Curriculum Electrical Engineering English Course — cohort 2015 - 2016

Propaedeutic phase		Core phase				Bachelor phase	
Year 1		Year 2		Year 3		Year 4	
S1	S2	S3	S4	S5	S6	S7	S8
Analog Electronics 1 (4 EC)	Analog Electronics 2 (4 EC)	Analog Electronics 4 (4 EC)	Analog Electronics 3 (3 EC)	Internship	Minor	Specialisation: (*to be determined) 1. Analog Design 2. Digital/Embedded Design 3. Business E-Engineer (4 modules of 4 EC)	Graduation
Digital Design 1 (3 EC)	Digital Design 2 (3 EC)		Digital Design 3 (5 EC)				
Software Design 1 (3 EC)	Software Design 2 (3 EC)	Embedded Systems (5 EC)	Embedded Connectivity (5 EC)				
Mathematics 1 (5 EC)	Mathematics 2 (5 EC)	Control Theory 1 (incl. Laplace) (5 EC)	Signal Processing (incl. Fourier) (4 EC)			Obligatory (4 EC): - Research methods - Curriculum Supporting Activity - Career Orientation	
Generic Eng. Skills (2 EC: Q2)	Measuring, Modelling & Simulation (5 EC)	Fields, Energy & Conversion (5 EC)	Telecommunications 1 (3 EC)				
System Eng. 1 (1 EC)	System Eng. 2 (2 EC)	Syst. Eng. 3 (1 EC: Q1)					
Project 1 Security (4 EC) / Project 2 Product & Design (4 EC)	Project 3 Bed Side Monitor / Sound Engineering (5 EC)	Project 4 EXPO (4 EC) / Project 5 EXPO (4 EC)	Project 6 EXPO (4 EC) / Project 7 EXPO (4 EC)			Project (10 EC)	
Com. skills 1 (2 EC)	Com. skills 2 (2 EC)	Com 3 (1 EC: Q2)	Com 4 (1 EC)				
Study & Career Orientation 1 (2 EC)	Study & Career Orientation 2 (1 EC)	CSA 1 (1 EC)	CSA 2 (1 EC)				

Modules Propaedeutic Phase:

Semester 1 (S1):

Analog Design 1 (AD1):

Main objectives/goals for this module: Being able to calculate and find solutions for varies DC and AC circuits.

Content of the module Q1: Ohms law, Kirchoff's voltage and current law, Series and parallel circuits, Mesh-analysis, Nodal-analysis, Superposition theorem, Thévenin and Norton theorem, Power delivering and consumption in circuit and op/amp curcuits.

Q2: RC series circuits, RC phasor diagrams, RC impedance diagram, RL series circuits, RL phasor diagrams, RL impedance diagram, RC parallel circuit, RC phasor diagrams, RL parallel circuit, RL phasor diagrams, Quality factor Q, Series circuits, Parallel circuits, Diodes, Average and effective value.

Communication 1 (CO1):

Main objectives/goals for this module : Gain insight into spelling en grammar skills and development in these aspects Learning how to write a report and make frame work in a structured way. Gain insight into presentation techniques.

Content of the module: In project 1 in Q1 the module design document (MDD), will be written individually, by a given framework. This framework is given by the communicationteacher(s). This document will be revieuwed and you will get feed back on it. In Q2 are the topics writing a report and presenting your results. You will get instructions how to write a report and make excersises to develop your skills. The excersises are to prepare you for the documents and presentations in project 2.

Digital Design 1 (DD1):

Main objectives/goals for this module: To design, optimize and test, relative simple combinatorial circuits. Translate the specification of a relative simple system into a state machine using the Moore architecture. Carry out relative simple sequential assignments, that are designed for; o Testing, o Verification.

Content of the module Theory: Combinational networks Truth tables of standard building blocks (AND, OR, INVERTOR, etc.). Notation: Sum of product terms (SOP) (∑) Notation: Product of sums (POS) Minimization of an equation (SOP) using Karnaugh maps Propagation delay Static hazards (spikes) Critical path Given the specification of a combinational network. (e.g. Half Adder, Comparator) o Draw the symbol, Write the truth table, Read the equations from the truth table. Latch and Flip Flop (FF), Set Reset (SR) latch, Edge triggered (on the edge of a clock), Set Reset FF (SR-FF), Edge triggered Data FF (D-FF), Asynchronous reset of a FF (clear) Shift registers Synchronous State Machines (only MOORE architecture). Counters, State diagrams, State coding (e.g. S0 = [0,0,0]. Internal architecture of the State Machines. Next State decoder (NS = f (PS, inputs)).Output decoder (Output = g (PS))

Practical: Building and testing the descriptions of the various assignments and exercises in a software environment.

General Electrical Skills (GES):

Main objectives/goals for this module: After studying this module and carry out the practicum you know the essential steps of designing a pcb for the realisation of a circuit on a printed circuit board.

After realising this module you can: Apply the design rules for a pcb.; Provide the correct print-outs to the production environment with the CAD program EAGLE. That is a schematic, pcb layout and bill of materials. Apply safety, EMC and ESD aspects. Identify the different types of pc board like Synthetic Resin Bonded Paper (SRBP), Flame Retardant (FR4), Flex (Polyimide), Low Temperature Cofired Ceramic (LTCC), Direct Copper Bond (DCB), Ceramic (thick film). Several production methods for through hole devices (THD) as for surface mounted devices (SMD).

Mathematics 1 (MA1):

Main objectives/goals for this module: The acquisition of knowledge, skills and insight in mathematical topics, which will be used in a number of other technical modules. Acquiring a systematic approach to mathematical problems: definition of the problem, organization of the information gathered, calculation, checking and interpreting the solution.

Personal Development Training 1 (PDT1):

Main objectives/goals for this module: The student: Gets acquainted with the organisation of Fontys Engineering Eindhoven. Becomes aware of his or hers learning style and can adapt it, if necessary. Should adopt a critical mind, showing a professional attitude at the end of the year. Learns to plan his study activities Can prepare himself for his exams.

Content of the module: Explanation of the Study Progress Guide. What can you expect from school and what can the school expect from you? Curriculum Vitae, study schedule, introduction of your country, cultural differences between continents and countries, working as an Engineer etc. You will be introduced to the career of engineering and what is expected of you as a student. You will be

tested on your attitude and behaviour throughout the course, through meetings, problem-solving techniques, discussions, presentations and reports.

Project Security (PROJ1):

Main objectives/goals for this module In this project you will deal with some basic skills and knowledge of the electrical engineer. The first skills needed to realize an electronic product is to be able to identify electronic components, to measure functionality and to solder components into a circuit. Besides these direct technical skills, it is important to use a methodic workflow in order to make design choices in a team and to verify these choices. Only then, you can deliver a product according to the specifications of the client. PROJ1 starts with four weeks of skill development after which the design project is started. This gives your first experience with design techniques and processes. In PROJ1 you will use knowledge and skills as offered in other modules and apply them in the perspective of the project and society (theme).

Content of the module The module will start with developing some basic technical engineering skills. These are for example the safety in an electronic workshop, soldering electronic components, and doing measurements. You will apply these by assembling an electronic expansion board. After four weeks you will apply these skills in a design project. In the meantime, you have developed a notion of the product context in the parallel module of System Engineering (SEN1). The chosen societal context relates to the opportunity of electronic products to make our daily life safer and more comfortable. In PROJ1 you will secure an environment yourself with an alarm installation. You will work in a group, but you will have your own responsibility for an electronic module as a sub-system. The course manual will guide you through the process of realizing and testing your electronic module to see several aspects of designing an electronic system. These aspects are: doing research, realizing, measuring, teamwork, communication, presenting and reflecting. The project will be finalized with a demonstration of the total system per team. After PROJ1 you will have a better idea on what is important in an electronic product design process, and so on what the job of an electronic engineer looks like.

Project and Design (PROJ2):

Main objectives/goals for this module The main goal of this project is to create a learning environment to experiment with strategic ways to work towards an effective way of communication and projectorganisation. A good group dynamic will stimulate the team members in being motivated in every way; resulting in a creative end product.

The project provides you with a learning environment in wich you can learn how to work efficiently in a team. The project allows a team to develop critical thinking and design methods which result in a group product. After completion of this project, you have developed:

Process skills, such as: ? Working in a team efficiently and obtain good results, ? Putting the theory of projectmanagement into practice, ? Writing a report about your project, ? Presenting and demonstrating your product, ? Monitoring and planning of activities, ? Working according to the Roles & Task Model.

Technical skills, such as: ? Find data from datasheets, tables, graphs and professional literature of materials and components and how to use them, ? Categorize most common materials and

components into class, type, applications, dimension and qualities, ? Apply existing designs and circuits from hobby or professional literature, ? Apply knowledge and understanding of the processing methods of materials, ? Simulating all electronic (sub'circuits and build a prototype to demonstrate your concept.

Content of the module The Product and Design project introduces working towards a tangibe groep product. As the best teams are often multidisciplinary teams, roles, tasks and responsebilities need to be clearly defined to prevent miscommunications. Fontys Engineering uses a Roles & Task Model to structure roles, which should help to allocate activities effinciently to team members. The team assignment is to create or improve a product.

Study Counselling (SCO1):

Main objectives/goals for this module The student learns to classify the study progress and is able to plan his or her's individual study program

Software Design 1 (SD1):

Main objectives/goals for this module After succesful completion of the course you are able to: ? Convert a given problem involving decisions in a program into pseudocode, a flow diagram or C# code following common notation conventions; ? Convert a given problem involving repetitions in a program into pseudocode, a flow diagram or C# code following common notation conventions; ? Manually extract a memory trace of a given segment of code. ? Design and implement structures when needed for a particular programming problem, and importing of visualising those structures. ? Practical: Design of simple Software Applications (Console Application of Windows Forms Application), coding, documenting and testing / debugging. As an indication for "simple": Reading of user provided data, displaying and ? 3 (nested) decisions or, alternatively, combination of a switch, and two nested repetition-loops.

Contents of the module Virtually every modern electronic device contains one or more microprocessors and this trend is still growing. As a consequence, every engineer will need (some) programming skills to be able to understand or design the devices of the future. Module Software Design 1 treats the basic concepts and skills of designing, documenting and realizing programs in the general purpose language of Visual C#. In particular, the proper way of designing interaction between humans and machines (so-called "user-interface") will get special attention.

System Engineering 1 (SEN1):

Main objectives/goals for this module ? To put design projects in a context ? First understanding of research ? Introduction to structured design

Contents of the module This course will give you an introduction of research. You will apply the lessons learned in your projects of semester 1. After Q1 you are able to put projects in a context and understand people have different ideas and opinions. You will share and discuss your ideas with the group in order to define your groups' perfect home security system for your defined target group.

After Q2 you will have a first understanding what "structured design" mean for Engineers. You investigate and discuss different views on this, how research can help you and apply the basics in your Q2 project "Product and Design".

Semester 2:

Analog Design 2 (AD2):

Overall objectives After following this module, the student is capable of: identifying the specific characteristics of a transistor and to design, with given specifications, a class A voltage amplifier (DC- and AC-behaviour), constructing a Bode plot of a first and second order filter and to calculate the belonging characteristic -3 dB points, To compose the complex transfer function () Hj , To compose the Bode plot of a first and second order filter with a resistive, capacitive or inductive load.

Digital Design 2 (DD2):

Main objectives/goals for this module After studying this module, you can: • Understand the Mealy architecture. • Design simple Mealy machines. • Understand the differences between Moore and Mealy machines. • Understand the syntax of ASM diagrams, and is able to apply these diagrams when designing state machines. • understand the data path controller architecture including full handshake • Design the controller, based on a simple data path and any communication protocol like full handshake from a given customer specification. • Implement and test a design by using a CPLD/fPGA.

Contents of the module The Mealy architecture and the differences with Moore architecture. Using ASM for description/design of a state machine (sequential system). Modelling digital systems components by using VHDL. Designing data path-controller architectures. Handshaking between digital systems Verification of designed digital systems

Software Design 2 (SD2):

Main objectives/goals for this module After successful completion of the course, you are able to: To design and implement a simple Graphical User Interface as a Window Forms Application; Apply the concept of object oriented programming (classes, methods and properties); Apply the concepts of random number generation, enumeration and timing; Apply the concept of arrays; Program in C to program the Arduino UNO; Hardware interfacing concerning the Arduino UNO and several components; Get acquainted with knowledge that is generally applicable to other programming languages. (See planning for a more specific list of topics).

Contents of the module Virtually every modern electronic device contains one or more microprocessors and this trend is still growing. Therefore, every engineer will need (some) programming skills to be able to understand or design the devices of the future. Module Software Design 2 continues where Software Design 1 finished concerning the basic concepts and skills of designing, documenting and realizing programs in the general purpose language of Visual C#. It continues with Graphical User Interfaces, object oriented programming (classes) and treats other useful topics such as arrays, random number generation, enumeration and timing. The second part of this module will apply the knowledge of C# programming so far to the design and realization of programs on the Arduino UNO.

Measurement, Modelling and Simulation (MMS):

Main objectives/goals for this module After this module, the student is able to: document measurements with respect to units, quantities and errors design a simple measurement set-up and implement it on a PC with the National Instruments myDAQ and the LabVIEW software apply the basics of National Instruments LabVIEW, amongst which arrays, variables, input/output, While/For-loops and state machines perform measurements correctly with standard measurement tools like a DMM, oscilloscope, and function generator construct a model of a given physical system apply this model to simulate by means of Excel and MATLAB/Simulink verify measurement results with a model and information from the Internet

Content of the module The MMS module consists of two different parts. First, in period 3 the focus is on measurements which on its turn has a practical part for measurement systems (MMS2P1) and a theoretical part on measurement theory (MMS2T1). In the practical part, some measurement problems have to be solved by implementing automated set-ups using the National Instruments data acquisition system myDAQ. The programming environment is National Instrument's graphical programming language LabVIEW. The chosen program implementations are more or less at the official National Instruments LabVIEW "Core 1" level. Next, in period 4 the topics are about modelling and simulation, both in theory and practice (MMS2T2 and MMS2P2). It is an introduction to modelling systems from various domains. A model can be calculated (simulated) by means of numerical integration of differential equations. We will do this first by means of Excel to understand the mathematical background. Next, we will use MATLAB/Simulink for a more professional and universal approach. One of the models is compared to real measurements in order to see the differences.

Mathematics 2 (MA2):

Main objectives/goals for this module 1. The arithmetic of complex numbers in the form of $a + bj$ and $rej\varphi$. How to solve quadratic equations with complex number solutions. 2. How to apply the basic principle of integration problems (Riemann sums) for example in electrical engineering. 3. How to apply the calculation rules to calculate the indefinite and / or definite integral of a given function 4. How to solve 1st and 2nd order linear differential equations (DE) with constant coefficients with and without preconditions. 5. The modelling of RLC networks (phasors), calculations and analysis of wave signals, impedance, transfer function and bode diagrams.

System Engineering 2 (SEN2):

Learning goals After this module you Have knowledge of the importance of product development for any business; the systematic product development process; the methodology of the V-model; the documents and test plans needed in each phase in the process of product development according the V-model standard. Are able to apply the V-model in your project work; to write the System Requirements Document (SRD) based on user requirements; to write the System Design Document (SDD); to understand the content of a Module Design Document (MDD) and to design and test according the V-model.

Project 3 Care and Cure / Sound Engineering (PROJ3):

Main objectives/goals for this module The student experiences the topics and forces when conducting a technical team project in the application area of electrical engineering. He or she learns to deal with: 1. A systematic project approach, 2. Planning a project according to the V-model, 3. Communication concerning the project in reports and presentations, and 4. Applying theoretical knowledge from basic courses in a real context.

Content of the module In this project, a product is designed in one of the societal application areas "Care & Cure" and "Sound Engineering". We will take to periods (Q3 and Q4) to deepen into the analysis/definition phase, and the (individual) realisation phase, as well as the presentation/demo phase. The emphasis is on the product development phases. To achieve this, we will: Dive into the V-model to conduct a plan in a structured way, Specify roles and tasks within the project team in order to understand interaction with the customer and experience the group process, Formalize documentation in order to fix technical decisions and decision moments in the product development process, and to underpin them with evidence.

The execution structure of the project is similar to the two earlier projects in the propaedeutic phase (PROJ1 and PROJ2). There will be project teams of 5 to a maximum of 8 students. The topics of interest will be recognized from other modules in the curriculum, and therefore there is a close relation to SEN2 and COM2.

In the first weeks, the team has to arrange a company visit. The results of this visit will primarily be used to define the system requirements. The company visit will also be used to present in the COM2 module, but play a role as well in the audit, the system design document, and the individual module design documents.

During the semester, the project will be conducted in line with the project management book of Roel Grit. Furthermore, we will work with the role and task model to prepare for the 2nd year projects. In the final phase, the products will be presented to the customer (played by the teacher and tutor). The best ideas will be nominated for an award.

Communication2 (CO2):

Main objectives In the second semester, the subject's group dynamics and reporting are the main subjects of the course communication. During the first quartile collaborating, group behaviour and meetings, skills are central. By practicing and discussing examples the student learns what the influence is of collaborating, group behaviour and group pressure of working within a group. The student learns in what way he/she can contribute within a group and what the consequences are of certain behaviour.

Study Counselling 2 (SCO2):

Main objectives/goals for this module After this module, the student is able: To classify his or hers the study skills, and his or hers shortcomings on this subject and to formulate improvement plans. To plan the study for the 2e, 3e and 4th year and answer the choices he or she made.

Content of the module Through the individual meetings and assignments, the student knows his or hers study progress, the choices he or she has to make and to answer them and describe all this in the Overall Reflection reports and SPI preparations. Furthermore, the student takes action to improve his or hers study skills and to orientate on the study program and career, like visiting companies, attending lectures about study and career orientation.