••• 정보전자융합공학부 •••

1. 교육목표

정보전자융합공학부(Division of IT Convergence Engineering)는 Autonomics, Communications & Networks, Nano Sensors & Systems, Biotechnology 라는 4 분야를 동시에 다루는 대학원으로써, 이를 통해 연구 분야의 다양성을 증대하고, 새로운 분야에서 세계적인 경쟁력을 확보하는 것을 목표로 한다.

2. 교과과정개요

정보전자융합공학부에서는 4 분야의 전문가가 협동하여 연구하게 되며, 학생들 역시 4 분야의 최신 동향을 두루 접함으로써, 4 분야 모두에 대해서 이전에 없던 새로운 방법론과 지식을 창출해낼 수 있다. 또한 이렇게 얻어진 신기술, 지식 및 방법론을 학과 내부에 한정하지 않고 다양한 학술 교류를 통하여 국내외 연구진에 공급하여, 학계 전체의 IT-NT-BT 융합기술에 대한 연구 역량을 증대 할 것이다. 또한 정보전자융합공학부는 국내의 경쟁력 있는 학제 간 공동연구 집단으로서 국내외적 공동연구를 활성화하고 첨단 연구를 창출, 국제적인 경쟁력과 명성을 확보할 수 있다. 이는 우리나라의 학문적 위상을 드높이며, 곧 국가 경쟁력 제고로 이어진다.

본 대학원은 과정 (track) 중심의 유기적인 대학원 운영 및 customized 교과과정을 개별 학생들에게 제공하도록 한다. 모든 학생은 4 과정 (track) 중 하나에 소속되나, 자신이 소속된 과정에 구애받지 않고 다양한 과목들을 수강하여 학생의 학업이 한 분야에만 한정되지 않도록 배려한다. 학생의 지도 교수는 학생과 상의하여 학생의 목표에 알맞은 교과과정을 추천하여 학생의 효과적인 학업을 돕는다. 또한, 해외 학자와 국내 학자를 공동 지도교수로 하여 지도받는 학생들은 서로 다른 두 연구자들에게서 연구 지도를 받으면서 자신의 시야를 넓히게 된다. 이러한 교육 과정을 통해 교육받은 학생은 자연스럽게 IT-NT-BT를 한 테두리 내에서 자유롭게 다룰 수 있는 고급 인력으로 육성되게 된다. 학제 간 협력을 통한 입체적인 연구 및 기술 개발, 그리고 해외 학자들과의 밀접하고 효과적인 연구 진행 방법 자체에 대한 노하우를 쌓은 인력을 양성하게 된다.

가. 과정(Track) 중심의 교과 과정

운영 본 과정에는 학제 간(interdisciplinary) 교육 효과를 극대화하기 위하여

1) Autonomics

2) Communications & Networks

3) Nano sensors / Systems

4) Biotechnology의 4 가지 교육 과정을 둔다. 다양한 학문적 배경을 갖는 학생들의 교육의 효율을 최대화하기 위하여, 모든 학생들은 4 과정 모두에 대한 전반적인 지식 습득을 위해 전공 필수로 개설되는 'IT 융합 입문'과 'Applications of IT Convergence'를 필수로 수강하게 한다. 전공선택 과목은 한 분야에만 국한되지 않은 고른 능력배양과 다른 과정과의 학문적 융합을 위하여, 타 과정(Track)에 개설된 과목을 학위과정에 따라 한 과목이상 수강하게 한다.

◈ Track 1. Autonomics

본 track은 컴퓨터 네트워크, 소프트웨어 공학, 기계학습 등에서 개발된 이론, 기술 등을 기반으로 하여 최소한의 인간 개입만으로도 원활히 작동하는 대규모 자율 시스템을 구현하는데 필요한 지식 및 기술의 이해 및 습득을 목표로 한다. Knowledge representation, 센서 네트워크 통신, 나노 센서를 비롯한 각종 센서의 데이터를 처리하기 위한 기술, Biotechnology에 기반한 생체 데이터 분석 기술, 시스템 보안, 아키텍처 설계 등 광범위한 분야에서의 교육과 연구가 이루어진다.

◈ Track 2. Communications & Networks

본 트랙에서는 무선 통신 및 네트워크 기술에 대한 전반적인 이론을 이해하고, 이를 다양한 응용 분야에서 활용할 수 있도록 교육하는 것을 목표로 한다. 새로운 고속 다중 안테나 전송 시스템을 위한 modulation/encoding/decoding/demodulation 기술, 유무선 통합 네트워크상에서 안전한 데이터 전송을 위한 네트워킹 프로토콜의 설계 및 분석, 네트워크 제어 시스템의 최적화 등에 대한 교육 및 연구가 이루어진다.

◈ Track 3. Nano Sensors & Systems

본 과정은 나노과학 및 나노공학 분야의 연구를 통하여 U-Health 및 U-Environment 용 저비용 최소형 집적 시스템에 이용될 첨단 전자소자 및 센서 등을 개발하는 것을 목표로 한다. U-Health 및 U-Environment 응용을 위한 autonomic system의 개발에 필요한 초저전력 무선 transceiver, intelligent signal processing, 차세대 메모리 소자 및 바이오센서 시스템 분야 등을 아우르는 정보통신, 나노 및 생명공학 분야의 연구 및 교육이 이루어진다.

◈ Track 4. Biotechnology

세포 내의 신호전달 (signal transduction)과정, 세포 분열과정, 유전자 발현 과정 등 U-Health care 등의 ubiquitous 시스템이 사용할 데이터의 원천이 되는 생체의 구조 및 시스템 차원의 이해를 목적으로 한다. 특히 분자 수준에서 시스템 수준까지의 생화학적 과정 연구, 지도 형성, 기억 및 세포분화 등의 개체 수준의 연구 등을 통하여 밝혀진 여러 생명 현상을 시스템 차원에서 이해하고 정량적이며 수리적인 방법을 개발, 이용하여 이를 해석, 규명하는 것을 목표로 한다.

나. 졸업학점

<table>
<tr><th rowspan="2">학위과정</th><th colspan="2">이수학점</th><th rowspan="2">비고</th></tr>
<tr><th>교과학점</th><th>연구학점</th></tr>
<tr><td rowspan="2">석사</td><td colspan="2">28학점</td><td rowspan="6">– 연구학점은 석사논문연구, 박사논문연구, 세미나 과목 임.
– 세미나과목 ITCE800A Seminars in IT Convergence Engineering 을 석사, 통합 및 박사과정에서 각각 2학기 이상 이수하여야 함. 단, 타 학과 컴퓨터공학과, 전자전기공학과, 생명과학과 등 에서 세미나 과목을 수강할 경우, "ITCE800A Seminars in IT Convergence" 과목 이수를 대체 인정함.
– 교과학점은 ITCE 교과목, 타 학과 대학원 교과목, 학부 400단위 교과목(6학점까지 인정)임.</td></tr>
<tr><td>18학점</td><td>10학점</td></tr>
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<tr><td>12학점</td><td>20학점</td></tr>
<tr><td rowspan="2">통합</td><td colspan="2">60학점</td></tr>
<tr><td>27학점</td><td>33학점</td></tr>
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다. 과정(Track)별 최소 이수 교과학점

과정	전공필수	소속 과정(Track) 전공선택	타 과정(Track) 전공선택
석사	6학점*	–	–
박사	6학점*	3학점	3학점
통합	6학점*	12학점	6학점

※ 2009년, 2010년 입학생은 3학점

※ 학위과정별 졸업이수 교과학점 중 과정별 최소 이수 교과학점 기준을 충족하여야 함.
단, 이전 학위과정에서 전공필수과목을 수강한 학생의 경우는 수강을 면제한다.

3. 전공과목 일람표

이수구분	학수번호	교과목명	강의–실험–학점
전공필수	ITCE500	Introduction to IT Convergence Engineering	3–0–3
	ITCE600	Applications of IT Convergence	3–0–3
전공선택 (Track1, Autonomics)	ITCE501/EECE700L	Autonomic Systems	3–0–3
	ITCE502	Ontologies and Semantic Reasoning	3–0–3
	ITCE503/EECE700M	Information and Data Modelling	3–0–3
	ITCE504/EECE515	Machine Learning	3–0–3
	ITCE505/EECE524	Probabilistic Graphical Models	3–0–3
	ITCE601/EECE600	Distributed Processing	3–0–3
	ITCE602/EECE702R	Wireless Network Security	3–0–3
	ITCE603/EECE702E	Self–Protection System	3–0–3
	ITCE605/EECE607	Network and Service Management	3–0–3
	ITCE606	Knowledge Representation, Reasoning and Inferencing	3–0–3
	ITCE607	Advanced Semantic Reasoning and Applications	3–0–3
	ITCE710 A/Z	Special Topics in Autonomics	가변학점
전공선택 (Track2, Comm.& Networks)	ITCE520/EECE609	Introduction to Random Variable and Process	3–0–3
	ITCE521/EECE576	Statistical Communication Theory	3–0–3
	ITCE522/EECE700O	Human Body Communication and Networking for Convergence Engineering.	3–0–3
	ITCE620/EECE608	Advanced Computer Networks	3–0–3
	ITCE621/EECE620	Mobile Networks	3–0–3
	ITCE622/EECE626	Multimedia Networking	3–0–3
	ITCE623/EECE663	Estimation Theory	3–0–3
	ITCE624/EECE668	Robust Control	3–0–3
	ITCE720 A/Z	Special Topics in Communications & Networks	가변학점

이수구분	학수번호	교과목명	강의-실험-학점
전공선택 (Track3, Nano Sensors & Systems)	ITCE540	Introduction to Nano Technology	3-0-3
	ITCE541/EECE560	Nano Electronics	3-0-3
	ITCE542/EECE593	Microwave Active Circuits	3-0-3
	ITCE543/EECE596	RFIC Design	3-0-3
	ITCE544/EECE569	Analog Integrated Circuits	3-0-3
	ITCE545/EECE570	Digital Integrated Circuits	3-0-3
	ITCE546/EECE401	Semiconductor Electronics II	3-0-3
	ITCE640	Low Power Integrated Circuits	3-0-3
	ITCE641	Semiconductor Theory	3-0-3
	ITCE642/EECE598	Advanced Nano Devices	3-0-3
	ITCE643	CMOS Circuits for Sensor Interface	3-0-3
	ITCE644	Nano Bio Sensor Engineering	3-0-3
	ITCE645	Sensor Technology for Convergence Engineering	3-0-3
	ITCE740 A/Z	Special Topics in Nano Sensors & Systems	가변학점
전공선택 (Track4, Biotechnology)	ITCE560/MOLS619	Bioinformatics	3-0-3
	ITCE561/MOLS502	Advanced Biochemistry	3-0-3
	ITCE562/MOLS515/IBIO655	Biology of Aging	3-0-3
	ITCE563/IBIO614	Frontiers of Interdisciplinary Biosciences	3-0-3
	ITCE564/IBIO615	Advanced Bioengineering	3-0-3
	ITCE565/MOLS508	Advanced Developmental Biology	3-0-3
	ITCE566/MOLS517/IBIO528	Advanced Molecular Genetics	3-0-3
	ITCE760 A/Z	Special Topics in Biotechnology	가변학점
연구과목	ITCE800 A/Z	Seminars in IT Convergence Engineering	가변학점
	ITCE699	Master Thesis Research	가변학점
	ITCE899	Doctoral Dissertation Research	가변학점

4. 교과목 개요

ITCE 500 Introduction to IT Convergence Engineering ····· (3-0-3)

This course generally introduces Autonomics, Communications & Networks, Nano Sensors & Systems, Biotechnology and other related studies and focuses on possible creative research areas so that students can choose their research themes.

ITCE 501/EECE 700L Autonomic Systems ····· (3-0-3)

This course is intended for the students who are interested in understanding autonomic systems. First, the need and motivation for autonomic systems will be described. Next, we will review different autonomic architectures from the US, Europe and Asia, emphasizing core mechanisms such as control loops, management abstractions, and how sensors and effectors interface the autonomic manager to the entity being managed. We will then examine the salient features of representative autonomic systems, and augment this with practical examples

based on our WCU ITCE program, and discuss potential research topics for autonomics graduate students. The course will conclude with examples that explain how to manage different types of systems, how to enable business needs to drive the management of systems and services, and how to orchestrate behavior.

ITCE 502 Ontologies and Semantic Reasoning ····· (3-0-3)
This course is intended for researchers and practitioners who are interested in designing ontologies to support knowledge engineering and management for use in semantic reasoning. This course emphasizes an understanding of the fundamentals required to build robust conceptual models using ontologies.

ITCE 503/EECE 700M Information and Data Modelling ····· (3-0-3)
This course provides a detailed understanding of object-oriented information and data modeling, and how to use models to represent, analyze, and act on knowledge. This course gives a deeper insight into the foundations of modeling, and emphasizes the use of modern software engineering practices, such as patterns, to represent and process information for common modeling problems. A detailed review of object-oriented information modeling fundamentals will be conducted, followed by hands-on experience in building different types of models for various applications ranging from well structured use cases to ad hoc design. Elements from our WCU ITCE program will be used as examples for students to build, analyze, and optimize models throughout the course to reinforce the theory learned.

ITCE 504/EECE 515 Machine Learning ····· (3-0-3)
Machine learning is the study of computer algorithms that allow computers to "learn". It is a method of creating computer algorithms such that computers are able to perform pattern recognition, prediction, decision, and so on. This introductory course on machine learning will address mathematical and statistical methods involving current statistical machine learning as well as various applications. Topics to be covered include density estimation, Bayes decision theory, latent variable models, mixture models, discriminant analysis, clustering, classification, dimensionality reduction, regression, kernel methods, VC-dimension, HMM, MLP, RBF, etc. Main focus will be given to statistical and probabilistic methods for machine learning, involving supervised, unsupervised, and semisupervised learning.

ITCE 505/EECE 524 Probabilistic Graphical Models ····· (3-0-3)
Probabilistic graphical models are a happy marriage between probability theory and graph theory, providing a flexible and powerful tool for the design and analysis of machine learning algorithms when uncertainty and complexity are involved. This course offers an introduction to graphical models, emphasizing both theories and applications. Trees, factor graphs, undirected/ directed graphs are considered, where nodes are associated with random variables. Probabilistic inference(belief propagation) and ststistical estimation methods are introduced for graphical models.

ITCE 520/EECE 609 Introduction to Random Variable and Process ····· (3-0-3)
Probability theory and random variables are discussed, which includes the relationship and transformation of

random variables. Stochastic or random process is discussed, including stationary and nonstationary random processes, dynamics and filtering problems.

ITCE 521/EECE 576 Statistical Communication Theory ·····(3-0-3)

Prerequisite : Undergraduate level Probability theory, Signal and systems, Linear algebra

- Review the basic principles of linear analysis, probability, statistics, and random processes
- Learn the analysis of linear and nonlinear systems with random inputs.
- Learn the design of systems that satisfy some statistical conditions for signal detection and waveform estimation
- Learn about how the information theory is applied to communication systems
- Learn the properties of noise in the communication systems

ITCE 522/EECE 7000 Human Body Communication and Networking for convergence Engineering ·····(3-0-3)

In this course, students will learn short-range wireless network solutions for personal and body area networks. Topics include network topologies, protocols, and industry standards for these networks such as Bluetooth, ZigBee, 802.15.3, and 802.15.4. They also include ultra low-power signal processing, RF communication near or in body networks, security provisions, and data fusion techniques. Personal and body area network scenarios and applications are also discussed.

ITCE 540 Introduction to Nano Technology ·····(3-0-3)

This course provides in depth understanding of nanotechnologies including nanoelectronics, functionalized carbon nanotubes or nanowires, and MEMS. The biomedical application like Biological field effects transisters (BioFETs) is covered in the course as well.

ITCE 541/EECE 560 Nano Electronics ·····(3-0-3)

This course covers analysis of semiconductor surface, quantum state, conduction mechanism at surface, optical properties and elastic properties, surface processing technique and device application.

ITCE 542/EECE 593 Microwave Active Circuits·····(3-0-3)

This course covers the basic concept of microwave active circuit designs such as s-parameter, twoport network, matching circuit and gain/stability of transistor based amplifier. Then, the circuit design methodology for the important functional blocks of microwave transceivers such as broadband amplifiers, LNA, power amplifier, microwave mixer and power oscillator is studied.

ITCE 543/EECE 596 RFIC Design·····(3-0-3)

The important RFIC chip design methods for the transceiver of the wireless communication system are studied. First, the transceiver architecture of the system is described. Then, the important functional blocks of the transceiver are covered. They include passive component design, LNA, mixer, oscillator and phase noise, and frequency synthesizer.

ITCE 544/EECE 569 Analog Integrated Circuits ·····(3-0-3)
Covers CMOS analog integrated circuit design techniques using hand analysis and SPICE simulation, reviews the operation of single transistor amplifiers such as CS CG CD amplifiers, frequency response and stability, noise analysis, bandgap voltage source and current source bias circuits, single-ended and fully-differential CMOS OP amp circuits, switched capacitor filter, phase locked loop and delay locked loop.

ITCE 545/EECE 570 Digital Integrated Circuits ·····(3-0-3)
Covers CMOS digital integrated circuit design techniques using hand analysis and SPICE simulation. Operation of CMOS inverter circuit, static logic circuit, dynamic logic circuits such as domino NORA and TSPC, pass transistor and differential logic circuits, VLSI building block circuits such as adder multiplier and data path, low power circuit technique, memory circuit such as ROM Fash memory SRAm and DRAM.

ITCE 546/EECE 401 Semiconductor Electronics II·····(3-0-3)
Based on the Semiconductor Electronics course 1, students will learn a more detailed knowledge of Semiconductor technology. This course will cover P/N Juction, Heterojuction, Bipolar transistor, MOSFET, nano-scaled CMOS HBT and HEMT.

ITCE 560/MOLS 619 Bioinformatics ·····(3-0-3)
This course addresses ways of searching for and analyzing DNA and protein information, as well as providing insight into biological literature and the latest trends in and the future of bioinformatics.

ITCE 561/MOLS 502 Advanced Biochemistry·····(3-0-3)
This course explores the structures and regulation of receptors and ionic channels, and the molecular regulatory mechanisms of factors in signal pathways that emanate from them. In addition, the principles of enzyme chemical structures, functions, and application and related metabolic pathways and their significance as well as contemporary research techniques are addressed. In particular, emphasis is placed on enzyme kinetics, reaction mechanisms, and active sites, labeling and determination techniques, structural relationships among active inhibitors and active sites, and the modification of enzymes using genetic engineering and gene expression.

ITCE 562/MOLS 515/IBIO 655 Biology of Aging·····(3-0-3)
The focus of this course is on current understanding of aging process at an organismic level. Emphasis is placed on genetic control mechanisms that regulate aging and age-related diseases. Moreover, students will discuss key molecular signaling pathways that regulate aging processes, which are conserved across phyla.

ITCE 563/IBIO 614 Frontiers of Interdisciplinary Biosciences·····(3-0-3)
The course helps students choose research topics.

ITCE 564/IBIO 615 Advanced Bioengineering·····(3-0-3)

The course analyses the emerging biotech industry, its prospects and research directions. In addition, the course introduces basic and novel technologies in biotech industry.

ITCE 565/MOLS 508 Advanced Developmental Biology ····· (3-0-3)
This course explores the mechanisms through which the fertilized egg develops into an entity composed of various cells, tissues, and organs.

ITCE 566/MOLS 517/IBIO 528 Advanced Molecular Genetics ····· (3-0-3)
This course is designed to help students learn recent exiting advances in the molecular genetics. The topics include functional genetics, model organisms, molecular genomics. In addition, students will discuss breakthrough findings in the molecular genetics field.

ITCE 600 Applications of IT Convergence ····· (3-0-3)
In this course, students will learn how to perform research to support their projects which were defined and specified in ITCE500 Introduction to IT Convergence Engineering. The project will culminate in a submission of a conference or journal paper submission. The course will provide a set of 4 soft skills lecture on scientific databases, scientific publishing, project management.

ITCE 601/EECE 600 Distributed Processing ····· (3-0-3)
This course will study the fundamental aspects of modern distributed systems. Issues concerned with distributed systems such as transparency, communication, resource sharing, fault tolerance, scalability, consistency, and security as well as those concerned with designing, developing, and managing distributed applications and services will be covered in this course. Special emphasis will lie on emerging Peer-to-Peer computing.

ITCE 602/EECE 702R Wireless Network Security ····· (3-0-3)
Students will learn security principle and types of security adaption of wireless networks such as WWAN, WLAN, WPAN, MANET. The security issues are handled in the respect of prevention and protection. The aim of the subject is to focus on fundamental issues regarding wireless network security and to make the students' own researches possible.

ITCE 603/EECE 702E Self-Protection System ····· (3-0-3)
The course deals with the principles and methods of self protection system to the unknown security intrusion from inner/ outer system. The course studies detection of attack and intrusion, automatic detection of weakness, complementation of weakness, automatic learning about intrusion, and automatic backup etc. and the methods for reducing weaknesses.

ITCE 605/EECE 607 Network and Service Management ····· (3-0-3)
The course will start with the fundamental concepts in network and service management, illustrated through a number of prominent frameworks. It will discuss key challenges in network and service management today

and show how these problems are tackled with example techniques from both theoretical and system design perspectives. This course will also show autonomic networking as a principle design objective in dealing with the current network and service management complexity.

ITCE 606 Knowledge Representation, Reasoning and Inferencing ·····(3-0-3)
This course focuses on approaches relating to representing different data in a common way, which is crucial for reasoning and planning for solving problems in autonomic systems. The course illustrates the importance of (1) defining a common form for relating different information from different sources to derive a combined understanding of a managed entity, (2) transforming the common representation of knowledge to a form amenable to efficient reasoning, and (3) adding constraints for performing intelligent search and planning.

ITCE 607 Advanced Semantic Reasoning and Applications ·····(3-0-3)
This course explains how to apply semantic reasoning provided by autonomic systems to build systems for current and Future Internet applications. This course starts by reviewing finite state machines, and then using finite state machines to model formal as well as natural languages.

ITCE 620/EECE 608 Advanced Computer Networks ·····(3-0-3)
The main goal of this course is to study advanced topics on network technologies. The course begins with the basic concepts and techniques on computer networks, and then covers technical details in advanced topics on computer networks. This course also covers the state of the art protocols in networking technology.

ITCE 621/EECE 620 Mobile Networks ·····(3-0-3)
Recently diverse wireless mobile networks are deployed. This course provides an in-depth understanding of the fundamental problems in the area of mobile networks and studies the state of the art solutions to solve the problems. This course also covers many important issues in the area of wireless mobile networks.

ITCE 622/EECE 626 Multimedia Networking ·····(3-0-3)
This course deals with the basic concepts that multimedia data can be effectively transferred through wire and wireless network. The course specifies media control technology considering networks and network control technology regarding media, introducing the best suitable technology which can connect those technologies.

ITCE 623/EECE 663 Estimation Theory ·····(3-0-3)
This course introduces the conventional linear estimators in frequency and time domains. In the algorithm point of view, two issues associated with the number of computations and the numerical stability are addressed and the modified estimators are provided. Furthermore, modern estimators, mainly designed with linear programming, are tackled under mixed criteria.

ITCE 624/EECE 668 Robust Control·····(3-0-3)
This course summarizes modern techniques, based on linear system theories, for analyzing and synthesizing

linear and even nonlinear systems. Especially, so-called LMIs (linear matrix inequality), belonging to convex conditions, are used to design robust controllers against nonlinearities or uncertainties under various criteria.

ITCE 640 Low Power Integrated Circuits ····· (3-0-3)
The low power design of CMOS Integrated circuits is essential to implement the low power sensor networks. The class starts with the review of the CMOS device physics with the emphasis on the subthreshold operation. It covers the low power analog circuits such as OP amps, switched capacitor circuits, continuous time filters, analog-to-digital converters and RF circuits. It also covers the low power design technique of digital circuits including low power logic circuits and SRAMs.

ITCE 641 Semiconductor Theory ····· (3-0-3)
This course provides a fundamental and in-depth knowledge of the theory of operation, modeling, parameter extraction, scaling issues, and higher order effects of active semiconductor devices that are used in mainstream semiconductor technology and emerging devices of practical interest. There will be a comprehensive review of the theories and latest models for the devices that are valid out to very high frequencies and the use of physical device modeling. A review of the latest device technologies and architectures will be presented. The course will be a prerequisite to the other applied courses in nanotechnology, nanoelectronics and photonics.

ITCE 642/EECE 598 Advanced Nano Devices ····· (3-0-3)
This course covers recent developments of nano devices. Lectures focus on basic device fundamentals, second order effects, fabrication processes, characteristics, and reliability of novel devices. Through term project assignments, students are expected to gain an understanding of advanced electron devices.

ITCE 643 CMOS Circuits for Sensor Interface ····· (3-0-3)
The operation principles of the sensors for monitoring the human body or the environment will be introduced. The low power circuit techniques will be studed by using the CMOS technology. The front-end analog amplifier, filter, analog-to-digital converter, microprocessor, memory and RF circuits will be covered.

ITCE 644 Nano Bio Sensor Engineering ····· (3-0-3)
The operation principles of the nano semiconductor devices and the bio-medical sensors are covered. The application examples of the nano devices to bio-medical applications will be studied.

ITCE 645 Sensor Technology for Convergence Engineering ····· (3-0-3)
Sensors are small devices, in a sense, designed to replace bulky analytical instruments to meet various needs in chemical, environmental, biomedical, agricultural, and several other industries. This course will discuss how micro and nonotechnologies have been shaping the sensor design and development. Development of sensors that are small, consume little power and inexpensive is key to realize the goals of U-health and U-Environment initiatives which are becoming common across the world.

ITCE 699 Master Thesis Research ····· (1~9)
A research course for Master' s thesis.

ITCE 710 A/Z Special Topics in Autonomics ····· (Credits can vary)
This course covers the new theory and topics of the Autonomics area.

ITCE 720 A/Z Special Topics in Communications & Networks ····· (Credits can vary)
This course covers the new theory and topics of the Communications & Networks area.

ITCE 740 A/Z Special Topics in Nano Sensors and Systems ····· (Credits can vary)
This course covers the new theory and topics of the Nano Sensors and Systems area.

ITCE 760 A/Z Special Topics in Biotechnology ····· (Credits can vary)
This course covers the new theory and topics of the Biotechnology area.

ITCE 800 A/Z Seminars in IT Convergence Engineering ····· (Credits can vary)
This course consists of seminars on recent developments in various topics.

ITCE 899 Doctoral Dissertation Research ····· (1~9)
A research course for Ph.D. thesis