جامعة القدس
Al-Quds University

FACULTY FOR ELECTRICAL ENGINEERING

Student's Manual

Dual Studies in Electrical Engineering (DSEE)

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CONTENTS

1. Characterization of the Degree Program Electrical Engineering

The dual studies IT program combines academic learning with the direct application and expansion of knowledge in professional practice. Two partners, the AQU and the companies, take on the task of training qualified new recruits.

AQU DS graduates can look forward to promising professional and career opportunities in interesting specialist and management positions. The vast majority of graduates will already hold employment contracts before they have even finished their studies.

The DS Bachelor degree program at the AQU lasts for four years. Alternating between theoretical academic (50%) and practical phases in industry (50%) instils the study with diversity and variety. The graduates usually take on responsible, professional tasks when they are still young.

AQU DS IT students are at the same time employed by their respective companies and are paid a monthly wage. This provides the first stage in becoming financially independent.

1.1. Quality Assurance Procedures

The responsibility of quality assurance issues at Al-Quds University is in the hand of the Quality Assurance Unit (QAU). This department is responsible for:

- The ongoing review of academic processes and its quality assurance, i.e. in all faculties, libraries, labs, etc.,
- The ongoing review of administration and financial processes in order to reach an acceptable level of international standards,
- Monitoring all ongoing academic program outcomes through communicating with the ALUMNI unit,
- Cooperation with the Students' Affairs Department for reviewing the students' needs from their view.

All academic programs of Al-Quds University have to be submitted to the national accreditation authority AQAC in the Ministry of Education and Higher Education. In order to ensure a high international academic standard the evaluation team consists mostly of foreign professors. In the case of Dual Studies the documents were evaluated by a German accreditation team in Germany. The appointed accreditation team consisted of German professors with a profound dual study background. The accredi-

tation of the DSEE program is currently under review. The final accreditation award is expected for November 2015.

The performance of all AQU full- and part-time professors are evaluated by the students at the end of each semester and yearly by the responsible department and the faculy.

1.2. Degree

Upon successful completion of study in this degree program, the following academic degree will be awarded:

Bachelor of Engineering (**B.Eng**.)

2. Data related to the Degree Program Electrical Engineering

2.1. Degree Programs on Offer

The Dual Studies Program of Electrical Engineering will be offered at Al-Quds University, campus Abu-Dis

3. Rationale for the Degree Program in Electrical Engineering

3.1. Justification of a Dual Studies Program

The Dual Studies program has been designed to highly satisfy the current and future market needs, in order to have highly qualified electrical engineering (EE) graduates to lead the advancement in the EE sector in Palestine.

Many studies have shown that most Palestinian universities are lacking practical training of EE students and graduates. In addition to the education system in Palestine still depends on memorization and old-style teaching methods and lacks the practical application, therefore the opportunity for employment with a bachelor degree is very limited.

Al-Quds University had the idea, to incorporate more practical training into the university studies similar to the approach followed by several higher education institutions in Germany, such as the Cooperative State University Baden-Württemberg (Duale Hochschule Baden Württemberg - "DHBW"). The results of a study showed a strong interest of the private sector in this new effective style of study.

In the year 2015 AQU has established a dual study program under the roof of the Dual Studies College that will be the first of its kind in Palestine. AQU has developed the curriculum of Bachelor in EE in collaboration with Dual Studies German experts and with EE companies who agreed to be partners of the Dual Studies. Then AQU has conducted a workshop with the EE private sector and validated the curriculum in order to ensure that the curriculum responds to the needs of the EE sector in Palestine.

AQU positions itself as a leader in education to create an environment of innovation, economic growth and job creation. The main aim of the Dual Studies program is "More Job Opportunities for the Palestinian Youth". AQU directly contributes to the Palestinian authority employment strategy which is" Reversing the Perspective for Youth – from High Unemployment and Low Paid Jobs to a Qualitative Perspective with Career Possibilities" [1]

This problem-based learning, mentored by the industry partners result in an add-on compared to a standard study program. Social competences, generic skills and customer-oriented practice are some of the competences filling the gap between the needs of industry and the skills delivered by University.

Outcomes from dual study programs - sometimes called work- integrated learning programs - are generally positively confirmed and include improved professional attitudes in students, enhanced employment outcomes for students, increased industry relevance, and savings in recruitment and training costs for them. Experience in Germany, Canada, US shows that approximately 85 % of the graduates remain within their training companies. The other great advantage is the low dropout rate of less than 20%, due to the high motivation of these students and the preselection by the company.

3.2. Demand among Prospective Students

In the first academic year almost 200 students applied for the newly established DSEE programme.

[1] National Employment Strategy, November 2010, Palestinian National Authority Ministry of Labour

3.3. Positioning of the Graduates on the Labour Market

The EE sector plays a vital role in the all industrial countries. Because of the growth of industrial production and the consumption of electrical energy the supply with electrical energy and the management of electricity production, transmission and distribution is one of the mayor problems worldwide. New technologies like the decentral production of electricity, the transportation with high voltage DC links and the optimization of the consumption with smart grids need a new type of engineers who have an excellent education at universities and practical experience of electrotechnical equipment and components in the practice.

Contacted EE companies have expressed their demand for skilled EE professionals and their willingness to cooperate in a Dual Study (DS) program by employing students. They expect that the new DS EE curriculum, in which theory and practice are linked, will close the gap between theory and practice and consequently shorten the period of professional adjustment for graduates.

Electrial Engineers can work for example as:

- Engineer for planning, implementing and maintaining building automation systems
- Technical Manager for companies in the EE sector
- Network planing engineer in public utilites
- Planing engineers in power production companies
- Engineer for designing electrical and electronical systems
- Engineer for programming embedded systems
- Engineer for automation of production lines
- Service and maintance engineerEngineer for improvement of automation processes
- Entrepreneur setting up his/her own EE related business

4. Concept and Objectives of the Degree Program in EE

4.1. Mission Statement

The mission of the Electrical Engineering dual study program is the preparation of a distinct experienced generation of graduates through cooperation with private sector, who are characterized not only as creators and innovators in their specialization field, but also capable to prove themselves as unique enigineers in a world of accelerated progress of technology and economics. They will be equipped with the necessary knowledge and appropriate skills for a decent place in the world of leadership of excellence and business, as well as to enable them to take the wheel of evolution, and to continue the march of advancement and prosperity in Palestine.

Nowadays, almost nothing runs without electrical engineering and electronics. Most of the industrial production depends directly or indirectly on the use of modern electro-technical systems. It is undeniable that innovations and new products in electrical engineering are the major key to overcome the difficult challenges facing the Palestinian economy, which can become a Hi-Tech one when a more profound and specialized electrical engineering study and training specifically designed to be highly relevant to both, the private sector and the society, is offered, satisfying the current and the future market needs from highly qualified engineers, who are capable to lead the advancement in Palestine. To achieve this, the graduates of the electrical engineering dual study program will have a key role in shaping the power and energy industry in order to solve the energy problems in Palestine, as well as to contribute to the growth of the Palestinian economy. Candidates are desired, who have clear goals and do not want to waste time, want to quickly complete the study, and, at the same time, wish to have a practical training in a company.

4.2. Educational Objectives

The educational objectives of the electrical engineering dual study program are centred on the graduation of qualified electrical engineers with solid foundations in all areas of electrical engineering, who are characterized by the following features:

- The ability and creativity in solving problems, and dealing and coping with the pace of modern technologies in the different areas of electrical engineering.
- Demonstrate proficiency in the design, analysis, improvement and implementation of modern electrical and alectronic systems.

- Compete effectively in a world of rapid technological changes, and to become leaders, businessmen and managers innovators or teachers in a broad context of electrical engineering.

- Work effectively in a professional environment and show the necessary communication skills, leadership, and commitment to professional ethics.

- Pursue post-graduate studies and research in the disciplines of advanced topics and electrical engineering, as well as to become consultants in their respective fields.

- Work professionally bolstered by a technical background and solid scientific and adequate skills in the field of electrical engineering, and the ability not only to design electrical power systems, but also to deal with all types of electrical systems and problems.

- Adapt to different roles and responsibilities in a multicultural work environment through respect for diversity and professional within the organization and society at the national and international levels.

4.3. Profile of Study Offer

The undergraduate programs of AQU are designed as in work-study. During the four-year study theoretical learning phases alternate with practical phases every three months. The practical studies take place at the cooperative industrial partners. The close links between theory and practice contributes significantly to the achievement of the qualification objectives.

The profile is from the academic side a broad, versatile and general study program in Electrical Engineering. In Dual Study programs a specialisation is mainly implemented in the 6 specific, individual practice periods and finally by the graduation project. The student will be involved in professional projects related to the products and services of his company. According to the working area of the employer and the educational plan the student specialises by corresponding projects and he or she is individually and closely supervised by the tutor of the company and the University academic staff.

4.4. Credit Point System

This curriculum of a dual studies Bachelor degree (B.Eng.) in Electrical Engineering (DS-EE) differs from the normal university track at certain points. The degree "Duals Study EE" accentuates the application specific character of electrical engineering, which is essential for the practiceoriented creation and oper-

ation of electrical and electronical EE systems. Students are taught specific skills from the area of application, implementation and operation of EE systems in the industrial environment. Skills, which are necessary for creating and applying electrical and electronic and software systems for various areas. The mathematical foundations are also geared to the area of application.

However, such a program, as described here, has also to fulfill all the standard national requirements for accreditation. Incorporating practical periods in the curriculum concludes in a reduction of the time for pure theory and at the same time an increase of the time for exercising and application of the knowledge.

Thus, the main difference of Dual Studies in Electrical Engineering with respect to normal studies is the method of delivering the skills and competences to the learner. For this purpose it had to be decided which subjects are better learned in a working environment and which are better taught at the University. It has to be stressed that both places have to undergo quality assurance processes, because credits can be given only if quality and learner's success are assessed.

The examples in the student's workload calculation demonstrate that the workload for one credit is kept at the same level, only the contact hours per week for delivering the knowledge is changed (increased). In summary the credit points for the DS-EE amount to 150 credits for the whole degree course (compared to the 168 credits of the normal track).

Of the 150 credits, 120 are still achieved by theory. The evaluation of the practical training and the application of knowledge in the company yield 30 credits, less than 20 % of total credit. The DS-EE is an add-on to the normal track and another form of learning is used to transfer additional skills, knowledge and professional expertise.

In the DS-EE program the learner's workload, the contact hours (defined das "contact to the lecturer") and the credit hours are kept at the same level as in the normal track. However, in DS-EE the contact hours are distributed within 12 weeks. This results in 4 weekly contact hours for Mathematics I, respectively in 2,67 contact hours for English in the DS-EE program. Implementation may be: the students have 3 contact hours during some weeks of the semester, only 2 contact hours per week during others.

4.5. Intended Learning Outcomes (ILOs)

Based on recommodations of the ABET, the Intended Learning Outcomes (ILO's) were extended for some practice specific competences (l, m, n) as follows:

- An ability to apply knowledge in mathematics, science, and engineering.

- An ability to design and conduct experiments, to analyse and interpret data.
- An ability to design a system, component, or process to meet desired needs.
- An ability to function on multidisciplinary teams.
- An ability to identify, formulate, and solve engineering problems.
- An understanding of professional and ethical responsibility.
- An ability to communicate effectively.
- The broad education necessary to understand the impact of engineering solutions in a global and societal context.
- A recognition of the need for, and an ability to engage in life-long learning.
- A knowledge of contemporary issues.
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- An ability to transfer theoretical knowledge into practical applications
- A knowledge of the professional environment
- Well developed social competences

5. Qualification Objectives and Compentencies

5.1. Expertise

Graduates of the dual study program of electrical engineering are able to transfer scientific findings into engineering applications to cope with current needs. They are able to use this to solve problems in technical and economical problems.

Through systematic practice missions they have additionally a great extent on social and methodological competences that they can empower in transdiciplinary thinking.

5.2. Social and Ethical Competence

Graduates of the electrotechnical engineering course possess a high competence in the social area of ethics. They perceive their own and others expectations, norms and values. They can adequately evaluate different situations and deal with potential conflicts and have learned to position itself with their own views. In the practical phases and especially in the project-oriented work at the partner companies, the students gain a high experience in this field. Graduates of the program are aware of the social and ethical impact of their actions and able to let that feed in their decisions.

5.3. Self-Compentence

Graduates of the study program Electrical Engineering are characterized by high reliability and high endurance. Through the design of the studies and the experience of the practical training in the companies the graduates are able to acticely participate in a team and to make independent and appropriate contributions. They accept criticism and dispute properly with that. They perceive conflicts and are able to contribute to constructive solutions

Graduates can adapt quickly to changes and changing situations and are able to activly co-create. They are ready to learn from experience and keep up to date their knowledge.

5.4. Cross-Empowerment

Graduates have acquired a solid basic understanding of academic work during their studies. This also includes the standalone critical observation, the systematic search of alternative ways of thinking and approaches as well as the questioning of old school dogmas. Graduates are able to transmit recent theoretical findings to practice and apply them. They have mathematical, statistical knowledge and analytical skills, which allow them to structure complex tasks and find efficient solutions.

Graduates can develop new areas of knowledge alone or in a team and are able to improve themselves independently. They can adress and resolve issues and new contents independently. This enbales them to meet the complex requirements of professional practice to a large extent.

The graduates will be able to set priorities. They meet on time and situation-based decisions and are willing to bear responsibility in companies and society. Graduates have acquired basic leadership skills and only a short time after graduation they are capable of taking over first management duties successfully..

6. Curriculum, Structure of the Subjects on Offer

The following list shows all courses offered in Electrical Engineering. The first 2 numbers (16) define the dual study program, the next 3 numbers (010) define the department of Electrical Engineering; the next number defines the year of study (1,2,3,4) and the last two numbers are consecutive numbering of the courses.

Table #: Course numbers and corresponding credits

Course Number	Courses		
	Name	Credits	Year/Sem
16010101	Mathematics I	3	1.1
16010102	Physics for EE	2	1.1
16010103	Fundamentals ef EE I	3	1.1
16010104	Fundamentals ef EE I lab	1	1.1
16010105	Basics of Business Administration	2	1.1
16010106	English I	2	1.1
16010107	Mechanical workshop	1	1.1
16010108	Mathematics II	3	1.2
16010109	Fundamentals ef EE II	2	1.2
16010110	Fundamentals ef EE II lab	1	1.2
16010111	Electronics I	2	1.2
16010112	Electronics I lab	1	1.2
16010113	Informatics I	2	1.2
16010114	Informatics I lab	1	1.2
16010115	English II	2	1.2
16010201	Mathematics III	3	2.1
16010202	Digital Logic Systems	3	2.1
16010203	Digital Logic Systems lab	1	2.1
16010204	Informatics II	2	2.1
16010205	Informatics II lab	1	2.1
16010206	English III	2	2.1
16010207	German I	2	2.1
16010208	Electronics II	2	2.2
16010209	Electronics II	1	2.2
16010210	Instrumentation and Measurement	3	2.2
16010211	Instrumentation and Measurement Lab	1	2.2
16010212	System Theory	3	2.2
16010213	Engineering Design and Drawing	2	2.2
16010214	German II	2	2.2
16010301	Electrical Workshop I	1	3.1
16010302	Electrical Power Generation	2	3.1
16010303	Electromagnetic Theory	2	3.1
16010304	Electric Power Engineering I	2	3.1
16010305	Control Systems I	3	3.1
16010306	Microprocessor	3	3.1
16010307	Microprocessor Lab	1	3.1
16010308	Electrical Workshop II	1	3.2
16010309	Electric Power Engineering II	3	3.2
16010310	Embedded Systems II	3	3.2
16010311	Electric Interfacing and PCB Workshop	1	3.2
16010312	Control Systems II	3	3.2
16010313	Electrical Machines and Transformers Lab	1	3.2
16010314	University Requirements I	2	3.2
16010401	Electrical Installation and Maintenance Lab	1	4.1
16010402	Automation and Electric Power Engineering	3	4.1
16010403	Electric Drive Engineering	3	4.1
16010404	Power Electronics and Drive Technology Lab	1	4.1
16010405	Renewable Energy I	3	4.1
16010406	University Requirements II	2	4.1

16010407	Power Systems and Transmissions	3	4.2
16010408	Control and Automation Lab	1	4.2
16010409	Electric Power Lab	1	4.2
160104xx	Elective Modul	3	4.2
16010411	University Requirements III	2	4.2
16010412	Study Project	3	4.2
16010190	Practice I	10	1
16010290	Practice II	10	2
16010390	Practice III	10	3
16010490	Graduation Project -	10	4

6.1. Course Content

YEAR 1 – Semester 1

16010101 Mathematics I **(3 credits)**

This course teaches the basics of mathematics for usage in the 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.
Derivates: the derivate as a function and as a rate of change, derivate of products, quotients and negative powers, derivates of trigonometric functions , the chain rule, implicit differentiation and related rates.

16010102 Physics for EE **(2 credits)**

This course gives an introduction to basics of physics, except for that subjects who are taught in Fundamentals of Electrical Engineering: units, vectors, motion in 1, 2 and 3 dimensions, work and energy, linear and angular momentum, kinematics, kinetics, geometrical optics

16010103 Fundamentals of Electrical Engineering I **(3 credits)**

Basic definitions, voltage, current, 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, Thevenin's and Norton theorems, source transformation capacitance, I-V relationship for capacitance and inductors.

16010104 Fundamentals of Electrical Engineering I Lab (1 credit)

Introduction to basic safety rules, instrument familiarization. Usage of multimeter: measuring of voltage, current, Ohm´s Law, basic DC circuits, characteristics of passive electronic components.

16010104 Basics of Business Administration (2 credits)

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

16010106 English I (2 credits)

This course aims to promote English language proficiency at undergraduate level. It focuses on core language skills such as listening, speaking, reading and writing by using traditional texts and interactive content.

16010107 Mechanical workshop (1 credit)

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, tapping. Overview of different types of raw material: metals, plastics, and ceramics.

YEAR 1 – Semester 2

16010108 Mathematics II (3 credits)

Transcendental functions and differential equation, 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, infinite series, test for convergence, alternating series, absolute and conditional convergence, power series, Taylor and MacLaurin series, application of power series.

16010109 Fundamentals ef EE II (2 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

16010110 Fundamentals ef EE II lab **(1 credit)**

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

16010111 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. Characteristics and applications. The Zener diode: characteristics and applications. Special purpose diodes, npn, pnp, BJTs, DC biasing techniques.

16010112 Electronics I lab **(1 credit)**

Diode and DC characteristics, half-wave rectification, full-wave diode rectification, power supply filtering, voltage doubler, Zener diode, Zener-diode voltage regulation, testing the junction of a transistor, emitter-based bias potentials

16010113 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/ouput in C language, expressions in C language, one-way, two-way & multiple-way selections in C.

16010114 Informatics I Lab **(1 credit)**

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

16010115 English II **(2 credits)**

The aim of this course is to enhance student's communications skills. After having the necessary English skills in the previous course, students will focus on writing essays, delivering speeches, and presenting their work.

YEAR 2 – Semester 3

16010201 Mathematics III **(3 credits)**

Multivariables 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.

16010202 Digital Logic Systems **(3 credits)**

Boolean algebra and its laws, theorems, operations, simplification. Description of the logical system behaviour 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.

16010203 Digital Logic Systems Lab **(1 credit)**

Combinational logic circuit design comparators and adders. Code conversion and multiplexers. Sequential circuit design. Counters. Sequential adders/subtractors. Shift registers. Design project.

16010204 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

16010205 Informatics II Lab **(1 credit)**

Implementing C progams, 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

16010206 English III 2 credits 16010207 German I (2 credits)

This is an introductory course that 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 basic foundation in German history and culture; and to interest students in traveling to German-speaking countries

YEAR 2 – Semester 4

16010208 Electronics II (2 credits9

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.

16010209 Electronic II Lab (1 credit)

BJT's and FETs: characteristics, DC biasing, circuit design, amplifiers and frequency responses, differential amplifiers, operational amplifiers basic applications, filters.

16010210 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 DACs. Position, strain, pressure and motion sensors (resistive, capacitive, inductive, optical). Flow sensors. Ultrasonic sensors.

16010211 Instrumentation and Measurement Lab (1 credits)

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

16010212 System Theory (3 credits)

Continuous and discrete-time systems analysis with illustrative applications. Linear and time-invariant systems, transfer functions. Fourier series, Fourier transformation. System modelling and simulation; linearisation; the state space module; La-

place transforms; time and frequency response of linear systems; block diagrams; feedback; stability of linear systems; introduction to discrete-time signals and systems.

16010213 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, multiviews projections, sectional views, perspective views, dimensioning.

16010214 German II (2 credits)

This course emphasizes on conversation skills and aims to enable students to effectively communicate with German speaking people. It focuses on interactive teaching materials.

YEAR 3 – Semester 5

16010301 Electrical Workshop I 1 credit

Drawing of electrical networks and building installations, electrical wiring, main supply, protective measures, lightning and excess voltage protection, residential circuit protection, network quality, lightning systems and circuits

16010302 Electric Power Generation (2 credits)

In this course the student gets the knowledge of the production of electric power in different type of power plants: Basics of thermodynamics, Energy management basics, power plant types: Steam turbine process, gas turbine process, gas turbine power plant, steam turbine, combined cycle plants, Nuclear power stations, Control of power plants, reciprocating engine (piston engine), microturbins, Stirling engines.

16010303 Electromagnetic Theory (2 credits)

Electrostatic fields. Magnetostatic fields. Vector analysis, solution of Laplace' and Poissons equations, Maxwell equations.

16010304 Electrical Power Engineering I (2 credits)

Review of network theory, AC power flow in linear networks, Polyphase networks, Introduction to symmetrical components, components

16010305 Control Systems I **(3 credits)**

Classical Control: principles of control; stability using Routh-Hurwitz and Nyquist; relative stability; design of compensators in the frequency domain; root locus design; PID controllers and tuning techniques; practical issues-cascade control; windup, etc; introduction to digital control.

16010306 Microprocessor Systems **(3 credits)**

Basic architecture of a microprocessor family. Introduction to assembly programming, memory mapping, interfacing and addressing. I/O interface programmings, serial I/O interfacing, interrupt system, DMA, co-processor, bus interfacing modules,

16010307 Microprocessor Systems Lab **(1 credit)**

Assembly language programming, I/O programming, timer, counter, A/D D/A programming.

YEAR 3 – Semester 6

16010308 Electrical Workshop II **(1 credit)**

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

16010309 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).

16010310 Embedded Systems **(3 credits)**

Computer communications, networks distributed systems, realtime operating systems, sensors and actors, serial and parallel bus systems (e.g. CAN, USB, LAN).

16010311 Electric interfacing and PCB workshop **(1 credit)**

PCB Development: drawing, routing, placing, drilling, soldering.

16010312 Control Systems II **(3 credits)**

Modern control: introduction to state-space techniques, solution of state equations; controllability; pole placement regulator design; observability; estimator design. Non-

linear control. Digital control: review of digital control basics; direct design techniques; pole placement design; state-space control.

16010313 Electric Maschines and Transformers Lab (1 credit)

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

16010314 University Requirements I (1 credit)

YEAR 4 – Semester 7

16010401 Electrical Installation and Maintenance Lab (1 credit)

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

16010402 Automation of Electric Power Engineering (3 credits)

Basics of data transmisson 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.

16010403 Electric Drive and Engineering (3 credits)

Electrical Drive Systems: fundamentals (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 introduction to their control issues. AC motors: examples of motor drives (e.g. induction motors), and introduction to their control issues. Servomotors and stepper motors: principles and their control. Examples of modern electrical drives in engineering applications.

16010404 Power Electronics and Drive technology lab (1 credit)

Semiconductores 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.

16010405 Renewable Energy I **(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.

16010406 University Requirements II **(2 credits)**

YEAR 4 – Semester 8

16010407 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.

16010408 Control and Automation Lab **(1 credit)**

Analog control: temperature control, analog control: liquid level - measurement and control, analog 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.

16010409 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, Generator Fed Transmission System with RLC Loads, protection of power engineering systems: current and voltage transformers, protection of a power transmission line

16010410 Elective Module **(3 credits)**

16010411 University Requirement III **(2 credits)**

16010413 Study 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 may be a design project, an analytical paper or an experimental work in 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.

University requirements:

16010501 Jerusalem through history **(2 credits)**

16010501 Nature and Environment of Palestine **(2 credits)**

16010501 Logic and language **(2 credits)**

6.2. Elective Courses

16010450 Quality Control **(3 credits)**

The principles of quality management and quality systems; quality management in both production and service environments; quality management systems with an emphasis on ISO 9000; statistical process control; the measurement and benchmarking of quality; tools and techniques for quality improvement; organizational and teamwork requirements for quality implementation; strategic issues in quality management; current developments in quality management.

16010451 Project Management **(3 credits)**

Project Management concepts, lifecycle of a project, project team, planning, scheduling, controlling and monitoring, resource allocation, and performance measurement.

16010452 Advanced German **(3 credits)**

This course aims to expand students' German linguistic skills as well as cultural knowledge, with a major emphasis on developing reading strategies and using the language to express ideas. By the end of the course students should be able to understand a range of authentic text types and increase their ability to communicate thoughts in German, both orally and in writing.

6.3. Practical Modules

General Objectives of Practice Periods in Dual Study Electrical Engineering

The frame education plan defines which central contents are taught in practice and thus specifies the contents of the practical modules of the study area electrical engineering.

The aim of in-company training should it be in addition to the appropriation of skills and knowledge to develop the students' experience world "company operation" in its entirety.

This will be achieved through active participation, through the acquisition of personal responsibility and integration into working groups so that technical, methodological and social skills are acquired. This form of learning helps to promote personal development.

This way students are enabled to methodically structured collaboration on complex tasks and constructive participation in different working groups and organizations.

In the practical phase, students link their acquired knowledge from the theory phase with the practical activity in their company. According to a planning drawn up by the company a "practice plan" is set up. It has to be regarded that not for each theory module will be an equivalent activity in the company, i.e. courses and work in company have not to fit 1:1. This is obvious for example in math but also in other subjects. The practice schedule should be adapted in time and content to the specificities of the company and take into account the individual level of knowledge of students. Adjustments of the plan according to the priorities and needs of the company are possible.

The following extra-curricular qualifications and learning outcomes must be promoted throughout the course:

- Communication and cooperation skills, teamwork
- Problem-solving ability and creativity
- Reporting and documentation creation
- Learning, working and presentation techniques

The practical period should therefore be designed not only for deepening the professional experience but also for developing the important broad spectrum of non-professional soft qualifications and competences. Industry and the labor market claim that there is a broad gap and lack of competences from regular graduates. Such the Dual Study model aims to improve the employment conditions for graduates by having them incorporated for almost 4 years already in the EE work environment.

16015190 Practice Period I - 1st year (10 credits)

In the first year, the basics of Electrical Engineering will be taught. These 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 EE 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.

Examples of areas the student might focus in their mentor companies:

1. 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
2. Additional Skills:
    - Organization
    - teamwork
    - project management and control
    - documentation
    - English

16015290 Practice Period II - 2nd year (10 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 is 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.

Examples:

1. 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

2. Additional skills:
    - Cost and budgets
    - time management
    - product quality
    - production

16015390 Practice Period III - 3rd year (10 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. In this year the students already become 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.

Examples:

1. Electrical Engineering knowledge
    - Power electronics
    - Electrical installation and Applications
    - Control Systems
    - Microprocessor Applications
    - Electrical Machines and Transformers
    - Embedded Systems
    - Product comparsion and market analysis

2. Additional skills:
    - Cost and budgets
    - time management
    - project management

- Business skills

16013490 Practice Period IV - 4th year (10 credits)

Graduation Project

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.

Learning Outcomes:

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 EE by applying scientific methods.
- The student understands the scientific basis of EE 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 students 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.

The project is monitored and assessed by 2 counsellors:

- A lecturer from the university
- A qualified supervisor from the company

6.4. Overview Lecture Modules

At the moment not available

6.5. Examination Regulations

With regards to official assessment methods, the Dual Studies program follows assessment policies and procedures of Al-Quds University for the theoretical part as follows:

1. Grading: 0-100 scale is adopted as the grading scale across all courses
2. A student passes a course if he/she scores 60% or more
3. Grading within a course is usually divided as follows:
    a. First Hour Exam 15-30%
    b. Second Hour Exam 15-30%
    c. Project/assignments 20-40%
    d. Final Exam 30-40%
4. Depending on the nature of the course, the course instructor can adapt items a, b, c in point 3 to serve the course goals. (for example, he/she might have a mid-term exam and put more emphasis on project(s), assignments)
5. Minimum grade for the final exam is 30%.
6. If a course requires lab sessions, part of the project/assignments grade is allocated for the lab sessions.
7. Students will pass the lab if he/she passes the course regardless of his/her lab grade. If a student's fails the course and passes the lab, he/she is required to retake the course without retaking lab sessions.
8. A student should score a GPA 65% or higher for a status of Normal students
9. An Honor-listed student must score 85% or more in all subjects per semester
10. A student with GPA lower than 65% will be placed on probation and will be allowed to register a maximum of 6 credit hours

11. If a student's GPA is lower than 65% for the third time, he/she is dismissed from the program

As for the practical period, both partner companies and the Dual Studies faculty assess students' performance as follow:

1. Students register a course (Practice Period I – VIII) that is compliant with the 0-100 grading scale mentioned above
2. Upon conclusion of a practical period, students submit a report detailing all activities performed at the work place
3. Partner companies also submit an evaluation form that assesses student's performance (Annex 3)
4. Students make a presentation to the Dual Studies faculty and discussion of the report and evaluation form is initiated.
5. Final grade is distributed as follows:
    a. Student's report 30%
    b. Evaluation form 50%
    c. Presentation 20%
6. Pass grade for a practical period is 70%
7. If a student fails a practical period, he/she should retake it in the next available practical period. Delays are not permitted as each practical period is a prerequisite for the next one.

Absentees and withdrawal:

A. Theoretical Period
    1. Students must attend classes
    2. If a student skips 20% of classes he/she is considered withdrawn from the course
    3. If a student skips 30% of classes he/she automatically fails the course
    4. Cases with acceptable excuses (i.e. sick leaves) are excluded
    5. Students can normally withdraw a course in the first week of the semester. They will be able to retain course fees and add another course if they like
    6. Late withdrawals are permitted before the second hour exam. Students will lose the course fees and will not be able to add a replacement course
B. Practical Period
    1. Students should adhere to company's policies and regulations regarding showing up to work
    2. Company can take whatever measure it sees fit in order to encourage students to adhere to company's policies and regulations

3. Attendance is an item that companies assess students in the evaluation form, mentioned above
4. Students cannot withdraw from a practical period unless for emergency situation (i.e. long-term illness, political unrest/violence/inability to reach workplace, etc.)