Course Descriptions

01205211 Electric Circuit Analysis I 3(3-0-6)

Definitions. Basic concepts and units. Circuit elements. Resistive circuits. Dependent sources. Circuit theorem and analysis. Node and mesh analysis. Network theorem. Graph theory. Energy storage elements. First order and second order circuits. Sinusoidal signal. Phasor diagram. Alternating current steady-state analysis. AC power circuits. Three-phase circuits.

01205212 Electric Circuit Analysis II 3(3-0-6)

Complex frequency and s-plane analysis. Network function. Frequency response. Laplace transformation and its application to circuit analysis. Resonance and scaling circuits. Coupled circuits. Transformer. Two-port networks.

01205213 Electronics and Electrical Engineering Laboratory 1(0-3-2)

Laboratory experiments about Ohms' law. Kirchhoff's law. Equivalent circuit. Electrical power. Transient response. Steady state response. Filter. Diode. Rectifier. Voltage regulator. Transistor. Transistor amplifier. Op-amp circuit.

01205214 Electrical Machines Laboratory and Electrical Practices 1(0-3-2)

Laboratory on electric generators. Motors. Transformers. 3-phase circuits. Electrical installation. Grounding. Electrical safety.

01205215 Computer Programming for Electrical Engineers 3(3-0-6)

Computing concepts. Hardware and software interactions. Flow charts. Structured program development. Flows control. Functions. Arrays. Pointers. Characters and strings. File processing. Stacks. Queues. Linked lists. Tree structures. Searching. Sorting. Complexity analysis. Applications of computer programming for solving electrical engineering problems.

01205216 Signals and Systems 3(3-0-6)

Continuous-time and discrete-time signals and transform analysis techniques. Linear and time-invariant systems. Transfer functions. Fourier series. Fourier transform. Laplace and Z

transform. Sampling theorem. Solution of differential and difference equations using transforms. Applications of signals and systems. MATLAB for Signals and Systems.

01205217 Electromagnetic Fields and Waves 3(3-0-6)

Vector analysis. Electrostatic fields. Potential and energy. Conductors and dielectric. Capacitance. Convection and conduction currents. Resistance. Solution of Laplace's and Poisson's equations. Magneto static fields. Magnetic materials. Inductance. Displacement current. Time-varying electromagnetic fields. Maxwell's equations.

01205218 Electrical Measurements and Instruments 3(3-0-6)
Prerequisite: 01205211

Units and standards of electrical measurements. Instrument classifications and characteristics. Measurement analysis. Measurement of DC and AC current and voltage using analog and digital instruments. Power, power factor and energy measurements. Measurements of resistance, inductance, and capacitance. Frequency and period/time-interval measurements. Noises. Transducers. Calibration.

01205219 Applied Probability for Electrical Engineering 3(3-0-6)
Prerequisite: 01417168

Axioms of probability. Conditional probability. Independent events. Independent trials. Discrete random variables. Continuous random variables. Expectation. Functions of a random variable. Conditional distribution. Conditional expectation. Pairs of random variables and their joint distribution. Function of two random variables. Independent random variables. Random vectors. Moment generating functions. Sum of independent random variables. The Central Limit Theorem.

01205231 Telecommunication Engineering 3(3-0-6)

Elements of communications system. Telephone network. Traffic engineering. Analog and digital signal. Pulse code modulation. Transmission. Data rate. Transmission media. Mobile communications. Satellite communications. Optical communications. Data communications.

01205241 Digital Circuits and Logic Design 3(3-0-6)

Number systems and codes. Logic gate. CMOS circuit. Boolean algebra. Combinational logic design principles and practices. Latch and flip-flop. Sequential logic design principles and practices. Computer-aided design (CAD) for digital circuit design.

01205242 Electronic Circuits and Systems I 3(3-0-6)

Prerequisite : 01205211

Semiconductor devices. Current-voltage and frequency characteristics of electronic devices. Analysis and design of basic electronic circuits including diodes and power supply circuit. Bipolar junction transistors (BJT) and field-effect transistors including MOS, CMOS, and BiCMOS. Transistor bias circuits and transistor small signal analysis. Basic amplifiers. Operational amplifiers and its applications in linear and nonlinear circuits. Multistage transistor amplifiers.

01205251 Electromechanical Energy Conversion I 3(3-0-6)

Prerequisite : 01205211

Magnetic circuits. Principles of electromechanical energy conversion. Energy and co-energy in magnetic circuits. Principles of rotating machines. DC machines. Starting method of DC motors. Speed control methods of DC motors.

01205311 Microprocessor 3(3-0-6)

Prerequisite : 01205241

Introduction to microprocessors. Structure of microprocessors. Assembly programming. Interface techniques. Memories. Input-output interfaces. Applications of microprocessors in instrumentation systems. Applications of microprocessors in automation systems.

01205312 Linear Control Systems 3(3-0-6)

Prerequisite : 01205211

Mathematical models of system. Transfer function and state-space representations. System models on time domain and frequency domain. Block diagram and signal flow graphs. Dynamic models and dynamic responses of systems. First and second order systems. Open-loop and closed-loop control. Feedback control and sensitivity. Steady-state error. Types of feedback control. Concepts and conditions of system stability. Methods of stability

test. Root locus. Time domain analysis and design of control systems. Bode plots. Nyquist plots. Frequency domain analysis and design of control systems.

01205313 Electrical Engineering Mathematics 3(3-0-6)
Prerequisite : 01417168

Matrices and systems of linear equations. Vector spaces. Orthogonality. Orthogonalization. Inner product spaces. Linear transformation. Eigenvalues and eigenvectors. Diagonalization. Applications to optimization problems in electrical engineering. Numerical analysis. Numerical methods for linear algebra. Applications of numerical methods in electrical engineering.

01205321 Principles of Communications 3(3-0-6)

Communication models, wire/cable and wireless/radio. Introduction to signal and system. Spectrum of signal and applications of Fourier series and transform. Analog modulation, AM, DSB, SSB, FM, NB/WBFM, PM. Noises in analog communication. Binary baseband modulation. Nyquist's sampling theory and quantization. Pulse analog modulation. Pulse Code Modulation (PCM). Delta Modulation (DM). Multiplexing techniques. Introduction to transmission lines, radio wave propagation, microwave components and communication, satellite communications, optical communication.

01205322 Microwave Engineering 3(3-0-6)

Review of Maxwell's equations. Plane waves. Microwave transmission lines and waveguides. Microwave network analysis. Impedance and equivalent voltage and current. The s-matrix. Signal flow graphs. Impedance matching and tuning. Microwave resonators. Power dividers and directional couplers. Microwave filters. Point-to-point microwave link. Radar system. Microwave propagation. Basic of microwave measurement. Applications.

01205323 Digital Signal Processing 3(3-0-6)

Introduction to digital signal processing (DSP). Continuous-time and discrete-time signals. Discrete-time systems. Discrete-time Fourier transform (DTFT) and discrete Fourier transform (DFT). Z-transform. Sampling theory and sampling rate conversion. Multi-rate systems and filter banks. Discrete wavelet transform (DWT). Spectral analysis of linear-time Invariance (LTI)

system. Finite impulse response (FIR) filter design and infinite impulse response (IIR) filter design. Probabilistic methods in DSP. Introduction to current DSP applications.

01205324 Digital Communications 3(3-0-6)

Review of probability and random process. Signal space. Minimum Nyquist bandwidth. Signal detections. AWGN. Digital modulation techniques. Sigma-delta. Performance analysis. Synchronization. Equalization. Introduction of information theory. Source coding. Channel coding. Multichannel and multicarrier systems. Spread spectrum techniques. Multipath fading channels.

01205325 Communication Network and Transmission Lines 3(3-0-6)

Wire and wireless communication. Wire communication network. Y, Z, F, G, H matrix. Relation. Connection and basic circuits. Network transformation. Transmission quantities. Signal transmission circuit techniques. Wave filters. Attenuator. Impedance matching. Transmission line theory. Equation. Solution for low, medium, high frequencies. Primary and secondary constant. Incident and reflected waves. Standing wave ratio. Line characteristics for open, short, terminated load. Lossless and lossy lines. Reflections in time domain. Bounce diagrams. Near-end and far-end crosstalk. Differential signaling. Composite line, types of cable, unshielded twisted pair, coaxial cable and current cable standards.

01205326 Data Communications and Networks I 3(3-0-6)

Introduction to data communications and networks. Layered network architectures. Point-to-point protocols and links. Delay models in data networks. Medium-access control protocols. Routing in data networks. Flow control. Network security. Cloud network. Architecture and system.

01205327 Mobile Communications 3(3-0-6)

Prerequisite *:* 01205321

Wireless communication system. Theory and principle of mobile communication system. Characteristic and impact of radio propagation. Modulation techniques. Speech coding. Diversity channel coding. Multiplexing technique. Interconnection components for mobile communication system. Standards of current mobile communication, 3G, 4G, 5G and

beyond. Cellular systems. Multiple access and interference management. Capacity of wireless channels. Multiuser capacity. MIMO system.

01205328 Optical Fiber Communications 3(3-0-6)

Cylindrical dielectric waveguides and propagating conditions. Structure and types of optical fiber. Optical fiber parameters. Optical fiber production. Optical cable types. Optical transmitters. Optical receivers. Signal degradations, attenuation and dispersion in fiber link. Optical repeaters and amplifiers. Link budget calculation. Multiplexing in optical link system. Introduction to FTTx.

01205329 Antenna Engineering 3(3-0-6)

Basic definitions and theory. Isotropic point source. Power and field patterns. Directivity and gain. Efficiency. Polarization. Input impedance and bandwidth. Friis transmission equation. Radiation from current elements. Ground effects. Radiation properties of wire antenna. Array antenna. Yagi-Uda antenna and log-periodic antenna. Aperture antenna. Microstrip antenna. Modern antenna for current applications. Antenna characteristics measurement.

01205331 Digital Signal Processing Design and Implementation 3(3-0-6)
Prerequisite : 01205323

Digital signal processing system and development tools. Real-time digital signal processing implementation. Practical filter design. Finite word length effects. Fast Fourier transform. Discrete cosine transform. Implementation of digital signal processing algorithms. Introduction to adaptive filters. Digital signal processing applications.

01205341 Electronic Circuits and Systems II 3(3-0-6)
Prerequisite : 01205242

Frequency responses of BJT, JFET and multistage amplifiers. Miller effect. Current mirror and current source circuits. BiFET, BiMOS and BiCMOS differential amplifiers. Op amp characteristics. Op amp active filters. Negative feedback system analysis. Tuned-oscillator circuits. Power electronic devices.

01205342 Solid-State Electronics 3(3-0-6)

Prerequisite : 01205242

Introduction to semiconductor devices. Energy band structure of crystals. Introduction to quantum theory of semiconductors in equilibrium. Transport of carriers in semiconductors. Introduction to semiconductor junctions. Bipolar junction transistor. Unipolar field-effect transistor.

01205343 VLSI Systems 3(3-0-6)

Prerequisite : 01205242

Theories and models of MOS transistor. CMOS gate construction. Integrated circuit technology and fabrication process. Techniques and rules for IC design. Performance estimation using CAD and simulation tools. Optimizing the performance of CMOS circuits. Theories of FPGA and related technologies. Prototyping VLSI circuits using VHDL. Testing and optimizing.

01205344 Industrial Electronics 3(3-0-6)

Prerequisite : 01205242

Electronic circuits for automatic manufacturing. Data acquisition circuits. Power semiconductor devices. Input and output devices for industrial control. Basic principles of power electronic circuits. Controlled rectifiers. DC-to-DC converters. Inverters and solid-state relay. Controller circuits for DC motors. AC motors and special-purpose motors. Industrial robots and data communication between intelligent machines.

01205345 Design of Analog CMOS Integrated Circuits 3(3-0-6)

Prerequisite : 01205242

Basic knowledge in analog circuit design. Physics of MOS transistors. Single-stage/multistage amplifiers. Current mirrors. Differential amplifiers. Feedback in analog circuits. Physics of noise. Low-noise design techniques. Operational amplifiers. Stability and frequency compensation. Computer-aided design (CAD).

01205346 Embedded System Design 3(3-0-6)

Embedded hardware concept. Embedded software concept. Principle of embedded system design. Principle of embedded system development and testing. Principle and application of real-time operating system for embedded system.

01205347 Introduction to Nanotechnology and Nanoelectronics 3(3-0-6)

Introduction to nanotechnology. Nanoscale fabrication. Nanoscale characterisations. 0D quantum structure, 1D quantum structure, and 2D quantum structure. Single electron devices. Carbon nanotubes. Graphene electronics. DNA chips. Quantum dot. MEMS/NEMS. Spintronics.

01205348 Electrical Engineering Materials 3(3-0-6)

Structure of materials. Electrical properties of materials. Magnetic properties of materials. Optical properties of materials. Electrical conductors. Introduction to semiconductor devices. Superconductivity. Solid, liquid and gas dielectrics. Applications of materials in electrical power devices.

01205351 Electromechanical Energy Conversion II 3(3-0-6)

Prerequisite : 01205251

Single phase and three phase transformers. AC machine structure. Synchronous machines. Single phase and three phase induction machines. Steady state performance and analysis of induction machines and synchronous machines. AC single phase motor structure and performance. Protection of machines.

01205352 Electric Power System Analysis I 3(3-0-6)

Prerequisite : 01205211

Electrical power system structure. AC power circuits. Per unit system. Generator characteristics and models. Power transformer characteristics and models. Transmission line parameters and models. Cable parameters and models. Fundamental of load flow. Fundamental of fault calculation.

01205353 Power System Protection 3(3-0-6)

Fundamental of protection practices. Instrument transformer and transducers. Protection devices and protection systems. Overcurrent and earth fault protection. Differential protection. Transmission line protection by distance relaying. Transmission line protection by pilot relaying. Motor protection. Transformer protection. Generator protection. Bus zone protection. Introduction to digital protection devices.

01205354 Electrical System Design in Buildings 3(3-0-6)

Basic design concepts. Power distribution schemes. Codes and standards for electrical installation. Electrical wires and cables. Raceway. Electrical equipment and apparatus. Electrical drawing. Load calculation and estimation. Wiring design. Short-circuit calculation. Grounding system for electrical installation. Coordination of protective devices. Lighting and appliances circuit design. Motor circuit design. Load, feeder and main schedule. Power factor improvement and capacitor bank circuit design. Emergency power systems.

01205355 Electric Power Plants 3(3-0-6)
Prerequisite : 01205251

Load curve. Diesel power plant. Steam power plant. Gas turbine power plant. Combined cycle power plant. Hydro power plant. Nuclear power plant. Renewable energy resources. Type of substation. Substation equipment. Substation layout. Substation automation. Lightning protection for substation. Grounding systems.

01205356 High-Voltage Engineering 3(3-0-6)

Generation and uses of high-voltage. High-voltage measurement techniques. Electric filed and insulation techniques. Breakdown of gas, liquid and solid dielectrics. Test of high-voltage material and equipment. Lightning protection. Insulation coordination.

01205357 Electric Drives 3(3-0-6)
Prerequisite : 01205351

Applications of electric drives in industrial automation. Electric drive components. Load characteristics. Four quadrant operating regions of electric drives. Accelerating and braking methods of motors. Power transmission and sizing calculation. Torque-speed characteristics

of electric motors. Power electronic devices for drive applications. DC motor drives. AC motor drives. Servo drives systems.

01205358 Renewable Energy 3(3-0-6)

Introduction to energy systems and renewable energy resources. Potential of renewable resources in Thailand. Difference of conventional and renewable energy technologies. Renewable technologies such as solar, wind, biomass, geothermal, biogas, municipal solid waste, wave energy, fuel cell. Energy storages. Laws, regulations, and policies of renewable energy. Economics aspects.

01205359 Power Electronics 3(3-0-6)

Prerequisite : 01205242

Characteristics of power electronics devices. Principles of power converters. AC to DC converter. DC to DC converter. AC to AC converter. DC to AC converter.

01205371 Process Sensors and Transducers 3(3-0-6)

Introduction to measurement and control devices. Analog and digital transducers. Distance, velocity and acceleration sensors. Pressure measurement techniques. Differential pressure transmitter. Fluid flow measurement includes primary meters, secondary meters and special method. Measurement of temperature includes nonelectric methods, electric method and radiation method. Types of liquid level measurement, direct liquid level measurement, indirect liquid level measurement includes hydrostatic pressure methods, electrical methods and special methods. pH Sensor. Conventional controller.

01205372 Digital Control Systems 3(3-0-6)

Prerequisite : 01205312

Linear discrete systems and the Z-transform. Discrete simulation of continuous systems. Sampled data systems. Digital controller design using transform methods. Digital controller design using state space methods.

01205373 Embedded Control Systems 3(3-0-6)
Prerequisite : 01205311

Introduction to embedded control systems. Programming language. Real-time operating systems. Interfaces between sensors, actuators, and embedded controllers. Applied control theory. Algorithms and implementations in embedded control systems.

01205374 Industrial Automation and Control 3(3-0-6)

Logical sensors and actuators. Relay and relay circuits. Timer and counter in relay circuits. Programmable logic controllers. Basic programmable logic controller instructions. Timer and counter programmable logic controller instructions. Control programmable logic controller instructions. Design techniques and programmable logic controller programming for industrial automation controls. Analog sensors and actuators. Introduction of Analog controls, programmable logic controller networks, human-machine interfaces.

01205381 Communication Architecture and Devices Laboratory 1(0-3-2)

Laboratory on analog and digital communication architecture. Source coding. Modulation techniques. Channel coding. Microwave devices. Antennas and parameter measurement.

01205382 Communication Systems and Networks Laboratory 1(0-3-2)

Laboratory on communication systems and networks. Broadcasting systems. Multiple access techniques. Network components. Virtual local area network. Internetworking of virtual area network.

01205383 Digital Signal Processing Laboratory 1(0-3-2)
Prerequisite : 01205323

Introduction to digital signal processing starter kit (DSK). Code composer tools learning. Digital signal processing starter kit testing. Analog to digital and digital to analog signals conversion control. Finite impulse response (FIR) filter design. Infinite impulse response (IIR) filter design. Implementation of fast Fourier transform (FFT).

01205384 Electromechanical Energy Conversion Laboratory 1(0-3-2)
Prerequisite : 01205251 or together

Laboratory experiments on topics in Electromechanical Energy Conversion I and other related topics.

01205386 Electronics Engineering Laboratory 1(0-3-2)
Prerequisite : 01205241 and 01205242

Applied transistor circuit. Applied op-amp circuit. Power electronics circuit. Combinational and sequential logic circuit implementation by programmable logic device. CAD for printed circuit board. CAD for analog and digital circuit.

01205387 Microprocessor Laboratory 1(0-3-2)
Prerequisite : 01205311 or together

Laboratory experiments on topics covered in Microprocessor.

01205388 Control and Measurement Laboratory 1(0-3-2)
Prerequisite : 01205312 or together

Laboratory for Electrical Measurements and Instruments, and Linear Control Systems.

01205389 Industrial Automation and Control Laboratory 1(0-3-2)
Prerequisite: 01205374 or together

Laboratory for Industrial Automation and Control.

01205399 Internship 1

Internship for Electrical Engineering in private enterprises, government agencies, government enterprises or academic places at least 240 hours and at least 30 workdays in order to get experiences from the assignment.

01205411 Complex Analysis in Electrical Engineering 3(3-0-6)
Prerequisite : 01205216

Complex number and complex functions. Cauchy-Riemann equation. Analytic functions. Harmonic function. Cauchy integral theorem. Taylor and Laurent series. Residue theorem. Complex integration. Conformal mapping. Applications in electrical engineering.

01205421 Broadband Communications 3(3-0-6)

Prerequisite : 01205326

Principles of broadband communication networks for switching telephone system. VoIP telephone. WAN infrastructure. Principles of ATM, VPN, FDDI, DSL and current techniques. Principles of internet, intranet, SDH, traffic engineering and QoS. FITH, WLANS, PON DWDM network. Theory of power line communications (PLC) for narrowband. Broadband communications. Standards of PLC-based networking.

01205431 Data Communications and Networks II 3(3-0-6)

Prerequisite : 01205326

Protocols and architectures of data networks. Broadband networks. Client-server computing. Naming and addressing. Media access protocols. Routing and transport protocols. Flow and congestion control and other application-specific protocols. Network security. Multicasting. Network planning and design. Traffic management.

01205432 Passive Radio Frequency Circuit Design 3(3-0-6)

Lumped elements at radio frequency. Transmission line theory. Impedance and admittance charts. N-port network parameters. Sonnet electromagnetic simulation software. Passive devices, couplers, filters. Input and output matching networks for amplifier. Measurements of S-parameters and transmission-line parameters

01205433 Applied Coding 3(3-0-6)

Fundamentals of information theory. Data compression and source coding. Channel capacity. Run-length-limited codes. Linear block error correcting codes. Cyclic codes. Convolutional codes. Trellis-coded modulation. Cryptography. Shannon’s coding theorems.

01205434 Digital Telephone Systems 3(3-0-6)

Public switched telephone network. Voice digitization algorithms. Digital transmission and multiplexing. Digital switching system. Digital signaling system. IP telephony system. Mobile telephony system.

01205435 Satellite Communications 3(3-0-6)

Theory and practice of satellite communications. Orbital aspects. Modulation and multiplexing. Coding. Multiple access techniques. Satellite link design. Propagation effects. Earth terminals and very small aperture terminal networks.

01205436 Mobile Network Systems 3(3-0-6)

Prerequisite : 01205327

Current trends in mobile networks. Mobile Internet. Small cells for mobile networks. Cooperation for wireless networks. Mobile clouds. Cognitive radio technology. White space spectrum concepts. Broadcast-broadband architecture. Security issues in wireless communications.

01205437 Active Radio Frequency Circuit Design 3(3-0-6)

Transmission line analysis. Smith charts. N-port networks. Active radiofrequency components and modeling. Radio frequency amplifiers. Oscillators. Mixers. Radio frequency receivers and transmitters. Computer-aided design of radio frequency circuits. Measurement techniques.

01205438 Simulation of Communication Systems 3(3-0-6)

Simulation and modeling methodology. Representation of signals and systems. Simulation of systems. Generation of random numbers and random processes. Monte Carlo simulation. Modeling of communication systems. Channel models. Performance evaluation of simulation.

01205439 Internetworking 3(3-0-6)

Exploring the network. Physical components of a network. Network Model. OSI reference model. Hub. Switch. Router. LAN segmentation. Collision domain. Broadcast domain. TCP/IP protocol suit. IPv4. IPv6. Subnet masks. CIDR notation. Default subnet mask. Network addressing scheme. Variable-length subnet mask. Host-to-host packet delivery. Internet connectivity. Network simulator. Network configuration. Port security. VLAN. Inter VLAN routing. Address resolution protocol. Routing protocol. OSPF. Network security. IPSec. VPN. Troubleshooting.

01205441 Feedback Circuit Design 3(3-0-6)

Prerequisite : 01205242

Benefits of feedback in electronic circuits. Modeling and responses of linear systems. Stability of feedback systems. Root locus technique. Nyquist stability criterion. Frequency domain technique. Compensation of feedback circuits. Describing function. Linear regulator circuit. Phase lock loop circuit. Switching DC-DC converter. Oscillators. Advanced applications of op-amp circuits.

01205442 Photonic Engineering 3(3-0-6)

Wave optics. Electromagnetic field. Reflection and refraction.Geometrical optics. Radiation and detection. Polarization. Interference andcoherence. Diffraction. Fourier optics. Holography. Photonic switchingtechnology. Applications.

01205443 Microelectronics Fabrication Technology 3(3-0-6)

Prerequisite : 01205242

Microelectronics fabrication technology. Crystal growth. Clean rooms. Lithography. Etching. Oxidation. Diffusion. Ion implantation. Thin film deposition. Device isolation and metal contacts. Packaging. CMOS technology. Si bipolar device technology. Micromachined technology.

01205444 Optical Devices 3(3-0-6)

Light. Solid state physics. Modulation of light. Display devices. Principle of laser operation. Types of laser. Technique and application of laser. Photo detectors. Optical fiber waveguides. Devices in optical communication.

01205445 Semiconductor Sensors 3(3-0-6)

Evolution of semiconductor sensors. Classifications of semiconductor sensors. Semiconductor fabrication technologies. Acoustic sensors. Mechanical sensors. Magnetic sensors. Thermal sensors. Chemical and bio-sensors. Integrated sensors. Micromachined sensors and microelectromechanical system sensors.

01205446 Biomedical Electronics 3(3-0-6)

Introduction to the fundamental and terminology in anatomy and physiology. Operation of heart, brain and muscle. Bioelectric phenomena. Electrode and transducer for biophysical measurements. Bioelectric signal amplification. Noise elimination. Electrocardiography. Blood pressure measurement. Defibrillator. Pace maker. Protection for patient safety.Ultrasonic measurement.

01205447 Hard Drive Technology and Manufacturing 3(3-0-6)

Structure and operation of hard drive. Writing and reading data. Magnetic recording head and disc. Reading and recording channel. Reading head positioning control system. Hard drive manufacturing and testing. Electrostatic discharge protection. Clean room and micro-contamination control. Computer interface.

01205451 Energy Conservation and Management 3(3-0-6)

Fundamental of energy efficiency. Principle of energy efficiency in building and industry. Load management. Laws and regulations of energy conservation. Energy Management and analysis in building and industrial. Technical aspects to use energy efficiently in lighting system, heating ventilating and air-conditioning (HVAC) systems. Industrial motor. Cogeneration. Energy Conservations and management measures and economics analysis.

01205461 Electric Power System Analysis II 3(3-0-6)

Prerequisite : 01205352

Load characteristics. Electrical power distribution systems. Power system equipment. Transmission and distribution networks calculation. Load flow. Load flow control. Symmetrical and unsymmetrical short circuit analysis. Power system stability. Economic dispatch.

01205462 Harmonics in Power Systems 3(3-0-6)

Quality and pollution in power systems. Harmonic sources. Harmonic effects. Harmonic measurements. Standard of harmonic level. Harmonic penetration in power systems. Harmonic elimination.

01205463 Introduction to Distribution System Reliability 3(3-0-6)

Power distribution system. Power outage causes. Applications of probability distributions. Minimal cut sets. Markov process. Availability and reliability indices. Reliability evaluation. Life cycle cost and power outage cost. Basic concepts of maintenance. Reliability improvement. Reliability analysis using computer program. Case studies.

01205464 Distributed Electric Generation System 3(3-0-6)

Introduction to distributed generation. Technologies of distributed generation. Conventional and renewable energy technologies. Grid interconnection. Technical impact of distributed generation on distribution system. Loss. Voltage profile. Reliability. Electric power quality. Protection. Load flow. Smart grids. Economics aspects.

01205465 Illumination Engineering 3(3-0-6)

Light sources. Light and color. Luminaries. Basic illumination. Lumen method. Point-point method. Interior lighting techniques, resident, office, school, hotel, industry, etc. Exterior lighting techniques, floodlight. Area lighting. Street lighting techniques. Sport lighting techniques.

01205466 Electrical Systems and Signal Systems in Building 3(3-0-6)

Fire alarm systems. Telephone systems. Sound systems. MATV systems. Lightning protection systems. Standby generators. Other systems for modern buildings.

01205471 Introduction to Robotic Systems 3(3-0-6)

Design, analysis, control, and operation of robotic mechanisms. Use of homogeneous coordinates for kinematics and dynamics. Camera orientation. Sensors and actuators. Control. Task planning. Vision and intelligence.

01205472 Introduction to Dynamic Control 3(3-0-6)

Prerequisite : 01205312

Introduction to State-space system. State-space model. State-space analysis. State-space design. Dynamic control systems. Observer functions. Observer system design. Describing functions of nonlinear control systems.

01205473 Process Control 3(3-0-6)

Prerequisite : 01205312 or together

Process control. Elements in process control system. Discrete and continuous process control system. PID control system. Feedback control. Feedforward control. Adaptive control and predictive control. Examples of industrial process control.

01205474 Real-Time Computer Control 3(3-0-6)

Introduction to real-time system. Concepts of computer control. Computer hardware requirements for real-time applications. DDC control algorithms and their implementations. Design of real-time languages. Programming languages.

01205475 Embedded Design for Instrument and Sensor Networks 3(3-0-6)

Prerequisite : 01205311

Introduction to embedded system for instrument and sensor networks. Signal converters. Signal transmitters. Instrument and sensor network structures. Recommended standards. Communications in instrument and sensor network. Network protocols and protocol layers. Task scheduling. Program structure design and implementation for instrument and sensor networks.

01205476 Applied Artificial Neural Networks and Fuzzy Logic 3(3-0-6)

Matlab and Simulink. Derivative-based optimization. Fuzzy logic and fuzzy set theory. Membership function. Fuzzy rule and fuzzy reasoning. Fuzzy inference system. Applications of fuzzy logic. Implementation of fuzzy logic in engineering applications. Artificial neural networks concepts. Perceptrons. Adaline and medaline. Back propagation. Recurrent neural networks. Selforganizing maps. Implementation of neural networks in engineering applications.

01205477 Computer Control of Machines and Processes 3(3-0-6)

Computer control. Elements of discrete modeling. Discrete controller design. Controlled computers. Computer interfacing. Sensors for computer control. Command generation in machine and process control. Sequential control using programmable logic controllers. Process modeling.

01205481 Digital Image Processing 3(3-0-6)

Human visual perception. Image sampling and quantization. Image sensing and acquisition. Introduction to image processing programming tools. Image enhancement in spatial domain. Detection of edge, line, corner, and basic shapes. Image segmentation and thresholding. Morphological image processing. Color image processing. Image transforms. Image enhancement in frequency domain. Image restoration. Current image processing applications.

01205482 Statistical and Adaptive Signal Processing 3(3-0-6)
Prerequisite : 01205323

Discrete time signal processing. Random processes. Linear models. Spectrum analysis. Eigenanalysis. Wiener filter. Steepest descent algorithm. Newton algorithm. Least mean squares algorithm. Least squares estimation. Recursive least squares algorithm. Kalman filter. Adaptive Filter Applications. Array signal processing.

01205483 Video Processing and Communications 3(3-0-6)

Fundamental of visual communication and television. Information theory. Models of human vision system. Bilevel image coding. Transform image coding. Video formation and representation. Video sampling. Video coding and motion estimation. Scalable video coding. Video compression standards. Stereo and multi-view sequence processing. Error control in video communications. Video over internet and wireless networks

01205484 Machine Learning for Image Applications 3(3-0-6)

Image capture and display. Basic image handling. Image pre-processing. Image descriptors. Machine learning basics. Supervised machine learning. Unsupervised machine learning. Image segmentation. Searching images and objects. Clustering and classification.

01205485 Image Analysis and Recognition 3(3-0-6)
Prerequisite : 01205481

Advanced image processing programming tools. Image transforms. Image formation physics. Image pre-processing. Image segmentation. Feature extraction. Shape representation and description. Object recognition. Introduction to image understanding. Current object recognition and image understanding applications.

01205486 High-Voltage Engineering Laboratory 1(0-3-2)

Prerequisite : 01205356

Laboratory experiments on topics covered in High-Voltage Engineering.

01205487 Electric Power System Analysis Laboratory 1(0-3-2)

Prerequisite : 01205352

Laboratory experiments about Electric Power System Analysis I and electric Power System Analysis II.

01205488 Process Control Laboratory 1(0-3-2)

Prerequisite : 01205473 or together

Laboratory for Process Control.

01205490 Co-operative Education 6

On the job training as a temporary employee in order to get experiences from the assignment for Electrical Engineering

01205491 Electrical Engineering Project I 1(0-3-2)

Select and prepare interesting project in electrical engineering.

01205492 Selected Topics in Power Engineering 3(3-0-6)

Study in selected topics in power engineering.

01205493 Selected Topics in Control and Measurement Engineering 3(3-0-6)

Study in selected topics in control and measurement engineering.

01205494 Selected Topics in Communication Engineering 3(3-0-6)

Study in selected topics in communication engineering.

01205495 Selected Topics in Electronics Engineering 3(3-0-6)

Study in selected topics in electronics engineering.

01205497 Seminar 1

Presentation and discussion on current interesting topics in electrical engineering at the bachelor's degree level.

01205498 Special Problems 1-3

Study and research in electrical engineering at the bachelor's degree levels and compiled into a written report.

01205499 Electrical Engineering Project II 3(0-9-5)

Prerequisite : 01205491

Continuing the same project as in electrical engineering project I.

Service Course (If any)

01205201 Introduction to Electrical Engineering 3(3-0-6)

Direct current and alternating current circuit analysis. Generators and their uses. Motors and their uses. Transformers. Three-phase systems. Power transmission system. Electrical instruments.

01205202 Electrical Engineering Laboratory I 1(0-3-2)

Prerequisite : 01205201

Laboratory experiments on topics covered in introduction to Electrical Engineering.

01205203 Electric Machinery Fundamentals 3(3-0-6)

Prerequisite : 01205211

Basic AC circuits. 3-phase AC circuits. Magnetic circuits. Principle of electromechanical energy conversion. Electric transformers. Construction and principle of rotating machines. Induction machines. Synchronous machines. DC machines. Performance and steady state analysis of rotating machines.

01205301 Digital Circuits and Microcontrollers 3(3-0-6)

Number systems and codes. Boolean algebra. Combinational and sequential logic circuit design. Karnaugh map. State machine. Synchronous and asynchronous sequential logic circuit design. Hardware and software development tools for microcontroller. Microcontroller architectures and peripherals. Compilers and debuggers. Timer and interrupt systems. Interfacing of devices. Data communication and networks.

01205302 Digital Circuits and Microcontrollers Laboratory 1(0-3-2)

Prerequisite : 01205301

Laboratory for digital circuit and microcontroller.

01205303 Electric Machinery Laboratory 1(0-3-2)

Prerequisite : 01205203 or together

Laboratory experiments on topics in Electric Machinery Fundamentals.

Course serviced by other curricula (If any)

01200431 Principles of Rail Engineering 3(3-0-6)

Thailand rail systems, State railway of Thailand system, BTS system, Operation and maintenance, Permanent way, Track works, Diesel locomotives, Diesel multiple units, Electric multiple units for mass rapid transit, Signalling and telecommunication systems, Supervision control and data acquisition system, Power supply system, Field trips required.

01200432 Rolling Stock Technology 3(3-0-6)

Prerequisite : 01200431

Thailand's rolling stocks. Diesel locomotives. Diesel multiple units. Electric multiple unit for mass rapid transit and commuter. High speed rolling stocks. Monorail rolling stocks. Trams and light rail rolling stocks. Train performance. Wheel-rail interactions. Rail vehicle dynamics. Rolling stock maintenance. Field trips required**.**

01200433 Signalling and Telecommunication Systems 3(3-0-6)

Prerequisite : 01200431

Thailand's signaling. Telecommunication. Supervision control and data acquisition system. And power supply systems. Interlocking system. Wayside equipments. On-board equipments. Rail telecommunication system. Central train control center. Rail power supply system. Third rail system. Catenary cables and pantographs. Rail power stations. Field trips required.

01200434 Rail Infrastructure 3(3-0-6)

Prerequisite : 01200431

Thailand's rail infrastructure. Rail route alignment design. Permanent way design. Viaduct/elevated way design. Tunnel design. Station design and location. Track works design. Depot design. Stabling yard design. Park and ride building design. Electrical and mechanical systems (Building Service Systems). Field trips required.

01200435 Rail System Operation and Maintenance 3(3-0-6)

Prerequisite : 01200431

Thailand's rail operation and maintenance. System operation planning. Headway time. Time table construction. Train control. Safety regulations. Fare collection system. Shunting operations for passenger and freight cars. Station operation. Principles of maintenance. Maintenance schedules. Rolling stock maintenance. Signalling/ telecom/supervision control and data acquisition system/power supply system maintenance. Track works maintenance. Electrical and mechanical system (building service system) maintenance. Field trips required.

01204111 Computers and Programming 3(2-3-6)

Basic structure of modern computer systems. Data representation in computer. Algorithmic problem solving. Program design and development methodology. Introductory programming using a high-level program language. Programming practice in computer laboratory.

01208111 Engineering Drawing 3(2-3-6)

Lettering techniques. Applied geometry drawing. Orthographic drawing. Pictorial drawing. Dimensioning and tolerancing. Sectional view drawing. Auxiliary views. Development. Sketching techniques. Detail and assembly drawing. Introduction to computer-aided drawing.

01208221 Engineering Mechanics I 3(3-0-6)

Prerequiste : 01417167

Force analysis. Equilibrium. Application of equilibrium equation to frames and machines. Centroid. Theorem of Pappus. Beams. Fluid mechanics. Friction. Virtual work. Stability of equilibrium. Area moment of inertia.

01213211 Materials Science for Engineers 3(3-0-6)

Relationships between structures, properties. Processes and performances of engineering materials. Phase equilibrium diagrams and their interpretation. Micro and macrostructures related to proprieties of engineering materials. Investigation of material structures. Material properties testing and analysis. Corrosion and degradation of materials. Production processes of engineering materials. Composite and construction materials.

01403114 Laboratory in Fundamentals of General Chemistry 1(0-3-2)
Prerequisite : 01403117 or together

Laboratory work for 01403117 Fundamentals of General Chemistry.

01403117 Fundamentals of General Chemistry 3(3-0-6)

Atomic structure. Periodic table and periodic properties. Chemical bonds. Stoichiometry. Gases. Liquids. Solids. Solutions. Chemical kinetics. Chemical equilibrium. Acids and bases. Ionic equilibrium. Representative elements. Metals. Nonmetals and metalloids. Transition metals.

01417167 Engineering Mathematics I 3(3-0-6)

Limits and continuity of functions. Derivatives and applications. Differentials. Integration and applications. Polar coordinates. Improper integrals. Sequences and series. Mathematical induction.

01417168 Engineering Mathematics II 3(3-0-6)
Prerequisite : 01417167

Vectors and solid analytic geometry. Calculus of multivariable functions. Calculus of vector valued functions.

01417267 Engineering Mathematics III 3(3-0-6)
Prerequisite : 01417168

First order linear differential equations. Linear differential equations with constant coefficients. Laplace transforms and inverse transforms. Power series solutions. System of linear differential equations.

01420111 General Physics I 3(3-0-6)

Mechanics. Harmonic motion. Waves, Fluid mechanics. Thermodynamics.

01420112 General Physics II 3(3-0-6)

Electromagnetism. Electromagnetic waves. Optics. Introduction to modern physics and nuclear physics.

01420113 Laboratory in Physics I 1(0-3-2)

Prerequisite : 01420111 or together or 01420117 or together

Laboratory for General Physics I or Basic Physics I.

01420114 Laboratory in Physics II 1(0-3-2)

Prerequisite : 01420113 and 01420112 or together or 01420118 or together

Laboratory for General Physics II or Basic Physics II.