**Department of Electronic Engineering**

**전자공학과**

**1.Department Introduction**

- Department of Electronic Engineering provides the opportunity of leading the future convergence technology in the area of IT, BT, NT, AI guaranteeing strong industrial links and high prospects after graduation.

- ABEEK Accreditation and qualify assurance of curriculum which ensures professional training and strong theoretical basis

- Participating in Leading in Industry-University Cooperation (LINC) Program

**2.List of Faculty Members**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Position | Name | Last School Graduated | Degree | Major |
| Professor | Park, Jung-il (박정일) | *Seoul National University, 1989* | *Ph.D* | Automatic Control Theory & System |
| Professor | Han, Kyo-Yong(한교용) | *Colorado State University, 1992* | *Ph.D* | III-V Optoelectronic Devices, Organic TFTs, Solar Cells |
| Professor | Ahn, Chang-Hoi (안창회) | *KAIST, 1992* | *Ph.D.* | Electromagnetic Wave Engineering |
| Professor | Suh, Youngsuk (서영석) | *POSTECH, 1995* | *Ph.D.* | Circuits and System, LED Driving Circuits |
| Professor | Seong, Kwang-Su (성광수) | *KAIST, 1997* | *Ph.D.* | VLSI Circuit & System Design |
| Professor | Lee, Chan-Su (이찬수) | *Rutgers University, 2007* | *Ph.D.* | Computer Vision, LED Lighting Control System |
| Professor | Kwon, Jae Kyun(권재균) | *KAIST, 2003* | *Ph.D.* | Mobile Communications, LED Communications |
| Professor | Jung, Sung-Yoon(정성윤) | *KAIST, 2006* | *Ph.D.* | Communication Signal Processing, Ubiquitous Communication |
| Professor | Park,Si-Hyun  (박시현) | *Seoul National University, 2004* | *Ph.D.* | Optical Semiconductor Device Design & Measurement |
| Associate Professor | Kim, Sungho (김성호) | *KAIST, 2007* | *Ph.D.* | Computer Vision, Deep Learning |
| Associate  Professor | Choi, Hyun-Chul  (최현철) | *POSTECH, 2011* | *ph,D.* | Computer Vision, Machine Learning |
| Associate Professor | Yang, Jong-Ryul  (양종렬) | *KAIST, 2009* | *Ph. D.* | RF/Millimeter-wave/Terahertz-wave Circuits and Systems |
| Assistant  Professor | Kwon, Nam Kyu  (권남규) | *POSTECH, 2017* | *ph,D* | Nonlinear Control |

**<Professors>**

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Professor

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Automatic Control Theory & System

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**3. Academic programs**

Master of Science in Electronic Engineering

Doctor of Philosophy in Electronic Engineering

**4. COURSE DESCRIPTION**

VLSI시스템설계특론 3credit

(SPECIAL TOPICS ON DESIGN OF VLSI SYSTEM)

This course covers design of full custom datapath for high performance microprocessor. The data to be processed on the microprocessor are usually processed on the datapath which consists of adder, shifter, multiplexer, flip flop and so on. For practice, we will design full custom datapath for 8bit microprocessor.

디지털신호처리응용 3credit

(SPECIAL TOPICS ON DIGITAL SIGNAL PROCESSING)

We consider the definitions of continuous-time signals and discrete-time signals and their spectrum representations. It is important to understand the Nyquist sampling theorem especially when the continuous-time signals are sampled to provide discrete-time signals. We also study about the basic definitions and structures of FIR and IIR filters, and their applications to the filter design problems. To understand the spectrum representations, the Fourier transform, Fourier series, DTFT (Discrete-Time Fourier Transform), and DFT (Discrete Fourier Transform) are studied with a particular emphasis on their inter-relations. Most of the algorithms needed to realize the digital signal processing are implemented using the MATLAB language, and the assoicated results are analyzed.

마이크로컴퓨터설계 3credit

(DESIGN OF MICROCOMPUTER SYSTEM)

This course covers design of microcomputer system which consists of microprocessor and IO system. We will discuss about pipeline, superscalar and branch prediction to increase performance of microprocessor, and also discuss about PCI and 3GIO(3rd generation IO) to increase performance of IO system.

반도체디바이스 3credit

(SEMICONDUCTOR DEVICES)

The purpose of this topic is to acquaint the student with the nature of semiconductors, conduction process in semiconductors and the electromagnetic properties of a various type of semiconductor devices and its applications. Topics include a brief introduction of quantum concepts, conduction process in semiconductors, the p-n junction and some of its applications, the transistors and their applications and the principles of integrated circuits,

전자장론 3credit

(ELECTROMAGNETIC FIELD THOERY)

Goals,

To provide the student with a basic background on electromagnetics and the understanding of what electromagnetic waves, scattering and differaction.

Topics,

- Maxwell Equations

- The Basics of Electromagnetic Wave

- Wave Scattering and Differaction

- Solutions of Wave Equation

전자회로설계 3credit

(DESIGN OF ELECTRONIC CIRCUITS)

This course covers analysis and design of electronic circuits using BJT and CMOS. We will discuss about DC bias circuit and AC model, and also discuss about design of amplifier.

개별연구(1) 3credit

(INDEPENDENT STUDY (1))

This course is offered to make it possible for a master's degree student to thoroughly investigate a topic related to his or her research interest.

개별연구(2) 3credit

(INDEPENDENT STUDY (2))

This course is offered to make it possible for a master's degree student to thoroughly investigate a topic related to his or her research interest.

전자공학과세미나 3credit

(SEMINAR)

The course covers various topics related to the recent research trends in communication, signal processing, image processing and computer vision, LEDs, optical design and so on.

특수문제연구(1)

(SPECIAL STUDY(1))

The goal of this course is to introduce a newly emerging research topics. The class may be offered jointly with another departments.

특수문제연구(2)

(SPECIAL STUDY(2))

The goal of this course is to introduce a newly emerging research topics. The class may be offered jointly with another departments.

LED공학특론 3credit

(ADVANCED LIGHT-EMITTING DIODE ENGINEERING)

Recently, light-emitting diodes (LEDs) have achieved much attention for the applications of back-light units of liquid crystal display, light source of automobiles, large size exterior displays, mobile displays, and general lighting. In this course, the theories on semiconductor physics and optics, fabrication process and characterization methods for the LEDs will be lectured. Furthermore, this course will provides the recent research results and trends for the LED technologies and convergence technologies of LEDs with information, environment, biology.

고체전자공학특론 3credit

(PHYSICS OF SOLID-STATE ELECTRONICS)

This course covers basic quantum mechanics and extends its coverage to solid-state crystallography, theory of energy bands, quantum electronics, lattice kinetics, scattering and motion of charge carrier, etc.

광전자공학 3credit

(OPTICAL ELECTRONICS)

This course covers basic theory and applications of optoelectronic components such as planar waveguides and optical fibers, modulators, photodetectors, LEDs, and LASERs. Special emphasis on the physics and design considerations of optoelectronic semiconductor devices are considered.

디스플레이디바이스 3credit

(DISPLAY DEVICES)

This course introduces display devices, including CRT, LED, LCD, PDP, EL, Organic EL, and micro mirror. The fundamental theories and applications of each devices are investigated.

디스플레이시스템 3credit

(DISPLAY SYSTEM)

This course discusses display devices, digital systems for display, and display interface. Projection display, head mount display(HMD), 3D display, and flexible display are introduced.

디지털영상처리3credit

(DIGITAL IMAGE PROCESSING)

Lectures on the representations of images, image processing systems, enhancement, morphology, transform coding, image restoration, compression, JPEG, MPEG, region and growing.

디지털제어시스템 3credit

(DIGITAL CONTROL SYSTEM)

This course deals with a linear discrete-time dynamic systems analysis, digital filters, sampled-data systems, design of digital control systems, state space methods, quantization effects.

디지털통신 3credit

(DIGITAL COMMUNICATION SYSTEMS)

Lectures on the modulation and demodulation systems for the baseband signal, band pass signal, ASK,FSK, PSK, M-ary ASK, FSK, PSK, error probability, multiplexing, spread spectrum systems, fading channel, statistical decision, and OFDM systems

랜덤신호처리 3credit

(RANDOM SIGNAL PROCESSING)

We understand the definitions of random variables and random vectors, and the associated mathematical background. The concept of discrete-time stochastic process is studied together with its applications. We consider the linear signal models including the all-pole model, all-zero model, pole-zero model, and their applications. The innovation and estimation methods are studied to design various filters and estimators. In addition, the non-parametric power spectrum estimation techniques are surveyed.

레이더공학 3credit

(RADAR ENGINEERING)

Radars have been originally developed for military purposes, but recent progress has been focused on non-military purposes such as the automobile applications. Modern radars can not only detect and locate targets of interests, but also generate 1-D and 2-D radar images.

This course focuses on the subjects such as basic principles of radar operation, detection and estimation of target and its location, as well as image generation principles.

마이크로파응용 3credit

(MICROWAVE ENGINEERING AND ITS APPLICATION)

Goals, To study several topics such as diffacrtion and scattering, guided wave, micorwave passive devices, and radar system. And provides the student with experiences about these applications.

마이크로파회로설계3credit

(MICROWAVE CIRCUITS DESIGN)

This course deals with microwave resistor, inductor, capacitor, BJT, FET and microwave amplifier, mixer, and oscillator.

박막공학 3credit

(THIN FILM ENGINEERING)

Thin film technology gives a very important role to develop semiconductor devices, functional devices and new materials made of insulators, semiconductors, metals and organic materials. Thin film fabrication technology is especially important process in VLSI. This course deals with thin film materials, the kind of thin films, various thin film fabrication techniques. characterization methods and applications of thin films.

비선형시스템이론 3credit

(NONLINEAR SYSTEM THEORY)

This course deals with Lyapunov approach and Operator-theoretic approach to the stability analysis of nonlinear control systems, classical methods such as phase plane method, describing function method, Lyapunov direct & indirect methods, and Popov/circle criteria Modern methods such as singular perturbation technique, feedback liberalization technique, robust H∞control, robust Lyapunov redesign, and sliding mode control.

생체전자공학 3credit

(BIO-ELECTRONIC ENGINEERING)

This course introduces the various electrical phenomena of bio-signals that occur in a living body. And students must study the measuring method, electronic circuits and systems that process the biological signals.

Especially, this course introduces the basic concept of bio-medical engineering, and the application of medical sciences.

선형시스템이론 3credit

(LINEAR SYSTEM THEORY)

This course deals with basic mathematics in linear space and algebra, dynamical system, fundamental matrices and state transition matrix, controllability and observability, stability issues, interconnection methods, canonical structure, stabilizable and detectable systems, Observer design methods.

센서및엑쥬에이터 3credit

(SENSORS AND ACTUATORS)

Sensors and Actuators are very important systems to catch and analyze physical, chemical and biological informations. Recently, IT(Information Technology) and BT(Bio-Technology) accelerate the development of a various of sensors and actuators. The aim of this course is to provide an understanding of fundamental principles and applications of sensors and actuators. Topics are the kind of sensors, characteristics, applications for sensors; the kind of actuators, mechanism and applications for actuators.

센서시스템특론 3credit

(SPECIAL TOPICS FOR SENSOR SYSTEM)

Sensors are the interface devices between various physical values and electronic circuits that understand moving electrical charges. Sensors which are a are essential components in any electronic systems that uses a digital signal processors which are used in modern electronic system. The processor is a device that manipulates binary codes generally represented by electric signals. Yet, we live in an analog world, where such devices function among objects that are mostly not digital. This course deals with the sensor chips for detecting various physical values and intelligent-sensor-system measuring, and processing the information from the outside world.

아날로그집적회로 3credit

(ANALOG INTEGRATED CIRCUITS)

Sensors and Actuators are very important systems to catch and analyze physical, chemical and biological informations. Recently, IT(Information Technology) and BT(Bio-Technology) accelerate the development of a various of sensors and actuators. The aim of this course is to provide an understanding of fundamental principles and applications of sensors and actuators. Topics are the kind of sensors, characteristics, applications for sensors; the kind of actuators, mechanism and applications for actuators.

양자물리전자 3credit

(QUANTUM PHYSICAL ELECTRONICS)

Through Quantum Physical Electronics we learn basic theory of quantum mechanics and then learn solid state physics and electronics inside it in addition to various electronic devices.

이동통신공학특론 3credit

(SPECIAL TOPICS ON MOBILE COMMUNICATIONS ENGINEERING)

This course covers essential topics of mobile communications for students who have basic knowledge on mobile communications by taking lectures on digital communications and mobile communications. This course includes OFDM, channel codes, MIMO, link adaptation, and introduction of recent technologies.

전자세라믹재료 3credit

(ELELTRONIC CERAMIC MATERIALS)

This course provides understanding about electronic devices and materials constituting the devices to the students. Therefore, it helps to promote the students to understand the advanced electronic circuits and systems; furthermore it will enhance the ability of students to investigate new functional and next generation electronic devices. This lecture will cover the insulating, semiconducting, conducting, dielectric, piezoelectric, thermoelectric, and magnetic materials for electronic, optoelectronic, and sensor devices.

전자파해석특론 3credit

(ADVANCED ANALYSIS OF ELECTROMAGNETIC WAVES)

Goals,

To provide the student with an understanding of recent methods for analysis of Electromagnetics, and how they are used in the analysis of electromagnetics.

Topics,

- recent techniques for EM wave analysis.

- state-of-art numerical method

집적회로공학 3credit

(INTEGRATED CIRCUIT ENGINEERING)

Theory and practice of basic silicon processing including photo-lithography, oxidation, diffusion, thin film deposition, ion implantation, packaging, yield, an process integration. Process simulation techniques.

컴퓨터비전응용 3credit

(COMPUTER VISION AND ITS APPLICATIONS)

As many camera-based application systems are developed, it is required to know techniques for image acquisition, image processing. In this class, basic computational methods for modeling, motion analysis, and pattern recognition are covered. Recent advance in pattern recognition and machine learning are also discussed.

패턴인식및머신학습 3credit

(PATTERN RECOGNITION AND MACHINE LEARNING)

Pattern Recognition and Machine Learning are very important technique for signal processing, image processing and computer vision. Therefore, we need to have a class that can focus on this topic and learn intensely in this field. This class provides basic methodology of pattern recognition and recently advanced techniques in pattern recognition.

In addition, machine learning techniques are frequently applied for pattern recognition and its imporance grows. So, students will basics of machine learning techniques and apply machine learning techniques for pattern recognition. During the class, students will plan and execute term projects with real pattern classification data.

푸리에광학 3credit

(FOURIER OPTICS)

Through Fourier Optics we learn optics based on the Fourier transform and linear systems and then learn its application in the area of optoelectronic technologies, including lasers and holography. physiology, and post-harvest and disease management through studying advanced scientific topics about pomology.

하드웨어설계언어 3credit

(HARDWARE DESCRIPTION LANGUAGE)

As the number of transistors integrated on a single chip are enormously increased, C-like hardware description languages such as Verilog and VHDL are suitable to effectively design VLSI and are used instead of schematic capture. In this course, we will discuss about syntax and usage of Verilog.

현대제어이론 3credit

(MODERN CONTROL THEORY)

This course deals with one of the optimal control theory, system identification theory, adaptive control, fuzzy system, neural network, instrumentation for system control.

고급선형대수 3credit

(Advanced Linear Algebra),

It reviews basic knowledge such as matrices and determinants, linear equations, vector spaces, eigenvalues and eigenvector problems, and deals with the special matrices such as Hermitian matrices, unitary matrices, and positive definite matrices, matrix factorization problems, linear transformations, linear matrix inequalities (LMIs).

추정론 3credit

(Linear Estimation Theory)

It reviews basic knowledge such as linear algebra/probability and random process, deals with the relationship of Equivalence, Duality, and Complementaryness along with the LS Problem, and deals with Kalman Filtering, SQ Algorithm, and other various filtering methods.

자동차조명과인간공학 3credit

(Human Factors for Automotive Lighting)

With the advent of self-driving cars, the role of automotive lighting is expected toshift from simple lighting to display. In the automotive lighting as a display device,the influence of lighting to the relevant people including drivers and interface aswell as regulations are exptected to become important. Therefore, it is necessary tounderstand the human factors of automotive lighting and to learn the foundations forthe future automotive lighting. In part 1, the basic understanding on the humanfactors and the research methods will be considered. In part 2, experimental methodsand approaches of human factors related to the lighting will be examined. Part 3 willdeal with the elements of human factors in vehicles and automotive lighting.

고급딥러닝 3credit

(Advanced deep learning)

This course provides an introduction to deep learning techniques for computer vision (artificial intelligence neural networks, mathematical basics for deep learning). In addition, this course handles convolutional neural networks, basic methods applied to visual recognition problems such as object detection, recognition, and tracking in a Python/Pytorch development environment.

It introduces the latest research topics such as multi-sensor image fusion, causal/correlated XAI, Bayesian deep learning, GAN, etc. Also, real-world problems are solved by implementing a real deep neural network based on this understanding.

논문대체

(Non-Thesis Project)

The thesis writing is waived if an SCI journal paper is published or accepted.