Fontys University of Applied Sciences

Fontys Automotive Programme Guide 2019-2020

Study year 2

Study year coordinator

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Content

1. Introduction

The Automotive degree programme at Fontys University of Applied Sciences presents a programme guide for study years 1 and 2. This guide describes the curriculum and includes information for each course with regard to learning objectives, lesson content, competencies, and TER tables for assessment and testing.
Further information about such things as the book list can be found on the portal and through N@tschool. Other important information about the programme can be found in the Engineering TER on the portal.

On the first day of the programme, you will be assigned a study career advisor for the entire programme. You can contact them, or the person named below, with any questions regarding this guide.

On behalf of Fontys University of Applied Sciences,

Resi Fuchs-Henzen

Coordinator of study years 1 and 2
Automotive Bachelor's programme

2. Fontys Automotive Curriculum Structure 2019-2020

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6	Semester 7 Specialisation		Semester 8
						Future Powertrain	Smart Mobility	
APJ1 4 EC	APJ3 4 EC	APJ5 4 EC	APJ7 4 EC	Internship 30 EC	Minor 30 EC	APJ13/14 10 EC	APJ13/14 10 EC	Graduation 30 EC
APJ2 4 EC	APJ3 4 EC	APJ6 4 EC	APJ8 4 EC					
APU1 2 EC	APU3 2 EC	AAT5 3 EC	AVD7 3 EC					
APU2 1 EC	APU4 1 EC	AAT6 3 EC	AAT8 2 EC					
ADT1 1 EC	ADT3 1 EC					AMF 2 EC	AMF 2 EC	
ADT2 2 EC	ADT4 2 EC							
APR1 1 EC	APR3 1 EC	APR5 1 EC				ASE 2 EC	ASE 2 EC	
APR2 1 EC	APR4 1 EC	APR6 1 EC						
AMD1 2 EC	AMD3 2 EC	AMD5 2 EC	AMD7 2 EC			AES13 4 EC	ACS13 4 EC	
AMD2 1 EC	AMD4 2 EC	AMD6 1 EC	AMD8 2 EC					
AMM1 1 EC	AHF3 2 EC	ACE5 1 EC	ACE7 2 EC			AED14 4 EC	ASI13 4 EC	
AMM2 2 EC	AHF4 1 EC	ACE6 2 EC	ABP8 2 EC					
ACE1 2 EC	ACE3 1 EC	AES5 2 EC	AES7 2 EC			AVE13 4 EC	ASI14 4 EC	
ACE2 2 EC	ACE4 2 EC	AES5 2 EC	AES8 2 EC					
AWIS1 2 EC	AWIS3 2 EC	AWIS5 2 EC	AVE7 2 EC			AVS14 4 EC	ACS14 4 EC	
AWIS2 2 EC	AWIS4 2 EC	AWIS6 2 EC	AVE8 3 EC					

APJ: Automotive Project
APU: Automotive Power Units
ADT: Automotive Drivetrain
AMD: Automotive Mechanics & Design
AES: Automotive Electronic Systems
APR: Automotive Practice
ABP: Automotive Basic Programming

AVD: Automotive Vehicle Dynamics
AAT: Automotive Applied Technology
AVE: Virtual Automotive Engineering
AMM: Automotive Materials & Manufacturing
ACE: Automotive Control Engineering
AWIS: Automotive Mathematics

AMF: Automotive Manufacturing
ASE: Automotive Systems Engineering
AES13: Automotive Engine Systems 13
AED: Automotive Electric Drive
AVS: Automotive Vehicle Systems
ACS: Automotive Control Systems
ASI: Automotive Sensing and Information

3. Module descriptions

3.1 Automotive Project and Automotive Professional Skills

Automotive Project 5	
Course code:	APJ5
Study load:	4 EC
Competences	Analyse: selecting relevant aspects in relation to the research question. Design: Creating detailed designs based on the selected conceptual solution (architecture). Implement: Using the appropriate materials, processes, methods, norms and standards. Manage: Implementing, testing, integrating and commissioning a new product, service or process. Manage: Task and process-oriented communication. Research: Drawing up the objectives of a requested study on the basis of the research question. Professionalisation: Reflecting on one's own thoughts and actions.
Learning objectives:	Students will calculate the fuel consumption and CO2 emissions of a vehicle. Students will also compare the measurement data using a software model which they will develop (e.g. in MATLAB or Amesim) and provide information on what is expected and what differs. Using the data, students will analyse the acceleration of the vehicle. Students will design a minimum of three drive concepts and recommend the one with the largest range and lowest energy use. Students will apply the Scrum methodology to their projects. Students will also discuss and reflect on the review presentations with the aim of identifying points for improvement.
Lesson content:	Students will learn to work with the Amesim program. They will use it to conduct consumption and emission calculations which will be compared with the measurement data. They will then optimise the three vehicles, using the different drive concepts, to operate at the lowest possible consumption quantity in the WLTP cycle. Students will use the Scrum methodology for their project management. Students will gain insight into their core qualities and personal effectiveness. Students will be required to give a presentation in order to hone their presentation skills.
Assessment and testing:	See TER table

Automotive Professional Skills 5	
Course code:	APS5
Study load:	Conditional for APJ5
Competences	Professionalisation: Independently determining and implementing a learning objective and learning strategy and using the results to achieve the learning objective. Reflecting on one's own actions.
Learning objectives:	The student will learn how to better present themselves (e.g. when applying for a job), a product, or an idea.
Lesson content:	Learning to properly present themselves by knowing where their strengths lie. This is done in preparation for writing an effective application letter, CV, and motivation letter (APS7 and APS8). Improving the presentation of a product or idea (more professionally and compellingly) through the use of tips and peer feedback.
Assessment and testing:	See TER table

Automotive Project 6	
Course code:	APJ6
Study load:	4 EC
Competences:	Analyse: selecting relevant aspects in relation to the research question. Design: Creating detailed designs based on the selected conceptual solution (architecture). Implement: Using the appropriate materials, processes, methods, norms and standards. Manage: Implementing, testing, integrating and commissioning a new product, service or process. Manage: Task and process-oriented communication. Research: Drawing up the objectives of a requested study on the basis of the research question. Professionalisation: Reflecting on one's own thoughts and actions.
Learning objectives:	Students will be able to name the different levels of autonomous driving. They will also learn to take a position and defend it with regard to an ethical dilemma related to autonomous driving. Students will design and test an adaptive cruise control system and report on their choice of a specific approach. Students will discuss their reasoning in a report.
Lesson content:	Students will design an adaptive cruise control (ACC) system using MATLAB/Simulink and will implement it in the Prius of the A-team. Students will become acquainted with the V cycle as a project management methodology. They will also design the ACC at the modular level and will test it using software (SiL) on a dynamometer at TNO (HiL) and during a road test (acceptance test). Attention will also be paid to ethical dilemmas related to relevant automotive topics and personal issues.
Assessment and testing:	See TER table

Automotive Professional Skills 6	
Course code:	APS6
Study load:	Conditional for APJ6
Competences	Research: Drawing up the objectives of a requested study on the basis of the research question. Analyse: Selecting relevant aspects in relation to the research question. Implement: Using appropriate materials, processes, methods, norms, and standards. Professionalisation: Independently determining and implementing a learning objective and learning strategy and using the results to achieve the learning objective. Reflecting on one's own actions.
Learning objectives:	The student will learn to recognise the role of ethics within automotive engineering and to take a professional position. The student will become more sensitive to moral issues, particularly those that fall under the responsibility of an automotive engineer. The student will be able to establish the relationship between personal standards and values. The student will be equipped to morally assess a situation verbally and in writing. They will be able to respect other moral convictions and assess them in a balanced manner.
Lesson content:	Guest lectures, ethical/morality theory, and standards and values will assist students in learning together in order to explain an ethical dilemma that they choose themselves. They will substantiate their dilemma with theory, multiple perspectives, and their own reasoning.
Assessment and testing:	See TER table

Automotive Project 7	
Course code:	APJ7
Study load:	4 EC
Competences:	Analyse: selecting relevant aspects in relation to the research question. Design: Creating detailed designs based on the selected conceptual solution (architecture). Implement: Using the appropriate materials, processes, methods, norms and standards. Manage: Implementing, testing, integrating and commissioning a new product, service or process. Manage: Task and process-oriented communication. Research: Drawing up the objectives of a requested study on the basis of the research question. Professionalisation: Reflecting on one's own thoughts and actions.
Learning objectives:	Students will design and analyse factors that lead to a low-energy vehicle and will motivate their choice. This choice will be substantiated using modelling (CAD and calculations).
Lesson content:	Students will design an eco-marathon vehicle that can operate on as little energy as possible. In doing so, they will use the knowledge that they have acquired up to this point to incorporate the chassis, drivetrain, aerodynamics, and project management methodology in the design process. The design must be substantiated with an FEM analysis, energy analysis, and a repeatable and logical design process. Attention will also be given to applying for jobs, writing a CV, and motivation letters.
Assessment and testing:	See TER table

Automotive Professional Skills 7	
Course code:	APS7
Study load:	Conditional for APJ7
Competences	Analyse: Selecting relevant aspects in relation to the research question. Professionalisation: Independently determining and implementing a learning objective and learning strategy and using the results to achieve the learning objective. Reflecting on one's own actions.
Learning objectives:	The student will learn how to prepare for an internship and to write a CV and motivation letter. They will have identified the competences that are applicable for their "dream job".
Lesson content:	Guest lectures, group lessons on practising job applications and writing motivation letters.
Assessment and testing:	See TER table

Automotive Project 8	
Course code:	APJ8
Study load:	4 EC
Competences:	Analyse: selecting relevant aspects in relation to the research question. Design: Creating detailed designs based on the selected conceptual solution (architecture). Implement: Using the appropriate materials, processes, methods, norms and standards. Manage: Implementing, testing, integrating and commissioning a new product, service or process. Manage: Task and process-oriented communication. Research: Drawing up the objectives of a requested study on the basis of the research question. Professionalisation: Reflecting on one's own thoughts and actions.
Learning objectives:	Students will create and redesign the vehicle developed in APJ7 and will describe any changes that are made. The consumption level achieved will be compared with the anticipated consumption determined in the analysis in APJ7. The vehicle will be tested and areas that need improvement will be identified and further developed.
Lesson content:	Students will refine, construct, and test the eco-marathon vehicle designed in APJ7. A comparison will also be drawn between the theoretical and actual consumption values. Attention will also be given to finding a suitable internship.
Assessment and testing:	See TER table

Automotive Professional Skills 8	
Course code:	APS8
Study load:	Conditional for APJ8
Competences	Professionalisation: Independently determining and implementing a learning objective and learning strategy and using the results to achieve the learning objective. Reflecting on one's own actions.
Learning objectives:	Students will learn how to choose an internship assignment based on the maximum utilisation of the student's individual talents as well as what the internship company and assignment have to offer. Exploration of APS7 objectives by means of a coaching interview.
Lesson content:	Internship satisfaction will be encouraged through stimulating work formats in collaboration with the Applied Engineering and HRM departments. The motivation letters written in the previous period will be further developed.
Assessment and testing:	See TER table

3.2 Automotive Applied Technology

Automotive Applied Technology 5: Applied Dynamics in Combustion Engines	
Course code:	AAT5
Study load:	3 EC
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Research: Summarising, structuring and interpreting the results and drawing conclusions related to the research question. Professionalisation: Reflecting on one's own actions and thoughts.
Learning objectives:	At the end of this period, you will have acquired knowledge of and insight into the kinematics and dynamics of the piston engine, the conversion of fuel into energy, the combustion cycle, combustion engine outputs, dynamics as a result of the charge exchange in the piston engine, and the thermodynamics of the internal combustion engine.
Lesson content:	AAT5 and AAT6 consist of both a theoretical and a practical component. In the theoretical component, the following topics will be covered: * Dynamics, the ability to explain the processes in piston engines * The ability to explain and describe the thermal processes and charge exchange in piston engines. In the practical component, the following topics will be covered: * Students will generate data on their own with the engine testing rig * Students will complete heat and current practical assignments with the engine testing rig
Assessment and testing:	See TER table

Automotive Applied Technology 6: Applied Dynamics in Combustion Engines	
Course code:	AAT6
Study load:	3 EC
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Research: Summarising, structuring and interpreting the results and drawing conclusions related to the research question. Professionalisation: Reflecting on one's own actions and thoughts.
Learning objectives:	At the end of this period, you will have acquired knowledge of and insight into the kinematics and dynamics of the piston engine, the conversion of fuel into energy, the combustion cycle, combustion engine outputs, dynamics as a result of the charge exchange in the piston engine, and the thermodynamics of the internal combustion engine.
Lesson content:	AAT5 and AAT6 consist of both a theoretical and a practical component. In the theoretical component, the following topics will be covered: * Dynamics, the ability to explain the processes in piston engines * The ability to explain and describe the thermal processes and charge exchange in piston engines In the practical component, the following topics will be covered: * Students will generate data on their own with the engine testing rig * Students will complete heat and current practical assignments with the engine testing rig
Assessment and testing:	See TER table

AAT 8: Elective component	
Course code:	AAT8
Study load:	2 EC
Competences:	Information to follow
Learning objectives:	Information to follow
Lesson content:	To follow
Assessment and testing:	See TER table

3.3 Automotive Vehicle Dynamics

Automotive Vehicle Dynamics	
Course code:	AVD7
Study load:	3 EC
Competences	Analyse: Modelling an existing product, process, or service. Implement: Using appropriate materials, processes, methods, norms, and standards. Research: Summarising, structuring and interpreting the results and drawing conclusions related to the research question.
Learning objectives:	* Understanding the technical aspects of vehicles that influence vehicle dynamics * Being able to perform vehicle dynamics calculations for vertical vehicle behaviour (comfort) * Understanding individual frequencies, damping, transfer operations, and phase-shift comfort identification * Being able to conduct (MATLAB/Simulink) simulations of second order systems (2 mass damper suspension) * Understanding lateral and longitudinal tyre behaviour * The ability to describe and substantiate road behaviour and the factors that influence it * Being able to conduct vehicle dynamics simulations using the existing user interface in simulation programs
Lesson content:	The driving experience of the driver and passengers is determined by many different vehicle characteristics. These include sound, climate, sensation, and smell. In the field of vehicle dynamics, the driving experience refers to the dynamic behaviour of the vehicle. This behaviour is divided into driving comfort (the ride), steering behaviour and dynamic stability (handling), and the smoothness of the drivetrain (driveability). In this module, the topics of ride and handling are covered, but not the subject of driveability. The AVD7 module consists of four parts: * Terminology and definition (plus a section on vehicle engineering) * Vehicle dynamics - vertical behaviour * Vehicle dynamics - horizontal behaviour * Vehicle dynamics - non-linear tyres and combined behaviours
Assessment and testing:	See TER table

3.4 Automotive Practice

Automotive Practice	
Course code:	APR5 and APR6
Study load:	APR5 1 EC and APR6 1 EC
Competences:	Research: Independently searching, selecting, and evaluating/validating (scientific) literature regarding vehicle constructions and the issues that affect them. Implement: Using the appropriate materials, processes, methods, norms and standards. Manage: Task and process-oriented communication Analyse: Researching, evaluating, and/or using information in order to develop new products/information.
Learning objectives:	During this module, you will learn how to apply the theory of vehicle and engine dynamics in practice. You will learn how to plan, how to apply the right tools, and what is meant by a professional work attitude.
Lesson content:	During the practical, you will receive assignments that match the content of the courses on motor construction and vehicle construction. Students will be able to schedule assignments using the practical planner.
Assessment and testing:	See TER table

3.5 Automotive Mechanics & Design

Automotive Mechanics & Design 5	
Course code:	AMD5
Study load:	2 EC
Competences	Analyse: Selecting relevant aspects in relation to the research question. Research: Drawing up the objectives of a requested study on the basis of the research question.
Learning objectives:	During this course, you will acquire a basic knowledge of dynamics and will be able to apply this knowledge in simple problems. Whenever possible, the FACER method must be used: Figure, Analysis, Core relationship, Elaboration, Review.
Lesson content:	* Kinematics and kinetics of a point mass * Power and acceleration * Work and energy * Shock and amount of movement
Assessment and testing:	See TER table

Automotive Mechanics & Design 6	
Course code:	AMD6
Study load:	1 EC
Competences	Analyse: Selecting relevant aspects in relation to the research question. Research: Drawing up the objectives of a requested study on the basis of the research question.
Learning objectives:	During this course, you will acquire a basic knowledge of dynamics and will be able to apply this knowledge in simple problems. Whenever possible, the FACER method must be used: Figure, Analysis, Core relationship, Elaboration, Review.
Lesson content:	* Kinematics of a rigid object in a flat plane * Power and acceleration * Work and energy
Assessment and testing:	See TER table

Automotive Mechanics & Design 7	
Course code:	AMD 7
Study load:	2 EC
Competences	Research: Drawing up the objectives of a requested study on the basis of the research question.
Learning objectives:	Further exploring the knowledge and skills based on those used for the themes in modules AMD1-4: Strength and Tension, Connections and Bearings
Lesson content:	This module focuses on Chapter 3 of the Roloff/Matek machine components. This chapter deals with the dynamic load of an automotive component. Smith diagrams and the version of this corrected for impact wear are important. A demo model of a Wohler fatigue device created by the staff will be present. The examination for this module will be an individual assignment. The course content tested via the individual assignment format consists of: - Roloff-Matek Chapter 3: Strength and acceptable tension - The additional course content addressed during the instructional meetings, which primarily consists of demonstrations and product-focused topics typical of the automotive industry The following skills will be tested via the individual assignment: - The calculation of strength and tension, including in a composite load - Drafting and drawing a Smith diagram, corrected for any existing impact wear and other influencing factors - Correcting the acceptable loads and tensions for a typical automotive component - Drawing/constructing a typical automotive component, during which the tolerances (dimensions/shape/location) and product-related aspects will also be taken into account - The creation of a brief specifications sheet for the component. Description of the assignment: The topic examined will be the main drive shaft as it has been used for many decades: a connecting, force transferring object, located between the clutch and the entrance to the gearbox.
Assessment and testing:	See TER table

Automotive Mechanics & Design 8	
Course code:	AMD8
Study load:	2 EC
Competences	Research: Drawing up the objectives of a requested study on the basis of the research question.
Learning objectives:	Further exploring the knowledge and skills based on those used for the themes in modules AMD1-4: Strength and Tension, Connections and Bearings
Lesson content:	This module focuses on Chapter 8 - screw connections and Chapter 14 - anti-friction bearings from the Roloff/Matek course book on machine components. Chapter 14 primarily builds upon the knowledge gained during AMD7. In particular, this involves the dimensioning and control calculation for one of the anti-friction bearings used in the main drive shaft, for which students previously conducted a fatigue analysis in order to complete the AMD7 module. The content in Chapter 8 addresses the dimensioning and inspection of bolt connections in general. This will be explained during lectures and a stress strain diagram will be the focus. However, it is essential for automotive students to have sufficient insight into and practice with the "stress input factor", but this is only addressed in passing in the book. A demo model/measurement installation on the theme of the "stress input factor" that has been constructed by the staff will also be shown in order to further explain the theme. The measurement assignment for students in this installation, designed as an online practicum, will be the focus. The examination for this module will be in the format of an individual assignment that consists of two parts: one on anti-friction bearings, as described above, and the other on screw connections, which primarily comprises individual detailing of the results from the online practicum mentioned above.
Assessment and testing:	See TER table

3.6 Automotive Electronic Systems

Automotive Electronic Systems 5	
Course code:	AES5
Study load:	2 EC
Competences:	Research: Drawing up the objectives of a requested study on the basis of the research question. Analyse: Modelling an existing product, process and service.
Learning objectives:	* Determining the voltage and current in a random resistance network * Determining the substitution resistance in a random resistance network * Calculating the terminal voltage and current of a random network with sources and resistors * Calculating the internal resistance of a random network with sources and resistors * Calculating the power balance of a random network with sources and resistors
Lesson content:	ACE1 is briefly revisited: serial and parallel connection, substitution resistance, voltage and current distribution, and capacity. Power balance: total provided power = total consumed power. Methods for determining voltages and currents in more complex networks: * Theorems of Thevenin and Norton * Superposition * Mesh method
Assessment and testing:	See TER table

Automotive Electronic Systems 6	
Course code:	AES5
Study load:	2 EC
Competences:	Research: Drawing up the objectives of a requested study on the basis of the research question. Analyse: Modelling an existing product, process and service.
Learning objectives:	* Measuring A/C and D/C current with a multimeter and oscilloscope and interpreting the measuring results * Determining the amplitude, effective value, and form factor of a signal * Determining the period, frequency, and duty cycle of a signal * Explaining the operation of condensers (charge, electrical field) * Explaining the operation of electromagnetic coil (magnetic field, self-induction) * Performing calculations for condensers (capacity) and electromagnetic coil (self-induction) * Explaining the operation of the ignition coil and spark plug * Calculating and explaining the RC and RL times * Calculating and explaining the reactance of a condenser and electromagnetic coil
Lesson content:	* Characteristics of alternating voltage and current (A/C), A/C vs. D/C measurements with a multimeter and oscilloscope. Electrical field: structure and operation of condensers. Capacity. * Magnetic field: structure and operation of electromagnetic coil. Self-induction * Ignition coil and spark plug: generator operation, ionisation * Charging and discharging a condenser via a resistor: RC time * Activating and deactivating electromagnetic coils: RL time, induction voltage * Condenser and electromagnetic coil in alternating current: phase difference between voltage and current, reactance (frequency dependent)
Assessment and testing:	See TER table

Automotive Electronic Systems 7	
Course code:	AES7
Study load:	2 EC
Competences:	Research: Drawing up the objectives of a requested study on the basis of the research question. Analyse: Modelling an existing product, process and service.
Learning objectives:	Understanding various automotive applied components and (analogue) connections.
Lesson content:	This module is an extension of modules AES5 and AES6. Various electronic components and analogue connections that occur in vehicle engineering are addressed. The components covered include: condensers, electromagnetic coil (ignition coil and electromagnetically driven actuators), diodes, Zener diodes, LED, bipolar transistors, MOSFET, op-amps, and timer ICs. These components are included in the following connections: indoor lighting inhibitors, flashers, ignition modules (voltage stabiliser, Schnitt trigger, contact angle regulation, and current amplification), electromagnetic induction protection.
Assessment and testing:	See TER table

Automotive Electronic Systems 8	
Course code:	AES8
Study load:	2 EC
Competences:	Research: Drawing up the objectives of a requested study on the basis of the research question. Analyse: Modelling an existing product, process and service.
Learning objectives:	Understanding digital techniques used in automotive applications.
Lesson content:	This module is an extension of module AES7. In AES7, auto engineering applications of analogue electronic connections are addressed, followed by a discussion of digital techniques in AES8. Several areas of digital engineering are covered: * Basic components (gates, flip flops) and basic techniques (Boolean operation tables, Boolean formulas, simplification methods) * Analogue-digital and digital-analogue conversion * Structure of digital control units (ECUs) * Serial communication connections (“networks”) between control units
Assessment and testing:	See TER table

3.7 Automotive Control Engineering

Automotive Control Engineering 5	
Course code:	ACE5
Study load:	1 EC
Competences:	Research: Drawing up the objectives of a requested study on the basis of the research question.
Learning objectives:	Dynamic system behaviour; * First order systems * Second order systems, frequency domain, Bode diagrams, feedback control system design * The design of a control system using presentation criteria such as precision, speed (settling time), and excess * The use of PI/PID * The analysis and validation of a control system * The evaluation and applicability of the various methods and tools * The collection and evaluation of data for system engineering
Lesson content:	During this course, the student will become familiar with the selection of the proper controller(s) for a system. In order to achieve this, students must know the system descriptions in the Laplace domain. PID controllers will be used in order to achieve the desired performance in a controlled system.
Assessment and testing:	See TER table

Automotive Control Engineering 6	
Course code:	ACE6
Study load:	2 EC
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Implement: Using appropriate materials, processes, methods, norms, and standards. Research: Drawing up the objectives of a requested study on the basis of the research question. Professionalisation: Reflecting on one's own thoughts and actions.
Learning objectives:	* The development of a (dynamic) vehicle model * The application of tools for modelling, simulation, and analysis of systems (MATLAB/Simulink) * The evaluation and applicability of the various methods and tools * The evaluation of the possibilities and consequences of the selected system architecture (verification)
Lesson content:	During this course, the student will become acquainted with analysis techniques for optimising a controller. The relationship between crossover frequency and bandwidth will be covered. Linearisation and expansion of systems outside of the mechanical domain will also be addressed.
Assessment and testing:	See TER table

Automotive Control Engineering 7	
Course code:	ACE7
Study load:	2 EC
Competences:	Design: Selecting the proper design tools. Research: Reporting results in accordance with the applicable standards in the professional field.
Learning objectives:	Accumulating knowledge and skills in: * The development of a (dynamic) vehicle model based on experimental methods * The design of experiments that can be used to determine/estimate the properties and parameters of systems based on quantitative methods (introduction to DOE) * The use of tools for the analysis and processing of data as well as the estimation of parameters (introduction to identification) * The evaluation and applicability of the various methods and tools
Lesson content:	Accumulating knowledge and skills in: * The discretisation of analogue measurement signals and the associated limitations (such as aliasing) * The post-processing of measurement signals through the use of spreadsheets (Excel) and scripts (MATLAB): removing NaNs and outliers, moving average, and first order filtering * The determination of empirical models based on the least squares method (i.e. regression) * The influence of measurement quality on a (controlled) system due to noise and limitations of the measurement system (sensor dynamics, signal discretisation)
Assessment and testing:	See TER table

3.8 Automotive Basic Programming

Automotive Basis Programming	
Course code:	ABP8
Study load:	2 EC
Competences	Analyse: Selecting relevant aspects in relation to the research question. Design: Selecting the proper design tools. Implement: Using appropriate materials, processes, methods, norms and standards. Manage: Testing the performance of a product, service, or process against quality criteria. Research: Drawing up the objectives of a requested study on the basis of the research question. Professionalisation: Reflecting on one's own actions.
Learning objectives:	The automotive engineer frequently works with systems that can be directed. These systems must be programmed using a script with code. Clients will encounter problems/challenges for which the engineer must devise a solution. The engineer must investigate, understand, and analyse the problem, come up with a solution, and then write a code. The engineer designs a solution step by step, creates it, and then tests the result.
Lesson content:	* Introduction to Arduino * Flow charts * Electrical connections * Arduino code: variables, statements, debugging, testing protocol See module guide
Assessment and testing:	See TER table

3.9 Automotive Mathematics

Automotive Mathematics 5	
Course code:	AWIS5
Study load:	2 EC
Competences	Analyse: Selecting relevant aspects in relation to the research question. Professionalisation: Reflecting on one's own thoughts and actions.
Learning objectives:	At the end of this period, you will have learned the mathematical techniques and solution methods that you will use in other parts of the programme, including in ACE.
Lesson content:	* Laplace transform, definitions, and standard functions * Inverse Laplace transforms * Laplace transform applications
Assessment and testing:	See TER table

Automotive Mathematics 6	
Course code:	AWIS6
Study load:	2 EC
Competences	Analyse: Selecting relevant aspects in relation to the research question. Research: Drawing up the objectives of a requested study on the basis of the research question. Professionalisation: Reflecting on one's own thoughts and actions.
Learning objectives:	During this mathematics module, you will learn how to handle uncertainties for measurement errors or production tolerances using statistical relationships and mathematical models. You will encounter both of these as an automotive engineer in professional practice.
Lesson content:	* Descriptive statistics * Position and standard deviation in observations and frequency distributions * Standard and binomial distributions * Use of the least squares method in correlation and regression analysis for the modelling of system behaviour
Assessment and testing:	See TER table

3.10 Automotive Virtual Engineering

Automotive Virtual Engineering 7 – Introduction to FEM	
Course code:	AVE7
Study load:	2 EC
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Design: Selecting the proper design tools. Implement: Using the appropriate materials, processes, methods, norms and standards. Research: Drawing up the objectives of a requested study on the basis of the research question.
Learning objectives:	The goal of this module is to enable students to become familiar with the options for executing 3D simulations in Siemens NX. In AVE7, you will learn to assess a construction and optimise rigidity and strength for the Final Elements Method (FEM). You will do this using most common approach: a linear static simulation.
Lesson content:	The AVE7-FEM is taught as a computer practical. The following aspects will be addressed during this module: * Insight into the various types of calculation elements * Insight into defining the required preliminary conditions (clamping, mechanical load) * Insight into choosing the correct mesh size * Learning to assess deformation and stress results, or thermal results * Learning to analyse and evaluate calculation results based on an underlying knowledge of mechanics and thermodynamics
Assessment and testing:	See TER table

Automotive Virtual Engineering 8 – Exploring CAD	
Course code:	AVE8
Study load:	3 EC
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Design: Selecting the proper design tools Implement: Using appropriate materials, processes, methods, norms and standards. Research: Drawing up the objectives of a requested study on the basis of the research question.
Learning objectives:	The goal of this module is to become familiar with the options for executing simulations in Siemens NX, just as in AVE7. During AVE8, you will learn to use more simulation options, such as applications for natural frequencies, buckling, thermal behaviour, and identifying forces (Motion module)
Lesson content:	The following aspects will be covered during this module: * Designing frame constructions * Using surfaces for thin-walled components * Boolean operations for combining bodies * Using skeletons to structure models * Using parameters to work more flexibly with CAD models * Part families (model variants) based on parametric models
Assessment and testing:	See TER table

4. Appendix: General appendix to the Fontys Automotive programme guide

Examination overview

The Automotive degree programme uses various types of examinations, specifically summative examinations and formative examinations. Summative examinations count towards the final assessment of a module (these may be weighted, see the study load table and standardisation). It is possible to repeat these examinations. Formative examinations provide students with insight into their development and may sometimes partially count towards their final mark. However, it is not possible to repeat these examinations. The examinations, which are also called interim examinations, are sometimes scheduled at separate times, but it is possible that they may be given during lectures.

Time extensions for exams

Students with physical or learning disabilities (e.g. dyslexia), will be given the opportunity to take examinations in a way that deviates from the norm. This may involve time extensions for examinations. Students who apply for eligibility must submit a written request to the Examination Board in a timely manner. The student deans can assist you in this process and can provide you with access to request letter templates. The services offered do not apply to interim examinations.

Registration is always required!

Please note! Registration is always required for examinations and resits. You will receive an e-mail within a reasonable time frame from the secretarial office regarding the start of the registration period. The first opportunity to take an examination is considered a regular examination (T). Regardless of whether or not you participated in the first opportunity, the second opportunity is considered a resit (H).

Fraud

In the general section of the Test and Exam Regulations (TER) includes the following definition of fraud:

Fraud is defined as any action (including plagiarism) or failure to act in which the party involved knew or should have known that this action or failure to act rendered it completely or partially impossible to properly assess a person’s knowledge, insight, skills, competences, attitudes, or reflection.

For example, there is evidence of fraud if the student used resources which were not permitted, thus making it impossible to correctly assess their knowledge and abilities. Other examples include looking at other students’ work or submitting the work of another student as one’s own (plagiarism). Plagiarism also includes the lack or improper citation of the work of others.

If a student commits fraud, the Examination Board is able to deprive the involved student of one or more opportunities to take an examination (to be indicated by the Examination Board) for a period of no longer than one year, as specified by the Board. In the case of serious fraud, the Executive Board, at the recommendation of the Examination Board, may definitively terminate the involved student's registration in the degree programme.

Study progress indication and study advice

During each period of the propaedeutic phase, the student will discuss their study progress with their study career advisor.

Six months after registering, each student will receive a notification with an indication of their study progress.

At the end of the first year of registration during the propaedeutic phase (12 months), a binding study advice will be given (See Article 32 of the TER).

The study advice is based on the student's academic results. When deciding on the study advice, a student's particular circumstances will be taken into account. The student must notify their study career advisor or the student dean of any special circumstances as soon as these arise.

5. TER table for the Automotive degree programme, full time, Dutch, primary phase, study years 2 and 3

Package	Education unit	EC	Course code	Examination format	Individual or group assessment	Assessment scale	Standardisation / compensation
4318HA	A18APJ5	4	A18APJ5P	Project assessment	I	1-10	at least 5.5
			A18APS5	Assignments	I	O-V	APS5 is required in order to obtain credits for APJ5
	A18APJ6	4	A18APJ6P	Project assessment	I	1-10	at least 5.5
			A18APS6	Assignments	I	O-V	APS6 is required in order to obtain credits for APJ6
	A18APJ7	4	A18APJ7P	Project assessment	I	1-10	at least 5.5
			A18APS7	Assignments	I	O-V	APS7 is required in order to obtain credits for APJ7
	A18APJ8	4	A18APJ8P	Project assessment	I	1-10	at least 5.5
			A18APS8	Assignments	I	O-V	APS8 is required in order to obtain credits for APJ8
	A18APR5	1	A18APR5	Assignments	I	O-V	minimum passing grade
	A18APR6	1	A18APR6	Assignments	I	O-V	minimum passing grade
	A18AAT5	3	A18AAT5	Examinations	I	1-10	at least 5.5
	A18AAT6	3	A18AAT6T	Examinations	I	1-10	at least 5.5 for theory; practical is optional
			A18AAT6P	Practical	I	O-V	
	A18AVD7	3	A18AVD7T	Examinations	I	1-10	at least 5.5 for theory; practical is optional
			A18AVD7P	Practical	I	O-V	
	A18AAT8	2	A18AAT8	Exercise	I	1-10	at least 5.5
	A18AMD5	2	A18AMD5	Examinations	I	1-10	at least 5.5
	A18AMD6	1	A18AMD6	Examinations	I	1-10	at least 5.5
	A18AMD7	2	A18AMD7	Exercise	I	1-10	at least 5.5
	A18AMD8	2	A18AMD8	Exercise	I	1-10	at least 5.5
	A18AES5	2	A18AES5	Examinations	I	1-10	at least 5.5
	A18AES6	2	A18AES6	Examinations	I	1-10	at least 5.5
	A18AES7	2	A18AES7T	Examinations	I	1-10	at least 5.5 for theory; practical is optional
			A18AES7P	Practical	I	O-V	
	A18AES8	2	A18AES8T	Examinations	I	1-10	at least 5.5 for theory; practical is optional
			A18AES8P	Practical	I	O-V	
	A18ACE5	1	A18ACE5	Examinations	I	1-10	at least 5.5
	A18ACE6	2	A18ACE6T	Examinations	I	1-10	at least 5.5
	A18ACE7	2	A18ACE7T	Examinations	I	1-10	at least 5.5 for theory; practical is optional
			A18ACE7P	Practical	I	O-V	
	A18ABP8	2	A18ABP8T	Examinations	I	1-10	at least 5.5 for theory; practical is optional
			A18ABP8P	Exercise	I	O-V	
	A18WIS5	2	A18WIS5	Examinations	I	1-10	at least 5.5
	A18WIS6	2	A18WIS6	Examinations	I	1-10	at least 5.5
	A18AVE7	2	A18AVE7	Exercise	I	1-10	at least 5.5
	A18AVE8	3	A18AVE8	Exercise	I	1-10	at least 5.5
	ASTAGE	30	ASTAGE	Exercise	I	1-10	at least 5.5
	Minor	30	Minor	Miscellaneous	I	O-/ 1-10	at least 5.5 or pass

Due to educational development and reform, a study component may be offered in a different manner than specified (e.g. it may be integrated). The study load is subject to change. Changes will be made prior to the start of the relevant educational programme and announced via the semester guides, the Engineering/Automotive portal, and N@tschool.