Courses' Descriptions

1810101 Mathematics for Engineers I 3 credits

This course contents the basics of mathematics for usage in specific courses for Electrical Engineering: System of linear equations and elementary row operations, linear transformations and matrix representation. Vectors in plane and polar functions: vectors, polar coordinates and graphs-introduction of complex numbers, operations and functions. Derivate: the derivate as a function and as a rate of change, derivate of products, quotients and negative powers, derivate of trigonometric functions, the chain rule, implicit differentiation and related rates.

1810102 Physics 3 credits

This course introduces basics of physics, except those subjects that are taught in the two courses Fundamentals of Electrical Engineering I and II. Units, vectors, motion in 1, 2 and 3 dimensions, work and energy, linear and angular momentum, kinematics, kinetics, geometrical optics.

1810114 Physics Lab 1 credit

Density and measurements of π, kinematics, vectors, Newton's second law, inclined plane, spring, simple pendulum, projectile motion, conservation of energy, conservation of momentum, free falling. Electric field, magnetic field, induction, specific heat capacity.

1810103 Fundamentals of Electrical Engineering I 3 credits

Basic definitions, power, circuit schematic and ideal basic circuit elements, voltage and current sources, resistance, Ohm's law, Kirchhoff's laws, circuit analysis techniques: nodal, mesh, linearity, superposition. The venin's and Norton theorems, source transformation capacitance, I-V relationship for capacitance and inductors.

1810104 Fundamentals of Electrical Engineering I Lab 1 credits

Introduction to basic safety rules, instrument familiarization, and usage of multimeter: Measuring of voltage, current, Ohm´s Law, basic DC circuits, and characteristics of passive electronic components. Diode DC characteristics, half-wave rectification, full-wave diode rectification.

1800001 Basics of Business Administration 2 credits

Important business terms (costs, revenue, profit, return on investment), factors of location decisions, production & operation management, basics of marketing; management structures and decisions.

1800002 Low-Intermediate English 2 credits

This course is the first of a series of four English courses which is designed for English language learners who can communicate in familiar topics and texts which contain common vocabulary, and understand the main points of a conversation, but with some difficulty and with the need of much more vocabulary. The course aims at enhancing students' competency in comprehending passages of

medium length, and improving students' fluency in expressing themselves orally and in writing through conducting short conversations and forming simple and compound sentences. It promotes students' real-life listening skills and enables them to comprehend spoken English in conversations and talks of average length. It develops students' writing skills at the level of forming a well-structured sentence based on the given input.

1810105 Engineering Workshop and Safety 2 credits

This workshop gives the student basic knowledge and ability for simple mechanical tasks for metalworking shop layout, industrial safety, materials, soldering, welding, fitting, metal cutting, drilling, milling and tapping. Safety engineering and management with emphasis on control of hazardous materials, fire prevention, safety considerations in production facility design and maintenance, and operation of effective safety programs.

1810106 Mathematics for Engineers II 3 credits

Transcendental functions and differential equations. Integrals, definite integrals, substitution in definite integrals, application of integrals, the mean value and fundamental theorems of calculus first order separable differential equations and first order linear differential equations. Infinite series: limit of sequence of numbers subsequences and bounded sequences, test for convergence, alternating series, absolute and conditional convergence, power series, Taylor and McLaurin series, application of power series.

1810107 Fundamentals of Electrical Engineering II 3 credits

This course gives the student the knowledge for analyzing AC fundamentals and single-phase analysis: Harmonic frequency in AC circuit, AC voltages and currents, complex representation of sinusoids, phasors, complex impedances of inductors and capacitors, driving-point impedance, frequency response of circuits, Bode Plots, power in AC circuits, energy storage in capacitors and induction, parallel and serial combination of capacitors and inductors.

1810108 Fundamentals of Electrical Engineering II Lab 1 credit

Oscilloscope, AC amplitude measurements, measuring AC voltage, current and impedance, inductors, inductive reactance and impedance, phase angles, serial and parallel RL/RC circuits.

1810109 Electronics I 2 credits

Insulators, conductors and semiconductors, intrinsic and extrinsic semiconductors, impurities, doping, n-type and p-type semiconductors, the p-n junction diode, characteristic and applications. The Zener diode: characteristics and applications. Special purpose diodes, npn, pnp BJTs, DC biasing techniques.

1810111 Informatics I 2 credits

Introduction to computing, computer organization and architecture, main & mass storage, operating systems, information representation, numbering systems, Boolean operations, gates Boolean circuits, machine language/instruction set traditional programming concepts , procedure & functions, implementation (translation, linking and loading), algorithm representation & discovery,

flowcharting, pseudo coding, iterative structures, introduction to C-programming, formatted input/output in C-language, expressions in C-language, one-way, two-way & multiple-way selections in C.

1810112 Informatics I Lab 1 credit

Computer architecture, hardware & software, maintenance, Windows & Linux, file & folders, internet, MS Office; Word/ Excel/PowerPoint/Access/Visio, writing C-programs, C-language: formatted input/output, expressions & selection statements in C.

1800003 Intermediate English 2 credits

This course is the second of a series of four English courses which is designed for learners who have good knowledge of English, understand the main points when listening to a native speaker if the topic is familiar and understand the main ideas in texts which contain high frequency or job related vocabulary, and can use basic tenses, but have problems with more complex grammar and vocabulary. It aims at developing students' levels of accuracy and fluency in English speaking and writing, awareness of the writing process and reading and listening sub-skills. During this course, students will have the opportunity to practice the skills of reading, writing, listening and speaking in English. Reading materials will range from notices and brochures to short articles and letters. Different types of spoken English used in a range of social situations will be used for listening comprehension, and students will be encouraged to write accurate English.

1810113 Thermodynamics 2 credits

Definitions and basic concepts. Perfect gases, laws related to perfect gases, mixtures of perfect gases. Properties and states of simple substances. The first law of thermodynamics. Kinetic energy, potential energy, work, and heat transfers. Control volume energy analysis, conservation of mass and energy for control volume. The second law of thermodynamics, heat engines and refrigeration systems, Carnot cycles. Entropy, T & S equations.

1810210 Complex Analysis and Engineering Transforms 3 credits

Complex analysis and engineering transform: The course provides a study of selected topics in mathematics and their applications for advanced courses in engineering. It covers the study of complex numbers, analytic functions, elementary functions, complex integration, integration methods, Laplace and Inverse Laplace transforms, Fourier series and Fourier transforms.

1810201 Mathematics for Engineers III 3 credits

Multivariable calculus, limits and continuity, partial differentiation, multiple integration, Gradient theorem, Stoke's theorem, Gauss's theorem, probability principles and set theory. Random variables and operations performed on random variables. Various distribution functions.

1810202 Digital Logic Systems 3 credits

Boolean algebra and its laws, theorems, operations, simplification. Description the logical system behavior in an algebra expression. Using Karnaugh maps, combinational logic networks and

applications. Logic functions implementation using multiplexer, decoder, read-only memories and programmable logic arrays, SR, JK, T and D flip-flops. Design and analysis of synchronous sequential logic networks and applications.

1810203 Digital Logic Systems Lab 1 credit

Combinational logic circuits design comparators and adders, code conversion and multiplexers, sequential circuit design, counters, sequential adders/subtractors, shift registers, design project.

1810204 Informatics II 2 credits

Revision of C language, basic types, iterative structures(loops), arrays, functions recursion, local and global variables, pointer and arrays, pointer and functions, strings, dynamic data structures, files, introduction in OOP, standard algorithms: Linear search, binary search, sorting, file-handling.

1810205 Informatics II Lab 1 credit

Implementing C programs, C language basic data types, iterative structures (loops), arrays, function, recursion, local and global variables, pointer and arrays, pointers and functions, dynamic data structures, files, classes and objects.

1810213 Probability and Engineering Statistics 2 credits

Set theory, basic concepts of probability, conditional probability, independent events, Baye's Theorem, discrete and continuous random variables, distributions and density functions, probability distributions (binomial, Poisson, hyper geometric, normal, uniform and exponential), mean, variance, standard deviations, moments and moment generating functions, linear regression and curve fitting, limits theorems and applications.

1800004 Upper-Intermediate English 2 credits

This course is the third of a series of four English courses, which is designed for learners who can understand lectures of familiar topics, understand the news on television reasonably well, interact with some fluency and spontaneity and take an active part in discussions on familiar topics. It aims at developing students' levels of accuracy and fluency in English speaking and writing, awareness of the writing process and reading and listening sub-skills. At this course, students can understand the main ideas of complex texts, including technical discussions in their field of specialization, interact with a degree of fluency and spontaneity that makes regular interaction with native speakers. In addition, they will be able to produce clear and structured texts on familiar subjects.

1800005 German I 2 credits

This introductory course aims to provide students with the ability to understand, speak, read and write simple German. Primary goals are to introduce beginning students to basic structures of the German language by developing vocabulary and a command of idiomatic expressions; to familiarize students with sentence structure through written exercises and short compositions; to give students a foundation in German history and culture; and to interest students in traveling to German-speaking countries.

1810206 Electronics II 2 credits

Field-Effect Transistor (FET) theory, DC biasing and symmetrical swing, small signal analysis of BJT and FET amplifiers, multistage amplifiers, Darlington pair amplifiers. Frequency response of single and multistage BJT and FET amplifiers. Differential amplifiers, operational amplifiers: theory, slew rate, offset, frequency response. Basic Op-Amp applications: summation, subtraction, integration and differentiation.

1810207 Electronic Lab 1 credit

Rectification, power supply filtering, voltage doubler, Zener diode and its regulation, testing the junction of a transistor, emitter-based bias potentials BJT's and FETs: characteristics, DC biasing, circuit design, amplifiers and frequency responses, differential amplifiers, operational amplifiers basic applications filters.

1810208 Instrumentation and Measurement 3 credits

Introduction to the principles and practice of instrumentation and measurement systems in an engineering context. Basic principles and instrument characteristics. Measurement errors, basic statistics, noise and its control. Dynamic characteristics of instruments, time and frequency domain responses. System identification using correlation techniques. Amplifiers, filters, ADCs and Disposition, strain, pressure and motion sensors (resistive, capacitive, inductive, optical). Flow sensors. Ultrasonic sensors.

1810209 Instrumentation and Measurement Lab 1 credit

Usage of different measuring instruments, error analysis, energy, dynamic measurement, amplifier and filter analysis, non-electric.

1810211 Engineering Design and Drawing 2 credits

To provide students with an understanding of engineering design, drawing practice and modelling in an applied context. Drawing, lettering, geometric constructions, sketching and shape description, Multiview's projections, sectional views, perspective views, dimensioning.

1810302 Electromagnetic Theory 3 credits

Vector analysis, electrostatic fields. magnetostatics fields, solution of Laplace's and Poisson's equations, Faraday's law and applications, Maxwell's equations, transmission lines. Plane waves propagation, reflection and refraction.

1800010 Advanced English 2 credits

This course is the fourth of a series of four English courses which is designed for learners who can understand lectures in the target language on both familiar and unfamiliar topics, and understand news on television and radio well, taking an active part in discussions on both familiar and unfamiliar topics, but still make mistakes and fail to make themselves understood occasionally. During this course, students will develop accuracy and fluency in speaking and writing, awareness of the writing process and reading and listening sub-skills. Learners can understand a wide range of demanding,

longer texts and recognize implicit meaning. They can also express themselves fluently and spontaneously without much obvious searching for expressions, use English flexibly and effectively for social, academic and professional purposes and produce clear, well-structured and detailed texts on different subjects, showing controlled use of organizational patterns connectors and cohesive devices. In addition, it aims at familiarizing students with the internationally recognized proficiency tests such as (TOEFL & IELTS) to ensure students have the integrated skills needed in taking the proficiency tests.

1800011 Entrepreneurship 2 credits

The course will cover the basic skills needed to improve the personality characteristics and enhance the interpersonal skills of the students. Broadening the student's visions and focusing on internal success factors are key elements of the course. The course will tackle issues like; entrepreneurship and entrepreneurial life, SMEs successes and failures, motivation and self-management, creativity and innovation, leadership and teamwork, networking and negotiation and developing personal goals and objectives, basic fundamental skills and functions needed to start a new business. Thinking of being unique, able to produce and sell and understanding the product life cycle are issues to be covered in this course.

1800012 Communications Skills 3 credits

This course provides the engineering student with vital knowledge that will expand his skills in aspects regarding technical terminology including scientific prefixes and suffixes, writing short and correct technical definitions, writing headings and titles, connecting ideas and sentences, writing a scientific paragraph and essay, writing scientific abstracts, and finally writing a technical report with a correct bibliography and citation. Oral, written and graphical communication principles are covered and exercised through the study of case histories, practical workshops and detailed assignments.

1810301 Electrical Workshop I 2 credits

Electrical drawings for building installations, electrical wiring, main supply including different types of circuit breakers, protective measures, lightning, and excess voltage protection, residential circuit protection, network quality, lightning and power systems wiring and installation of the circuits.

1810310 Communication Systems 2 credits

Amplitude Modulation: Baseband and carrier communications. Noise: Mathematical representation, Signal to Noise Ratio, Noise in AM, FM, and PM systems Pulse Modulation: Sampling and Quantization, Pulse Amplitude Modulation, Pulse Position and Pulse width Modulation, Quantization Noise, Signal to Quantization Noise Ratio, Pulse code Modulation, Delta Modulation, Frequency Shift Keying, Phase Shift Keying.

1810323 Electrical Machines 3 credits

Electrical Machinery Principles: Magnetic Field and Circuits, Magnetization curves Characteristics of hard and soft magnetic materials, losses. Transformers: Ideal Transformer, Single Phase transformer: Operation and Equivalent Circuit, auto-transformer. DC Machinery fundamentals: Basics, loop rotating between pole faces, Commutation, Windings, Armature reaction, Induced

Voltage and torque equation. Power flow and losses, Types of DC motors, Permanent magnet DC motors. AC Machinery fundamentals: Rotating Magnetic Field, Magneto motive force and flux distribution, Induced Voltage and Torque, Windings, Power Flow and Losses, Introduction to Induction Machines. Special Purpose Motors: Introduction to Single phase Induction Motors, Switched Reluctance motors, Hysteresis motors, Stepper, brushless DC motors.

1810320 Electric Power Generation 2 credits

In this course the student gets the knowledge of the production of electric power in different types of power plants: Basics of thermodynamics, energy management basics, power plant types: steam turbine plants, gas turbine power plant, combined cycle plants, nuclear power stations, control of power plants, micro turbines, Stirling engines. Moreover, students get to know a glance about the economic dispatch and optimum distribution of generation units geographically.

1810321 Electrical Power Engineering I 2 credits

Review of network theory, AC power flow in linear networks, polyphase networks, introduction to symmetrical components, components.

1810330 Control Systems 3 credits

Modeling of electrical, mechanical control systems, Open and closed-loop systems, Block diagrams. Second order systems. Step and impulse response. Performance criteria. Steady state error. Sensitivity, s-plane system stability. Analysis and design with the root loci method. Frequency domain analysis, Bode plots, Nyquist criterion, gain and phase margins, Nichols charts. The State-space method, state equations, flow graphs, stability, compensation techniques. Simulation and Controller design using MATLAB.

1810309 Numerical Engineering Analysis 2 credits

Floating point number system, error analysis, solutions of equations, interpolation, splines, numerical differentiation and integration, numerical methods in linear algebra, systems of linear equations, method of least squares, eigenvalues, eigenvectors, solution of ordinary and partial differential equations. This subject is to be supplemented with extensive MATLAB exercises.

1810303 Microprocessor and Microcontroller 3 credits

This course includes the fundamentals of microprocessor and microcontroller systems. Architecture, addressing modes, instruction set & assembly language programming and input/ output devices. Concerning the Programmable Logic Controllers, the course teaches the techniques of installation, programming and interfacing of industrial PLC’s. Then Appling knowledge of PLC programming to control and automate industrial systems.

1810304 Microprocessor and Microcontrollers Lab 1 credit

Microprocessors lab helps the students to develop their knowledge on processor architecture and the programming skills. It provides facilities for the use of 8/16 bit microprocessors/microcontrollers and their interfacing for different applications, using hardware and software concepts to meet industry standards.

1810305 Electrical Workshop II 2 credits

Advanced skills electrical wiring; industrial wiring projects; building installations for communication, building automation with KNX.

1810322 Electric Power Engineering II 3 credits

Switchgear, design of power lines and power systems under normal operation, load-flow calculation, AC-transmission, HVDC-transmission, flexible AC-transmission systems (FACTS).

1810306 Embedded Systems 3 credits

Computer communications, networks distributed systems, real-time operating systems, sensors and actors, serial and parallel bus systems, e.g. CAN, USB, LAN.

1810307 Electronic Interfacing and PCB Prototyping Workshop 2 credits

Electronic interfacing: basic concepts and principles of interfacing, interrupt interfacing, parallel and serial interfacing, programmable interfacing devices, data conversion. PCB prototyping: drawing, routing, placing, drilling, soldering etc.

1810324 Electric Machines Lab 1 credit

DC machines, AC machines, three-phase asynchronous machines, three-phase synchronous machines, servomotors, single- and three-phase transformers.

1810212 Engineering Materials 3 credits

Materials for conductors and resistors, semiconductors, dielectric materials, insulating materials, fibrous insulating materials, ceramics, mica, glass, rubber, magnetic materials.

1810401 Electrical Installation and Standards Workshop 2 credits

Lamps and appliance circuits, door communication systems, basics of building management system, building management: Line coupling unit, lighting management.

1810325 Power Electronics 3 credits

Principles of power electronics, converters and applications, circuit components and their effects, control aspects. Power Electronic Devices: Power diode, power BJT, power MOSFET, IGBT and SCR, GTO and TRIAC and DIAC. Construction, characteristics, operations, losses, ratings, control

and protection of thyristors. Semi controlled and fully controlled rectifiers, three-phase rectifiers: un-controlled, semi controlled and full controlled, six-pulse, twelve-pulse and 24-pulse rectification, PWM converters, DC to AC converters, three-phase inverter, six-pulse, twelve-pulse inverters, PWM inverters, switching mode power supplies, DC to DC conversation, buck converter, boost converter and buck-boost converters, isolated converters, forward converters, fly back converters.

1810421 Electric Drive and Engineering 3 credits

Electrical Drive Systems: Translational and rotational motion, power rating and classes of duty. 4-quadrant operation. Torque/power limits. Note on closed-loop control of drives. Electrical and mechanical transformers. DC drives: Brushed and brushless, and intro to their control issues. AC motors: examples of motor drives (e.g. induction motors), and intro to their control issues. Servomotors and stepper motors: principles and their control, examples of modern electrical drives in engineering applications.

1810422 Power Electronics and Drive Technology Lab 1 credits

Semiconductors for power engineering, IGBT, fundamentals of converter circuits, static converter valves, uncontrolled and line - commutated static converter circuits, controlled static converter circuits: Self-commutated static converter circuits: Turn-off static converters and chopper converters, switched-mode power supply, inverters, compact static converter - fed DC machines, frequency converter drive, static converter fed asynchronous machines.

1810423 Renewable Energy 3 credits

Renewable energy in the context of our primary energy needs, global energy consumption, climate protection and sustainability, national and international regulations, solar thermal energy, solar photovoltaic, bioenergy, hydroelectricity, tidal power, wind energy, integrating renewable energy into energy systems.

1810424 Power Systems and Transmission 3 credits

Power system, the symmetrical three-phase system, power system components, synchronous generators, power and control transformers, transmission lines, the characteristics of the loads, network analysis, voltages, currents and powers at sending and receiving ends. Fault analysis, systematic short-circuit computations, unbalanced system analysis, symmetrical component theory. Power system economics, embedded or dispersed generation, issues and technical impacts of embedded generation. Introduction to smart grids and future power systems.

1810420 Control and Automation Lab 1 credit

Analog control Temperature control and liquid level (Measurement and control), speed control, recording of frequency responses, digital control, control of an industrial machine 300 W, basic circuits of control technology, inductive proximity switches, capacitive and optical proximity switches, automation and bus technology, PLC.

1810425 Electric Power Lab 1 credit

Synchronization circuit, power station control: Generator Cos Phi Control, power transmission/power

distribution: Three-phase transformers, power transmission/power distribution: Transmission line model 380 KV, power transmission/power distribution: Generator fed transmission system with RLC loads, protection of power engineering systems: Current and voltage transformers, protection of a power transmission line.

1810426 Special Topics in Electric Power Engineering 2 credits

The final content of this course will be decided in the third study year. The course shall give the opportunity to deal with important topics in the field of Electrical Engineering (Electric Power Engineering). As Electrical Engineering is a very dynamic area with very short product cycles, new services and actual trends shall be discussed.

1810430 Power System Automation 3 credits

Basics of data transmission techniques, structure of network control, distribution network control, protection in power plants and other industrial plants, analysis of failures and other disruptions, expert works of grids condition, concepts work concerning objects protection, short-circuit calculations, commissioning of protection systems for generators and GT units., PLC, SCADA. Power system software tools ETAP and PWS.

1810402 Introduction to Project 3 credits

During the study project, which extends over one semester, the student will be assigned a specialized engineering application problem of limited scope under the supervision of a faculty member. The problem definition spans from gathering all pertinent information and data through studying, analyzing and recording the problem. This study project must be done at Al-Quds University and it can be a design project, an analytical paper or an experimental work in the form of hard- or software. The associated work is an individual effort that demands initiative, creativity and individual responsibility. At the end of the project, the result of the student's findings must be provided in form of a report, and an additional system demo and/or an oral examination.

1810434 High Voltage Technology 3 credits

Introduction to high voltage engineering & technology. Duties and future of high voltage technology, measurement of high AC, DC and impulse voltages, Stressing of isolations, Classification and calculation of electrical field, Physical discharging theory of gases fluids and solid isolators, Ionization and decay processes, thermal, ionization. Electric breakdown in gases. Surge breakdown voltage-time lag. Corona discharges under switching surges. Breakdown in solid and dielectric. Attenuation voltage. Transient voltage. Generation of Dc, AC high voltage and Impulse voltage, specifications of high voltage, equipment of measurement of high voltage. Insulation coordination of electrical system

1810490 Graduation Project I 3 credits
1810491 Graduation Project II 4 credits

The last year will take care of the professionalization of students. Theory and practice have to match and the student shows being capable of solving market related problems. The graduation project demonstrates the student's ability to deal and solve practice-related problems from the respective field by using practical and scientific knowledge and methods. The graduation project is a specific, well-described task out of the company. The students have to apply their acquired complex theoretical knowledge and practical experiences to solve this task by a scientific and systematic approach. Note that the project is monitored and assessed by two counsellors, lecturer from the university and a qualified supervisor from the company. The various attributes and specifications of the DSEE program's graduates after successfully completing the graduation project are listed in the following:

- Knowledge and Understanding
  - The student demonstrates in an autonomous work that he/she can work out or to develop solutions for complex technical problems in Electrical Engineering by applying scientific methods.
  - The student understands the scientific basis of Electrical Engineering and has demonstrated that he/she can deepen and apply it.
  - The student knows the current state of research in his/her specific project area.
  - The student writes the project report according to the rules of scientific work.
  - The student can create a project plan for monitoring and tracking of the project.
- Cognitive/Intellectual/social skills
  - The student has analyzed the problems and evaluated alternative solutions.
  - The student can expand his knowledge and interpret current knowledge.
  - He can formulate subject-specific solutions and can communicate to customers and colleagues.
  - As a team member, he/she takes over responsibility for a task.

1810190 Practice I **3 credits**
1810191 Practice II **3 credits**

In the first year, the fundamentals of Electrical Engineering will be taught. They enable students to understand the design of electrical circuits and to use them in applications. In addition, multidisciplinary basic knowledge is taught and skills are built up for personal development. In the practical phases of the first year, the DSEE student should get to know the organization and area of business of their company. The students have learnt basic theory to understand the simple networks of electric elements and will apply this in this period under intensive monitoring. In addition to the understanding of the workflow processes, out of the knowledge and skills acquired in the theory modules, they will be applied and deepened through little practical tasks. The student has to write a practice report and to submit it. The following lists contain some examples of the knowledge and skills to be acquired during this practice phase:

- General Electrical Engineering knowledge
  - Simple Electrical Applications and Installations
  - Measurement techniques
  - Analog Electronics
  - Mechanical Basic Skills
  - Introduction to computer systems
  - Working with standard computer applications
  - Basics of programming
- Additional Skills:

- Organization structure
- Documentation
- English
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1810290 Practice III 3 credits
1810291 Practice IV 3 credits

In the second year of theory, the digital systems are introduced and the programming skills of the students had been increased. Furthermore, the soft skills are further developed. The practical phases of the second year are typically characterized by use in projects in which the students already perceive small, independent tasks. Ideally, the knowledge of the theory phases are immersed in at least one or two of the module topics. A personal project of the practical phase shall be documented as a practical report and be provided as a presentation for discussion. The following lists contain some examples of the knowledge and skills to be acquired during this practice phase:

- Electrical Engineering knowledge
  - Analog and digital electronics
  - Basic understanding of electrical network and circuits
  - Instrumentation and measurement
  - Internet-service
  - Programming in C
  - Engineering Design and Drawing
- Additional skills:
  - Cost and budgets
  - time management
  - product quality
  - production

1810390 Practice V 3 credits
1810391 Practice VI 3 credits

The third year will take care of the professionalization of students. It will deepen existing knowledge and topics and, at the same time, expanded the horizon by the treatment of specific methods and research-related technologies. They can specialize in this year towards their future professional focus, normally in line with the demand of their employer. The students become in this year already a valuable, esteemed staff member in their companies, taking over responsibility for limited tasks. With supervision, they are used to work on their own and to deliver their problem solutions in time. The following lists contain some examples of the knowledge and skills to be acquired during this practice phase:

- Electrical Engineering knowledge
  - Power electronics
  - Electrical installation and Applications
  - Control Systems
  - Microprocessor Applications
  - Electrical Machines and Transformers
  - Embedded Systems
  - Product comparison and market analysis
- Additional skills:

- Cost and budgets
- time management
- project management
- Business skills