Dept. of Xcultural Studies

Due to the fact that the administration of this cooperative course is based on the cooperation of professors who have similar ideals and interests and the cooperation of related majors, students are able to step outside the boundaries of their own major and take advantage of the available resources to the fullest. Also, by strongly encouraging cross registration of credits and the involvement of professors from other universities, the program's sound and practical quality of education is unparalleled to any other universities that offer a single subject graduate school program.

The Xcultural phenomenon that this program is based on is a phenomenon that occurs all around us without our knowing. Therefore, various major fields that are involved with our lives participate in this cooperative program, with the belief that academic subordination is inevitable without introspection of "our lives" and that true globalization can be achieved only when "our lives" and "their lives" combine and form the "life world."

The curriculum for individual students can be composed freely while sharing the above mentioned points in prospective. The curriculum will be selected and developed with the help of the advisor according to each student's interest. Also, in order to widen the platform of the shared interest, the effort to develop research methods and acquire practical techniques will simultaneously be carried out.

☐ Courses

❑ Core Courses

- **Theories and Methods in Cultural Studies (3)**

- **Identification of Xcultural Studies (3)**

  "Modernism" in the studies of humanities and social science forms a paradigm. However, various problems arise from applying identical standards to the East and West without being aware of the relativity. Based on this understanding, we will examine the existing theories of arts, humanities and social sciences related to the Xcultural phenomenon and search for the possibility of an alternative theory.

- **Characteristics of Eastern and Western Thoughts (3)**

- **Seminar in Western Cultural Theories (3)**

  In this class, students will master anthropology and traditional cultural approach comprehensively and acquire relevant analytical techniques and ability.

- **Seminar in Eastern Thought Traditions (3)**

  In this class, students will get a glimpse of the thinking process that has been

commonly practiced in the East, from ancient to modern times, and also examine how this affects modern day life and thought processing.

- **Seminar in Western Thought Traditions (3)**

  In this class, students will get a glimpse of the thinking process that has been commonly practiced in the West, from ancient to modern times, and also examine how this affects modern day life and thought processing.

- **Readings in Eastern Classics (3)**

  This course interprets Eastern classics from the Xcultural perspective.

- **Readings in Western Classics (3)**

  This course interprets Western classics from the Xcultural perspective.

- **Phenomenology and Xcultural Studies (3)**

  This course conducts a phenomenological approach to the phenomena of confusion, the loss of meaning and doubling and others.

- **Hermeneutics and Xcultural Studies (3)**

- **Special Topics in Xcultural Studies (3)**

  To capture the field of culture-crossing, this course review authors, periods, writings, and others.

- **Social Culture Scape (3)**

  Architecture is social and cultural complex. This course depicts ours cities from the perspective of the culture scape.

- **Team Teaching in Xcultural Studies (3)**

  Scholars from various disciplines cooperate to analyse and evaluate current issues from the Xcultural perspective.

- **Adoption and Hybridzation of Foreign Culture (3)**

- **Independent Study (3)**

- **Workshop (3)**

- **Thesis Research (3)**

- **Building Urban Villages (3)**

- **Education through Work and Play (3)**

· **The Flow of Thinking in Modern Korea (3)**

Assuming that different thinking harbors different behavior, we review various materials containing people's thinking in modern Korea. In this process, we find out how people's thinking affects their behavior, and distinguish between right and wrong.

· **Seminar in Discourses on Culture (3)**

In this class, we examine meanings of culture accepted in cultural studies and daily life. In this process, we find out that arguments about cultural phenomena such as imitation, convergence, coexistence, and crash stem from improper understanding about culture, and inquire into the proper meaning of culture.

· **Aesthetics in the East and the West (3)**

Aesthetics is the study of what beauty is, and it can be found within me. Recognizing the beauty by understanding my true self is why we discuss aesthetics.

· **Cultural Studies and Writing (3)**

We think the problems of writing in current academics and explore the practice of writing(of a research paper) in Cultural Studies. We examine how the researchers('I') present their self-reflexivity and understanding of research perspective.

· **Korean Political Thought and Reality (3)**

· **Seminar in Korean History: Fragmentation and Continuity (3)**

Knowing that the emphasis of the fragmentary nature of Korean history does not help understand the identity of Korean society, this course approaches from the perspective of continuity to relive the lives of Korean past.

· **Seminar in an Asiatic Mode of Change (3)**

By comparing the development a list view of history and the circulative view of history, students will examine the unique characteristic that is embodied in the transformation of Asia.

· **Understanding Eastern Classics (3)**

In this class, we divide philosophical classics in the eastern thought tradition into the three era; the ancient times, the middle ages, and the modern times. On the basis of the time series, we are going to read the original texts which is carefully selected by our goal. The mission in this class is firstly to avoid listening to the summaries provided by the so-called philosophical specialists, next is to intend to meet, in person, the philosophers existing in the each era. Finally this philosophical training leads us to enhance the power of our thought to read the original texts,

so that we are able to recover the power of the intellect having the judgement distinguishing right from wrong.

· **Understanding Western Classics (3)**

In this class, we divide philosophical classics in the western thought tradition into the three era; the ancient times, the middle ages, and the modern times. On the basis of the time series, we are going to read the original texts which is carefully selected by our goal. The mission in this class is firstly to avoid listening to the summaries provided by the so-called philosophical specialists, next is to intend to meet, in person, the philosophers existing in the each era. Finally this philosophical training leads us to enhance the power of our thought to read the original texts, so that we are able to recover the power of the intellect having the judgement distinguishing right from wrong.

· **Experience of Eastern Classics (3)**

In this class, we aim to read the selected works in the eastern thought. On the basis of our reading we will write our own impressions on the works. So we want to ascertain whether the classics live vividly in our ordinary life. By doing this study, we are able to know what the nature of the right thinking is and to know what the happy life is.

· **Experience of Western Classics (3)**

In this class, we aim to read the selected works in the western thought. On the basis of our reading we will write our own impressions on the works. So we want to ascertain whether the classics live vividly in our ordinary life. By doing this study, we are able to know what the nature of the right thinking is and to know what the happy life is.

· **Reading Philosophy with the Movie (3)**

Movies are a medium that shows potential reality and presents various philosophical topics. This class offers an opportunity to share their philosophical views with such topics and explore the hidden truths behind visible phenomena.

· **Healing through Logos=Mousike=Gymnastike (3)**

"Healing through Logos=Mousike=Gymnastike" is a learning to study how blessed it is for a naturally good feeling to live like its own by reaffirming its own good nature. The essence of this study is a self understanding of feelings, i.e. feelings that always new in an infinite way understand its own actuality under its own eternal truth. Therefore "Healing through Logos=Mousike=Gymnastike" is a self healing by understanding the logic of Logos=Mousike=Gymnastike.

❑ Science of Feelings Major

· Xcultural Ethics (3)

Xcultural Ethics originates in Plato and Mencius' teachings, and Science of Emotion founded by Spinoza's Ethics and Toegye's Holy Learning exists as the apex of it. The core of Xcultural Ethics is to learn and think the true understanding of emotion which is common to the West and the East. Xcultural Ethics is Science of Emotion.

· Science of Feeling (3)

· Xlogical Understanding of Current Social Problems (3)

As students review the visual materials dealing with various social problems, they are trained to see the troubles consistently stemming from the betrayal of emotional logic in people's thinking, and to get ready for applying the logical thinking to theory evaluation and fieldwork.

· Xlogical Reading of Classics (3)

In the reading of classics, students are to find and confirm the practice of the emotional reasoning of great thinkers and to become more confident of themselves by realizing that they themselves have never been far away from the thinker's footsteps in their life's journey.

· Understanding Feelings (3)

In this class we seek the nature of the right understanding on feelings. So we look forward to conceiving the foundation of the happy life and the essence of the ethical life. To explore these intriguing challenges we read Toegye's Ten Diagrams on Holy Learning in the 16th century of the east and Spinoza's Ethica in the 17th century of the west.

· Writing in The Science of Feeling (3)

This course is aimed to learn the necessity of feeling itself. The science of feeling understands feeling itself not on the basis of external causes but on the basis of its own necessity. That is, the science of feeling is the study on feelings by 'feeling itself.' This is the reason why the science of feeling starts with conceiving our own feeling, so that feeling itself is able to inquire into its own necessity. By writing our own understandings on our own feelings, we are able to grasp the essence of the science of feeling.

· Bodily Understanding of Emotions (3)

Bodily Understanding of Emotions is a study that allows a participant to further self-explore and experience 'true self/ complete self (완전자인 나)' that one encounters during classic reading exercise by bringing close attention to the natural

sound of one's body.

❑ **Cultural Study of Arts Major**

· **Design and Culture (3)**

This deals with the theories and practices of design, focusing on culture as a design element.

· **Cultural Approach to Living Space (3)**

This course analyses functional and disfunctional cultural adaptations in living space construction.

· **Social History of Arts (3)**

· **Developing Culture Contents (3)**

Finding cultural elements in our life-world, this course explores the ways to apply them in developing cultural contents.

· **Narrative and Cultural Studies (3)**

In the age of the culture and story, we share the importance of narrative thinking and pay attention to the effect of mind in narrative communication.

· **21C Cultural Trends (3)**

❑ **Cultural Socio-psychology Major**

· **Cultural Psychology (3)**

This course attempts show how culture affects self-concept, social concept, motivation and ethics.

· **Religion at the Crossroad of Cultures (3)**

Religion as Culture is the focus of interest in this course.

· **Critical Evaluation of Modernism and Postmodernism (3)**

This course critically review the Modern and Postmodern Philosophies from the Xcultural perspective.

· **Culture and Pedagogy (3)**

Assuming that different cultures and traditions harbors different educational goals and methods, this course attempts to understand how traditional educational practices affect the current education in Korea.

· **Theories on Education (3)**

The educational theory on illustrious virtue(明德) is departed from our flawless nature-being what Heaven has conferred. An accordance with this nature is called Instruction. We will compare this theory with Hermeneutical Education to dispute the differences.

· **Xcultural Approach to Korean Society (3)**

This course probes the relevance of the Western social thoughts and institutions in Korean cultural horizon.

· **Philosophical Coaching Practice (3)**

The course provides the opportunities for the students to understand the ways of the existence and perception described in the Eastern and Western Classics. Through this philosophical thinking and reasoning, you can develop and apply coaching communication in real life situation by practicing various questions.

❑ **Xcultural Study of Korean Style Major**

· **Seminar in Korean Culture (3)**

This course helps to understand the Korean identity from the Xcultural perspective.

· **Seminar in Korean Style and Cultural Narrative (3)**

We examine the Korean feeling and thought in Korean dramas, films and novels. Moreover we pay attention to the aesthetics of feeling and peace in Korean narrative text.

· **Topics on Korean Literary Thoughts (3)**

By reviewing writers, their works and reviews, students will examine the change of ideology and style of adaptation of Korean literature that were influenced by modernization.

· **Topics on the Changing Asian Interrelations (3)**

Focusing on the fast growing interrelations among Asian countries, this course reconstructs the meaning of this exchanges from the Xcultural perspective.

· **Discourse on Korean Style (3)**

We approach the Korean style and Korean identity in the context of universality and speciality. We examine the current cultural discourses about Korean style, and explore the cultural vision of sustainable Korean style.

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Dept. of Financial Information Security

Department of Financial Information Security offers excellent education and interdisciplinary cutting-edge research programs to train future leaders and innovators in information security of financial services industry. Faculties from the fields of mathematics, management information system and business administration provide a broad range of courses and joint research projects in partnership with academia and industry.

❑ **Information Security Major**

Information security major focuses on producing researchers and specialists in privacy protection, protection against hacking, information authentication, and technology evaluation for information security, etc. Our program trains future leaders and innovators in information security by offering an excellent education and cutting-edge research projects.

❑ **Financial Security Major**

Financial security major focuses on producing researcher and specialists in managing and protecting financial big data, legal and institutional aspects of financial information security, consumer-oriented financial services and e-Discovery, etc. Our program trains future leaders and innovators working for secure and sustainable environment in financial service areas by offering an excellent education and cutting-edge research projects.

☐ **Courses**

❑ **Core Courses**

· **Information Security Protocols (3)**

This is an introductory course for financial information security. After providing brief reviews for cryptographic algorithms, the course covers several topics in protocol including key distribution, secret sharing, authentication, and zero-knowledge protocol.

· **Financial Information Security (3)**

We study the information Security Technology in Financial Field, such as Electronic cash, Secure Electronic Transaction, and Internet Banking Systems, etc.

· **Research Ethics & Thesis Study (3)**

This course provides an overview of methods used to conduct and evaluate research. This course will include discussion on the scientific method, development of research questions, exploration of literature, formulation of research designs, and professional critique of methodologies. Also, ethical issues in research are discussed.

· **Legal and Institutional Issues in Informational Security of Financial Services (3)**

This course covers legal and institutional issues in Information Security of Financial Services with real-life examples in the field. For example, information security laws, structures of governments and private firms including financial institutions for information security will be discussed.

❑ **Information Security Major**

· **Cryptographic Algorithms (3)**

We study classical cryptography and modern cryptography such as stream ciphers and block ciphers based on Shannon theory.

· **Hash Functions and Message Authentication (3)**

This course covers the design principle of collision-free hash functions and message authentication codes which can be used in digital signatures.

· **Cryptanalysis of Public-key Cryptosystems (3)**

This course covers the cryptanalysis of public key cryptosystem based on the mathematical methods such as factorization of numbers, discrete logarithm problems.

· **Topics in Symmetric Key Cryptanalysis (3)**

This course covers the cryptanalysis of symmetric key cryptosystem such as stream ciphers and block ciphers.

· **Parallel Implementation of Cryptographic Algorithms (3)**

This course provides a systematic approach to parallel implementations of cryptographic algorithms. Topics include a brief introduction to computer architecture and operation system. Particularly, parallel computing with GPU will be considered in depth.

· **Evaluation and Validation Techniques for Cryptographic Modules (3)**

This course is an introductory guide for developers who build cryptographic modules. Mandatory standards for cryptographic modules including ISO 19790, 24759, and FIPS 140 will be considered. Students are supposed to understand CMVP(Cryptographic Module Validation Program) in US and Korea and related polices. Also, techniques for security evaluation will be studied.

· **Side Channel Attacks (3)**

This course covers any attack based on side channel information such as timing information, power consumption, electromagnetic leaks or even sound gained from the physical implementation of a cryptosystem, rather than brute force or theoretical weaknesses in the algorithms (compare cryptanalysis).

· Countermeasures of Side Channel Attacks (3)

This course provides secure S/W and H/W cryptographic design and implementations against side channel attacks. The countermeasures fall into two main categories: (1) eliminate or reduce the release of such side channel information; and (2) eliminate the relationship between the leaked information and the secret data.

· Security Implementation Methodology (3)

This is a practical guide for implementing security functions. Based on the understanding of cryptographic algorithms, students are required to build an application as a group project and learn how to protect their software from malicious attacks by removing potential vulnerabilities.

· Introduction to PKI (3)

The goal of the course is to provide an introduction to PKI (Public Key Infrastructure) and relevant technologies including public key encryption, authentication, and digital signature. As an application. we study how to apply PKI to financial services.

· Mobile Security (3)

We study the latest mobile networks security architecture and technology.

· Wireless Security (3)

We study the latest wireless communications technology and the security technology of the applications.

· IT Convergence and Security (3)

We study Convergence Technology on IT field and other fields, and the security technology of the applications.

· Financial Information Security Policy (3)

We study the management and the policy of information security. We study the management methodology that can supplement the limit of information security techniques.

· Information Security Consulting (3)

This course is a field that focuses on advising IT businesses on how best to use information technology to meet their business objectives. To providing advice, we study how to estimate, manage, implement, deploy, and administer information security products or the IT security related organization about security level, vulnerability, policy, standard, and monitoring process.

· Information Security System Evaluation Methodology (3)

This course covers evaluation methodology for information security systems. To understand conformance tests, we refer testing methodology in CC (Common Criteria),

CMVP(Cryptographic Module Validation Program), and PIV(Personal Identity Verification).

· Analysis and Implementation of Security Technical Standards (3)

This course has two main goals. One is understanding of standardizations of security techniques and the other is having ability to build systems based on the standard techniques. We refer standard documents by ISO/IEC, IETF (Internet Engineering Task Force), ITU-T. Students are supposed to be familiar with standards and applying them.

· Introduction to Digital Forensics (3)

We study the forensic science encompassing the recovery and investigation of material found in digital devices such as personal computers, notebook computers and cellular phones, often in relation to computer crime.

· Special Research of Digital Forensics (3)

Study and research current cutting-edge technologies and methodologies in digital forensics.

· Financial Device Attacks (3)

The goal of the course is how to seeks and exploits weaknesses in financial device such as PC, smart phone, smart card, Micro-SD, OTP and so on. And then we study some countermeasures which are secure against these attacks.

· Countermeasures against Financial Device Attacks (3)

Study various H/W- and S/W-based methods and technologies for protecting financial transaction devices from current avaliable security attacks.

· Financial Key Management System (3)

Study key management systems used for providing secure financial services and protecting systems for those services. Students will study the current technologies and theories applied in generating, distributing, and recovering keys used in security systems and mechanisms for financial transactions.

· Financial Networks Security (3)

Students will learn security technologies and theories for protecting important and valuable financial data transmitted through communication systems, e.g., VPN (Virtual Private Networks), IPSec, SSL, TLS, and so forth.

· Electronic Commerce Security (3)

Topics covered include information security schemes to protect the electronic commerce, especially electronic cash, electronic payment, electronic wallet.

· Provable Security (3)

Deals with Computational complexity, Unconditional security, Complexity theoretic

security, Provable security under assumptions, Ad hoc security.

· Implementation of Cryptographic S/W (3)

Acquire the software implementation technologies of International standard Symmetric Key Encryption Algorithm and public key Encryption Algorithm.

· Analysis of Randomness (3)

Deals with Probabilistic theory of randomness, Design and security analysis of cryptographic random number generators, Statistical test of random sequences.

❑ Financial Security Major

· Advanced Information Communication Theory (3)

It aims to educate about the ubiquitous network and context awareness and localization that are the core technologies of computing. It provides information on various application systems including context-awareness / localization, and ubiquitous network architecture, requirements of ubiquitous network, etc.

· Model-based System Design (3)

This course is an introduction to model-based system design with domain specific and domain independent aspects. The metamodeling concepts are introduced for various information systems, and hybrid system such as cyber physical systems. From the fundamental system design with UML up to metamodeling system design will be covered. The object programming language is used to implement the design process.

· Data Mining (3)

Data mining is concerned with the extraction of novel knowledge from large amounts of data. This course introduces and studies the concepts, issues, tasks and techniques of data mining. Topics include data preparation and feature selection, association rules, classification, clustering, evaluation and validation, scalability, spatial and sequence mining, and data mining applications.

· Data Management (3)

This course is concerned with the use of Database Management Systems (DBMS) to solve a wide range of information storage, management and retrieval problems, in organizations ranging from large corporations to personal applications, such as research data management. The course combines the practical aspects of DBMS use with more theoretical discussions of database design methodologies and the "internals" of database systems.

· IoT Network (3)

It educates about the next generation network such as IoT(Internet of Things), M2M(Machine to Machine Communication), WoT(Web of Things), UIoT(Underwater IoT) and so on. Furthermore, we will also study about the related international standards.

· **Embedded System (3)**

This course aims to enhance the understanding of ARM architecture and the ability to design and implement embedded system based on firmware.

· **Real-time System (3)**

This course aims to enhance the understanding of real-time system and the ability to design and implement embedded system based on RTOS(Real-Time Operating System).

· **Information System Development Methodology (3)**

It educates about the methodology of developing information system concerning embedded system. Thus, we will study about the data structures and algorithms, the overall process of design and implementation of embedded system and so on.

· **Intellectual Property and IT Patent (3)**

This course focuses on promoting the global mind on intellectual property among the university students by studying IP education course. The fundamental concepts of intellectual property such as patent, trademark, industrial design, and patent information are covered, and the impact of IP on international trade also studied in the perspective of business domain and IT applicable domains.

· **Financial Management (3)**

An introduction to advanced concepts and methods of financial management. Topics include risk and return, asset evaluation, capital budgeting, capital structure, business financial planning and working capital management.

· **Financial Institutions (3)**

This course focuses on financial institutions, and will cover both markets and intermediaries. We will examine the structure of debt, equity and derivatives markets, as well as specific financial instruments traded on these markets. In addition, we will study financial intermediaries such as commercial and investment banks, mutual funds and insurance companies in order to develop a critical awareness of the risks faced by these institutions.

· **Statistics for Financial Analysis (3)**

This course deals with statistical techniques related to financial analysis. The techniques include probability & sampling distributions, estimation, hypothesis testing, linear and nonlinear regression, experimental design, modern business decision theory.

· **Financial Engineering (3)**

This course is the design, development and implementation of innovative financial products and financial processes in the major segment of equities, currencies, interest rates and commodities for trading investment hedging and complete risk management.

· Principle of Entrepreneurship (3)

This is an introductory course focusing on the individual entrepreneur, the generation of innovative business ideas, the creation of business ventures, and the role of entrepreneurship within society.

· Practice of Entrepreneurship (3)

This course is aiming to inspire students and provide them with the entrepreneurial skill and confidence needed to put plans into action. Students gain a full understanding of the practice of entrepreneurship through exposure to the experience of successful entrepreneurs and are given a solid understanding of the realities of business start-up.

· Entrepreneurial Finance (3)

This course examines the elements of entrepreneurial finance, focusing on technology-based start-up ventures and the early stages of company development.

· Strategic Management of Technological Innovation (3)

This course examines certain fundaments of enterprise success as derive from the strategic management and innovative deployment of technology – with particular emphasis on the ICT sector.

· Strategic Management (3)

This course covers topics of mission, goal, strategy formulation, strategy implementation and strategy evaluation. Strategic techniques include Industry: Analysis, Analysis of the Competitive Environment, Key Success Factors, Strategic Scenario Analysis and SWOT Analysis. Additional topics covered include strategic thinking, competitive advantage, vertical and horizontal integration, and planning horizon.

· Entrepreneurship in Financial Information Security

This course focuses on the industry structure, especially the barriers to potential entrants and competition, and market characteristics in the area of financial information security. The course also provides the analysis of successful startups, which allows students to design appropriate business model for their potential entrepreneurial opportunity.

· IT Audit Technique (3)

We study an information technology audit, which is an examination of the management controls within an Information technology (IT) infrastructure. It covers IT audit process such as planning, studying and evaluating controls, testing and evaluating controls, reporting and follow-up. The evaluation of obtained evidence determines if the information systems are safeguarding assets, maintaining data integrity, and operating effectively to achieve the organization's goals or objectives.

· **Business Data Communication (3)**

This course is about the fundamentals of data communications and networking. We will discuss information representation, network topologies, transmission medium, OSI model and TCP/IP networking models, and mainstream LAN and WAN technologies. The OSI model is used as a framework to organize and discuss the network technologies. The technical and managerial aspects of data communications and networking are both emphasized.

· **Cloud Computing (3)**

This course introduces the fundamental technologies and issues in this cloud computing environment. In terms of everything as a Service in cloud computing service, we learn main considerations in SaaS (Software as a Service), PaaS (Platform as a Service), IaaS (Infrastructure as a Service), and the related technologies. Students learn concepts and applicable areas of infrastructure system of cloud computing and VM provisioning via cloud environment. Also we will study the trends of enterprise cloud adoption, application integration, and various service provider and application to form the cloud service.

· **Big Data Infrastructure System (3)**

This course provides the fundamental concepts and knowledge of distributed system and middleware technologies for Big Data Infra system architecture. To understand IT infrastructure of Big Data processing, this course gives a lesson about the Hadoop Distributed File System and Map Reduce technique for storing and processing big data. Also, the recent IT evolution of conventional infra system of the Big Data domain and applications is introduced. Distributed systems, middleware, Hadoop Ecosystem, infra technologies, and IT service architectures are covered.

· **Financial Accounting (3)**

Financial Accounting provides an introduction to the concepts and uses of financial accounting information in a business environment and its role in the economic decision-making process.

· **Managerial Accounting (3)**

This course examines the principles, techniques, and uses of accounting in the planning and control of business organizations from a management perspective.

· **Investments (3)**

An examination of investment markets, transactions, planning and information. Topics include investment risk and return measures, debt and equity instruments, evaluation techniques, hybrid and derivative securities, mutual funds, real estate investments, tax planning and the investment process, and portfolio management.

· **Research Methodology in Finance (3)**

This course is an introduction to empirical methods commonly employed in finance. The course is organized around empirical papers with an emphasis on econometric methods. heories and real-life cases of risk management in corporations and financial institutions.

· **Derivatives (3)**

In this course, students develop an understanding of financial derivative instruments and their applications to corporate strategy and risk management.

· **Introduction to Payment and Settlement System (3)**

This course covers legal and institutional structures on payments and settlements among financial institutions. Also, the course identifies risks that arises from payments and settlements and discusses how to manage the risks.

· **Operational Risk Management (3)**

This course focuses on the risks arising from the people, systems and processes through which a company operates. It also include other classes of risk, such as fraud, legal risks, physical or environmental risks.

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Dept. of Security Enhanced Smart Electric Vehicle

As an effort to address technical demands and issues from rapidly changing future societies and to lead the creatively integrated technical industries, Department of Security Enhanced Smart Electric Vehicle has been established since September 2013, to educate topic oriented engineers. More specifically, the department targets to cultivate engineers with thorough understanding of IT security and smart electric vehicle with the grant of BK21 plus for the education of target-oriented engineers from the government. As of September 2018, 11 full time professors are leading the department to educate 10 Ph.D. and 22 M.S. students to become the specialist in the field of Security Enhanced smart electric vehicles. With the strong relationship with Hyundai-Kia Motors, Hyundai Mobis and many other tier 1 and tier 2 companies, many research topics related to security enhances electric vehicle systems are pursued in the department. 3 out of 11 full-time faculties are specializing in the automotive engineering and the rest are specializing in the electronic and in the computer engineering. Furthermore, some members of the faculty have successfully implemented the integrated solution of a battery swappable smart electric bus and with this experience from the industrial applications, it is strongly believed that the department has a full capacity of educating graduate students with industry oriented solution approach.

☐ **Courses**

❑ **Core Courses**

· **Power System Control (3)**

Characteristics of power system will be introduced and the related fundamentals will also be provided. Furthermore, various operation and management strategy for the power system control including economic load dispatch, unit commitment, state estimation, voltage control, frequency control and stability analysis and more.

· **Control and Applications of Electric Machines (3)**

Fundamentals and applications of electric machines are discussed. Initially, theory of electric energy conversion is introduced to understand the function of transformers and electric machines. Secondly, most popular electric machines such as AC synchronous motor and induction motor will be studied in detail and finally the control algorithms for the rpm and torque of the machine utilizing power inverters with PWM control with axis transformation system.

· **Understanding of Information Security (3)**

Basic concept of information security will be discussed and the advanced theory will also be introduced. Symmetric key algorithm, hash function, MAC technique, Public key system, digital signature, key management techniques will be discussed.

· **Understanding of the Principles of Electric Vehicles (3)**

Fundamentals of the electric vehicle structures and core components are explained in

this course. Prior to the discussion of secured smart electric vehicles, solid understanding of the electric vehicle will be achieved.

· **Electric Vehicle Control Engineering (3)**

Based on the fundamentals of control theory, system analysis of the electric vehicle will be discussed and the control algorithm for the analyzed electric vehicle will be detailed.

· **Knowledge of some kind of Communication (3)**

Fundamentals of M2M and IoT will be introduced to understand the core concepts and furthermore. new trends for the M2M, IoT will be discussed.

· **Vehicle Sound and Vibration (3)**

In this class, noise and vibration sources of vehicle are found out and various kinds of control methods are treat to decrease their levels through the objective and subjective evaluation. In addition, sound design and vibration reduction technique considering human perceptual feelings are studied.

· **Smart Electric Vehicle System (3)**

Advanced functionality in the smart electric vehicle systems and the core components are discussed in the lecture. Further applications and future of the smart electric vehicles are also detailed.

· **Charging System for Smart Electric Vehicle (3)**

Battery charging systems, battery exchange system, battery management system and communication protocols for the smart charging architectures are introduced and detailed.

· **Security System for Smart Electric Vehicle (3)**

Enhanced security systems for the internal and external communications of the smart electric vehicle will be introduced. Various possibilities will be further discussed in the lecture.

· **Information System for Smart Electric Vehicle (3)**

Information exchange systems for smart electric vehicles such as vehicle to vehicle connection, vehicle to infrastructure networks are introduced and discussed to evaluate the pros and cons of various information sharing technologies.

· **Secured Smart Electric Vehicle System (3)**

In order to prevent hacking of the vehicle control systems, various security system has to be implemented in the secured smart electric vehicle systems. Especially for the system which directly controls the brake system, electric machines, higher security level is required. In this course, various ideas and techniques will be discussed to achieve the higher security levels for the smart electric vehicle operation.

· **Charging Infrastructure for Secured Smart Electric Vehicle (3)**

In this course, charging facility, communication system, central operation of the facility management including fee collection methods for the electricity used for the smart electric vehicle charging will be generally discussed. Future technologies for the advanced charging infrastructures will also be introduced.

· **Information Security System for Secured Smart Electric Vehicle (3)**

Specialized security enhancement for the smart electric vehicles will be discussed and the related security encoding algorithms will be introduced and trained.

· **Linear Control System (3)**

In order to understand the linear system modeled based on the state-space model of modern control theory, stability of the model, pseudo controllability, pseudo observability will be introduced and discussed. Based this understanding, optimum control and observational design will be studied through examples of successful applications.

· **Embedded Linux System Programming (3)**

Several considerations on implementation of embedded system based on Linux operation system are discussed. Programming techniques for embedded systems using Linux system calls are studied.

· **ECU Design (3)**

Fundamentals of ECU(Electronic Control Unit) design and ECU Hardware/Software design techniques are studied.

· **Advanced Topics on Transportation Infrastructure (3)**

This subject will demonstrate the development trends of transportation infrastructure; and discuss modernization of transportation and technical factors that should be considered when planning transportation infrastructure.

· **Transportation Planning for Smart Electric Vehicle (3)**

Transportation planning and applied research in related technologies regarding provision of safe and efficient driving environment for smart electric vehicle.

· **Vehicle Network System (3)**

Vehicle network system is a automobile-IT convergence technology, which wireless communication network combined with vehicle. The vehicle network technology provides vehicle safety and diagnostics, telematics, ITS and other services. This course goes to training for vehicle communication network technology. Details educational contents is as follows: One is a In-Vehicle Network technologies including LIN(Local Interconnect Network), CAN(Controller Area Network), FlexRay. And the other is Vehicle-to-Vehicle Network and Vehicle-to-Infrastructure Network(V2I) technologies based on Wireless Access In Vehicle Environments(WAVE), Dedicated Short-Range Communications(DSRC), Wireless Personal Area Network(WPAN), and so on. Additionally, study networking technologies for autonomous driving based on the previously learned vehicle network technologies.

· **Signal Measurement and Analysis (3)**

This class studied how to measure and analyze acoustic and vibrational signals. To this end, the followings are treated: acoustic and vibrational sensors, FFT, transfer function, filters, sound identification techniques.

· **Understanding of Automotive Electronic Systems (3)**

This course involves understanding of characteristics and basic operation of analog

passive/active elements, digital logic circuits and microcontrollers. It is also an introductory course on instrumentation, control, and diagnosis of drive systems, chassis systems, and body systems in vehicles.

· Understanding of Battery Management Circuit for Smart Electric Vehicle (3)

Understand the basic structure and operation of a battery management system. Also, core analog/digital circuits for the battery management system such as DC-DC converters or active battery balancing circuits are introduced.

· Understanding of Intelligent Transport System (3)

Develop an understanding of ITS which applies advanced technologies in electricity, control and communication to modes and systems of transport in order to enhance the efficiency and safety of transportation operation.

· Automotive Application of Kalman Filters(3)

Fundamental probability theory, random variables and estimation theory will be studied to learn how to design Kalman filters for automotive application. Then design procedures and application area of the Kalman filters will be introduced as a optimal estimator for stochastic system.

· Research Ethics & Thesis Study (3)

Research ethics will be discussed for the M.S. and Ph.D. students with the typical examples occurring in the research and development environment. Furthermore, internationally acknowledged rules and regulations will be discussed and the purpose and the importance of observing the regulations will be studied with renown examples and cases.

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Dept. of Nano Science & Technology

❑ **Nano-material Major**

The graduate school of Advanced Materials Engineering Department in Kookmin University was established in November 1974 after the authorization of Ministry of Education. The goal of our graduate course is to educate students who will become pro-active leaders with creative mind in the field of materials related industry by utilizing knowledge of materials engineering. Until now, more than 200 students with master and doctor degrees have been produced and they play a critical role in the field of industry, academia, and education. 19 faculty members in the graduate school of Advanced Materials Engineering Department are actively doing research works in the field of metals, ceramics, polymers, semiconductors, displays, energy/ environment. Also, the department possesses many up-to-date experimental equipments for various materials-related researches.

❑ **Nano-electron Major**

Nano-Electronics Major offers one of the most comprehensive research and instructional programs with Master's degree. In this Major, 1 Nano-electronic semiconductor devices including extremely scaled conventional devices, quantum effect devices, and nano-structured volatile and nonvolatile memory devices, 2 Nano-electronic analog integrated circuit design, 3 Nano-electronic low-voltage-low-power integrated circuits, 4 Nano-electronic mixed-mode integrated circuits will be intensively taught and investigated.

❑ **Nano-physics Major**

The goal of the Department of Nano Science and Technology (Nano-Physics Major) at Kookmin University is to educate the scientists and researchers in the emerging field of nanoscience and nanotechnology, and to carry out the innovative research in multidisciplinary environment. The courses offered in our department covers various topics with an emphasis on Physics and research activities includes the fabrication and measurement at nanometer scale as well as the physical analysis.

❑ **Nano-chemistry Major**

Nanochemistry is a subject dealing with the chemistry of making, analyzing, and applying substances that are active in the nanoscopic world in which substances are measured in one billionths of a meter. Nanochemistry, while serving as the basis for various sciences and technologies, is a very broad field involving the life sciences, energy, electronics, environment, and materials. So, the new discipline of nanochemistry has already made it possible for us to step into the world of superfine substances, make first-hand observations of and work with molecules and atoms on a nano-meter scale, including biomolecules and other functionally advanced materials.

☐ **Courses**

❑ **Nano‐material Major**

· **Advanced Semiconductor Physics and Technology (3)**

Behaviors of electrons and holes in semiconductor are discussed and their relevant p‐n junction, Schottky junction, MOS capacitors and MOSFET are studied.

· **Thin Film Science and Processing (3)**

The object of "Thin Film Science and Engineering" class is not only to document what is known about thin films including multilayers, but also to promote the potential of these versatile thin films and to facilitate the adsorption of the technology by others. The field introduced in this class is new. This class will show that thin films including multilayers represent a model platform for promoting modern research and furthermore, the intellectual distance between concept and application is minimal.

· **Nanotechnology (3)**

This course will introduce students to the relevant concepts related to the synthesis, science, characterization, and engineering of nanomaterials. Special applications in nanotechnology will also be reviewed, including bio‐medical, environmental, energy, defense, and telecommunication areas.

· **Electrochemical Engineering (3)**

Electrochemical Engineering is the course to understand the electrochemical principles and how to apply those theories to the relevant industries such as corrosion, surface finishing, battery and fuel cell and hydrometallurgy. This course covers the fundamental concept of electrochemistry, the equilibrium and the kinetics of electrochemical reactions, the corrosion of materials, the surface‐treatment, and the energy conversion methods such as battery and fuel cell.

· **Mechanical Properties of Thin Films (3)**

This course covers the mechanical properties of the thin films deposited on various substrates with an emphasis on thin film dynamics, process‐related stresses, and the measurement of thin film stresses. In addition, effects of the microstructure of thin film depending on the process variables such as substrate temperature and pressure, on its plastic deformation and elastic behavior will be discussed.

· **Multilevel Interconnect Technology(3)**

This course covers the integration process for multilevel metallizations in an advanced semiconductor device fabrication. The process includes the formation of metals, diffusion barrier metals and compounds, the insulators over a complex structure, and the planarization process as well. In addition, the dependence of device characteristics and reliability on the metallixation process will be discussed.

· **Plasma Physics and Processing (3)**

The goal of this course if to provide the student with a sound, scientific understanding of plasma physics and plasma chemistry through which he can better use plasma processes for microelectronic fabrication. The introduction of various plasma processes for sputtering, etching, plasma‐enhanced chemical deposition of thin films helps him to

know the main factors affecting each plasma process. In addition, vacuum technology and surface measurement is to be provided to improve his practical ability to control the processes.

· Powder Processing (3)

Topics include fabrication, properties, components of powder and fundamentals of sintering. Industrial application examples of powder metallurgy are also examined.

· Electronic Materials Fabrication Processing (3)

The goal of this course is to provide the student with a fundamental understanding of each process for the fabrication of microelectronic and electronic devices. The processes of oxidation, diffusion, iron implantation, etching, photolithography, metallization and packaging will be discussed with an emphasis on the principle of each process and its equipment, and the process-related issues.

· Process Integrate Circuits (3)

This course is to provide the student with an understanding of each process for the fabrication of semiconductor devices and the process integration of Integrated Circuits. In addition, the process for 1㎛, 0.8㎛, and 0.5㎛ CMOS will be introduced, and then discussing its device characteristics. Based on the technology roadmap, the progress for the process development required for the future devices will be predicted and discussed.

· Electronic Ceramic (3)

Principles of various electronic ceramics are introduced and semiconducting, insulating, high dielectric, magnetic, superconducting ceramics are discussed. Applications, such as sensors, actuators, solid oxide fuel cells and MEMS are also discussed.

Fracture Mechanics of Engineering Materials.

Based on fracture mechanics, characterization and design applications of fracture, fatigue, creep of metals are studied.

· Electronic Materials (3)

This course is designed to achieve knowledge of principles, properties and applications of electronic materials. Topics include conductor, semiconductors, superconductors, dielectrics and ferroelectrics.

· Advanced Process Design of Metallic Materials (3)

Recent advanced technology in processing and design of metallic materials is presented and studied along with their applications, such as processing of nano-materials, multi-phase materials, and shape-memory alloys.

· Advanced Computational Materials Science(3)

This course introduces advanced computer modeling methods in materials science and engineering using discrete particle systems and continuum fields. It covers techniques and software for statistical sampling, simulation, and uses statistical, quantum chemical, molecular dynamics, Monte Carlo, mesoscale and continuum methods to study fundamental physical phenomena encountered in the fields of computational physics, chemistry, mechanics, materials science, biology, and applied mathematics. A term

project allows development of individual interests. Students are mentored by members of CMS Lab. in KMU.

· Surface and Interface Science(3)

This course surveys the basic concepts of surface and interface free energy, various phase transitions on the surface and interface such as surface roughening, surface reconstruction, etc.. Goals of the course also include the understanding of reation rate on the surface and interface, physi- or chemi-sorption, the role of stress in thin film growth, etc..

· Advanced Ceramic Materials (3)

Definition and crystal structures of ceramic materials are fundamental topics and different kinds of bonding and defect structures are advanced subject in this course. In addition it includes effect of crystal structures and defect structures on their physical properties.

· Materials for Information Technology (3)

This course will present to students information storage, transmission, and related materials and technology with special emphasis on materials technologies in the areas of optical information processing, memory semiconductors, and large-scale information storage.

· Electronic Display Engineering (3)

The purpose of this course is to gain an understanding of the principles and techniques of materials and process for flat panel displays EL, LCD, PDP, FED.... fabrication. Topics also include the characterization and evaluation of display materials and related technologies. Emphasis on materials design in relation to fundamental device characteristics.

· Nano-material Chemistry & Technology (3)

In this course, students will learn critical knowledge of chemistry and technology in the areas of advanced metals, polymers, and ceramics. Course modules will cover the fundamental scientific principles of molecular structure, chemical bonding, and structural measurement and analysis of materials at nano-scale level as well as related basic theories and mechanisms.

· Advanced Polymer Materials(3)

Overview of the problems associated with the selection, design, and function of advanced polymers is presented in this course. Particular emphasis is placed on discussion of the advanced application areas of polymer materials, which may include display, semiconductor, and energy technologies.

❑ Nano-electron Major

· Semiconductor Physics (3)

In this lecture, semiconductor physics, including crystal lattice structures, properties of semiconductors, wave phenomena and magnetic properties, electron emission, carrier generation and recombination property in the semiconductors, will be discussed.

· **High-Speed and High-Frequency Semiconductor Devices (3)**

In this lecture, high-speed and high frequency characteristics of microwave- and millimeter-wave devices, which include compound semiconductor devices such as HEMTs high-electron mobility transistor and HBTs heterojunction bipolar transistors, will be discussed in detail. Design, implementation, and characterization techniques will be discussed for better electrical performances.

· **Quantum Electronics (3)**

In this lecture, properties of the quantum mechanical electronic systems, basic concepts of the quantum mechanics, crystal structure in the quantum-mechanical scale, spins and energy band diagram theory in the lattice semiconductors will be discussed.

· **Application Specific Integrated Circuit Design (3)**

Analog and digital IC designs for a single-chip implementation of the application-specific integrated systems with signal processing, automatic control, artificial intelligence, and image processing.

· **Semiconductor Device Physics and Characteristics (3)**

Secondary effects and non-ideal device characteristics in semiconductor materials and devices will be discussed. Hot carrier effects and reliability-related physical mechanisms will be also discussed in this lecture.

· **Advanced Topics on Semiconductor Device Physics and Characteristics (3)**

Electrical characteristics of unipolar-type IC devices JFET, MOSFET, MESFET, as analog or digital IC components, will be taught in detail.

· **Characterization of Semiconductor Materials and Devices (3)**

In this lecture, analysis, modeling, parameter extraction method of the characterization parameters and their applications for the electrical and optical characteristics of the semiconductor devices will be discussed in detail.

· **Analog Integrated Circuit Design (3)**

Analog signal-processing chip design based on a standard CMOS process will be discussed in this lecture. In the first, the basic concept of analog signal-processing with various transformation techniques including the z-transform and the op-amp, which is a basic building block in the analog signal processing circuits, will be taught in detail. The concept of the switched-capacitor filter for accurate analog signal-processing and its application analog filters will be also considered in the lecture.

· **VLSI Process Technology (3)**

Modern CMOS VLSI technology is covered in depth in this course to understand the physical phenomena in the fabrication process and characterize the VLSI circuit. In this course, the individual process steps including epitaxial growth, lithography, oxidation, metallization, etching, and so on are discussed in details. Moreover, the integrated manufacturing processes using many individual steps are covered.

· **Digital VLSI Design (3)**

Based on the knowledge on the fundamental digital logic and CMOS technology, this course aims to convey knowledge of advanced concepts of circuit design for digital LSI

and VLSI components in state of the art CMOS technologies. Emphasis in this course is on the circuit design, optimization, and layout of CPU, ALU, register file, digital filter, RAM, ROM, and so on.

· **Low-Power Integrated Circuit Design (3)**

Low power circuit technology is strongly required to enhance battery lifetime especially in portable devices such as mobile phone and notebook. This power consumption can be divided into two categories of the dynamic and static consumption. Recently developed logic families and clocking strategy to reduce the dynamic power consumption are discussed in this course. In addition, static-power reduction techniques using dynamic threshold-voltage scheme, power cut-off switch, and so on are covered.

· **Memory Circuit Design (3)**

Memory devices as a core semiconductor industry, specifically, a circuit design of DRAM will be discussed in the lecture. The principle of the memory cells, cell-arrays, circuit technologies of various peripheral circuits incorporated in the row path, column path, and the performance enhancement strategy of the overall chip in the high-speed DRAMs, including SDRAM synchronous DRAM or DDR dual-data rate SDRAM, will be considered in detail.

· **Optical Semiconductor Devices (3)**

Operation principle, design method, characterization and its applications of optical-electrical / electrical-optical semiconductor devices for the absorption and emission of the light will be discussed in this lecture.

· **Advanced Topics in Integrated Circuit Design (3)**

The current research trends and problems in modern CMOS VLSI design are discussed in this course. In modern very deep-submicron VLSI design, high-speed signaling and low power issues such as signal integrity, interconnect, power distribution, power consumption, and timing becomes important, as devices go scaled further down. This course aims to introduce the recent design techniques, the optimization algorithms, and the layout methodologies to solve the signaling and low power issues in modern very deep-submicron VLSI design.

· **Nanostructure Semiconductor Device Technology (3)**

The principle, characterization, analysis, and applications of nano-structure electrical and optical devices, which focus on the quantum effects in the semiconductor, will be discussed in this lecture.

· **VLSI System Design (3)**

Digital circuit technology based on the standard CMOS process will be discussed in this lecture. The delta-sigma data converters adopting digital signal-processing theory, in order to achieve a very high resolution, will be intensively considered. For this purpose, a digital signal-processing, especially the multi-rate sampling frequency system, will be taught in depth. Various types of delta-sigma architectures, digital behavioral blocks and VLSI implementation will be also treated in the lecture.

· **SoC Design (3)**

The methodology for the IP-based SoC system-on a chip design will be discussed in detail. The hardware-description languages of VHDL or Verilog-HDL as a basic design tool for the SoC design will be studied, and the synthesis of digital circuits, verification methods, an auto-placement and routing technique in the layout design will be taught in hand. Some standards for the coding guideline and mixed-mode specs will be also introduced.

· **Mixed-Mode Integrated Circuits (3)**

Main subsystems of the mixed-mode integrated circuits, based on a standard CMOS process, will be discussed. Issues on the design of analog filters adopting switched-capacitor circuits, A/D converters, D/A converters, PLL phase-locked loop and DLL delay-locked loop will be studied in depth.

❑ **Nano-physics Major**

· **Classical Mechanics (3)**

This course on the classical mechanics presents Lagrangian and Hamilton mechanics using Hamiltonian theory. Various aspects of mechanics such as small oscillation, collision of two particles and relativistic theory will be discussed.

· **Electrodynamics (3)**

This course covers the advanced topics in electromagnitism such as electrostatic fields in vacuum and in dielectrics, magnetic fields associated with constant and variable currents, magnetic materials, and Maxwell's equations.

· **Quantum Mechanics (3)**

This course introduces the advanced concepts in Quantum Mechanics: Schroedinger equation, operators, angular momentum, harmonic oscillator, atomic hydrogen, perturbation theory, scattering theory, identical particles, and radiation.

· **Solid State Physics (3)**

This course discusses various physical phenomena in solid. The topics covered in the course are atomic, molecular and crystal structure, energy levels of electrons, and binding energies in molecules and solids.

· **Statistical Mechanics (3)**

This course discusses the concepts and application of statistical mechanics in varous fields of physics. The topics include introduction to equilibrium thermodynamics and elementary statistical mechanics.

· **Mechanics Physics (3)**

This course introduces the various aspects of mathematical physics including ordinary differential equation, complex variable, and calculus of variation. The course also presents the methods of the numerical solution.

· **Semiconductor Physics (3)**

This course discusses the physical properties of semiconductor physics such as lattice vibration, band structure and conductivity of semiconductor.

· **Material Physics (3)**

This course presents the topics in modern material physics. This course also discusses the current theoretical and experimental works in the field of material physics in addition to the introduction of the basics of magnetic, superconducting and dielectric materials.

· **Magnetism (3)**

This course discusses the advanced topics on modern physics of magnetism and magnetic materials such as spintronics and multiferroic materials as well as their applications in addition to the basics of magnetic, electronic properties and applications of magnetic materials.

· **Physics of Thin Films (3)**

This course is intended to serve as an advanced course onthin films and their properties as well as their applications. In addition, the growth mechanism of thin films and various film growth techniques such as PECVD, LPCVD, and MOCVD will be discussed. Especially, this course focuses on various physical properties of superconducting, metallic, semiconducting, magnetic thin films.

· **Research in Solid State Physics (3)**

This course presents the current topics in the field of solid state physics. This course introduces current theories in solid state physics and offers chances to review some of solid state physics experiments. This course is intended for a small group of students involved in various research projects to discuss the current topics in solid state physics, which are actively pursed in the field of solid state physics.

· **Research in Magnetism (3)**

This course presents the current topics in physics of magnetism. This course introduces current theories in the field of magnetism and offers chances to review some of experiments such as spintronics and dilute magnetic semiconductors. This course is intended for a small group of students involved in various research projects to discuss the current topics in magnetism, which are actively pursed in the field of magnetism and their applications.

· **Surface Physics (3)**

This course is intended to serve as a graduate level course on the surface physics. This course describes the fundamental physical processes on surfaces. Also, this course covers the basic theories of surface physics and their applications. In addition, this course describes the various analysis methods on the solid surface using ARS, SIMS, XPS, AFM, SEM, TEM and RBS.

· **Semiconductor Process (3)**

This course provides technological aspects of the semiconductor process such as crystal growing, vacuum technology, diffusion barrier and amorphous process, in addition to the introduction of the basics of the semiconductor physics.

❑ **Nano-chemistry Major**

· **Advanced Analytical Chemistry (3)**

Treatment of the basic issues of importance in modern analytical chemistry. Topics include basic chemical and measurement concepts, measurement instrumentation and techniques, and principles, tools, and applications in spectroscopy, electrochemistry, separations, sensors, mass spectroscopy and surface characterization.

· **Advanced Physical Chemistry (3)**

The principles of physical chemistry are studied from the standpoint of the laws of thermodynamics, kinetic theory, statistical mechanics, quantum chemistry and molecular spectroscopy.

· **Biochemistry (3)**

This subject gives an opportunity to understand the life science by dealing with Enzyme structure and mechanism, protein modification, signal transduction in sensory systems, DNA and RNA biochemistry, and biochemistry of disease.

· **Material Chemistry (3)**

Chemistry has a vital role to play in materials processing and in the development of new materials. This course is concerned with the basic underlying principles and the technological relevance of major topics in advanced material chemistry. This course includes organic, inorganic, solid-state, and surface chemistry as well as polymer and materials science.

· **Chemical Instrumentation (3)**

Principles of instrumental analysis. Application of separation techniques and instrumental analysis.

· **Thin Films (3)**

This course includes the developments in the physical and chemical sciences that have changed the design, manufacture, and analysis of thin films, and their application, especially in communications and information processing, storage, and display.

· **Solid State Chemistry (3)**

Solid state chemistry has emerged as a very important element of mainstream chemistry and modern materials science. This course is concerned with the synthesis, structure, and properties and applications of solid materials, and plays a crucial role in determining the properties of materials. An understanding of solid state chemistry is also essential in materials design.

· **X-Ray Diffractometry (3)**

The principles and practice of the determination of structures by single crystal x-ray diffraction techniques. Crystal symmetry, diffraction, structure solution and refinement. Opportunities for hands-on experience in structure determination.

· **Nanochemistry (3)**

Nano chemistry is related with chemical methods to build nano structures with atoms and molecules. This course presents nano chemistry with the most up to date survey of current applications, research, and technical challenges.

· **Molecular Spectroscopy (3)**

The course will explore the interaction of light with matter. We will start with the quantum mechanical foundations of spectroscopy and follow with a detailed treatment of a variety of different spectroscopies, including the study of rotation, rotation and vibration, and electronic spectra for simple molecules as well as polyatomics.

As time and interest allow, we will cover special topics such as magnetic resonance, nonlinear and molecular beam spectroscopies.

· **Surface Nano Chemistry (3)**

Introduction to the behavior of molecules adsorbed on solid surfaces: the structure of surfaces and adsorbate layers. The bonding of molecules to surfaces: adsorbate phase transitions: trapping and sticking of molecules on surfaces. An introduction to surface reactions: kinetics of surface reactions. A review of principles of chemical reactivity: reactivity trends on surfaces: prediction of rates and mechanisms of reactions on metals, semiconductors, and insulators.

· **Solid State Physical Chemistry (3)**

Introduction to the theory of electrons in solids: bands and zones. Absorption of light and excitons. Vacancies, interstitials, electronic defects and dislocations and their roles in chemical reactivity.

· **Research in Physical Chemistry (3)**

An upper-division student in good standing is urged to pursue an experimental research in physical chemistry with the guidance of any member of the chemistry faculty chosen.

· **Research in Organic Chemistry (3)**

An upper-division student in good standing is urged to pursue an experimental research in organic chemistry with the guidance of any member of the chemistry faculty chosen.

· **Research in Inorganic Chemistry (3)**

An upper-division student in good standing is urged to pursue an experimental research in inorganic chemistry with the guidance of any member of the chemistry faculty chosen.

· **Research in Nano Chemistry (3)**

An upper-division student in good standing is urged to pursue an experimental research in nanochemistry with the guidance of any member of the chemistry faculty chosen.

· **Research in Biochemistry (3)**

An upper-division student in good standing is urged to pursue an experimental research in biochemistry with the guidance of any member of the chemistry faculty chosen.

· **Seminar in Physical . Analytical Chemistry (3)**

To aid students in learning to speak well publicly. The focus is on discussing in physical and analytical chemistry topics from journal articles appearing in recent year.

· **Seminar in Organic Chemistry (3)**

To aid students in learning to speak well publicly. The focus is on discussing in organic chemistry topics from journal articles appearing in recent year.

· **Seminar in Inorganic Chemistry (3)**

To aid students in learning to present well publicly, the class is focused on discussing in inorganic chemistry topics from journal articles appearing in recent years.

· **Seminar in Nano Chemistry (3)**

To aid students in learning to speak well publicly. The focus is on discussing in nano-chemistry topics from journal articles appearing in recent year.

· **Seminar in Biochemistry (3)**

To aid students in learning to speak well publicly. The focus is on discussing in biochemistry topics from journal articles appearing in recent year.

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1. Dept. of Applied Information Technology

This Graduate School program for the interdisciplinary studies offers an excellent education of applied information technology (AIT). The AIT focuses on the emerging high - technologies of science and engineering in a student - chosen application area. Therefore the wide range courses of this postgraduate study are provided by the Departments of Computer Science, Electronics Engineering, Mathematics, Physics, as well as College of Forest Science.

Graduate training in AIT aims to meet the advancing research and emerging needs of the information technology industry for creating new markets. The master program is rooted in educating classic information technology, centered around its applications such as professional development of security-related technology and of bio-medical engineering based on human welfare.

가. □ Courses

1) Data Structure and Algorithm (3)

An introduction to the design of algorithms. The emphasis is on learning techniques for creating algorithms, analyzing them, and proving their correctness. Topics include models of computation, asymptotic notation for analysis of algorithms, sorting and searching algorithms, design techniques such as divide - and conquer and dynamic programming, graph algorithms including spanning tree, shortest paths. Additional topics chosen from pattern matching, NP - hard, and NP – complete.

2) Numerical Analysis (3)

Advanced topics in scientific computation. Topics include differentiation, integration, solution of differential equations, equation solving, minimization/ maximization, linear algebra, interpolation.

3) Wireless Network (3)

The course includes the wireless networks protocols and physical layers for wireless multimedia applications. It covers WLAN, WPAN, ad - hoc networks, sensor networks. The course also deals with IPv6, Mobile IP, Cellular IP, and QoS MAC protocols.

4) Operating System (3)

This course covers in detail many advanced topics in operating system design and implementation. It starts with topics such as operating systems structuring, multi - threading and synchronization and then moves on to systems issues in parallel and distributed computing systems.

5) Digital Communication System (3)

This course is devoted to a detailed and unified treatment of digital communication theory as applied to communication system focused on the system reliability. Topics include source coding, signal encoding, representation, and quantization; methods of modulation, synchronization, and transmission; optimum demodulation techniques; and communication through band -limited and random channels.

6) Advanced Artificial Intelligence (3)

This course addresses the use of artificial intelligence and cognitive psychology to build computer-based intelligent tutoring systems. Students will learn empirical and theoretical methods for creating cognitive models of human problem solving. Such models have been used to create educational software that has been demonstrated to dramatically enhance student learning in domains like mathematics and computer programming. This course will have three components: a literature review of some of the fundamental papers in the field; lectures on the needed cognitive psychology and human -computer interaction (HCI) background; and a significant project component in which students will be practicing the use of methods used to design tutors.

7) Ubiquitous Sensor Network (3)

We introduce ubiquitous sensor network and its applications. Sensor network protocol and sensor node's architecture will be studied. We will cover physical layer, localization, tracking, MAC protocol, network layer including routing protocols, sensor tasking and control, sensor network platform, and mesh network. Convergence with WLAN, cellular network, satellite network, and greedy system will be studied, and the future of sensor network also will be explored.

8) Telegeoinformatics (3)

An introduction to mobile mapping. The course deal with 4 features, i.e., geopositioning of mobile devices, data and processing generally performed on spatial objects, distributed database management and processing, and location -based techniques required for computing and decision making.

9) Precision Agroforestry (3)

Advanced technology to both farm and forest production, management and manufacturing at a new scale of resolution and accuracy with the goal of producing economic and environmental benefits. The course provides practice examples on RS, GIS and GPS as a tool to support precision agroforestry.

10) Digital Photogrammetry (3)

This course provides the useful understanding of modern photogrammetry for deriving and acquiring digital imagery. It includes image processing algorithms for image correlation and calculation.

11) Theory of Discrete Distribution (3)

Probability generating functions, Poisson distribution, mixed discrete distribution, multivariate discrete distribution.

12) Applied Optics (3)

This course is intended to serve as a graduate level introductory course on optics. This course focuses on introducing general theories of optics such as geometric and physical optics, aberrations, optical instrumentation, interference, and polarization in optics. In addition, brief description of current researches in optics and their applications in modern technologies will be presented.

13) Database System (3)

Introduction to advanced database systems from a perspective of implementation. Topics include query processing, transaction management, concurrency control techniques, database recovery, database security and authorization, and how these concepts are implemented in real systems.

- **Image Processing (3)**

The course will provide mathematical foundations and practical techniques for digital manipulation of images; image acquisition; preprocessing; image transforms, image enhancement, image restoration, image coding, edge detection and segmentation, feature extraction, and image analysis.

- **Programming Language (3)**

This course covers formal and practical study of the definition, application and implementation of programming languages. It includes linguistic concepts of syntax and semantics, translation of high level languages into executable form. Data structuring, sequencing constructs and modularization features of representative languages.

- **Sampling Theory (3)**

Study on sampling theory, problem in sampling methods, decision of sample size, and sample survey.

- **GPS Applications (3)**

Introduction to the concepts needed to use GPS, GLONASS and QZSS. This course is also intended to increase student's enabling many kinds of GPS applications.

14) Web Information Processing Applications (3)

Introduction to the methods used to search for and discover information in the Web and Web information systems. Methods that are covered include techniques for searching, browsing and filtering information, classification, clustering, filtering, web mining, the use of classification systems and thesaurus, and Web search systems.

15) Advanced Object Oriented Programming (3)

Introduction to the principles underlying state of the art object-oriented technology. Besides the object-oriented programming language, topics also include object-oriented analysis and design, unified process, and design patterns issues.

16) Concepts of Functional Programming Languages (3)

Introduction to the concepts of programming languages which combine functional and logic programming techniques. The course covers high-order functions, pure functions, recusion, strict versus non-strict evaluation, type systems and pattern matehing, functional programming in non-functional languages.

17) Advanced Information-Technology Mathematics (3)

Study the math. fundamentals of information theory in the foundation of information technology. The course deal with uncertainty, entropy, and channel coding theory based

on statistics and probability.

18) Signal Processing for Remote Sensing (3)

Fundamentals of signal Processing application in remote sensing. This course covers principal component analysis, projected principal component analysis, Kalman adaptive filtering, time series analysis, neural network parameter retrieval, and independent component analysis.

19) 'Radiometry (3)

Fundamentals of measuring the radiation of various objects. This course also involves both the techniques of calculating radiative transfer and the measurement of fluxes and radiometric properties of different sorts.

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Dept. of Conservation of Cultural Heritage

The value of cultural properties is immeasurable. Cultural properties often have a very significant information concerning a people's origin, history and traditional setting. Department of Conservation of Cultural Heritage carries out the humanistic and scientific research into a broad range of conservation issues for cultural heritage. The department aim is focused in understanding the overall conservation science and practice for the protection of cultural heritage. For this purpose, the program is organized by integrated academic fields in history, archaeology, art & art history, architecture, chemistry, physics, material science, paper & wood science, and conservation science. The academic courses cover the entry-level introduction to the scientific methods and techniques, and the rationales of scientific investigation and practice for the conservation of cultural heritage. The specific areas of department include the records repository, art museum and art gallery, museum, and related conservation research center.

☐ **Courses**

❑ **Conservation of Cultural Heritage Major Courses**

· **Thesis Research**

Understanding the nature and definition of research ethics and producing new knowledge, new materials, or new methods in the student's field of specialization.

· **Topics in Korean Cultural History**

Considering historical characteristics by looking at transition of culture of the development of Korean history.

· **Readings in Korean History Original**

Reading historical materials that are the basis for understanding pre-modern and modern Korean history to cultivate the ability to understanding a social aspect in that time and to interpret literature.

· **Studies in Archives Management of History**

Acquired to fundamental knowledge of archives management of history.

· **Old Document Researches in Korea**

Considering description methods of traditional history with Quellenkritik by looking at Old document.

· **Study of Korean History and Cultural Properties**

Intensifying historical understanding about cultural heritage by looking at Korean

cultural heritages.

· **Seminar on Korean History**

Understanding historical and social background by grasping trends and features of various remains and heritages.

· **Research & Investigations in Archaeology**

Developing basic skills for archaeology by acquiring conception and method of various theoretical models about archaeology.

· **Advanced Study of Museum & Gallery**

Considering expert knowledges about storage of cultural heritage, display, preservation treatment and education.

· **Studies of Folklore**

Understanding folk cultural theories and methodologies by studying traditional culture by examiningly a folk customs, and faiths.

· **Topics in Legislation of Cultural Assets**

Considering expert knowledges about preserving and repairing cultural properties.

· **Eastern Art History Research**

Asian Art History Seminar : Seminar on Asian art examining the development of the art in Korea, China, and Japan along with the historical and theoretical contexts.

· **Western Art History Research**

Western Art History Seminar : Seminar on Western art history in its social, cultural, and theoretical context, while discussing the notion of modernity and examining the development of modern art practices.

· **Understanding & Conservation Theory in Art Works**

Studying conservation theory of art work as a management plan about various elements that cause damage of perception subjective and damage of work to art work.

· **Theory of Organizing Exhibition Planning**

Developing executive ability to display cultural heritages in museums, and studying expert knowledges about overall plan of display.

· **Introduction to Conservation Science for Cultural Properties**

Understanding the overall theories and material properties for conservation, cause analysis of deterioration, and studying the new trends of conservation science by scientific approaches.

· **Repair and Maintenance Technology in Wooden Cultural Properties**

Covering the conservation-restoration treatments for the continuance of wooden cultural properties to exist in its best condition possible, regardless of age and degradation.

· **Advanced Study of Conservation Science for Paper Cultural Assets**

Understanding the organic and inorganic materials for paper or fabric-based cultural properties, and studying the aging factors of paper materials, destructive and non-destructive methods for paper cultural properties.

· **Advanced Conservation Science and Technology in Wooden Cultural Properties**

Covering the related theories and technologies in area of conservation & restoration of wooden cultural properties. Key focus of conservation science is studying the protect methods, wood preservatives, remedial treatments as well as maintenance technologies.

· **Conservation Science for Cultural Properties Seminar**

Discussing the general topics of conservation science for cultural properties, and studying the research trends for understanding the modern conservation technologies.

· **Advanced microbiology and insectology in Cultural Properties**

Dealing with the related theory of destroying microorganisms and insects for the various cultural properties, emphasizing concepts as well as understanding deteriorating characteristics.

· **Nondestructive Research for Cultural Properties**

Understanding the status survey methodologies of cultural properties by non-destructive methods and combination technologies with various conservation approaches.

· **Chemical Instrumentation analytics**

Understanding the principles of chemical equipments and instruments, and applications of FT-IR, UV, and visible spectroscopy, nuclear magnetic resonance spectroscopy, mass spectrometry, x-ray diffraction technique and other modern instrumental techniques for analysing the various cultural properties.

· **Basic Chemistry for Cultural Assets**

Understanding the fundamentals of organic and inorganic chemistry, regarding on basic chemical bonding, reaction and mechanism for researching the cultural properties.

· **Materials of Cultural Properties and Practice**

Understanding the conservation materials according to the types of cultural assets, and the application of various materials to the cultural properties.

· **Analytical Studies & Practice for Cultural Properties**

Understanding the necessity and analytical research trend of cultural properties, and studying the analytical techniques of materials from cultural properties.

· **Practice for Hand-made Paper**

Covering the properties of papermaking fibers and non-fibrous additives, papermaking process, additional finishings, and the physical, mechanical and optical properties of paper, and also leaf-casting theories and application with fibrous materials.

· **Practice in Reproduction of Painting Cultural Assets**

Practice courses in reproduction process of painting cultural properties, and understanding the history, purpose and ethnics for conservation and restoration process.

· **Practice of Conservation Technique for Painting Cultural Assets**

Practice courses in conservational process and treatment of painting cultural properties.

· **Practice of Conservation Technique for Paper Cultural Assets**

Practice courses in reproduction process of paper cultural assets by understanding the characteristics of paper, and materials & process of restoration process.

· **Practice of Conservation Technique for Organic Cultural Assets**

Practice courses in conservational process and treatment of paper and fabric material-based cultural properties.

· **Practice of Conservation Technique for Inorganic Cultural Assets**

Practice courses in conservational process and treatment of glass and ceramic material-based cultural properties.

· **Practice of Conservation Technique for Metal Cultural Assets**

Practice courses in conservational process and treatment of metallic material-based cultural properties.

· **Practice of Conservation Technique for Wooden Cultural Assets**

Practice courses in conservational process and treatment of wooden material-based cultural properties.

· **Photographics in Cultural Properties & Practice**

Understanding the concept and techniques of photography for the status analysis, exhibition and work portfolio of cultural properties.

· **Advanced study Tradition Architecture**

Advanced course in traditional architecture for understanding the characteristics and structures of oriental/Korean architecture, and studying the history and morphological changes of architecture.

· **Advanced Study of Deterioration in Wooden Cultural Properties**

Managing the advanced theories centered on the causes of occurrence and detailed damage properties for wooden cultural properties by weathering conditions and wood deteriorating organisms.

· **Inspection of wooden cultural properties**

Dealing with the condition inspection methods and technologies of wooden cultural properties, which include various informations on visual inspection techniques, mechanical coring or probing techniques, and stress wave or ultrasound-based techniques etc.

· **Advanced Material Research on Art Work**

Medium of Artwork: Study on the material nature and specific characteristics of the medium of painting and sculpture, along with the material relations between mediums and supporting materials of the artwork.

· **Modern Art Conservation & Practice**

Practice in Restoration and Preservation of Modern Art: Study on practices of restoration and preservation of oil paintings and sculptures made in the modern era, while examining the particular nature of the medium.

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Dept. of Integrative Biomedical Science & Engineering

The Department of Integrative Biomedical Science and Engineering offers an excellent education and interdisciplinary cutting-edge research programs to train future leaders and innovators in biomedical science and engineering. Faculties from biochemistry, epidemiology, materials, electrical and mechanical engineering, and computer science provide a broad range of courses and joint research projects in partnership with academia and industry.

❑ **Biomedical Science Major**

Biomedical Science Major specializes in biological or medical application of basic sciences in the context of medicine. A wide range of courses are provided by faculties from biochemistry, epidemiology, materials, and engineering. Our program trains future leaders and innovators in biomedical science by offering an excellent education and cutting-edge research projects.

❑ **Biomedical Engineering Major**

Biomedical Engineering Major specializes in biological or medical application of engineering principles or engineering systems to living things. A broad range of courses are provided by faculties from mechanical and electrical engineering, computer science, materials, and biochemistry. Our program trains future leaders and innovators in biomedical engineering by offering an excellent education and cutting-edge research projects.

☐ **Courses**

❑ **Core Courses**

· **Molecular and Cellular Biology (3)**

The goal of the course is for graduate students to learn about basic concepts in molecular cell biology. Topics include chemistry of nucleic acids, DNA topology, DNA replication, repair and recombination, recombinant DNA technology, transcription, RNA processing and post-transcriptional control, translation and post-translational modification, protein structure and function, techniques for protein purification, tools for protein analysis, membrane biology, intracellular trafficking, cytoskeleton, cell cycle and division, cell signaling, and programmed cell death.

· **Introduction to Biomedical Engineering (3)**

Designed as a freshmen course, this lecture will provide the overview of the biomedical engineering field. Faculty from various School of Engineering departments will give

background lectures to introduce students to the fundamental basis for biomedical engineering and its application and impact to biomedicine. Topics include but not limited to biomaterials, biomechanics, bioelectronics and medical imaging.

· **Seminar on Modern Bioengineering (3)**
This course will examine the recent research trends in the biomedical science and engineering field. Specialists and scholars will be invited to give lectures on the new technologies and innovations. This course will focus on the currently debated areas of research in the relevant fields.

· **Independent Study1 (3)**
Under guidance of instructor, the basic procedures for thesis writing will be studied from selection of research topic in biomedical science and engineering, literature survey, methodology, analysis of results, paper writing and presentation.

· **Independent Study2 (3)**
Under guidance of instructor, the basic procedures for thesis writing will be studied from selection of research topic in biomedical science and engineering, literature survey, methodology, analysis of results, paper writing and presentation.

❑ **Biomedical Science Major**

· **Advanced Biology (3)**
This lecture will cover the up-to-date knowledge of biochemistry, molecular biology, molecular cell biology, microbiology, animal cell and tissue, and human physiology, which are the basis of biomedical science and biomedical engineering.

· **Current Topics in Bio Medicinal Materials (3)**
Studies and discuss on the current research trend in pharmaceutical and medical applications.

· **Advanced Biotechnology (3)**
This course covers the recent research trend and technology in the area of bio informatics, gene cloning, construction of genetically modified microorganisms, production of recombinant enzymes in microbial systems and kinetic analysis of recombinant enzymes.

❑ **Biomedical Engineering Major**

· **Biomaterials (3)**
The purpose of this course is to intruduce various biocompatible materials and to let students understand synthesis technology and material properties of biomaterials.

· **Biotransport Phenomena (3)**
Understanding the physical, chemical and biological processes governing the movement of mass and transmission of forces throughout an organism is important in biomedical

engineering and physiology. This course will cover transport processes which influence the normal and pathological function of cells and organs and provide fundamental knowledge of transport processes which are important in the design and operation of a number of biomedical devices.

· **Biomedical Optical Imaging (3)**

This course is intended to provide the optical imaging techniques and related photonics theory in biomedical field to visualize multiscale biological processes which are highly dynamic and complex in nature.

· **Cell Mechanics (3)**

This course focuses on the mechanical aspects of the cell including mechanotransduction. To study how cell biology and biochemistry influence the mechanical properties of the cell, we will discuss how cell properties can be measured experimentally and how they can be characterized in the form of equations. We will also study how mechanical environment, such as load, pressure, stress or strain, can influence the cell's shape and integrity, and eventually its biology and biochemistry.

· **Biomechanics (3)**

The biomechanics means the research and analysis of the mechanics and the application of engineering principles to and from biological systems. This lecture deals the analysis of joints, muscles, and bones of human body. The computer software for system integration is also studied.

· **Applied Haptic System (3)**

The haptic system is a tactile feedback technology that takes advantage of a user's sense of touch by applying forces, vibrations, and/or motions to the user. This lecture is composed of the theories for the haptic analysis and system integration technology.

· **Rehabilitation Engineering (3)**

Rehabilitation engineering is the systematic application of engineering sciences to analyze, design and develop the mechanisms and devices which can help individuals with disabilities. This lecture covers the rehabilitation theory and the system application.

· **Electrochemistry (3)**

In order to get insights on fundamentals of bioelectronics and related applications, chemical reactions which take place in a solution at the interface of an electron conductor (a metal or a semiconductor) and an ionic conductor (the electrolyte), and which involve electron transfer between the electrode and the electrolyte or species in solution are studied. In detail, the scope includes the electrolysis in which a chemical reaction is driven by an external applied voltage to and the battery in which a voltage is created by a chemical reaction. Furthermore, fundamentals of semiconductor device physics will be covered for understanding the operation principles of nanoscale biosensor devices and circuits.

· **Bioinformatics (3)**

Bioinformatics is the application of techniques and theory in statistics and computer science to solve problems arising from the management and analysis of biological data such as nucleic acid(DNA/RNA) and protein sequences in the filed of molecular biology. The primary goal of this course is to understand the computation techniques to process the biological data: sequence alignment, genome assembly, protein structure alignment, analysis of gene/protein expression, DNA chip, etc. The software tools and web services implementing the techniques are also covered in this course.

· **Medical Image Processing (3)**

This course presents the fundamentals of medical image processing. Topics include digital image fundamentals, image acquisition, image enhancement, image restoration, image segmentation, and image analysis. Students will develop practical experience through projects using the MATLAB Image Processing Toolkit.

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Dept. of Sports Engineering Convergence

The Department of Sports Engineering Convergence (SEC) is established to train professionals who are interested in converging sport science to engineering. It provides a knowledge and skills of the exercise science and kinesiology as well as engineering in general, which are appropriate in applying to sports industry. The demand of sports industry is emerging in the area of health, safety, and environmental services anchoring kinesiology and mechanical engineering. While the sociocultural environment is ever changing, a demand of human oriented services, platform, hardware, and software are growing enormously. SEC focuses on training human resources targeting knowledge building, skill improvement, and field experiences. SEC offers two major fields; 'Convergence Kinesiology Major' and 'Convergence Mechanical Engineering Major'. Students are free to select one of the two majors, and will earn one of two academic degrees; 'Master of Science' or 'Master of Engineering'.

☐ Courses

❑ Core Courses

· Sports Science and Industrial Technology

Understand the concept, relationship and application of sports, sports science, sports engineering and sports technology.

· Sports Engineering Convergence Seminar Ⅰ

Topical issues worth sharing will be given for students.

· Sports Engineering Convergence Seminar Ⅱ

Presentation and debates will be given for students.

· Sports Industry Field Practice

Students will experience dynamic aspects of sports industry and understand the practical demands of the business for sports engineering. Students are expected to gain field experiences at sports related locations.

· Research Ethics & Thesis Study

Students will understand research ethics which is required in dealing with humans in sports engineering and how they proceed a research thesis in the regards. Whether approaches of engineering toward social demands can correspond positively and

actively to agendas of sport ethics are examined. How competition and sportsmanship, gender equality and disability, ethics and cultural background, commercialization and sports values can be related to engineering will be studied.

❑ **Convergence Kinesiology Major**

· **Dynamics of Sports**

Mechanisms of human body dynamics related with sports and health care are studied. Understand the concept and application of the human movement mechanics for development and evaluation of various sports equipment.

· **Sports Media System**

Students will understand how the ever expanding media system in modern society would impact on sports and learn how the system could be applied to sports.

· **Sports Biomimetics**

Morphologic construction and ecological world of nature and human bodies are explored and studied. Possibility of application of natural structure on human body as well as on nature-friendly mechanical engineering is evaluated. Applicability of biomimetics on sports world will be assessed.

· **Big Data Analysis in Sports**

Through this course, it is able to obtain the knowledge of what the big data is in the multidisciplinary studies in sport, health, and rehabilitations. The students are able to apply the knowledge and skills of the big data analysis to the field by learning statistical analysis methods (e.g., R, SAS, etc) and theoretical models.

· **Sports Center Management Service Technology**

Students will understand importance of service management in sports center and learn what elements should be considered for effective center administration.

· **Research Methods in Sport Engineering**

Various research designs and methods applied in sport engineering are introduced and practiced within the classes so that the students can conduct their own research studies.

· **Human Energetics**

The aims of this course are to understand energy system for movements of human body by applying metabolic changes and biochemical mechanisms to mechanical systems designed and to learn energy economics and nutritional benefits in mechanical systems based on the mechanisms.

· **Sports Wear**

This course is designed both for enrolled graduate students at sports engineering program in Kook-Min university and sportswear industry personnel. Students will learn to design sportswear (sports apparel, sports goggle, sports shoes. etc) based on functionality, human performance, aesthetic sense, and environmental challenges.

· **Sports Rehabilitation**

Students will learn how to rehabilitate various types of injuries and damages effectively which could be happened in sports field and what kinds of techniques and methods will be delivered for the purpose.

· **Sports Car**

Students will learn characteristics and functions of sports car and explore modality pursuing of the human safety and performance.

❑ **Convergence Mechanical Engineering Major**

· **Sports Engineering Research**

Students will learn how to pull out research agenda which could be studied in sports engineering and learn how to solve the problems.

· **Trends in Sports Engineering**

Current trends of sports engineering including sports gear, equipments, and rehabilitation tools will be examined. Cutting edge ideas in academic and industrial terms will be discussed.

· **Rehabilitation and Robotics**

The state of art and core technology of rehabilitatin Robots in the sports and medical

fields are studied. And, motion of rehabilitation robots are studied based on the structure and movement of a human.

· **Mechanism Design for Sports and Rehabilitation**

The mechanism design for sports and rehabilitation is studied. Basic theory for the mechanism design is covered. The case studies for mechanism for sports and rehabilitation is introduced. The final term project should be carried for the mechanism design practice.

· **Sports Industry and IT Technology**

Students will learn how sports industry and IT technology could be converged and understand methods and techniques of field application.

· **Sports Industry and Electronic Engineering**

Students will learn how sports industry and electronic engineering could be merged and understand methods and techniques of field application.

· **Sports Bioengineering**

Basic theory, concept and terminology of biomechanics related with sports are introduced and how the theories of bio-solid and bio-fluid mechanics are applied on the bio-system and human body will be studied. Especially, the theme of contact mechanics which acted in human body or sports action will be studied.

· **Sports Sensor, Measurement and Analysis**

Based on the understanding for various sports related sensors and measurement techniques, the evaluation methods for body and sports performances are studied.

· **Sports Thermal Fluid Engineering**

Based on the theoretical understanding on the heat, energy and fluid drag force, student can learn about the design method to improve the efficiency of sport utility and the performance of competition ability.

· **Do-it-yourself for Sports Equipment**

This course deals with sports equipments in aspects of manufacturing engineering. Among the required features such as performance, aesthetic design,

price-competitiveness, eco-friendliness, the course particularly focuses on price and safety. Designing and manufacturing experience in classroom, as termed as DIY (Do-it-yourself), will be attempted.

· **Design and Evaluation in Sports Equipment**

Mechanical designing techniques and evaluating methods for spors equipments will be reviewed in this course. Historical evolution and features will be discussed in the classroom.

· **Application of Advanced Materials in Sports Products**

Applications and case studies of advanced materials in sports- or health-related products are studied. The course deals with materials selection basing on the mechanical behavior of sports-related products such as elastic, plastic or failure-limited design. The case studies that how the advanced materials are contributed to improve the record of player will be also studied.

· **Sports Wearable Device**

The hardware and working principles of various sports and health related wearable devices are studied. Smart wearable coaching systems for the feedback coaching through expert systems can be designed and fabricated.

· **Sports Intelligent Design**

This course introduces recent theories and systems for sports related 3D solid modeling. We study the latest sports intelligent design techniques combining with information technologies such as an artificial intelligence and virtual reality applications.

· **Fitness Facility Design and Leveraging Technology**

Given in this course are planning, design, construction, maintenance, and management of sports facilities such as athletic ground tracks, swimming pool, and fitness room.

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Dept. of Convergence Design & Technology

This department was established to take on researching and developing a fashionable smart fashion offering customized service according to the purposes of users through a "differentiation" strategy instead of a "me-too" strategy in the wearable device form whose sales had been limited to ancillary smartphone products. The goal of the department is to develop a flexible electronics-based module system and smart fashion platform that would allow users to choose a specialized module for each function according to their purposes, attach and detach it, and reorganize it.

❑ **Convergence Design Major Course**

Convergence Design Major aims to cultivate professional manpower for convergence design to propose the methodology and criticism, seeking for a new design based on basic design principles and engineering (electronic engineering, computer science, and materials science). That is to say, we produce high-quality human resources of academic field with both theoretical basis and realistic sense of design and promote development of convergence design.

❑ **Convergence Electronic, Materials, and Computer Science Major Course**

Convergence Electronic, Materials, Computer Science Major aims to cultivate professional manpower for convergence between engineering and design to propose the methodology and criticism, seeking for a new engineering design based on basic design principles and engineering (electronic engineering, computer science, and materials science). For the purpose, this program provides the basic understanding of engineering principles and industrial design which lead to creation of design and devices for smart fashion. It also offers the research experience and course work required for convergence between engineering and design.

☐ **Courses**

❑ **Core Courses**

· **Convergence research (3)**

Graduate students are doing research on modular smart fashion in terms of convergence, which consists of design, engineering, and marketing. Students are urged to pursue an research and scientific writing with the guidance of faculty members.

· **Convergence technology seminar (3)**

Several experts in various areas such as electronic enginnering, computer engineering, materials science and engineering, fashion design, industrial design will give lectures in convergence technology's point of view. Students will study basics

and applied knowledges on various fields.

· **Convergence technology and management (3)**

This lecture is composed of three parts. First part is to introduce typology of technology management, and basic concept and characteristics of technology innovation. Second part introduces strategic management of innovation process such as]managing R&D teams, projects, and organizations, based on theories of technological innovation. The last part includes cases and issues associated with technology management, e.g. R&D management, new product development, high tech marketing, and management of innovation output.

· **Convergence creative project (3)**

The aims of this course is to develop creative content, product, or service that has high degree of completion, meets sensitivity of consumers, and improves value of one's life. Each project group chooses a project that is proposed by institutions, companies, or students themselves. And they should perform overall process containing planning, design, production, and marketing. The final outcome will be shown to publics in the form of exhibition, showcase and others.

· **Independent Study (3)**

In this course, smart fashion research will be understood as an independent discipline. Characteristics of smart fashion research will be studied based on convergence technology. Basic principles, structure, process required for writing thesis paper and research paper will be learned, applicable research methods for smart fashion research fields will be explored. Students will experience methods for writing thesis paper through writing research proposal, and examine optimal research methods in accordance with personal research theme.

❑ **Convergence Design Major Course**

· **Emotional design trend research (3)**

It is a convergence project course designed to predict trends in the future society, write a future scenario based on them, and propose creative ideas about smart fashion products and services through multidisciplinary convergence.

· **Design and technology seminar (3)**

This course will focus on industrial design related to the analysis and principles of human emotional signal. Students will study the basic concept of emotional design, sensitivity measurement method, and human signal analysis.

· **Fashionology convergence project (3)**

It focuses on convergence researches to investigate design, technology, and market

strategies and develop prototypes through the development of creative user-centric content on the topic of smart fashion.

· **Emotional interface design (3)**

This course provides a comprehensive overview of the user interface and user experience design process, and is intended to familiarize students with the concepts and techniques necessary to make user interface and user experience design an integral part of developing media interfaces. The course provides students with an opportunity to acquire the skills and hands-on experience they need to design, develop, and evaluate media interfaces from a user-centered design perspective.

· **Transmedia content (3)**

This course is designed to enhance student's integrated perspective on design, humanities and technologies. It provides insights about methodologies for planning and developing cultural content and mobile & interactive technologies by using stories, images, text, design trend, audio and film. Relying upon analyzing case studies, students have a chance to draw out their own creativity both in developing an user-scenario and in designing a content prototype.

❑ **Convergence Electronic, Materials, and Computer Science Major Course**

· **Advanced open source software (3)**

Advanced Open Source Software is a subject dealing with definition, concept, and properties of open source software. It generally uses the principles of the open source, and practices in the community of open source software using the self-developed software. Through advanced open source software, students learn that source code which is developed in a collaborative public manner provides the rights to study, change, and distrubute the software to anyone and for any purpose.

· **Open source hardware architecture (3)**

Open source hardware architecture is a subject dealing with definition, concept, and properties of open source hardware. It generally uses the principles of the open source, and practices in the community of open source hardware.

· **Networks and application (3)**

Students will understand the basic concept of network and study state-of-the-art network research areas such as next-generation wireless networks, next-generation IMS, SDR, cognitive radio networks, and cross-layer optimization methods.

· **Advanced multimedia (3)**

Advanced Multimedia lays the foundation for graduate students to build multimedia computing applications comprising images, video, and audio. The module covers the important multimedia computing methods by presenting comprehensive coverage of

the underlying content processing, content transformation and resource optimization techniques in a variety of systems.

· **Interactive smart materials (3)**

In this course, graduate students will study the principles and application of interactive smart materials. Students will also research materials for smart fashion applications.

· **Convergence materials technology (3)**

In this course, graduate students will study the principles and application of interactive smart materials. Students will also research materials for smart fashion applications.

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