전 기 공 학 과

(DEPARTMENT OF ELECTRICAL ENGINEERING)

**Department Introduction**

The Graduate Program in Electrical Engineering at Yeungnam University was established in 1971 (Master Degree Program in 1971 and Doctoral Degree Program in 1973) in order to achieve the educational commitments including studying in-depth academic research and producing outstanding engineers for the industries. For the last 40 years, we achieved a remarkable development in electrical engineering research and produced a great deal of advanced engineers. Twelve faculty members currently devote themselves to education and research in electrical engineering. We have two academic tracks including (1) Energy & Electromagnetic Compatibility Engineering and (2) Control, Electric Machine, & Energy Conversion. The research field of the former academic track includes electrical energy which is a fundamental element for building information technology society, energy storage and power transmission based on a superconductivity technology, photoelectronic engineering based on laser, electric discharge and high voltage engineering, plasma application engineering, electromagnetic compatibility engineering, and smart grid power system engineering. The research area of the latter academic track includes robotics and industrial automation which are fundamental elements for advanced industrial society, control engineering such as fuzzy control and robust control system, and energy conversion engineering such as power electronics, electric machine drive, electric machinery analysis, alternative energy conversion, and power quality.

**List of Faculty Members**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Position | Name | Last School Graduated | Degree | Major |
| Professor | Lee Suk Gyu | UCLA | Ph.D | Control Robotics |
| Professor | Kim Ki Chai | Keio Univ. | Ph.D | Electromagnetic Wave Engineering, EMI/EMC |
| Professor | Lee Hai Young | KAIST | Ph.D | Process Control & Diagnosis |
| Professor | Kwon Soon Hak | Tokyo Institute of Tech. | Ph.D | Systems Science & Image Processing |
| Professor | Lee Dong Choon | Seoul National Univ. | Ph.D | Power Electronics, Electric Machine Drives |
| Professor | Jessie Juhyun Park | POSTECH | Ph.D | Nonlinear Dynamics |
| Professor | Seok Jul Ki | Seoul National Univ. | Ph.D | Power Electronics |
| Assistant Prof. | Rhee Sang Bong | Hanyang Univ. | Ph.D | Smart Grid, Power System |
| Assistant Prof. | Woo Dong Kyun | Seoul National Univ. | Ph.D | Electric machinery |
| Assistant Prof. | Kim Ji Hong | Korea Univ. | Ph.D | Electrical/Electronic Materials and Devices |

**Academic programs**

- Ph.D Program

- Master Degree Program

**Course Description**

**■ Basic Major Courses**

선형시스템해석 3 credit

(LINEAR SYSTEM ANALYSIS)

Basic mathematics in linear space and algebra. Mathematics of dynamic processes. Characterization of systems. Stability analysis. Controllability and observability. Canonical structure, Realiation. Estimation and advanced topics including Kalman-Bucy filter and adaptive control systems.

에너지공학특론 3 credit

(ADVANCED ENERGY ENGINEERING)

This lesson covers a wide range of theory and technologies related to energy situations in domestic and other countries, energy generation, energy distribution, energy applications, energy saving, development of new energy storage, energy and environment.

전자장특론 3 credit

(ADVANCED ELECTROMAGNETIC FIELD THEORY)

The subject deals with electromagnetic phenomena extensively including time-dependent dynamic electromagnetic fields and time-independent static electromagnetic fields and analyzes their physical phenomena. The class also discusses relativity and its application to electromagnetic phenomena.

회로망해석및합성 3 credit

(CIRCUIT NETWORK ANALYSIS AND SYNTHESIS)

This subject lectures a circuit analysis for series and parallel circuits of resistor, inductance, and capacitance in steady state and transient state. Also, Circuit synthesis of passive and active elements, design of two-terminal and two-port circuits, analysis of distributed circuits in frequency domain, and circuit design by optimization are lectured.

선형제어특론 3 credit

(ADVANCED LINEAR SYSTEM THEORY)

The objective of this course is to introduce various applications of linear control systems such as stability analysis and stabilization of large-scale system and time-delay systems, problem of guaranteed cost control, nonfragility of controller, introduction of MIMO system, hybrid system and discrete-event system, etc. To this end, one should be needed the following basics: applications of Lyapunov equation and Riccati equation, convex optimization theory.

**■ Major Courses**

개별연구(1) 3 credit

(INDEPENDENT STUDY (1))

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

개별연구(2) 3 credit

(INDEPENDENT STUDY (2))

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

전기공학과세미나 1 credti

(SEMINAR)

Invited seminars for various topics are performed by academic and industrial specialists who are working in electrical engineering areas.

특수문제연구(1) 3 credit

(SPECIAL STUDY(1))

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

This class is intended to introduce recent academic fields that are newly emerging in each major fields. This class is also opened as an inter-disciplinary subject in association with other major.

Special study for emerging materials, synthesis and fabrication.

특수문제연구(2) 3 credit

(SPECIAL STUDY(2))

Special study for emerging materials, synthesis and fabrication.

회로망해석및합성 3 credit

(CIRCUIT NETWORK ANALYSIS AND SYNTHESIS)

This subject lectures a circuit analysis for series and parallel circuits of resistor, inductance, and capacitance in steady state and transient state. Also, Circuit synthesis of passive and active elements, design of two-terminal and two-port circuits, analysis of distributed circuits in frequency domain, and circuit design by optimization are lectured.

**■ 에너지및환경전자전공**

**(ENERGY AND ELECTROMAGNETIC ENVIRONMENT MAJOR)**

레이저공학특론 3 credit

(ADVANCED LASER ENGINEERING)

Laser is coherent light and it has so many applications in the industry. In this lecture we will study laser oscillation, laser resonators and modes, laser qualities, laser control technologies, laser equipments and materials. In addition we will study applications of laser.

방전및고전압공학 3 credit

(DESCHARGE AND HIGH VOLTAGE ENGINEERING)

This lecture deals with the discharge phenomena and its mechanism with the kinds of dielectric materials like solid, liquid, complex material. The discharge phenomena in vacuum also will study. The discharge characteristics in the cryogenic temperature liquid will be specially discussed. In this lecture we will study breakdown phenomena and mechanism about a solid, liquid, gas dielectrics, complex dielectrics, And this lecture deals with a method of high-voltage measurement, high-voltage generator and high-voltage experiment.

방전응용공학 3 credit

(DISCHARGE APPLICATIONS ENGINEERING)

This lecture deals with discharge phenomena and its mechanism in solid, liquid, gas, complex dielectrics and vacuum. Also, discharge applied illumination, ozonizer, reactor for removal of NOx, SOx, electro static precipitation, electro static painting, MHD, EFD generations and environment improvement facilities will be discussed.

신발전공학 3 credit

(NEW POWER GENERATION ENGINEERING)

This lectures understand power generations using hydraulic, heating, atomic energy and deals with generation method of a new electric energy using solar energy, suberranean energy, hydrogen energy, MHD, solar battery and nuclear fusion reactions. And storage method of electric energy using spring, compressed gas, water pumping generation, flywheel, superconductive coil, condenser, battery will be introduced.

에너지및환경전자세미나(1) 3 credit

(SEMINAR IN ENERGY AND ELECTROMAGNETIC ENVIRONMENT Ⅰ)

It will conduct a seminar on a paper of special study that has relation to energy and electromagnetic environment.

에너지및환경전자세미나(2) 3 credit

(SEMINAR IN ENERGY AND ELECTROMAGNETIC ENVIRONMENT Ⅱ)

It will conduct a seminar on a paper of special study that has relation to energy and electromagnetic environment.

전기잡음특론 3 credit

(ADVANCED ANALYSIS OF ELECTRICAL NOISE)

전력계통공학특론 3 credit

(ADVANCED ELECTRIC POWER SYSTEM ENGINEERING)

This lecture is focused on outline of electric power system, basic theory of electric power system, the calculation of electric power trend, economical operation of electric power system, and the frequency & voltage control of electric power system.

전리이온공학특론 3 credit

(ADVANCED IONIZATION GAS DYNAMIC ENGINEERING)

This lecture deals with ionzation plasma, which new utilization method of electric energy, and ion generation and its control technology, new material development under physical or chemical reactions, high efficiency laser generation, new energy source development and measurement by laser

전자파와생체 3 credit

(BIOLOGICAL EFFECT OF ELECTROMAGNETIC WAVES)

Electromagnetic waves are widely used in the present. This lecture deals with the biological effect of electromagnetic waves.

전파전송공학특론 3 credit

(ADVANCED ELECTROMAGNETIC WAVE TRANSMISSION ENGINEERING)

The point of this lecture, starting from the Maxwell Equations, is a full understanding of an elementary knowledge for an Electric wave engineering and the application of various branches of electric wave. This class is treated of the Maxwell equations, the medium equation, the solution of wave equation, a radiation of electric wave and basic of antenna.

플라즈마공학특론 3 credit

(ADVANCED PLASMA ENGINEERING)

Plasma is widely applicable to nuclear fusion study, MHD generation, illumination, gas laser, plasma processing, ion engine as well as important as fundermentals of gas electron engineering. Firstly, lecture will be processed about plasma study, basic experimental items, and secondly, discussion will be processed about interesting topic related with plasma fields.

환경전자공학특론 3 credit

(ADVANCED ELECTROMAGNETIC COMPATIBILITY)

From this lecture, students can learn that electrical and electronic devices and systems can be sources of electromagnetic noise and can be affected by noise from other devices and systems at the same time. And they can learn EMC/EMI required to make harmonious electromagnetic environment among electrical and electronic devices and systems.

In detail, students learn components of electromagnetic interference, properties and characteristics of electromagnetic noise source, devices and sensors for electromagnetic interference measurement and EMC standard regulations, and so on.

제품친환경성평가및실습 3credit

(ENVIRONMENTAL EFFECT ASSESSMENT OF PRODUCT AND PRACTICE)

A product has negative environmental effect during the production, usage, and end-of-life treatment process. In order to reduce these effect, some factors should be take into consideration in the designing phase like use of energy, choise of material and structure of product.

LCA 3 credit

(LCA(LIFE CYCLE ASSESSMENT))

LCA(Life Cycle Assessment) is a process to evaluate the environmental burdens associated with a product system, or activity by identifying and quantitatively or qualitatively describing the energy and materials used, and wastes released to the environment, and to assess the impacts of those energy and material uses and releases to environment. The assessment includes the entire life cycle of the product or activity, encompassing extracting and processing raw materials; manufacturing; distribution; use, re-use, maintenance; recycling and final disposal; and all transportations involved. Life-Cycle Assessment in general should be looked upon as a design discipline to be applied at different level

Eco디자인3 credit

(ECO-DESIGN)

The widespread use of industrial products has drawn increased awareness to their environmental impacts. As a result, legislation, as well as market-driven requirements for Eco-design is emerging. The goal of eco-design is the reduction of adverse environmental impacts of a product throughout its entire life cycle.

In this lecture teach the background knowledge and methods for concept design related to eco-design. Some experts in the field will be invited to describe their practical experience.

탄소관리 3 credit

(CARBON MANAGEMENT)

Carbon-based energy system today has two decisive disadvantages, accelerated depletion of energy resources and threatening influences to the global environment. Law-carbon energy system is known as basic alternative method to stabilize global warming in an appropriate level, to prolong resource limit and to make our economic-social system sustainable. Carbon management is aimed to reduce input of carbon-based energy into the industrial and service processes, to develop renewable energy and to use Clean Development Mechanism (CDM) and Emissions Trading (ET) introduced by UNFCCC. This study course covers law-carbon energy technologies and systems and its use in the Flexible Mechanism provided by Kyoto Protocol. The students also are to learn to generate Certified Emission Reduction (CER) and its trading through some practical training projects.

레이저공학특론 3 credit

(ADVANCED LASER ENGINEERING)

Laser is coherent light and it has so many applications in the industry. In this lecture we will study laser oscillation, laser resonators and modes, laser qualities, laser control technologies, laser equipments and materials. In addition we will study applications of laser.

신발전공학 3 credit

(NEW POWER GENERATION ENGINEERING)

This lectures understand power generations using hydraulic, heating, atomic energy and deals with generation method of a new electric energy using solar energy, suberranean energy, hydrogen energy, MHD, solar battery and nuclear fusion reactions. And storage method of electric energy using spring, compressed gas, water pumping generation, flywheel, superconductive coil, condenser, battery will be introduced.

환경전자공학특론 3 credit

(ADVANCED ELECTROMAGNETIC COMPATIBILITY)

From this lecture, students can learn that electrical and electronic devices and systems can be sources of electromagnetic noise and can be affected by noise from other devices and systems at the same time. And they can learn EMC/EMI required to make harmonious electromagnetic environment among electrical and electronic devices and systems. In detail, students learn components of electromagnetic interference, properties and characteristics of electromagnetic noise source, devices and sensors for electromagnetic interference measurement and EMC standard regulations, and so on.

신재생에너지공학특론 3 credit

(ADVANCED RENEWABLE ENERGY ENGINEERING)

The objectives of this course are to understand green energy systems, to develop their modeling techniques, and to understand the integration technologies of the green energy systems into the utility grids. In order to achieve such objectives, students will learn the modeling techniques of photovoltaic power systems and wind power systems as well as the configuration methods of such green energy systems.

마이크로그리드와에너지저장시스템 3 credit

(DC MICROGRID AND ENERGY STORAGE SYSTEM)

The objectives of this course are to understand DC microgrids, energy storage systems, and integration technologies of green energy systems into the utility grids. In order to achieve such objectives, students will learn the technologies of DC microgrids, energy storage systems, and renewable energy systems as well as their configuration methods.

전력계통과도현상해석3 credit

(POWER SYSTEM TRANSIENT THEORY)

This course explores the topic of transient problems on electric utility and industrial power systems. The purpose is to teach students the fundamentals and to enable them to recognize and solve transient problems in power networks and components. Topics include: a review of the Laplace transform and dc circuit transients, ac switching transients, transients in three-phase circuits, transients waves on transmission line, system modeling, computer analysis methods, lightning, and insulation coordination.

전력시스템최적제어3 credit

(OPTIMAL POWER SYSTEM CONTROL)

To provide students with an understanding of the advanced topics in power system stability, control and optimal operation. Economic dispatch of thermal units and methods of solution; transmission losses; unit commitment. Transmission line transients. Control of generation. Active power-frequency and reactive power-voltage control. Automatic generation control. Optimal power flow. Power system protection and reliability of protection system. Power system stability and protection for stability enhancement.

Eco디자인세미나3 credit

(ECO-DESIGN SEMINAR)

Seminar lectured by experienced company expert in the area of DfE (Design for Environment). The seminar covers topics related to trends and examples related to the environment friendly products, international regulation related to environment, and world trends.

**■ 제어및기기ㆍ전력변환전공**

**(CONTROL AND ELECTRIC MACHINERY․POWER CONVERSION)**

강인적응제어 3 credit

(ROBUST ADAPTIVE CONTROL)

Objectives

- To present the fundamental issue of performance/stability robustness tradeoff.

- To facilitate and enhance the student's understanding of robust control system analysis and design methods through the use of computer aided design software.

- To present the methodology for designing of adaptive control algorithms using direct and indirect adaptive schemes.

- To present the methodology for designing of linearizing adaptive control algorithms for a class of nonlinear systems.

Detail topics: Model uncertainty description. internal stability, nominal performance, robust stability, robust performance. Coprime factorization. Controller parameterization. Loopshaping. Model-matching problem. Stability margin optimization, Hinf optimization. Mixed sensitivity problem. Parametric robustness analysis, The adaptive problem statement. The identification problem and identification algorithms. Model reference adaptive control problem, Direct and indirect adaptive control, autotunning adaptive control.

계장시스템 3 credit

(INSTRUMENTATION SYSTEM)

This subject cover analysis and design technique of process automation systems.

Main topics to be treated are as follows:

- Several Processes: Paper, water-treatment, iron and steel making

- Structure of Instrumentation System

- Mathematical modeling of process

- Major control technique : PID, Feedforward, Ratio, Cascade, Sample PI etc

- Term project : Design of Instrumentation System

고주파스위칭전력회로 3 credit

(HIGH FREQUENCY SWITCHING POWER CIRCUIT)

The objective of this course is to introduce high frequency switching power circuit and topology. The following details are considered in resonant and quasi-resonant mode :

1. Zero-current switching(ZCS)

2. Zero-voltage switching(ZVS)

3. Other application topologies

기기및전력변환세미나(1) 3 credit

(MACHINERY AND POWER CONVERSION SEMINAR Ⅰ)

This subject consists of different kinds of new topics related with the major of machinery and power conversion.

기기및전력변환세미나(2) 3 credit

(MACHINERY AND POWER CONVERSION SEMINAR Ⅱ)

This subject consists of different kinds of new topics related with the major of machinery and power conversion.

디지털제어특론 3 credit

(ADVANCED DIGITAL CONTROL)

This course deals with special topics on recent techniques related to analysis and design of industrial digital control systems. Main topics are design of digital controllers, design of distributed control system, data communication technique, information processing methods and etc. Also project on analyzing performance of digital control system in special industrial process is done.

로봇공학응용 3 credit

(APPLICATION OF ROBOTICS)

The objective of this course is to provide students with basic concepts underlying the design and application of manipulators and mobile robots;

This course covers geometry, kinematics, dynamics, control, trajectory planning, and sensors of manipulators and mobile robots. Some special topics such as web based control of robot and enhanced navigation strategy are also discussed.

마이크로프로세서기반시스템설계 3 credit

(DESIGN OF MICROPROCESSOR-BASED SYSTEM)

The objective of this course is to enhance the design ability of the system based on microprocessor, microcontroller and DSP. This course covers the structure of the components and programming skill to design a target system such as a microrobot.

반도체전력변환시스템 3 credit

(SOLID-STATE POWER CONVERSION SYSTEM)

This course covers the principles of solid state power conversion system. The details include the introduction of power semiconductor devices, AC/DC, DC/AC, AC/AC power conversion system.

비선형제어이론 3 credit

(NONLINEAR CONTROL THEORY)

Introduction to the nonlinear system analysis and design of nonlinear control systems. Analysis of nonlinear systems using phase plane method, describing function method, Lyapunov direct & indirect methods, and Popov/circle criteria. Design of nonlinear controllers using a variety of methods: liberalization, absolute stability theory, feedback liberalization technique, and sliding mode control.

서보제어시스템 3 credit

(ADVANCED SERVO CONTROL SYSTEM)

This subject covers the principles of precision position control theory for servo control system. The frequency domain analysis is performed and the performance is compared to time domain results. And also, linear motor drives are introduced.

스위칭전원시스템 3 credit

(SWITCHING POWER SUPPLY SYSTEM)

The subject puts emphasis on helping students intensively understand power semiconductor converter system and its applications. The lectures deal with class D current/voltage-driven rectifiers, class Erectifiers, class D resonant/ZVS inverter system, class D resonant-CLL converter system as well as basic concepts of switching power supply system.

영상처리특론 3 credit

(ADVANCED IMAGE PROCESSING)

This course deals with theory and application of digital image processing such as formation of digital images, image preprocessing, image segmentation, shape representation and description, pattern recognition, image understanding, and case studies.

전기기기디지털제어 3 credit

(DIGITAL CONTROL OF ELECTRICAL MACHINES AND APPLICATION)

This subject cover analysis and design technique of digital control for machine drives and its applications.

Main topics to be treated are the current, speed, and position controller and simulations using Matlab/Simulink are carried out.

전기기기해석및설계 3 credit

(ANALYSIS AND DESIGN OF ROTATIONAL ELECTRICAL MACHINES)

This course deals with analysis and design problem of rotational electrical machines. The details include mechanical shaping, basic flux/torque generating principles, magnetic circuit, and design equations.

전동기제어공학 3 credit

(CONTROL OF ELECTRICAL MACHINE DRIVES)

The objective of this course is to provide students with basic concepts of d-q transformation, d-q modelling, and vector control theory. This course also derives steady state and transient equivalent circiut of machine for high performance drives.

전력전자공학특론 3 credit

(ADVANCED POWER ELECTRONICS)

The purpose of this courese is to give the students knowledge of PWM techniques and control method. In more details, the focus is: Simulation studies are performed using Matlab/simulink or PSIM package to obtain practical design problems.

전력전자응용 3 credit

(APPLICATIONS OF POWER ELECTRONICS)

In this subject, a varity of applications of power electronics is dealt with, for example, such systems as HVDC(high voltage dc) transmission, FACTS(flexible ac transmission systems), SVC(static var compensator), APF(active power filters), and UPS(uninterruptible power supply) to control electric power transmission and to improve the power quality. Also, a lecture on electronic ballast, induction heating, and electric welding is presented.

전자기노이즈공학 3 credit

(ELECTROMAGNETIC NOISE THEORY)

The objective of this course is to understand the principles of electromagnetic noise generation and coupling path. And then, the noise suppression techniques of the digital equipment and PCB are introduced.

제어기기및장치 3 credit

(INSTRUMENTATION DEVICE)

This course treats various automatic controllers which are operating in industrial plants and deals with function, structure and usage of related apparatus. Main topics are programmable logic controller, one-loop controller, one-chip controller, A/D and D/A borad, data communication board and etc.

지능제어특론 3 credit

(ADVANCED INTELLIGENT CONTROL)

Concept of intelligent systems and controller, Fuzzy set, fuzzy logic, fuzzy inference and reasoning, Fuzzy modeling. Analysis and design of fuzzy controllers. Fundamental concept of artificial neural networks. Learning mechanisms. Neuro-fuzzy model and its learning. Concept of genetic algorithms.

최적제어이론 3 credit

(OPTIMAL CONTROL SYSTEM THEORY)

This course deals with theory and application of optimal control systems such as definition of optimal control problems, dynamic programming, Hamilton-Jacobi equation, Pontryagin necessary conditions, and computational methods in optimal control.

특수기기제어 3 credit

(SPECIAL MACHINE CONTROL)

This subject covers the operation principles and driving techniques of Synchronous/Switched Reluctance Motor, Step Motor, BLDC Motor, IPMSM, and High Saliency Motor.

확률제어 3 credit

(STOCHASTIC CONTROL)

Design, analysis and optimization of controlled stochastic systems. Review of probability theory. Stochastic processes. Stochastic state models. Analysis of dynamic systems with stochastic inputs. Parameter optimization. Minimal variance control strategies. Prediction and filtering. Linear stochastic control.

컴퓨터제어시스템이산모델링 3 credit

(DISCRETE TIME MODELING OF COMPUTER CONTROL SYSTEMS)

The objectives of this course are to develop an understanding and practical insight in physics-based discrete time system modeling and physics-based control structures for computer control systems as well as to develop depth in this insight via practical design mini-projects for electromechanical systems. Discrete time physical system modeling using latched input response for physically cross-coupled state variable models including variable sampling capability.

모델링및시뮬레이션 3 credit

(MODELING AND SIMULATION)

This subject provides modeling and simulation techniques for power electronic application systems such as power converters, motor drives, and renewable energy. Different softwares for power electronics simulation are introduced.

전력전자제어시스템설계 3 credit

(DESIGN OF POWER ELECTRONICS CONTROL SYSTEMS)

This lecture provides hardware design and implementation for power electronics system control. The students will learn DSP programming, interface circuits such as A/D converter, D/A converter, speed measurement, gating, communication, and PWM converter control, inverter-fed motor control, and filter design.

신재생에너지변환시스템 3 credit

(RENEWABLE ENERGY CONVERSION SYSTEM)

In this subject, the conversion mechanism to the electric energy from the renewable energy such as the wind energy, the solar energy, and fuel cell are dealt with. Also, the power conversion systems to supply the load from the generated electric energy investigated. The detail topics are as follows: the principle of wind power generation, the principle of photovoltaic generation, the operating mechanism of fuell cell, hybrid generation, power conversion system for ac output voltages, maximum power tracking control, isolated-load system, grid connection, parallel operation, etc.

고전력밀도전력변환장치설계 3 credit

(HIGH POWER DENSITY POWER CONVERSION SYSTEMS)

The objectives of this course are to explore Non-isolated/isolated high power density power conversion systems for sustainable power distribution systems. This course builds the foundation of choice of switching devices, passive elements, and state space modeling.

제어및자동화세미나(1) 3 credit

(CONTROL AND AUTOMATION SEMINAR Ⅰ)

This course has been designed to provide a group of students interested in control and automation with the opportunity to explore new topics on control and automation in a small-seminar setting, and focuses on the introduction to new topics on control and automation with a faculty member or the invited experts. Topics may vary from a faculty to experts and from semester to semester.