallel processing, programming techniques which fully utilize the parallelism in program and the requirements of Software development tool that ease development of such programs will be investigated. So in the lecture, parallel processing that is not only the high-performance hardware issue but also software-related issue will be studied. And actually, techniques of parallel processing program will be acquired by practice coding for parallel processing program.

- **EO716 Advanced Embedded System Design 3credits**

Microprocessor is exploited over everyday life and industry as a core component of microcomputer system and various Control Unit. In this lecture, in order to design of various Control Units and computer system, wide range of microprocessor and microcontroller will be introduced. The structure and operation of peripheral supporting units and peripheral devices will be investigated, and application design including software design for development of control program will be studied. Various examples that include from simple to complex problem using high-performance microprocessor/microcontroller will be studied and term-project that is to design control unit and to develop control program for real-world application will be carried out.

- **EO717 Advanced System Simulation 3credits**

The performance prediction, the problem analysis and the repletion by simulation and modeling become core process to develop new digital system. In this lecture, the basic and related subjects of modeling and simulation for digital system will be introduced. The modeling by AweSim, the performance prediction techniques by analysis of simulation result and the model improvement by analysis and repletion will be studied with practice. The operation of digital system will be studied in detail by simulation and the ability of simulation for application will be acquired by theory and practices.

- **EO718 Computer System Seminar 3credits**

The development of computer engineering is accelerated by the interdisciplinary work with diverse field. In the class, various topics will be discussed in detail by lectures of invited experts and seminars of students. The topics will include but not limited to the past, present, future of computer systems. Students will participate in the open discussion with lecturers to fully understand of the concepts dealing with within the classes. The computer hardware and software, the

development of communication environments, the prospect fields considered to be influenced to the advancement of computer engineering such as the genetic algorithms and the neural networks, the changes of social environment by the development and application of software, will be discussed in the class. Special lectures and individual seminars will cover many topics reflecting the industrial changes and development of computer engineering such as the leading technology in computer communication environment.

- **EO720 Special Topics on Radar Engineering 3credits**

The modern radar system demand the capability of non-cooperative target recognition(NCTR) as well as the detection and tracking of targets. NCTR technology is the one of the various pattern recognition techniques. This subject will handle the topics of feature extraction, classifier design, one-dimensional radar image, two-dimensional radar image such as SAR (Synthetic Aperture Radar) and ISAR (Inverse SAR), etc. The students should have a programming skill using Matlab or C language.

- **EO721 Advanced Electromagnetics 3credits**

This class handles the advanced electromagnetics based on the undergraduate level field theory. The scope of topics are the Maxwell equation, electrical property of matter, Green's function, wave equation and its solutions, wave propagation and polarization, reflection and transmission, scattering, etc. Prerequisite for this course is a basic field theory and microwave engineering.

- **EO722 Selected Topics in Advanced Communication Networks 3credits**

The areas of the computer and communication networks are changing rapidly. In this subject, one of the state of the art research topic is selected and discussed in advanced level. The topic may be one of the following areas including the Next Generation LANs, wireless networks, all-optical networks, Satellite networks, and New Generation Internet protocols.

- **EO723 Data Converter Design 3credits**

A mixed-signal data converter circuit design will be covered in this course. Capacitive/Resistive array digital-to-analog converters and analog-to-digital converters including flash ADCs, pipelined ADCs, SAR ADCs and delta-sigma modulators will be studied in this lecture. Also, recent low-power circuit design methodology will be covered by dealing with recently introduced low-power data converters.