**DEPARTMENT OF INFORMATION AND COMMUNICATION ENGINEERING**

**정보통신공학과**

**1.Department Introduction**

■ About ICE

The graduate school in the department of information and communication engineering was established in November, 1999. The infrastructure of our school, which was constructed by receiving several big grants from the Ministry of Information and Communication, is the state of the art facilities in Korea. Especially, our graduate school was named is in ITRC (2000-2007, 2016~), BK21+(2013~) by highly recognizing research and education in our graduate school and is now performing the state of the art research with the best research environment in Korea. We have been actively participating in the national engineering innovation programs, such as BK21, NURI, NEXT, etc.

■ Research

Our graduate school is performing the world-best research, focusing on multimedia information processing, high-speed communication network and next-generation Internet, and wireless and mobile communication. The detailed research areas are next-generation Internet, software platform technology, wireless and mobile communication, high-speed communication system and its material technology, audio, image and video signal processing (MPEG-1, -2, -4 and H.26X), embedded systems, storage systems, network security and cryptography.

■ Education

The goal of our graduate school is to develop practical skills, to develop specialized skills and to be an international expert. To develop practical skills, we teach advanced information and communication technology, co-work with industries, and foster creative entrepreneurship. We focus on develop specialized skills through in-depth education with experiments, and research on the future information and communication areas. To be an international expert, we encourage international exchange programs, and international research projects, and international researcher exchanging programs.

**2.List of Faculty Members**

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| --- | --- | --- | --- | --- |
| Position | Name | Last School Graduated | Degree | Major |
| Professor | Young-Tak Kim  | KAIST | Ph.D. | - Internet of Things (IoT)- Smart Engineering with IoT- QoS-guaranteed service provisioning in next generation network (NGN) |
| Professor | Yongwan Park | SUNY@Buffalo | Ph.D. | - 5th generation mobile communication system and service- Wireless Multimedia system design technology- Next Generation Location Based Service- Smart Vehicle |
| Professor | Ho-Youl Jung  | INSA de Lyon | Ph.D. | - Image signal processing- Deep-Learning- Camera/Lidar based Object Recognition- Autonomous vehicle  |
| Professor | Kook-yeol Yoo  | KAIST | Ph.D. | - Standard video compression (MPEG-x, H.26x)- M/M communication over Internet and control method- M/M compression and communication over mobile terminal  |
| Professor | Kwonhue Choi  | POSTECH | Ph.D. | - Digital Communications- Mobile Communications - Wireless Communications- Satellite Communications |
| Professor | Sung Won Kim  | SNU | Ph.D. | - Wireless networks- Mobile networks- Embedded system  |
| Professor | Seung Yeob Nam  | KAIST | Ph.D. | - Network Measurement(Monitoring) and Management- Traffic Engineering- Network Security- Network Performance analysis- Wireless Network |
| Professor | Gyu Sang Choi  | PennState | Ph.D. | - Big Data - Data Science |
| Associate Prof. | Jin-Ghoo Choi | SNU | Ph.D. | - Mobile and Wireless Networks- Wireless Sensor Networks |
| Associate Prof. | Heejung Yu | KAIST | Ph.D. | - Wireless Communications and Networks- Stochastic Signal Processing  |
| Associate Prof. | Wooguil Pak | SNU | Ph.D. | - Network/System Security- Machine-Learning based Intrusion Detection System |

**3.Academic programs**

■ Degrees Offered

Master

Ph.D.

■ Major tracks

- Communication systems

- Computer networks

- Embedded systems

- Multimedia signal processing

**4.Course Description**

■ 기초공통(Basic Major Courses)

고급프로그래밍 3 credit

(Advanced Programming)

This course covers the advanced techniques to design and implement the telecommunication system and telecommunication protocol software in object-oriented concept. The contents of lecture includes following issues:

- Object modeling

- Dynamic modeling & functional modeling - Design methodology

- System design & object design

- From design to implementation

- Programming style

- Object-oriented language vs. Non-object oriented languages

- Relational databases

- Term projects: Applications & Experimental Labs.

임베디드시스템응용 3 credit

(APPLIED EMBEDDED SYSTEM)

This course studies the systematic design methodologies for an embedded system consisting of both hardware components and software components. We also verify and practice the design methodologies with a simple real embedded system. It also covers the optimized system implementation with efficient partitioning of a system into software components and hardware components.

정보통신융합설계 3 credit

(CONVERGENCE DESIGN WITH INFORMATION AND COMMUNICATION TECHNOLOGY)

This course covers the basic issues in systematic convergence designs for various applications with information and communication technology. Especially, the basic knowledge of information and communication engineering, such as computer network and embedded system, are studied at first stage. Also, this course covers the step-by-step systematic approaches in convergence design with signal processing, mobile communication, system and network security for various applications, such as cloud computing, smart vehicle, smart grid, energy management and control system.

In this course, several capstone design projects which are proposed by industry will be performed in parallel in order to enhance the practical capabilities in the field of information and communication engineering.

선형대수학 3 credit

(LINEAR ALGEBRA)

In this class, basic concepts on vector and matrix are reviewed first. It covers the solution of linear algebraic

systems of equations, the use of elementary matrices for row operations and the definition of the determinant. It also provides the concepts of linear dependence, independence, basis, dimension, the dimension theorem, change of basis, linear transformations, and eigenvalues. Finally, it covers the basics of inner products, orthogonal projections, orthonormal bases, orthogonal transformations and the connection with rotations, and diagonalization of symmetric matrices.

확률및랜덤프로세스 3 credit

(PROBABILITY AND RANDOM PROCESS)

In this class, basic concepts on elementary probability theory and statistics are reviewed first. In order to improve the ability of the graduate students to analyze a given communication system mathematically, more detailed issues on random variable and stochastic processes are discussed, and an introductory material on queuing theory is provided. In addition, advanced topics on linear algebra might be covered especially focusing on the issues in signal processing and communication theory.

■ 전공

개별연구(1) 3 credit

 (INDEPENDENT STUDY (1))

개별연구(2) 3 credit

(INDEPENDENT STUDY (2))

정보통신공학과세미나 1 credit

(SEMINAR ON INFORMATION AND COMMUNICATIONS ENGINEERING)

특수문제연구(1) 3 credit

(SPECIAL STUDY(1))

특수문제연구(2) 3 credit

 (SPECIAL STUDY(2))

■ 정보통신공학전공 (INFORMATION AND COMMUNICATION ENGINEERING MAJOR)

DTV공학특론 3 credit

(Special Topics on DTV)

Most multimedia system consists of the AV(Audio/Video) Codecs and system and its highlight lies in the video technology. In this lecture, we mainly investigate the video compression technology and standard codecs such as H.261(3), MPEG-1,-2, -4. Also, some basic technologies to implement such standard codecs are also studied. For the better understanding the concept and implementation methods, we also study the following topics and their programming based implementation:

- characteristics of video signals

- quantization

- entropy coding method

- transform coding

고급디지털신호처리 3 credit

(ADVANCED DSP)

In this subject, we investigate the various real problems when processing the real multimedia data, such as still image, video, audio signals. We investigate the filtering, sampling, quantization and frequency analysis for the still image, video and audio signals. As the preliminary course, DSP (Digital Signal Processing) is required for this lecture.

고급디지털통신공학 3 credit

(ADVANCED DIGITAL COMMUNICATIONS)

This course covers the advanced issues related to the modern wireless digital communications. Specifically, we will cover the most recently used transmission and coding schemes such as

-Spread Spectrum systems

-OFDM

-UWB

-Space-Time codes

-MIMO

-Turbo-like codes

- MIMO system

- Turbo-like codes

공업경영 3 credit

(ENGINEERING MANAGEMENT)

This course addresses 1) the use of telecommunications technology on business to develop distinct competitive advantages and the way to start a new telecommunications business from the micro perspective, and 2) the present and future of the global telecommunications industry from the macro perspective. The student will first study principles of management, management strategy and competitive potential for strategic use of information systems including inter-organizational systems and electronic commerce. The student then will hear about the way to start a new telecommunications business and the current environment of the local and global telecommunications industry.

Next topic which the student will further investigate is the global telecommunications market. This will include the environment of the current telecommunications market, strategic alliances of giant global telecommunications companies such as AT&T, MCI, NTT, BT, etc., merger and acquisition of telecommunications companies. The course also includes the discussion of the state-of-the-art of telecommunications technologies and the trends of their standards.

네트워크 보안 특론 3 credit

(Advanced Network Security)

This course covers many aspects of securing networks and computer systems. There are three topics that this course deals with: the first topic is applied cryptography including basic cryptographic algorithms, key management and authentication protocols. As the second, the security issues over network infrastructures are covered, which contains routing security, IP-layer security, naming security, and denial-of-service and spam attacks. As the final issue, we address application security area as anonymity and privacy, and web security.

대기이론 3 credit

(Queuing Theory)

The mathematical study of waiting lines (or queues) is covered. The theory enables mathematical analysis of several related processes, including arriving at the queue, waiting in the queue, and being served by the server(s) at the front of the queue. The theory permits the derivation and calculation of several performance measures including the average waiting time in the queue or the system, the expected number waiting or receiving service and the probability of encountering the system in certain states, such as empty, full, having an available server or having to wait a certain time to be served.

데이터통신특론 3 credit

(ADVANCED DATA COMMUNICATIONS)

This course covers the advanced telecommunication technologies to transfer multimedia information the broadband networks. The advanced issues of high-speed data networks, high-speed LAN technologies, next generation internet(NGl), broadband telecommunication networks for multimedia communications, and ATM/B-ISDN are analyzed in detail.

디지털신호처리특론 3 credit

(SPECIAL TOPICS ON DIGITAL SIGNAL PROCESSING)

This course covers various basic digital signal processing techniques such as discrete signal and systems sampling of continuous-time signals, the Z-transform, transform analysis of linear time invariant(LTl) systems, structures of discrete-time system, linear digital llR and FlR filter design techniques, discrete Fourier transform, and fast Fourier Transform(FFT). Some advanced techniques such as non-linear filter, multi-rate signal processing and spectrum analysis are also included.

디지털통신공학특론 3 credit

(DIGITAL COMMUNICATION ENGINEERING)

This course intends to understand the basic communication theories and recently digital communication to grow the capacities of system design and applications.

We deal with the kinds of signals, random processing to study spread bandwidth communication, in detail, modulation/demodulation theory, channel coding, synchronization, multiplexing, source coding, encryption/decryption.

멀티미디어신호처리특론 3 credit

(SPECIAL TOPICS IN MULTIMEDIA SIGNAL PROCESSING)

This course will focus on the study of signal processing techniques for numerous multimedia data such as speech, audio, image, video, and 3-D computer graphics. This course will cover basic concepts on source signal model, its representation techniques, data structures, and various kinds of transform techniques. In addition, this course covers also various applications for multimedia signal, including data compression techniques, and copyright protection techniques, and so on.

모바일네트워크특론 3 credit

(SPECIAL TOPICS IN MOBILE NETWORKS)

This course studies technical issues in mobile network architecture and services. It covers a set of solutions from IETF, 3GPP and 3GPP2 for mobility management, location management and paging, QoS management in mobile environment and upper-layer performance enhancement, etc.

무선통신공학특론 3 credit

(SPECIAL TOPICS ON WIRELESS COMMUNICATION ENGINEERING)

To cultivate the basic knowledge about mobile communication, this course studies the major technologies for realizing cellular system and next generation personal communication systems.

The history of cellular phone, multiplexing methods of mobile system and cellular phone technologies are also investigated. The structure of mobile communication system and the concepts of frequency reuse, hand over and roaming are covered.

영상신호처리특론 3 credit

(SPECIAL TOPICS ON IMAGE SIGNAL PROCESSING)

This course covers concepts of various 2-D signal processing techniques and their applications in image signal processing. The general concepts of image data such as image representation, sampling, color image representation are introduced. We deal some application techniques including separable and non-separable multi-dimensional filters, image transformation, image enhancement, image restoration, computer vision and etc.

운영체제특론 3 credit

(Advanced Operating Systems)

This course provides recent trends and technologies in operating systems, including real-time operating systems, parallel and distributed systems which wasn't covered in undergraduate courses. The main topics include real-time scheduling, virtualization technology, NAND-based storage system, parallel and distributed systems, multi-core scheduling, cluster system, supercomputing.

음성신호처리 3 credit

(SPEECH SIGNAL PROCESSING)

The aim of this course is to show how digital signal processing techniques can be applied in problems related to speech communication and recognition. Starting from a brief survey of fundamentals of speech production process and its model based on one-dimensional signal processing, this course will cover speech signal analysis and synthesis, speech enhancement, speech coding, speech recognition and speaker recognition techniques.

음성인식특강 3 credit

(TOPICS ON SPEECH RECOGNITION)

This course will cover basic concepts and fundamental techniques used in various automatic speech-recognition systems, such as speech production/perception process in human being, filter bank and linear prediction based speech spectral analysis, vector quantization (VQ), dynamic time warping(DTW), hidden Markov model(HMM), neural network, As examples, several recently developed recognition systems using DTW and HMM will be in details discussed.

이동멀티미디어통신공학 3 credit

(Mobile Multi-Media Communications)

This subject explains contents which are introduction and using method of various application (wireless internet, Wireless-LAN, Bluetooth, etc), compensation method of mobile multimedia communication and high speed information transmission technology in wireless channel environment. It also explains about basic concept of CDMA, extension and application in practical environment. To implement previous contents, we discuss about technique and structure of mobile communication network, standardization trend, basic knowledge of next-generation mobile communication and IMT-2000 network.

Furthermore, we discuss about planning of advanced development and implementation of higher mobile multimedia communication.

이동통신특론(1) 3 credit

(SPECIAL TOPICS ON MOBILE COMMUNICATION ENGINEERING(1))

This course covers the current research issues on the most recent mobile communications networks. From the first generation wireless communication systems to fourth generation LTE systems are covered to understand the major technologies for realizing cellular system and next generation personal communication systems.

이동통신특론(2) 3 credit

(SPECIAL TOPICS ON MOBILE COMMUNICATION ENGINEERING(2))

This course covers the current research issues on the most recent mobile communications networks. Specifically, we will cover the following mobile networks

- Low power communications

- Ubiquitous communications network

- Sensor networks

- RFID

인터넷공학특론 3 credit

(SPECIAL TOPICS IN INTERNET ARCHITECTURE AND SERVICE)

This course studies recent topics in the upper layer protocol stacks related to the Internet architecture and services including the IETF protocol RFCs/internet-draft and other research papers. The selected topics and the reading list may vary from one offering to the next.

임베디드모바일멀티미디어통신시스템 3 credit

(EMBEDDED MOBILE MULTIMEDIA COMMUNICATION SYSTEM)

This course is the capstone-type one to design and implement the embedded mobile multimedia communication system, which is the integrated system based on the core major fields, such as "multimedia", "mobile communications", and "next-generation Internet". The target of this course is the students who took the basic courses for the three fields provided in the department of ICE. With this course, the graduate student can build the ability to design and implement the detail technologies of the above three fields and to integrate them into the system.

정보통신망설계및분석 3 credit

(DESIGN AND ANALYSIS OF TELECOMMUNICATION NETWORKS)

This course the design analysis technologies of high-speed telecommunication networks. It analyzes the fundamental technologies for CPN (Customer Premises Network), Access Network, Local Network, and Transit Network. It also covers the Intelligent Network (IN) technologies and its application services, such as Virtual Private Network (VPN) and Virtual Home Environment(VHE).

최신정보통신공학(1) 3 credit

(ADVANCED TOPICS IN INFORMATION AND COMMUNICATION ENGINEERING(1))

This course covers the cutting-edge research issues in the fields of the information and communication engineering. This course is offered based on the special topics designed for the semester.

최신정보통신공학(2) 3 credit

(ADVANCED TOPICS IN INFORMATION AND COMMUNICATION ENGINEERING (2))

This course covers the cutting-edge research issues in the fields of the information and communication engineering. This course is offered based on the special topics designed for the semester.

컴퓨터구조특론 3 credit

(Advanced Computer Architecture)

This course provides next-generation technologies and trends of computer architecture, and study how to evaluate computer performance based on simulation methodology. The main topics include superscalar architecture, VLIW architecture, multi-core architecture, storage system, performance comparison based on simplescalar.

컴퓨터네트워크특론 3 credit

(ADVANCED COMPUTER NETWORKS)

This course covers the up-to-date advanced technologies of NGI (Next generation Internet) and broadband telecommunication networks. Following terms are introduced in detail:

●NGI protocol suite : IPv6, IDRP

●DiffServ, IntServ

●MPOA/NHRP, MPLS

●Mobile IP

●Gigabit networking, GII (Global Information Infrastructure)

●Residential Broadband Network

●IP-over-ATM, IP-over-SDH

●ATM-based intranet

●Wireless ATM

통신망운용및관리 3 credit

(OPERATION AND MANAGEMENT OF TELECOMMUNICATION NETWORKS)

This course covers the advanced topics in the management of telecommunication networks. The SNMP-based internet managements, TMN (Telecommunication Management Network)-based management of public telecommunication networks, such as ATM/B-ISDN are discussed in detail.

통신시스템응용 3 credit

(APPLICATION OF COMMUNICATION SYSTEM)

This course deals with system analysis and applications, known communications methods of communication system. Following issues are covered: Features of Paging system, characteristics of WLL (wireless local loop), features of CDMA/PCS technique, structure and features of GSM, definition of IMT-2000, Mobile Multimedia, GPS System, Satellite communication system, Smart-Antenna technique, Adaptive-Modulation technique.