Fontys University of Applied Sciences

Fontys Automotive Programme Guide 2019-2020

Study year 1

Study year coordinator

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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	APJ2 4 EC	APJ3 4 EC	APJ3 4 EC	APJ5 4 EC	APJ6 4 EC	APJ7 4 EC	APJ8 4 EC	Internship 30 EC	Minor 30 EC	APJ13/14 10 EC	APJ13/14 10 EC	Graduation 30 EC
APU1 2 EC	APU2 1 EC	APU3 2 EC	APU4 1 EC	AAT5 3 EC	AAT6 3 EC	AVD7 3 EC	AAT8 2 EC					
ADT1 1 EC	ADT2 2 EC	ADT3 1 EC	ADT4 2 EC							AMF 2 EC	AMF 2 EC	
APR1 1 EC	APR2 1 EC	APR3 1 EC	APR4 1 EC	APR5 1 EC	APR6 1 EC					ASE 2 EC	ASE 2 EC	
AMD1 2 EC	AMD2 1 EC	AMD3 2 EC	AMD4 2 EC	AMD5 2 EC	AMD6 1 EC	AMD7 2 EC	AMD8 2 EC			AES13 4 EC	ACS13 4 EC	
AMM1 1 EC	AMM2 2 EC	AHF3 2 EC	AHF4 1 EC	ACE5 1 EC	ACE6 2 EC	ACE7 2 EC	ABP8 2 EC			AED14 4 EC	ASI13 4 EC	
ACE1 2 EC	ACE2 2 EC	ACE3 1 EC	ACE4 2 EC	AES5 2 EC	AES5 2 EC	AES7 2 EC	AES8 2 EC			AVE13 4 EC	ASI14 4 EC	
AWIS1 2 EC	AWIS2 2 EC	AWIS3 2 EC	AWIS4 2 EC	AWIS5 2 EC	AWIS6 2 EC	AVE7 2 EC	AVE8 3 EC			AVS14 4 EC	ACS14 4 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 1	
Course code:	APJ1
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:	This project will teach you: - To be accountable for the decisions you make and to resolve any conflicts constructively - To communicate with each other openly - To accept and understand each other, to encourage one another to gain knowledge through the use of independent study, and to observe your own behaviour and actions (reflection)
Lesson content	AJP1 is a part of the total programme for the first lecture period. This period is the first of four periods (each 10 weeks in length) that make up your first study year. The focus of this period is: collaboration, planning, and organisation. This is why the programme for this part of the project has been designed to include activities that reflect these topics. The emphasis lies on collaboration, communication, planning, and organisation. These are significant competences that you will need throughout your studies and in your future career as an automotive engineer. The assignment for this study year is as follows: The design and construction of a model vehicle using the Lego Mindstorms package. You will use this vehicle to run a pre-designed course, in addition to completing a variety of other tasks. The Main Event serves as a finale: the various teams will compete against each other using their vehicles.
Assessment and testing:	See TER table

Automotive Professional Skills 1	
Course code:	APS1
Study load:	Required to take APJ1
Competences:	Research: Drawing up the objectives of a requested study on the basis of 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 APS component focuses on developing the professional skills required to be able to communicate and collaborate effectively in the prospective professional field.
Lesson content:	During APS1 and APS2, the focus is on personal development and the ability to work together. During the programme, students often work in project groups or in pairs. It is important that future engineers gain insight into their individual role and actions within the group and the effect of these on the function and results of the group. Understanding one's own personal development provides a good basis for effective communication. In order to do this, it is necessary to first focus on oneself. This provides insight into the role of the person within the group context. During APS1 and APS2, the emphasis lies on collaboration.
Assessment and testing:	See TER table

Automotive Project 2	
Course code:	APJ2
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:	After this semester, you will understand the design methodologies which you should employ in order to develop products/systems. You will learn how to create a schedule of requirements and how to make well-founded decisions. Based on an action plan, you will learn how to work on a project basis as well as how to collaborate better with others, plan properly, and communicate effectively. You will also learn how to work independently and how to write reports.
Lesson content:	The assignment in APJ2 is to conduct preliminary research into various components of the powertrain, truck chassis, auto-loading crane, and container. Next: * Drafting technical specifications for the final product * Configuring a truck with an auto-loading crane based on your individual specifications * Analysing parameters * Presenting and reporting to clients
Assessment and testing:	See TER table

Automotive Professional Skills 2	
Course code:	APS2
Study load:	Required to take APJ2
Competences:	Research: Drawing up the objectives of a requested study on the basis of 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:	This part of APS provides support in starting to work on a project basis. The workshops focus on (1) making joint agreements (roles, schedule, actions/decisions); (2) creating an action plan with a focus on establishing the issue, the primary question, and other accompanying questions; and (3) reporting with an emphasis on the introductory remarks.
Lesson content:	During APS1 and APS2, the focus is on personal development and the ability to work together. During the programme, students often work in project groups or in pairs. It is important that future engineers gain insight into their individual role and actions within the group and the effect of these on the function and results of the group. Understanding one's own personal development provides a good basis for effective communication. In order to do this, it is necessary to first focus on oneself. This provides insight into the role of the person within the group context. During APS1 and APS2, the emphasis lies on collaboration.
Assessment and testing:	See TER table

Automotive Project 3	
Course code:	APJ3
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:	This project will teach you: - Calculating forces and setting construction dimensions for detailed concepts (instructions in AMD) - Conventional 2D drawing (instructions in APS) - CAD model creation - CAD model simulation with test results - Working on a project basis (collaboration, planning, communication) - Working independently - Reporting - Presenting
Lesson content:	In APJ3, several components, such as design within APJ2, are addressed in greater depth (deepening and broadening). This will be done in both individual and group assignments. * Create an FBD calculation for the chosen design * Create a 2D drawing (pp) * Create an NX drawing (pp) * Create an NX simulation with load (pp) * Draft a hypothesis (pp) * Give an interim presentation for your class * Write a partial report
Assessment and testing:	See TER table

Automotive Professional Skills 3	
Course code:	APS3
Study load:	Required for APJ3
Competences:	Research: Drawing up the objectives of a requested study on the basis of 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 APS3 workshops are partially practical and partially focused on the individual. After completing the workshop, you will be able to (1) specify your key qualities and use these (2) to formulate what your talents are and how to best put these to use in a team setting. In terms of practical skills, after this course, you will be able to properly report on technical calculations and substantiate them based on the rules of reporting.
Lesson content:	The individual is the focus during APS3 and APS4. What do you contribute in a team setting? What qualities do you have and how can you use these constructively for collaboration? The year will be concluded with a brief presentation about yourself. In addition to these themes, reporting will continue to be a central topic. Describing and substantiating technical calculations will serve as the basis for APJ3 support.
Assessment and testing:	See TER table

Automotive Project 4	
Course code:	APJ3
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:	This project will teach you: - Model creation - Working on a project basis (collaboration, planning, communication) - Working independently - Reporting - Presenting
Lesson content:	During APJ4, components, such as design in APJ2 and APJ3, will be further elaborated upon in a model. This model can consist of: * A 3D print * A calculation (at a higher level than in period 2) * An NX drawing (at a higher level than in period 3) * An NX simulation (at a higher level than in period 3) * An NX motion * An object component Everything should be discussed with your tutor. All aspects addressed in APJ1 through 4 will be incorporated into a final report and presentation. These must meet the requirements that apply to the final thesis and presentation.
Assessment and testing:	See TER table

Automotive Professional Skills 4	
Course code:	APS4
Study load:	Required for APJ4
Competences:	Research: Drawing up the objectives of a requested study on the basis of 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 APS4 workshops are partially practical and partially focused on the individual. There will be a continued focus on personal themes related to team collaboration. After completing the workshops, you will be able to formulate your competency development for this year based on the STARR model. You will also write a measurement report, such as the one used for APJ4.
Lesson content:	The individual is the focus during APS3 and APS4. What do you contribute in a team setting? What qualities do you have and how can you use these constructively for collaboration? The year will be concluded with a brief presentation about yourself. In addition to these themes, reporting will continue to be a central topic. The APJ4 support involves reporting on measurement data and the associated work.
Assessment and testing:	See TER table

3.2 Automotive Power Units

Automotive Power Units 1	
Course code:	APU 1
Study load:	2 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.
Learning objectives:	Combining thought and action is a key goal of this course. However, the central focus will be on theoretical knowledge and understanding, as well as the application of your knowledge of engines. You will learn about the types of engines and how they are constructed.
Lesson content:	During this course, students acquire a fundamental knowledge of engine construction. This course not only addresses the structure and construction of engines, but also their various operating principles. It is also important that students understand why specific constructions have been chosen (for specific applications). During APU1, the following topics will be addressed: * Various operating principles of combustion engines * The various indicators, magnitudes, and outputs of the engines used
Assessment and testing:	See TER table

Automotive Power Units 2	
Course code:	APU2
Study load:	1 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.
Learning objectives:	Combining thought and action is a key goal of this course. However, the central focus will be on theoretical knowledge and understanding, as well as the application of your knowledge of engines. You will learn about the types of engines and how they are constructed. By the end of these two periods, you will also know a great deal about engine output, cooling, and lubrication.
Lesson content:	During this course, students acquire a fundamental knowledge of engine construction. This course not only addresses the structure and construction of engines, but also their various operating principles. It is also important that students understand why specific constructions have been chosen (for specific applications). The processes that enable the engine to operate will also be covered. During APU2, the following topics will be addressed: * The structure of various components: block, rotating/moving parts, cylinder head, etc. * Basic knowledge of gas exchange and exhaust emissions * Cooling and lubrication, which are very important aspects to ensure that a combustion engine operates without issues
Assessment and testing:	See TER table

Automotive Power Units 3	
Course code:	APU3
Study load:	2 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.
Learning objectives:	The goal is to continuously combine thought and action, even though the core of this part of the programme will focus on theoretical knowledge, understanding, and application.
Lesson content:	Mixture formation: The following will be addressed: * Mixture formation in an Otto engine * Mixture formation in a diesel engine * Exhaust gas emissions The course not only focuses on the construction of engines, but also on their various operating principles. It is also important that the reasons for choosing specific constructions are clear. The processes that enable the operation of the engine, the various operating principles during mixture preparation, and the structure and construction of various components will also be reviewed.
Assessment and testing:	See TER table

Automotive Power Units 4	
Course code:	APU4
Study load:	1 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.
Learning objectives:	The goal is to continuously combine thought and action, even though the core of this part of the programme will focus on theoretical knowledge, understanding, and application.
Lesson content:	Hybrid and electric drivetrains: It is anticipated that, in the future, current vehicles will largely be replaced by electric vehicles (EVs), hybrid vehicles (HEVs), and vehicles that operate on fuel cells. For this reason, the hybrid and electric drivetrain module focuses on air pollution, emissions that are caused in part by global warming, and the exhaustion of oil reserves. We will also address the historical development and future expectations for hybrid vehicles. The following are among the topics addressed in this module: * Layout of EV and HEV vehicles * Drivetrain management * Components of hybrid vehicles * Electric vehicles * Battery management systems The teaching methods are both theoretical and practical. Through the use of practical exercises and measurement with available equipment, the student will be guided through the electrical system and its primary aspects. Upon completion of APU4, you will be able to explain the operation of hybrid vehicles, electric vehicles, and individual systems, as well as to conduct measurements on a hybrid system.
Assessment and testing:	See TER table

3.3 Automotive Drivetrain

Automotive Drivetrain 1	
Course code:	ADT1
Study load:	1 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.
Learning objectives:	This course will provide you with a thorough understanding of the various components and constructions used in vehicles. Specifically, we will focus on the chassis, wheel suspension, and braking and steering systems. During the course, you will become familiar with different concepts regarding the construction of the entire vehicle and the dynamic rules which apply.
Lesson content:	During the Drivetrain course, you will learn the basics of vehicle construction. Not only the structure/construction is addressed, but also the various tasks/movements. The course also addresses the processes that enable the proper operation of a vehicle. The topics addressed in ADT1 are: tyres, wheel suspension, suspension systems, and damping.
Assessment and testing:	See TER table

Automotive Drivetrain 2	
Course code:	ADT2
Study load:	2 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.
Learning objectives:	This course will provide you with a thorough understanding of the various components and constructions used in vehicles. Specifically, we will focus on the chassis, wheel suspension, and braking and steering systems. During the course, you will become familiar with different concepts regarding the construction of the entire vehicle and the dynamic rules which apply.
Lesson content:	During the Drivetrain course, you will learn the basics of vehicle construction. Not only the structure/construction is addressed, but also the various tasks/movements. The course also addresses the processes that enable the proper operation of a vehicle. The topics addressed in ADT2 are: steering controls, power steering, braking, and ABS/ASR.
Assessment and testing:	See TER table

Automotive Drivetrain 3	
Course code:	ADT3
Study load:	1 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.
Learning objectives:	The goal is to continuously combine thought and action, even though the core of this part of the programme will focus on theoretical knowledge, understanding, and application.
Lesson content:	During the Drivetrain course, you will learn the basics of vehicle construction. Not only the structure/construction is addressed, but also the various tasks/movements. The course also addresses the processes that enable the proper operation of a vehicle. The topics addressed in ADT3 are: air brakes, the clutch, torque converter, and the gearbox.
Assessment and testing:	See TER table

Automotive Drivetrain 4	
Course code:	ADT4
Study load:	2 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.
Learning objectives:	The goal is to continuously combine thought and action, even though the core of this part of the programme will focus on theoretical knowledge, understanding, and application.
Lesson content:	During the Drivetrain course, you will learn the basics of vehicle construction. Not only the structure/construction is addressed, but also the various tasks/movements. The course also addresses the processes that enable the proper operation of a vehicle. The topics addressed in ADT4 are: robotic gearboxes, automatic gearboxes, drivetrain axles and final drive, and differentials.
Assessment and testing:	See TER table

3.4 Automotive Practice

Automotive Practice 1 and 2	
Course code:	APR1 and APR2
Study load:	APR1 1 ECTS and APR2 1 ECTS
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Implement: Using the appropriate materials, processes, methods, norms and standards.
Learning objectives:	During this course, you will learn how to apply the theory of engine and vehicle construction 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

Automotive Practice 3 and 4	
Course code:	APR3 and APR4
Study load:	APR3 1 ECTS and APR4 1 ECTS
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Implement: Using the appropriate materials, processes, methods, norms and standards.
Learning objectives:	During this course, you will learn how to apply the theory of engine and vehicle construction 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
Lesson content:	Mechanics are part of the physics that deal with the state of motion of bodies. Various forces often play an important role in products and constructions. These could be external and internal forces. If there is no acceleration or deceleration, this concerns a branch of mechanics called statics. You can use calculations to show whether these forces are permissible, to ensure that a product or construction does not fail. During this course, you will learn to combine and separate forces and moments and to calculate the reactive forces, internal forces, and moments in equilibrium situations.
Assessment and testing:	See TER table

3.5 Automotive Mechanics and Design

Automotive Mechanics & Design 1	
Course code:	AMD1
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 basic knowledge regarding statics and the ability to apply this knowledge to simple problems. The following are some of the skills that you should have at the end of this period: - Calculating forces and moments - Determining the centre of gravity of a body - Creating a Free Body Diagram (FBD) for simple constructions Breaking down composite constructions into free bodies in order to analyse the load of the individual components - Creating equilibrium equations and using these to determine the reactive forces exerted on the construction by the environment Where possible, the FACER method must be used: Figure, Analysis, Core relationship, Elaboration, Review.
Lesson content:	Mechanics are part of the physics that deal with the state of motion of bodies. Various forces often play an important role in products and constructions. These could be external and internal forces. If there is no acceleration or deceleration, this concerns a branch of mechanics called statics. You can use calculations to show whether these forces are permissible, to ensure that a product or construction does not fail. During this course, you will learn to combine and separate forces and moments and to calculate the reactive forces, internal forces, and moments in equilibrium situations.
Assessment and testing:	See TER table

Automotive Mechanics & Design 2	
Course code:	AMD2
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 basic knowledge regarding statics and the ability to apply this knowledge to simple problems. By the end of this period, you will be equipped to identify and calculate internal forces and moments in constructions. You will also be able to identify and calculate moment force, drag (vertical shear), and normal force lines in constructions. You will be equipped to calculate the moments of inertia and resistance for specific geometries.
Lesson content:	Mechanics is the part of physics that deals with the state of motion of bodies. Various forces often play an important role in products and constructions. These could be external and internal forces. If there is no acceleration or deceleration, this concerns a branch of mechanics called statics. You can use calculations to show whether these forces are permissible, to ensure that a product or construction does not fail. This course teaches you how to identify internal forces and moments. You will then learn to determine the course of internal forces and moments throughout a construction in order to use this for such things as determining the areas of greatest load and calculating distortions in the construction.
Assessment and testing:	See TER table

Automotive Mechanics & Design 2 Sketching and CAD	
Course code:	AMD2P
Study load:	Practical course required for AMD2
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:	During the course, you will learn how to create technical drawings in a 3D CAD system. You will learn the basic concepts that are required to read technical drawings as well as drawings used for the modelling of products/objects in 3D CAD.
Lesson content:	Reading and creating technical drawings. Practical courses in which basic concepts are applied.
Assessment and testing:	See TER table

Automotive Mechanics & Design 3	
Course code:	AMD3T
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:	Acquiring a basic knowledge of material strength and the ability to apply this knowledge to simple problems. After this quarter, the student must master: see N@tschool. Where possible, the FACER method must be used: Figure, Analysis, Core relationship, Elaboration, Review.
Lesson content:	Topics covered in AMD3 are: * The elastic curve, creating equations for displacement and angles. Integration method, load combinations, clamped beam deflection, method of sections, the “tail wagging effect”, superposition, notional clamping, and static indeterminate constructions.
Assessment and testing:	See TER table

Automotive Mechanics & Design 4	
Course code:	AMD4
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:	Acquiring a basic knowledge of material strength and the ability to apply this knowledge to simple problems. After this quarter, the student must master: see N@tschool. Where possible, the FACER method must be used: Figure, Analysis, Core relationship, Elaboration, Review.
Lesson content:	Mechanics is a part of physics that deals with the state of motion of bodies. Various forces often play an important role in products and constructions. These could be external and internal forces. You can use calculations to show whether these forces are permissible, to ensure that a product or construction does not fail. This module is a direct follow-up to AMD3. The course content delves deeper into the calculations and concepts regarding bending, shear, and buckling in constructions.
Assessment and testing:	See TER table

3.6 Automotive Materials & Manufacturing

Automotive Materials & Manufacturing 1	
Course code:	AMM1
Study load:	1 EC
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Implement: Using the appropriate materials, processes, methods, norms and standards.
Learning objectives:	In order to achieve the learning outcomes of the study programme, students who have completed this module must be able to: - Effectively and efficiently use field-specific terminology from materials science in communications with materials experts, producers, designers, and automotive professionals - Explain and predict material properties and behaviours - Select materials, material treatments, production techniques, production processes, production parameters, and measurement methods for mechanical properties and behaviours using logical reasoning - Explain the ways in which the measurement of material properties can go wrong in the technical field (e.g. the influence of measurement installations and environments) - Indicate and explain measures to prevent production problems - Find various sources, both hardcopy and digital
Lesson content:	The course covers the following topics: * Learning about the chemical and physical properties of materials * Learning to describe how the mechanical properties of materials are measured * Learning to specify the inspection methodology and non-destructive research * Learning to explain the meaning of tribology * Learning to describe how wear and friction can be measured * Reproducing formulae used to calculate wear and friction * Learning to name the characteristics of wear and friction * Learning to name the components of an anti-friction bearing
Assessment and testing:	See TER table

Automotive Materials & Manufacturing 2	
Course code:	AMM2
Study load:	2 EC
Competences:	Analyse: Selecting relevant aspects in relation to the research question. Implement: Using the appropriate materials, processes, methods, norms and standards.
Learning objectives:	In order to achieve the learning outcomes of the study programme, students who have completed this module must be able to: - Effectively and efficiently use field-specific terminology from materials science in communications with materials experts, producers, designers, and automotive professionals - Explain and predict material properties and behaviours - Select materials, material treatments, production techniques, production processes, production parameters, and measurement methods for mechanical properties and behaviours using logical reasoning - Explain the ways in which the measurement of material properties can go wrong in the technical field when working in a team context (e.g. the influence of measurement installations and environments) - Indicate and explain measures to prevent production problems - Find various sources, both hardcopy and digital
Lesson content:	* Identifying and applying chemical and physical properties * Identifying and describing polymer composites, explaining their function, and describing the manufacturing processes
Assessment and testing:	See TER table

3.7 Automotive Heat and Fluid

Automotive Heat & Fluid 3	
Course code:	AHF3 Thermodynamics-3
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:	At the end of the period, you will have acquired the necessary basic knowledge of thermodynamics and will be equipped to apply this knowledge to address simple problems. A detailed explanation of the knowledge the student should have at their disposal at the end of this period can be found on N@tschool.
Lesson content:	Thermodynamics is a sub-discipline of physics that deals with energy conversion in equipment and systems. The behaviour of (ideal) gases plays an essential role in this field. Summary of the course programme: * Introduction, including thermodynamic terminology * Addressing the first law of thermodynamics for closed systems * Equation of state for an ideal gas * Change of state for an ideal gas
Assessment and testing:	See TER table

Automotive Heat & Fluid 4	
Course code:	AHF4 Thermodynamics-4
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:	At the end of the semester, you will have acquired the necessary basic knowledge of thermodynamics and will be equipped to apply this knowledge to address simple problems. A detailed explanation of the knowledge the student should have at their disposal at the end of this period can be found on N@tschool.
Lesson content:	Thermodynamics is a sub-discipline of physics that deals with energy conversion in equipment and systems. The behaviour of (ideal) gases plays an essential role in this field. Summary of the course programme: * Thermodynamic cycles * Addressing the first law of thermodynamics for open systems * State diagrams * The second law of thermodynamics and entropy
Assessment and testing:	See TER table

3.8 Automotive Control Engineering

Automotive Control Engineering 1	
Course code:	ACE1
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 the ACE1 course, you will acquire a basic knowledge of electrical engineering that is required to determine voltage and current in simple resistance networks. This will also be your first exposure to measurement technology (temperature and elasticity measurements, Wheatstone bridge). Finally, you will become familiar with detection/systematic thinking, which is required for the description, modelling, and analysis of dynamic systems (addressed in greater detail in ACE3).
Lesson content:	* Basic electrical engineering concepts (voltage, current, resistance, capacity, energy, load) and the laws of Ohm and Kirchhoff * Using a multimeter and oscilloscope for measurements * Serial, parallel, and mixed resistor connections, voltage and current distribution * Specific resistance and temperature dependence * Special resistances such as sensors * Temperature measurements with NTC and PTC resistances * Strain gauges and the Wheatstone bridge * Block diagrams and sensitivity
Assessment and testing:	See TER table

Automotive Control Engineering 2	
Course code:	ACE2
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:	In this module, you will begin using the mathematics programme, MATLAB, for the first time. Over the course of the programme, MATLAB will be used in several different modules and, as such, it is essential that you become familiar with it at an early stage. After taking this course, you should have an understanding of MATLAB basic skills and be able to process and analyse measurement data.
Lesson content:	* Applying the concept of “system” and determining the input/output of a system * Basic MATLAB skills and working with row and column vectors and matrices * Creating plots * Creating simple programs in MATLAB and saving these as scripts (*.m files) * Using "if then", "for", and "while" statements * Creating and using “function” scripts * Incorporating and analysing measurement data with MATLAB and importing data files * Recognising outliers in measurement data and filtering them out using MATLAB scripts * Determining the (linear) relationship between input and output * Publishing MATLAB scripts (in PDF) and saving them in the submission environment.
Assessment and testing:	See TER table

Automotive Control Engineering 3	
Course code:	ACE3
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:	- Introduction to modelling dynamic systems and simulation. - Learning how to use Simulink.
Lesson content:	* When designing vehicle systems, the knowledge of dynamic (time-dependent) behaviour is essential. In the ACE3 module, the principles of dynamic behaviour are addressed for systems with mass, damping, and elasticity. * In the ACE3 module, the creation of differential equations from mathematics will be discussed. You will also work with integrals and differential equations. * Block diagrams: this technique for describing systems in terms of signals (input/output) is the foundation for simulation modelling. * The practical case is a D/C servo motor that can realise a valve actuation system, for example. * You will learn how to investigate dynamic system behaviour using simulation. During simulation research, a (simplified) representation of a system in a simulation model will be described, in which all key variables and system parameters will be able to be changed. One of the most important simulation software packages is Simulink. Simulink is a MATLAB toolbox which was introduced in the ACE2 module.
Assessment and testing:	See TER table

Automotive Control Engineering 4	
Course code:	ACE4
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:	There are a large number of active and passive systems in vehicles, which guide and regulate the function of the vehicle itself. The objective of this module is to develop the detection/systematic thinking required for the description, modelling, and analysis of controlled dynamic systems.
Lesson content:	The ACE4 module provides an introduction to control technology, in which a single-input/single-output (SISO) feedback controlled system is described. In order to understand the effect of feedback controller settings, you will become familiar with several analysis techniques for dynamic system behaviour: * Controller principles * Applying differential equations * Creating block diagrams of a system with a controller * Analysis in the time domain: the core concepts of the time constant, precision, and stability * Analysis in the S domain: through the use of the Laplace transform (from times t to s), a controlled system can be described in block diagrams. The block diagram representation can be analysed in Simulink using the simulation techniques that were learned in the ACE3 module. The block diagram representation also serves as the basis for the analysis and design of “standard” feedback controls.
Assessment and testing:	See TER table

3.9 Automotive Mathematics

Automotive Mathematics 1	
Course code:	AWIS1
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:	By taking the courses Mathematics 1 and 2, you will have acquired the necessary knowledge and skills which you will need to complete the other courses in the Automotive degree programme. Your general secondary school knowledge will also be reinforced, such as improving your analytical thinking capacity and your ability to consistently resolve problems and issues.
Lesson content:	During Mathematics 1, the following topics will be covered: * Introduction to algebra: eliminating brackets, notable products, and factoring * Algebra: fractions, exponents, and solving formulas * Linear functions: domain, range, function rule, graphs, equations, and inequalities * Quadratic functions: factoring, ABC formula, relationship between zeroes of a function and factoring, domain, range, drawing graphs, calculating intersections, and inequalities * Fractions and fractional functions: limits, domain, range, graphics, fractional equations and inequalities * Exponents and root functions: domain, range, and graphs. Calculation rules for exponents and roots. Equations and inequalities * Exponential functions: domain, range, graphs. Rewriting equations and inequalities * Logarithms and calculation rules * Introduction to differentiation (for polynomials, exponential and logarithmic functions) * Introduction to integration (for polynomials, exponential and logarithmic functions)
Assessment and testing:	See TER table

Automotive Mathematics 2	
Course code:	AWIS2
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:	By taking the courses Mathematics 1 and 2, you will have acquired the necessary knowledge and skills which you will need to complete the other courses in the Automotive degree programme. Your general secondary school knowledge will also be reinforced, such as improving your analytical thinking capacity and your ability to consistently resolve problems and issues.
Lesson content:	During Mathematics 2, the following topics will be covered: * Trigonometry * Trigonometric functions and waveforms * Trigonometric identities * Differentiation * Engineering applications of differentiation
Assessment and testing:	See TER table

Automotive Mathematics 3	
Course code:	AWIS3
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:	The mathematical arrangements within the Automotive degree programme primarily aim to ensure that students acquire enough knowledge and skills to be able to apply these directly in the other subjects in the study programme. General secondary school competences will also be reinforced, which will include important aspects such as analytical thinking capacity and targeting problems.
Lesson content:	During Mathematics 3, the following topics will be covered: * Complex numbers: introduction, notation, concepts, and calculation rules for z=a+bj * Complex numbers: notation, concepts, calculation rules for the polar form, and complex numbers in exponential form * Complex numbers: calculation rules in the exponential form and solving equations in higher powers * Integration: differential summary, introduction to integration, the Riemann sum, and calculating surface areas * Integration: calculating surface areas, undefined integrals, and applications * Integration: the substitution method and partial integration * Integration: integrating fractional functions and improper integrals
Assessment and testing:	See TER table

Automotive Mathematics 4	
Course code:	AWIS4
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:	The mathematical arrangements within the Automotive degree programme primarily aim to ensure that students acquire enough knowledge and skills to be able to apply these directly in the other subjects in the study programme. General secondary school competences will also be reinforced, which will include important aspects such as analytical thinking capacity and targeting problems.
Lesson content:	During Mathematics 4, the following topics will be covered: * Matrices: definition and notation, counting, subtraction and scalars, and multiplication * Matrices: calculation rules and inverse matrices * Matrices: solving linear equations, determinants, and practical applications * Differential equations (DE): concepts, creating DEs, directional fields, substitution, dividing variables, solving first order DEs, homogenous and particular, second order DEs and characteristic equations, and applications
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, study year 1, 2019 cohort							
Package	**Education unit**	**EC**	**Course code**	**Examination format**	**Individual or group assessment**	**Assessment scale**	**Standardisation / compensation**
4319PA	A19APJ1	4	A19APJ1P	Project assessment	I	1-10	at least 5.5
			A19APS1	Assignments	I	O-V	APS1 is required in order to obtain credits for APJ1
	A19APJ2	4	A19APJ2P	Project assessment	I	1-10	at least 5.5
			A19APS2	Assignments	I	O-V	APS2 is required in order to obtain credits for APJ2
	A19APJ3	4	A19APJ3P	Project assessment	I	1-10	at least 5.5
			A19APS3	Assignments	I	O-V	APS3 is required in order to obtain credits for APJ3
	A19APJ4	4	A19APJ4P	Project assessment	I	1-10	at least 5.5
			A19APS4	Assignments	I	O-V	APS4 is required in order to obtain credits for APJ4
	A19APU1	2	A19APU1	Examinations	I	1-10	at least 5.5
	A19APU2	1	A19APU2	Examinations	I	1-10	at least 5.5
	A19APU3	2	A19APU3	Examinations	I	1-10	at least 5.5
	A19APU4	1	A19APU4	Examinations	I	1-10	at least 5.5
	A19ADT1	1	A19ADT1	Examinations	I	1-10	at least 5.5
	A19ADT2	2	A19ADT2	Examinations	I	1-10	at least 5.5
	A19ADT3	1	A19ADT3	Examinations	I	1-10	at least 5.5
	A19ADT4	2	A19ADT4	Examinations	I	1-10	at least 5.5
	A19APR1	1	A19APR1	Assignments	I	O-V	minimum passing grade
	A19APR2	1	A19APR2	Assignments	I	O-V	minimum passing grade
	A19APR3	1	A19APR3	Assignments	I	O-V	minimum passing grade
	A19APR4	1	A19APR4	Assignments	I	O-V	minimum passing grade
	A19AMD1	2	A19AMD1T	Examinations	I	1-10	at least 5.5 for theory; practical is conditional
			A19AMD1P	Assignments	I	O-V	
	A19AMD2	1	A19AMD2T	Examinations	I	1-10	at least 5.5 for theory; practical is conditional
			A19AMD2P	Practical	I	O-V	
	A19AMD3	2	A19AMD3	Examinations	I	1-10	at least 5.5
	A19AMD4	2	A19AMD4	Examinations	I	1-10	at least 5.5
	A19AMM1	1	A19AMM1	Examinations	I	1-10	at least 5.5
	A19AMM2	2	A19AMM2	Examinations	I	1-10	at least 5.5
	A19AHF3	2	A19AHF3	Examinations	I	1-10	at least 5.5
	A19ACE1	2	A19ACE1	Examinations	I	1-10	at least 5.5
	A19ACE2	2	A19ACE2T	Examinations	I	1-10	at least 5.5 for theory; practical is conditional
			A19ACE2P	Practical	I	O-V	
	A19ACE3	1	A19ACE3T	Examinations	I	1-10	at least 5.5 for theory; practical is conditional
			A19ACE3P	Practical	I	O-V	
	A19ACE4	2	A19ACE4	Examinations	I	1-10	at least 5.5
	A19WIS1	2	A19WIS1	Examinations	I	1-10	at least 5.5
	A19WIS2	2	A19WIS2	Examinations	I	1-10	at least 5.5
	A19WIS3	2	A19WIS3	Examinations	I	1-10	at least 5.5
	A19WIS4	2	A19WIS4	Examinations	I	1-10	at least 5.5

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.