Course Description (전체 개설 교과목 개요)

-공통 교육 과정

Linear System Theory
Study linear model analysis in the physical world, the state variables and state equations, controllability and observability state feedback and state estimation, stability, system implementation of the minimum order.
Electromagnetic Field Theory
After the static field theory is studied based upon the uniqueness theorem, solution of the Maxwell's equations for time varying electromagnetic field and scattering characteristics on the conductor and dielectric boundary surface (i.e. electromagnetic field theory) are dealt with.
Probability and Random Process
Learns a probability density function, expected value theory to analyze the results of some experiments with probabilistic. Try research for such a random signal and a power density function to expand the time axis.

-반도체 및 회로설계 그룹 (Group of Semiconductor and IC Design)

Physics of Semiconductor Devices
This course introduces the properties of semiconductor materials and describes the electrical characteristics of basic semiconductor devices.
Fabrication Process of Integrated Circuits
This course provides the processing steps for semiconductor device fabrication and the problems of modern CMOS technologies. The process solutions for these problems are discussed.
Integrated Circuit Engineering(1)
This course provides mathematical formulation of the physically based models of semiconductor devices. By using suitable approximations, mathematical equations of the physically based models are simplified to a degree that closed-form analytic solution exit.
Digital Integrated Circuit

This is an introductory course which covers basic theories and techniques of digital VLSI design in CMOS technology. Issues to be covered include the fundamental concepts and structures of CMOS devices and circuits, standard CMOS process, static and dynamic logic structures, sequential circuits, low power techniques, design for testability and various building blocks such as adders, multipliers, ROM and RAM.
Computer Arithmetic
Computer arithmetic is a subfield of digital computer organization. It deals with the hardware realization of arithmetic functions to support various computer architectures as well as with arithmetic algorithms for firmware/software implementation. A major thrust of digital computer arithmetic is the design of hardware algorithms and circuits to enhance the speed of various numeric operations. Thus much of what is presented in this course complements the architectural and algorithmic speedup techniques. This course provides standard and unconventional number representations, design of fast two-operand and multioperand adders, high-speed multiplication and division algorithms, and floating-point numbers.
SoC Architecture
This course forms a foundation in the understanding and design of system on a chip (SoC). Building on a computer organization base, this course explores techniques that go into designing a SoC. This course explores how the computer architect can utilize the increasing number of transistors available to improve the performance of a processor. Focus will be given to architectures that can exploit different forms of parallelism. This course also covers memory subsystem, peripheral devices, interconnection networks, and debugging features
SoC Design Methodology
A current-day system on a chip (SoC) consists of several different microprocessor subsystems together with memories and I/O interfaces. This course covers SoC design and modelling techniques with emphasis on architectural exploration, assertion-driven design and the concurrent development of hardware and embedded software. This is the front end of the design automation tool chain
Special Topics in Semiconductor Devices
This course provides the operation principles of the latest semiconductor devices with new functionality.
Integrated Circuit Engineering(2)

This course provides physically based models of deep submicron semiconductor devices and control of electrical characteristics(threshold voltage, breakdown voltage, on/off currents, current gain) in deep submicron semiconductor devices. The various device structures in deep submicron semiconductor devices are discussed.
Micro Electro-Mechanical Systems
The course is an introduction to the various micromachining techniques used to fabricate MEMS devices and the operation principles of several MEMS devices.
Full Custom Design
This course focuses on the full-custom design flow used for both analog and digital circuits. Issues to be covered include CMOS fabrication technologies, full-custom layout designs, EDA tools and design verification covering the full-custom design of CMOS integrated circuits. In addition, a variety of trade-offs in full-custom design such as circuit style will be discussed.
Advanced Display
The course introduces the driving principles and fabrication technologies of flat panel display(FPD). The current technology trends in the FPD are described.
Advanced Solid-State Electronics
This course provides quantum mechanics in solids, carrier transport theories, and optical absorption and emission of a photon. The basic principles of several semiconductor devices are discussed.
Image Sensor and Camera System
In this subject, we will learn how to design the image sensor and deal with comprehensive technology of the camera system.
Advanced Image Sensor
This subject will introduce various application of the image sensor and deal with the latest theory and technology.
Sensor Technology
This subject will introduce various sensors for obtaining physical and chemical quantities such as temperature, image, light, pressure, gas, flow, proximity, bio, and so on) and their applications.
Sensor Interface Circuit)

This subject will deal with the design of the interface circuit (signal conditioning circuit, ADC, DAC, and so on) for processing the analog output signals of various sensors.

-디지털 신호 및 영상처리 그룹 (Group of Digital Signal and Image Processing)

Digital Signal Processing
This course covers theories and practices of digital signal processing. In the first part, the concepts of digital signals and systems in the time and frequency domains such as introduction of basic signals, convolution, sampling, DTFT, DFT/FFT, and z-transform are studied. In the second part, it introduces the design of digital filters and their applications.
Digital Filter Theory
This course introduces simply the general concepts of digital signals and systems, and provides mainly the theory and design of digital filters such as FIR and IIR. It also covers diverse applications of the digital filters in various areas to improve practical ability.
Advanced Digital Signal Processing
This course deals with statistical signal processing, multirate signal processing, spectral estimation, and linear prediction as an advanced course in digital signal processing,
Biomedical Signal Processing
This course introduces various signal processing methods to analyze biomedical signals such as electroencephalogram (EEG), electrocardiogram (ECG), and electromyogram (EMG), and etc. Major topic includes signal analysis in both time and frequency domains, design of FIR/IIR and adaptive filters, and application these methods to the biomedical signals.
Special Topics on Signal Processing
This course briefly analyzes various applications such as communication, audio, video, radar, ITS, and seismic observation systems, and also studies on designing, analyzing and improving the project-centered aspects of signal processing by selecting topics according to the latest technology trends.
Image Processing
The purpose of this course is to introduce some basic image processing theories such as image enhancement, restoration, segmentation, transformation and filtering methods. It also covers various techniques of image processing such as edge detection, particle analysis, pattern matching, and etc.

Adaptive Digital Signal Processing
The characteristics of the practical signals are often unknown and/or time-varying. The adaptive signal processing methods are required to handle these uncertainties. This course studies theories of adaptive signal processing including gradient searching methods, LMS and RLS algorithm, etc. and also covers the design of adaptive digital filters and their applications.
Special Topics in Image Processing
This course introduces the topics that are not taught in the regular courses and that are related to the current interests and trends. It also covers recent topics of digital image processing published on various journals.
Biomedical Image Processing
This course introduces some basic principles of CT(Computed Tomography), MRI(Magnetic Resonance Imaging), Ultrasonic scanning apparatus, and etc. It also studies various techniques on image improvement, analysis, segmentation, classification, compression, 3D representation for medical images.
Advanced Adaptive Signal Processing
This lecture studies theories such as adaptive array signal processing, nonlinear adaptive filter, blind identification, adaptive beamforming, and analyzes mobile communication, radar, and various applications.

-전파통신공학 그룹 (Group of Radio Communication Engineering)

Theory of wave propagation
The theory of radiation and scattering problem of electromagnetic wave is studied based upon understanding of wave propagation phenomena.
Numerical Analysis of Electromagnetics
The finite difference method (FDM) and finite element method are studied as numerical methods for obtaining solutions of electromagnetic boundary value problems. And also the moment method (MoM) is dealt with for obtaining solutions of integral equations.
Advanced Microwave Theory

This course provides a understanding on the principle of operation and analysis of Microwave oscillator, amplifier and mixer based on scattering matrix.
Microwave Circuit
This course provides a understanding on the characteristics of microwave frequency active component. And amplifiers which are low noise, broadband and high power will be introduced.
Antenna Engineering1
The equivalent circuit and various characteristics of antenna are studied based upon the fundamental theory of antenna.
RF Analog Integrated Circuit
This course provides a understanding on the basic theory, simulation and layout of COMS analog integrated circuit. Also, RF characteristic of components and design methods of function block, comparator, operational amplifier, switched-capacitor circuit and ADC/ DAC will be introduced.
Electromagnetic wave propagation engineering
The electromagnetic waves are classified into direct wave, reflected wave, ground wave, refracted wave and scattered wave according to propagation path. In this course, characteristics of these waves are considered for frequency band and electromagnetic noise.
RFIC Design
This course provides a understanding on the RFIC design method of passive and active components, VCO, Mixer, LNA based on CMOS technologies.
Satellite Communication
This course helps students to learn the technical elements of satellite communications such as communications network and services, geometry of the geostationary orbit, S/N calculation of the satellite RF link, multiple access techniques(TDMA, FDMA and CDMA) modulation method and understand the functions of satellite transponders and earth station.
Radar Engineering
This course provides a understanding on the analysis methods and configuration of radar signal, various radar characteristics and special radar.
Antenna Engineering2)

Design and fabrication of planar antennas such as microstrip patch and slot antenna are studied based upon the theory studied in the course of antenna engineering1.
Microwave Measurement
This course provides a understanding on the measurement methods of microwave power, impedance, S-parameters, effective dielectric constant and transistor S-parameter.
Microwave Devices
This course provides a understanding on the linear and nonlinear circuit design method of high speed passive and active semiconductor components and tube based on basic microwave circuit theory.
Microwave Filter design
This course provides a understanding on the microwave filter design method of Butterworth, Chevyshev and Elliptic type. Also, various filter design using Inverter will be introduced.
Microwave Amplifier Design
This course provides a understanding on the small signal amplifier design method of single transistor, low noise and balanced type. Also, the linearization methods of predistortion and feedforward will be introduced.
Microwave Communication System
This course provides a understanding on the networking and system design methods of satellite, wireless and multi-media communication based on analog and digital communication theory.
Electromagnetic scattering analysis
After the analysis method for electromagnetic scattering problem is dealt with, scattering phenomena for tetragonal, cylindrical, spherical conductor as well as periodic structure are studied.
Field and Wave theory1
The modal analysis and transmission line method for waveguide with arbitrary shaped cross section are dealt with.
Field and Wave theory2
The guided wave theory for conductor and dielectric waveguide is dealt with based upon the theory studied in the course of field and wave theory1.
Application of Microwave

This course provides a understanding on the design methods of microwave integrated circuit, ferrite components, mixer and oscillator.
Non-linear Microwave Theory
This course provides a understanding on the nonlinear microwave theory of microwave transistor and diode and mixer and frequency multiplier.
Antenna System Design
In this course, design and fabrication for various antennas are performed. And also antenna system for mobile communication as well as phased array antenna are studied.
Topics in Radio Engineering
This course provides a understanding on the EMI/EMC of RF cirucit and electronic equipments.

-제어 및 시스템 그룹 (Group of Control and System Engineering)

Neural Network
This course covers neural network model, Hopfield network, Boltzmann machine, backpropagation algorithm, analysis and design of learning algorithm, examples and applications of neural networks.
Power Electronics
Power conversion circuits and systems are discussed with the specified focus on harmonic analysis, Fourier analysis, PWM controller, and drives for AC and DC motors.
Robotics
Kinematic equations for robot manipulators, Velocity Kinematics for robot manipulators, Static Forces, Robot dynamics, Trajectory planning, Robot simulation, robot applications.
Advanced Power Conversion System
Advanced topics for power conversion systems are discussed. Soft switching techniques for high power density implementation of converter system are described. Resonant converter and phase-shift converters are included.
Advanced Digital System Design

This lecture deals with the design of various logic circuits, the problem of speedup, the special purpose digital filter, the special problem on the analysis and design of small computer.
Special Topics in Power Electronics
The topics on recent trends in the field of power electronic engineering are discussed. The examples are solar power system, wind power system, electric vehicles, and medical power supply.
Intelligent Robot
Kinematics and dynamics for mobile robots, Intelligent robot system, Sensors for intelligent robots. Robot languages, Application of intelligent robot system.
Advanced Robotics
Multivariable control, Force control, Feedback linearization, Modern control
Power System Stability
This course deals with the theory of stability of power system. Students learn analytical models of synchronous generators in steady state and transient states, and learn transient and small signal stability analysis. Students will learn active power control and reactive power control with power system control technique.
Power Quality in Electrical Systems
This course deals with dynamic phenomena occurring in power system. Students discuss how to analyze and mitigate harmonic problems in power systems. In addition, students will understand the problems of power quality and learn techniques and equipment to solve them.
Programming for Robotics
This course gives an introduction to the Robot Operating System (ROS) with the various tools that are commonly used in robotics. Firstly, Students learn Git (version control system) and Linux programming basic. And then, students learn ROS architecture, how to interface the individual sensors, and how to simulate with ROS.

-통신 및 네트워크 그룹 (Group of Communications and networks)

Error Correct Coding Theory
This course provides a basic principle of channel encoding and decoding.
Mobile Communication
Introduce the concepts of wireless / mobile communication using cellular environment. Make the students to know about the various modulation techniques, propagation methods, coding and multi access techniques used in the mobile communication. Various wireless network systems and standards are to be introduced.
Information Theory
This course provides a information theory in the aims of compression and decompression.
Computer Network and Applications
Introduction to networks and digital communications with a focus on Internet protocols: Application layer architectures and protocols, Transport layer operation, Network layer operation, Data Link layer, Physical Layer. Some selected current topics such as security, multimedia protocols, Quality of Service, mobility, wireless networking, emerging protocols, network management, and network applications.
Filter Theory
This course provides an analog and digital filter theory for digital communications.
Optical Networks
This course provides an optical communication including wired and wireless technology.
Broadband Communication
This course provides a high speed and broadband networks and relevant applications.
Spread Spectrum System
This course includes the fundamentals of key technologies for spread spectrum systems such as DS, FH, and TH.The comparision between the systems is also studied in this course.

Digital System Design
This course provides digital systems and their applications.
Digital Communication System Design
This course provides the theory and practical applications of receiver and transmitter of digital communications.
Industrial Network System
This course provides fault tolerant networks in the field of industrial applications.
Real Time System
This course provides basics and theory for industrial networks and fieldbus system.
Analog Communication System
This course provides analog systems and their applications.
Embedded Software Programming
This course mainly focuses on intelligent imbedded systems in real aspect.
Special Topics In Embedded System
Educate special challenge project for small embedded system design and application in wired and wireless communications, image processing and intelligent control area.
Next Generation Mobile Communication System
This course provides a broad and comprehensive perspective on the evolution to next generation wireless networks especially on 5G. Major 4G enabling technologies such as OFDM and MIMO are examined first. Expectations on 5G are introduced. And major Radio Access Technologies (RATs) which are candidates for 5G such as Massive MIMO, NOMA, etc will be examined.
Communication Network Analysis
This course provides quantitative understanding on computer and communication network based on probability, stochastic process, and queueing theory. And gives some opportunities to use network

simulation tools such as NS2/3, OPNET, and matlab.
Communication Security
This course provides technologies used to provide secure transport of information across networks. Specific topics include symmetric-key and asymmetric-key cryptography, authentication, digital signatures, digital certificates, and network security such as E-mail security, IP security, and Web security.
Simulation of Communication System
This course provides network programming simulation with Java and C++.
Topics in Communication System
This course provides a special lecture regarding the-state-of-the-art communications.
Queueing Theory
This course provides a queueing theroy to analyze the networks.
Signal Detection and Estimation Theory
This course provides a signal detection and estimation theory based on the random process.
Advanced HDL Design
This course provides an advanced HDL design lecture.
Deep Learning
This course improves understanding and application of instructional and non-instructional learning, and also learn about linear regression, support vector machine, nearest neighbors, CNN(Convolutional Neural Network), RNN(Recurrent Neural Network), autoencoder, and GAN.