Descriptions of Courses

EE201 Circuit Theory
The aims of this course are to make the student understand principles and fundamental concepts of circuit analysis; to develop the student's familiarity and understanding in modeling and analyzing circuits through a variety of real-world examples. Another important aim is to extend the student's ability to apply system analysis to other branches of engineering.

EE202 Signals and Systems
This course is an introduction to continuous-time and discrete-time signals and systems. The course covers Fourier series, Fourier transform, Laplace transform, and z-transform. Various types of systems with emphasis on linear time invariant system is studied.

EE203 Digital System Design
This goal of this course is to understand the basic principles of digital logic circuit, and the fundamental concepts, components and operations of digital system.

EE204 Electromagnetics I
This course is designed to cover basic electromagnetic theory. The course discusses electrostatics, magnetostatics, and magnetic induction.

EE205 Data Organization for Engineering Application
This course is to provide EE students with understanding and ability for design and implementation of data structure for problems solving in the EE area using computer programming. It deals with information representation using data abstraction, object-oriented programming, Algorithm analysis. Basic data structures to be covered are Array and Linked list, Stack and Queue, Tree, Graph, Sorting, and Hashing. Applications of such basic structures in EE problems using C++ are also covered.

EE206 Electronic Circuits I
This course is an introduction to electronic circuits and the analysis and design of transistor amplifiers. First, the course extensively explains the basic operation principles of diodes, BJTs, and MOSFETs derived from physical structures and gives a concept of equivalent device models. Then, we will study the design and analysis of basic BJT and FET amplifiers and differential and multi-stage amplifiers.
(Prerequisite: EE201)

EE209 Programming for Electrical Engineering
This course covers data structures, algorithms, JAVA for electron electronics engineering. We study object-oriented programming techniques and use programming language C, JAVA.

EE301 Electronic Circuits II
This course starts with the basic circuits for the design of BJT and CMOS amplifiers. The topics include the frequency response of amplifiers, feedback, an introduction to analog integrated circuits, various types of amplifier output stages, the study of analog filter, oscillator, and signal generators.
(Prerequisites: EE201, EE206)

EE302 Introduction to Physical Electronics
This course covers introductory material for semiconductor physics and semiconductor device physics. The course material starts from a discussion of crystal structure and progresses up to p-n junction. More specifically, the course covers the following topics: crystal structure of solids, principles of quantum

mechanics, Schrödinger wave equation, energy band theory, statistical mechanics, carriers in semiconductors, extrinsic semiconductor-donors and acceptors, carrier drift, carrier diffusion, carrier generation and recombination, ambipolar transport equation, excess carrier lifetime, p-n junction - equilibrium, p-n junction & applications.

EE305 Electronics Lab. I

Experiments related to circuit theory and electronic circuits are performed. Focus is made for both hands-on experience and design practice through the following experiments:

- Circuit theory: 1. Measuring equipment and RC transient response, 2. Phasor and AC steady-state response, 3. 3-phase circuits.
- Electronic circuit: 4. Diode and BJT characteristics, 5. BJT and MOSFET amplifier, 6. Application of operational amplifiers.
- Design: 7. Sine / square wave function generator design, 8. Active filter design, 9. DC power supply design.

(Prerequisite: EE201, EE206)

EE306 Electronics Lab. II

Experiments related to digital system implementation with hardware and software are performed for both hands-on experience and design practice with the following experiments:

1. Combinational circuit design, 2. Flip-flop and counter, 3. Sequential circuit design, 4. ALU and carry generator using FPGA, 5. Multiplier using FPGA, 6. Coffee vending machine design using FPGA, 7. Digital design using microcontroller, 8. Filter design using microcontroller.

(Prerequisite: EE203, EE305)

EE308 Applied Electronics Lab

The main purpose of this course is to carry out project work related to VLSI, semiconductor, communication, DSP, microwave, optics, control, and power electronics. Two students form a group, and selects a project topic, project advisory professor, and perform the project research. A student's progress includes selection of project topic, presentation of proposal, presentation of an interim progress report, demonstration, and presentation of the final report.

(Prerequisites: EE305, EE306)

EE312 Introduction to Computer Architecture

The objective of this course is to understand the basic principles and hardware structures of computer systems including personal computers and workstations, and to learn how to design computers. This course covers data representation, CPU organization, instruction classification, language processing of assemblers and compilers, pipelining for performance enhancement, memory hierarchy, cache memory, and IO peripheral devices. In addition, high-performance computer systems are to be introduced.

(Prerequisite: EE203)

EE314 Embedded Systems

In this lecture, various hardware and software components and system implementation aspects of embedded system are covered. Covered topics inlcude bus-based expandable ARM processor based board, open-source embedded Linux operating system, PC-based software development environment, digital and analog interface techniques, ARM assembly language, device drivers. Hands-on experience is gained to enhance firm understanding.

(Prerequisite: EE203)

EE321 Communication Engineering

This course is a brief introduction to random processes. Topics include: Basic operating principles and circuits of AM, FM, and SSB modulation/demodulation, PLLs, mixers and ADCs; Noise performance of communication systems; Introduction to digital communication techniques such as BPSK, FSK and QAM keying / detections. Issues related to multiple access techniques are covered.

EE341 Electromagnetics II

This course starts with Maxwell's equation and discusses time-varying electromagnetic fields. Plane waves, transmission lines, waveguides and antenna basics are presented.

EE342 Radio Engineering

This course is designed to provide a cohesive overview of fundamental topics required for the design and analysis of RF stages of the modern wireless communication circuits, components, and systems.
(Prerequisite: EE204, EE206)

EE372 Integrated Circuits Design

This course covers basic concepts of fabrication, operation and design techniques related with CMOS integrated circuits based on combinational / sequential logic blocks for arithmetic, logic and memory blocks. Also covered are such issues as timing, interconnect and design methodologies.

EE381 Control System Engineering

This course will cover general methods for analysis and design of the dynamic system. The main contents include modeling in the frequency and time domain, time response, reduction of multiple subsystem, stability, steady-state error, root locus technique, frequency response technique, and design via frequency response and state-space.
(Prerequisite: EE202)

EE391 Electronic Control of Electric Machines

This course discusses the operational principles, analysis, modeling and design of power conversion circuits in power electronics and carried out Spice simulations.
(Prerequisite: EE202)

EE401 Communication Skills

This listing is for engineers performing research and development for new technologies and products based on market demand, communication skills are essential to fully exploit one's professional skills. This course covers important principles and skills through presentations, lectures, dialogue, group discussions, negotiations, both technical and nontechnical.

EE402 Future Society and Electrical Engineering

This course is aimed at providing students with opportunities and skills for career planning and thus better preparing them for the future change in society by taking a look at technical trends in various areas of electrical engineering and the expected demands from the future society.

EE405 Electronics Design Lab

In this design experiment laboratory, knowledge learned in many other courses in this division are brought to bear on performing a project combining analog / digital and hardware / software. Hence, a chipstone design experiment will be performed, which establishes synthesized application of undergraduate theory courses. For example, analog AM radio will be designed using various analog circuits, and voice recorder will be designed using Linux based embedded system.

(Prerequisite: EE306)

EE406 Project Lab

The objective of this course is to educate students as electronics engineers that yields hands-on experience and creates team spirit. Every research team consisting of two students develops an innovative electronic system. Each team selects a proper research topic and designs / realizes / verifies the system. All students present their research progress twice in class and demonstrate the final results.

EE411 Switching and Automata Theory

This course provides theory and technique for design and analysis of combinational / sequential digital circuits using discrete mathematics. Topics include: basics for set, relation and lattices; switching and boolean algebra, and switching function; combinational logic synthesis by functional decomposition; fault detection in combinational / sequential circuits; structure of finite state automata; automata-to-machine transformation; state and machine identification; properties of finite state machine with memory span; inverse machine; communicating finite state machine and systems verification; binary decision diagram and its application.

(Prerequisite: EE203)

EE413 Networking Design and Programming

This is an introductory networking course based on the Cisco Networking Academy Program and provides knowledge and practical experience with the design, configuration, management, and maintenance of computer networks. Topics include OSI 7-layer architectures, cabling, Ethernet, routing, TCP / IP protocols, IP addressing, routing protocols, WANs, network troubleshooting, and access control lists.

EE421 Communication Systems

This course emphasizes practical implementation aspects of digital communication systems. A physical-layer software implementation project will be assigned for a selected commercially-deployed communication system. Topics covered in this digital communication course include : (1) Digital modulation and demodulation, Optimum receivers, (2) Adaptive equalization and Synchronization, (3) Channel capacity, Error control codes.

(Prerequisite: EE321)

EE432 Digital Signal Processing

This course studies the representation, analysis, and design of discrete-time signals and systems. Topics include a review of the z-transform and the discrete Fourier transform, the fast Fourier transform, digital filter structures, digital filter design techniques, analog-to-digital and digital-to-analog data conversion, rate conversion, sampling and aliasing issues.

(Prerequisite: EE202)

EE441 Introduction to Fiber Optic Communication Systems

This introductory course is intended to familiarize students with underlying principles of fiber optic communication systems. Topics include an overview of fiber optic communication systems, optics review, lightwave fundamentals, light detectors, noise analysis, and system design, etc.

EE461 Semiconductor Devices

In this course, we study in depth how the basic semiconductor devices operate. Various semiconductor devices are examined including a pn junction diode, a bipolar junction transistor (BJT), and two-field effect transistors (MOSFET, JFET). This course will also cover non-ideal effects in the real semiconductor devices.

EE481 Intelligent Systems

Two major themes of this course are 'Modern Control System' and 'Computational Intelligence'. Each lecture will address a balanced emphasis on the theory about the control system and its applications in practice. The first part of this course includes digital control system design and state-space methods for control system design. The basic system identification scheme will also be included, considering the control of unknown systems. Once background knowledge of the modern control system is established, this course will then focus on the second part composed of computational intelligence using fuzzy logic, artificial neural network and evolutionary computation as main topics to introduce recent trend in intelligent control. Term projects will be assigned to test the algorithms to the given problems.

(Prerequisites: EE202, EE381)

EE484 Special Topics in Electrical Engineering

Special topics in electrical engineering for new theoretical and applied fields will be covered in this lecture that involves a suitable subtopic(s).

EE490 B.S. Thesis Research

In this course, the student selects an advisor and a research topic, and conducts research to expand his basic understanding and application regarding a specific research topic in electrical engineering.

EE495 Individual Study

In this course, the student select an advisor and a research topic, and conducts research for basic understanding and application of a simple specific topic in electrical engineering.

EE496 Seminar

This course is composed of invited lectures from experts in electrical engineering and various areas.

EE505 Electronics Lab.

The goal of this course is to improve problem-solving techniques and ability for real design problems by performing electronic circuit designs and learning high-precision measurement techniques and error analysis methods. This course deals with five electronics experiments such as feedback amplifier design, controller design using EPLD, digital signal processing using DSP boards, device driver programming, and RF experiments, each of which is conducted for two or three weeks.

EE511 Computer Architecture

The goal of this course is to understand the principles and organization of computer systems, and to learn the performance enhancing techniques and quantitative analysis methods used in advanced processors. This course covers high-performance techniques such as pipelining and out-of-order processing, memory hierarchy including cache memory and virtual memory, interrupt processing, and how to design a processor based on quantitative analysis. In addition, recent important topics such as SIMD and multiprocessors will be introduced and a design and simulation for a virtual processor is to be practiced for a comprehensive understanding of computer systems.

(Prerequisite: EE203, EE312)

EE512 System Programming

This course provides students with the knowledge and skills necessary to build a foundation in system programmings, and is especially focused on operating systems and implementation. Topics include an overview of the components of an OS, concurrency, synchronization, processes, memory management, I/O devices, and file systems.

EE516 Embedded Software

This lecture covers the topics of embedded software programming including Linux basic commands, shell programming, kernel structure, interprocess commumication, file system, device drivers, and bootloader structure. Each students will practice to implement the lectured topics on a embedded computer to be a real embedded system programmer.

(Prerequisite: EE209)

EE520 Telecommunication Networks

Topics covered in this course include layered network architecture, open system interconnection (OSI), and various network protocols, such as Ethernet, Token Ring, FDDI, DQDB, X.25, Frame Relay, SMDS, Internet, telephone network, signaling network, and ATM network.

EE521 Random Processes

This course is one of the fundamental courses especially for students in the area of communications and signal processing. Topics include fundamentals and applications of probability and random variables, random vectors, characteristic functions, random processes, expectations, correlation functions, and power spectrum.

EE522 Communication Theory

Fundamental principles and mathematical bases underlying digital communication systems are introduced. Topics include MAP detection theory, optimum receivers, information theory, coding theory and diversity techniques.

(Prerequisite: EE321, EE521)

EE524 Telecommunication Software Design

The design and implementation of physical layer, data link layer and network layer protocols are explained. Also, client / server programming using UNIX and windows sockets is studied. Moreover, the architecture of SDR based terminal is investigated. Finally, this course involves protocol design, verification and optimization.

(Prerequisite: EE527)

EE525 Networking Technology and Applications

Topics covered in this course include timing recovery, channel equalizer, speech codec in wireless communications, electronic switching system, router, protocol design and validation, network simulators, data transmission using Winsock, Linux porting and Linux routing, network device driver, CDMA base transceiver system, and network management.

EE526 Telephone and Internet Telephony Networks

This course covers overall aspects of telephone networks and newly emerging IP based next generation networks (NGN). Topics include overview of telephone networks, traffic theory, control and software system, performance evaluation of switching systems, transmission systems, signaling systems, intelligent systems, voice-over IP, IP signaling protocols, and next generation networks (NGN).

EE527 Data Communication

This is a graduate level course on data communication. The first half of the course involves an overview, data transmission and data communication network. The latter half of the course involves internet protocol, internet service and wireless internet.

EE535 Digital Image Processing

This course deals with the fundamental concept of digital image processing, analysis, and understanding.

Topics include sampling, linear and nonlinear operations of images, image compression, enhancement and restoration, reconstruction from projections, feature extraction, and image understanding.

EE538 Neural Networks
This course covers the theory and application of neural networks. In particular lectures explore the structure and function of neural networks and their learning and generalization. Also various models of neural networks and their applications are illustrated.

EE541 Electromagnetic Theory
This course is designed to treat electromagnetic theory with applications in wave-guides and antennas. The course will start with Maxwell's equations and show how to apply Maxwell's equations to the basic electromagnetic wave phenomena.

EE542 Microwave Engineering
This course is designed to provide in-depth understanding and knowledge on the theory and applications of microwave circuits, components, and systems used in Microwave and RF wireless communication systems.
(Prerequisite: EE204)

EE546 Fields and Waves
This course covers fields and sources in wave-guides, coupled mode theory, and wave propagation in periodic structures and anisotropic media. Green's functions and their applications to radiation and scattering of waves are extensively considered.

EE555 Optical Electronics
This course covers propagation of lightwave in isotropic and anisotropic media, Gaussian beams, interaction of matter and light, principles of lasers, modulation and switching of light, and nonlinear optical phenomena.

EE561 Introduction to VLSI Devices
This course covers fundamental VLSI device physics for graduate students. After a brief review of basic quantum mechanics and semiconductor processes, the lecturer will cover basic principles of operation in semiconductor devices including PN junction, MOS Capacitor, MOSFET and bipolar transistors with a strong emphasis on deep submicron secondary effects of MOSFET and bipolar transistors for extensive understanding of advanced device engineering.
(Prerequisite: EE461)

EE563 Display Engineering
In this course, the technology trend of the next generation information display devices will be introduced and their basic principles will be studied. In particular, LCD, PDP, OLED, and FED are mainly discussed.

EE564 Integrated Circuit Fabrication Process
In this course, we study in depth the most up-to-date processing techniques in the field of integrated circuits (IC). Various processes on which today's IC technology is based are examined including deposition, lithography, etching, and packaging. This course will newly cover emerging areas of microelectromechanical systems (MEMS) processing techniques.

EE565 Modern Physics for Engineers
This course primarily emphasizes "quantum mechanics" and "statistical physics" for engineers. Quantum mechanics includes a history of quantum physics, Schrödinger equation, concept of wavepacket, and N-degrees of freedom. Statistical physics covers a motivation, concept of ensemble average, Boltzmann

distribution, Bose-Einstein distribution, Fermi-Dirac distribution, and Non-Equilibrium statistics.

EE566 MEMS in EE Perspective

In this course, we will discover microelectromechanical systems (MEMS) in electrical engineering perspective, touching a complete set of design, fabrication, and applications. With respect to designing MEMS, we will explore various working principles, CAD tools including semiconductor design tools, and signal processing circuits. Also, core semiconductor processing technologies and a wide range of micro-machining techniques are studied in depth, in order to fabricate MEMS. We will address important issues in major fields of MEMS applications, including microsensors, RF / microwave, optical, and bio / microfluidic MEMS, specially in an electrical engineering viewpoint.

EE567 Photovoltaic Power Generation

In this course, various photovoltaic devices and systems are introduced. This course deals with basic theory of solar cells, the structures and characteristics of various solar cells, and the recent R&D trend and future prospects of photovoltaic technologies.
(Prerequisites: EE302)

EE571 Advanced Electronic Circuits

This course introduces new analysis methods for analog-circuits implemented by using bipolar and MOS transistors. Since the design of analog circuit requires both approximation and creativity, this course explains how to approximate and design complicated circuits.
(Prerequisites: EE206, EE301)

EE573 Introduction to VLSI Systems

This course covers the role, application and various issues in the design and verification of various VLSI chips including SoC (System-on-Chip). Additional topics include HW / SW co-design and co-verification, full-custom design, reconfigurable systems, low-power system, interconnection and packaging, clock distribution, VDSM (Very Deep Submicron) issues. Students will be given two opportunities for poster and oral presentations, respectively, on the topic of his / her choice within the course subject.

EE574 Computer Aided Design of VLSI Circuits and Systems

This course covers basic concepts and algorithms for CAD and design methodology for VLSI circuits and systems including automatic synthesis at various levels of abstraction, timing analysis and timing closure, and testing and testable design.

EE581 Linear Systems

Topics include system representation (input-output description, state variable description), solutions of linear dynamical equations, controllability and observability, irreducible realization, stability (BIBO stability, Lyapunov stability) for rigorous treatment of linear systems. In addition, feedback linearization is to be covered.

EE582 Digital Control

This course describes the analysis and design of digital control systems. Sampling and data reconstruction and Z-transform in computer control system will be covered. Analysis and design of digital control systems using frequency domain techniques will be introduced. Also, design of the digital control system using state space approaches will be covered. As a term project, a real-time digital control system will be implemented on a microprocessor system.

EE584 Computer Aided Control System Design

This course is intended for graduate students including senior level undergraduate students in engineering to introduce the concepts and techniques of the linear control system design. Students are encouraged to have a MATLAB experiment and asked to verify the computations using a MATLAB-SIMULINK software tool. Emphasis is placed upon application of the design technique to systems of interest to students.

EE594 Power Electronics Systems

This course covers the design and analysis of the topology about the DC / DC converter, PFC (Power Factor Correction) circuit and control methode in that topology. Also the topology such as inverter, resonant converter, and active power filter is introduced, and the control algorithm of that topology is studied in this course. Finally the state of the art in power conversion system is discussed, and every student carries out a term project about design and modeling of power supply. On completion of this course students will have built confidence on their ability to design and analyse the power conversion system.
(Prerequisite: EE391)

EE612 Discrete Event System Modeling and Simulation

This course provides theory and practice for modeling and simulation of discrete event systems which include communication networks, manufacturing systems, and high level computer systems. Topics include system taxonomy and discrete event systems (DES) characteristics; three entities in modeling and simulation; model representation and formalism construction; DEVS (Discrete Event systems Specification) formalism and DES modeling; simulation algorithm for DES; Petri Net modeling and analysis; statistics for modeling, simulation and analysis; model validation; output analysis and performance evaluation; advanced topics in DES modeling and simulation.

EE621 Coding Theory

This course is the advanced course dealing with methods for correcting and detecting error in data and covers finite field theory, cyclic code, BCH code, Reed-Solomon code, convolutional code, trellis-coded modulation, turbo code, LDPC code, space-time code, and adative coding.
(Prerequisite: EE521, EE522)

EE622 Signal Detection Theory

This course is to provide the students in electrical and electronics engineering - especially, those who are pursuing their Ph.D. - with the fundamental statistical and theoretical knowledge and applications. Among the main contents are hypothesis testing and various criterion, known signal detection, signal detection in discrete-time, random signal detection, and narrow-band signal detection.
(Prerequisite: EE521)

EE623 Information Theory

This course covers the core concept of information theory, including the fundamental source and channel coding theorems, coding theorem for Gaussian channel, rate distortion theorem, vector quantization, multiple user channel and multiple access channel.
(Prerequisite: EE521, CC511)

EE624 Mobile Communication Systems

Topics covered in this course include an overview of various mobile communication systems, cellular system architecture, access technologies, radio propagation, fading, antennas, diversity, link analysis, CDMA spread spectrum systems, physical layer, data link layer, network layer protocol, traffic control, mobile communication network architecture, and 3G system.

EE627 Performance Analysis of Communication Networks

This course focuses on advanced techniques for control, modeling and performance analysis of high-speed communication networks and the Internet. Traffic, network queueing, quality of services, various network algorithms and protocols are quantitatively analyzed and discussed.

EE628 Visual Communication Systems

This course deals with the efficient coding of still image and video sequence and the international standards for transmission and storage of image information. Topics cover the representation of image signals, sampling, quantization, entropy coding, predictive coding, transform coding, subband coding, vector quantization, motion estimation, motion-compensated coding, segmentation-based coding, various international standards for bi-level image coding, still image coding and video coding.
(Prerequisite: EE432)

EE631 Advanced Digital Signal Processing

This course aims to learn fundamental technologies for signal modeling and estimation and covers deterministic and random signal modeling, lattice filter realization, parameter and signal estimation, Wiener and Kalman filter design, parametric and nonparametric spectrum estimation, and adaptive filtering.
(Prerequisite: EE432, EE521)

EE633 Digital Speech Processing

This course explains how digital signal processing techniques can be applied in the field of speech communication. The initial part of the course covers some background material in signal processing and the acoustic theory of speech production. Later lectures cover coding, recognition and synthesis of speech.
(Prerequisite: EE202)

EE634 Pattern Recognition

This course deals with fundamental techniques of statistical pattern recognition. Topics cover Bayes decision theory, parametric pdf estimation, non-parametric pdf estimation, feature transformation and selection, linear discriminant function, multi-layer neural networks, unsupervised learning, clustering.
(Prerequisite: EE521)

EE641 Monolithic Microwave Integrated Circuits

Key elements of microwave ICs for wireless systems including mobile communications are covered. Subcircuits for MMIC, MMIC design methods, Various integrated circuits, and measurement method are studied based on Si and compound semiconductor foundries.
(Prerequisite: EE204, EE206)

EE652 Optical Communication

This course involves the fundamental principles for understanding and applying fiber optic technology to modern telecommunication systems. This course starts with a brief review of telecommunication network, and covers various aspects of fiber optic communication technology including the fundamentals of fiber optic waveguides, signal degradations, photodetection, optical receiver design, fiber optic link design, and amplified WDM systems.

EE661 Solid State Physics

This course is for graduate students. The course will cover basic concepts in solid state physics including solid structures, symmetry, reciprocal space, lattice dynamics, electrons in metals, semiconductors, dielectric and magnetic properties of both bulk solids and nano-structure.

EE663 High Frequency Electronic Devices

This course aims to give an understanding of the fundamental principles and technological developments in high-frequency electronic devices for microwave and high-speed digital / analog electronic systems and applications.

(Prerequisite: EE461)

EE676 Analog Integrated Circuits

This course deals with advanced level of analog circuits emphasis on CMOS. The topics include wideband operational amplifiers, comparators, Switched capacitor filters, ADC, DAC, continuous time filters, etc.

(Prerequisite: EE571)

EE678 Digtal Integrated Circuits

This course is designed to expose students to the important issues in high performance CMOS circuit design. This course covers the data path design in full custom design methodology, clocking strategy, and the state-of-the art CMOS logic styles.

EE681 Nonlinear Control

This course is intended to present the fundamental result of analysis and design of nonlinear control systems. Especially, this course is concerned with the analysis tools for nonlinear dynamical systems and the design techniques for nonlinear control systems.

(Prerequisite: EE581)

EE682 Intelligent Control Theory

Among the various well-known intelligent control techniques, the methods of fuzzy control and neural net-based learning control are first introduced to allow for handling ambiguous / uncertain situations and effective supervised learning, respectively. Specifically, the theory of fuzzy sets and fuzzy logic-based inference mechanism are studied and the design techniques of fuzzy control are introduced. Then, the neural net learning structure is discussed and the control system based on the artificial neural nets is studied. Fuzzy-neuro systems are also considered. In the second part of the course work, some other computational intelligence techniques such as GA and the rough set are briefly covered and then the basic machine learning techniques and the reinforcement learning method are studied in conjunction with the their use in control system design.

(Prerequisite: EE581)

EE683 Robot Control

This course is intended to cover kinematics, dynamics and control algorithm of robot manipulator. After covering homogeneous transformations, kinematics equations, motion trajectory planning, we will handle various control methods. We will compare the utilization of these control methods through simulation.

EE686 Optimization Theory

This course deals with optimization theories to solve problems in engineering, economics, management, and other practical applications. Classical methods based on geometry through linear vector space and function analysis are studied. Also optimization methods based on evolutionary computation and neural network are dealt with as an advanced technology. The contents include linear planning, nonlinear planning, dynamic planning, function optimization, least squares method, etc.

(Prerequisite: EE581)

EE687 Real-Time Control

Real-time control is an important field in electrical engineering with applications to industrial automation,

aerospace, and medical instrumentations. In this course, various topics for real-time control system are covered including performance, deadline, task scheduling, real-time operating system, real-time communication, and fault-tolerance.

EE726 Optimization in Communication Networks
The course covers parallel and distributed algorithms for optimization problems with special emphasis on the application of these algorithms to various communication network algorithms such as distributed power control, flow control and routing. In particular, asynchronous algorithmic models are emphasized.

EE731 Adaptive Signal Processing
The course covers fundamental theories and key techniques for applications in adaptive signal processing. More details are signal modelling, optimal estimation theory, Wiener and Kalman filters, eigen-filters, LMS/RLS algorithms, and their variants. We also deal with advanced topics such as adaptive equalization, adaptive beam-forming and adaptive interference cancellations.
(Prerequisite: EE432, EE521)

EE733 Multirate Signal Processing
This course introduces fundamentals of multirate digital signal processing, such as decimation, expansion, theory and design of multirate filter banks, wavelet transform, and applications of multirate signal processing.
(Prerequisite: EE432)

EE735 Computer Vision
This course will explore the principles, models and applications of computer vision. The course consists of five parts: image formation and image models; generic features, such as edges and corners, from images; the multiple view analysis to recover three dimensional structure from images; segmentation of images and tracking; the object recognition methodologies.
(Prerequisite: EE535)

EE737 Imaging Systems
This course is designed to introduce several medical image systems and the related applications based on various image processing techniques. Topics include image reconstruction algorithms, X-ray CT, single photon emission CT, positron emission tomography, magnetic resonance imaging, ultrasound imaging, and related post processing techniques.

EE741 Radiation and Diffraction of Waves
This course deals with radiation & diffraction phenomena of electromagnetic waves by various mathematical representations including classical Green's function, mode functions. Asymptotic evaluation of their integrals for several cases is introduced, and diffraction problems by a dielectric wedge are also explained.

EE742 Ray Analysis for Electromagnetic Scattering Problems
This course is designed for introducing ray analysis to analyze electromagnetic scattering problems. As one of the ray analyses, GTD (Geometrical Theory of Diffraction) is explained and employed to solve various electromagnetic scattering problems.

EE745 EMI / EMC Design and Analysis
This course is designed to provide fundamental principles of EMI / EMC with numerous design practices of high performance circuit, module, and system to meet EMI / EMC compliant specifications.
(Prerequisite: EE204, EE206)

EE757 Nonlinear Fiber Optics

This course is designed to lecture nonlinear optical phenomena in optical fiber and their applications including effects on optical communications. The course will start with general concepts of nonlinear optics and wave propagation in optical fiber.

EE762 Advanced MOS Device Physics

This course will cover advanced device physics of MOSFETs and their ultimate scaling. Recent trends such as a new device structure and a new material will be introduced, and various types of memory devices as an example of detailed applications are also covered. Through a depth of study in quantum effects, reliability issues, and modeling, this course can provide core knowledge of next device technologies and a chance to explore new applications.

(Prerequisite: EE461, EE561)

EE783 Adaptive Control Theory

This course deals with system identification to know the unknown system parameters for controlling the system. There are two schemes for the control of the unknown system: one is direct adaptive control and the other is indirect adaptive control. Robust adaptive control and adaptive control for nonlinear systems are dealt with.

(Prerequisite: EE581)

EE784 Supervisory Control Theory

This course is an introduction to supervisory control from a theoretical perspective aimed at graduate students in engineering. The lecture will cover the brief presentation of discrete event dynamic systems, operations on state machines, nonblocking supervisors, controllability, observability, modular control, and decentralized control.

EE785 Robust Control Theory

This course introduces variable structure control (VSC) theory which is one of the robust control theories. Various basic theorems of VSC will be analyzed in the sliding mode. Expanding the target plant from a second order plant to the n-th order plant, it will be studied how to determine switching conditions and switching vectors. Stability will be analyzed by designing a feedback control loop. By integrating multi-variable structure with optimal control theory and adaptive control theory, the problem of system optimization and the problem of determining coefficients of switching vector in sliding mode will be resolved. Based on those theories, discrete variable structure control (DVSC) will be introduced. Finally, it will be studied how to apply those theories to the control system in robot systems, space aerial planes, satellites, chemical plants, power plants and motors.

(Prerequisite: EE581, EE681)

EE786 Optimal Control Theory

This course deals with the derivation of maximum principle and the design of optimal control system. It includes an optimal design method for minimum time and energy along with dynamic programming and discrete maximum principle. Also advanced topics of optimal control are introduced.

(Prerequisite: EE581)

EE788 Robot Cognition and Planning

This course deals with sensor fusion, decision making and information procession on real time for intelligent robots. To have a higher level of cognition, advanced level of problem solving methods are presented for task planning, scheduling and navigation planning.

(Prerequisite: EE682, EE683)

EE789 System Modeling and Identification

This course covers a mathematical modelling of the dynamic system and identification schemes for the parameters of the model. The main contents include system and model, parameter estimation algorithms, nonlinear modelling, convergence and consistency, recursive identification algorithm, experiment design, choice of identification criterion, model validation, etc. On completion of this course, students will have gained skills and confidence in identifying unknown systems. The identification will be used for adaptive control.
(Prerequisite: MA250)

EE791 Power Conversion Circuits and Systems

This course covers the practical design and analysis of various DC / DC converters in the power conversion system. High frequency transformer, inductor, Magnetic Amplifier, Snubber, and Feedback Stabilization is studied to give students deep insight of power conversion system. Also the power factor correction circuit is introduced as AC / DC converter. Every student carry out the term project about design and modeling of a DC / DC converter. On completion of this course, students will have confidence on their ability of design and analysis of power conversion system.
(Prerequisites: EE391, EE594)

EE792 Advanced Theory and Design of Electric Machine

This course deals with the advanced theory and design of Brushless DC machine. This includes the AC windings, EMF and MMF of an AC winding, air gap and leakage flux distribution, parameter determination, Influence of parameters on performance, characteristics of permanent magnet, permanent magnet MMF calculation, power and torque relation, and performance evaluation.
(Prerequisite: EE594)

EE807 Special Topics in Electrical Engineering

This course covers topics of interest in electrical engineering at the graduate level. The course content is specifically designed by the instructor.

EE817 Special Topics in Computer Engineering

This course covers topics of interest in computer engineering to students at the graduate level. The contents of this course are specifically designed by the instructor.

EE827 Special Topics in Communication

This course covers topics of interest in communication engineering at the graduate level. Course content is specifically designed by the instructor.

EE837 Special Topics in Signal Processing

This course is to introduce some important topics in the general area of communications and signal processing. Topics may vary from year to year.

EE838 Special Topics in Image Engineering

This course introduces a selected topics of recent technologies and algorithm related to image processing and imaging systems.
(Prerequisite: EE432, EE535)

EE847 Special Topics in Electromagnetics

This course is designed to cover the special topics of current interests in electromagnetics.

EE857 Special Topics in Optical Engineering
This course is designed to cover the special topics of current interests in optical engineering.

EE867 Special Topics in Physical Electronics
This course covers topics of interest in physical electronics at the graduate level students. The course content is specifically designed by the instructor.

EE868 Special Topics in Solid-State Physics
This course covers topics of interest in solid-state physics for students at the graduate level. The content is specifically designed by the instructor.

EE877 Special Topics in Integrated Circuits
This course covers topics of interest in integrated circuits for students at the graduate level. The course content is specifically designed by the instructor.

EE878 Special Topics in VLSI
This course covers recent issues related with the VLSI System design.

EE887 Special Topics in Robotics
This course covers topics of interest in robotics for graduate level students. Course content is specifically designed by the instructor.

EE888 Special Topics in Control Theory
This course covers topics of interest in control theory at the graduate level. Course content is specifically designed by the instructor.

EE897 Special Topics in Power Electronics
This course covers topics of interest in power electronics for students at the graduate level. Course content is specifically designed by the instructor.

EE898 Special Topics in Intelligent Information Processing
The relationship between intelligence and information is explained. New realization techniques of intelligent systems are illustrated. Design methods of intelligent systems are explained with relation to information flow.

EE960 M.S. Thesis
In this course, the student selects an advisor and a research topic, and conduct research for basic understanding and application of a specific topic in electrical engineering.

EE966 M.S. Seminar
This course is composed of invited lectures given by experts in electrical engineering and various related subject areas.

EE980 Ph.D Thesis
In this course, the student selects an advisor and a research topic, and conducts research for basic understanding and application of a specific topic in electrical engineering.

EE986 Ph.D Seminar
This course is composed of invited lectures from experts in electrical engineering and various areas.

EE990 Technical Writing

This course addresses essential elements in how to correctly write a research / technical paper. Topics include: a right understanding into graduate studies, a method of doing good research, how to note a memo, writing a technical paper, and case studies.