

ECQA Certified Electric Powertrain Engineer

5 Days Training



Background

One of the main technological challenges forced by CO2 reduction regulations in the automotive sector nowadays is the need to develop and implement efficient electric powertrains. To be able to cope with this change and be able to propose innovative solutions, engineers must be able to understand the domain-specific knowledge. In this paper, we introduce the skill set defined as the basic knowledge of the electric powertrain engineer and present the pilot course implementation developed to cover the needed skills. The skill card is based on the analysis of different stakeholders' viewpoints and combined views from different technical domains; mainly mechanical, electronics, and software engineering.

The ECQA Certified Electric Powertrain Engineer project (ECEPE) is co-funded by the Erasmus+ Call 2019 Round 1 KA203 Programme of the European Union under the agreement 2019-1-CZ01-KA203-061430. This work is partially supported by Grants of SGS No. SP2021/87 and SP2021/49, VSB - Technical University of Ostrava, Czech Republic.

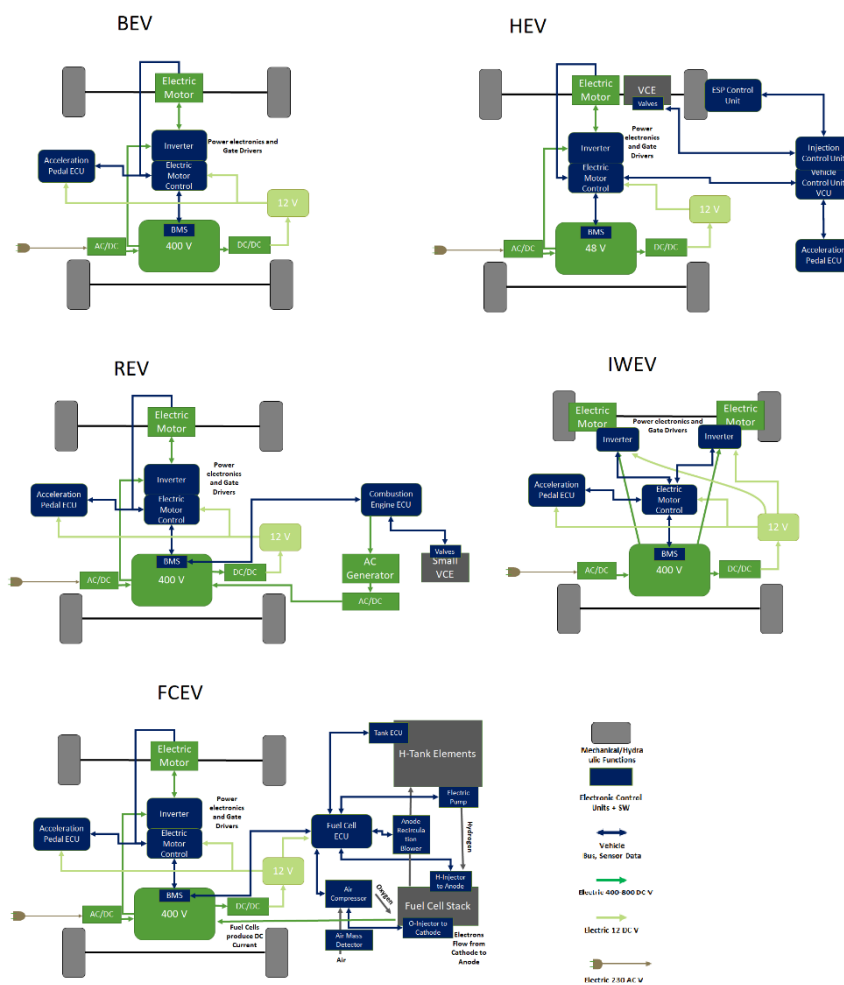
Based on the defined scope and skills requirements described in the previous section, we have established the structure of the electric powertrain (ePowertrain) skill card as follows:

- **U.1 Introduction**
 - U1.E1 ePowertrain Engineer
 - U1.E2 Product life cycle
 - U1.E3 Product homologation and standards
 - U1.E4 Embedded automotive systems
 - U1.E5 ePowertrain Architecture
- **U.2 System engineering (Function-based-Development)**
 - U2.E1 Function-Based Development
 - U2.E2 Functional Safety Aspects
 - U2.E3 Cyber Security aspects
- **U.3 Propulsion systems**
 - U3.E1 eMotor

- U3.E2 Power electronics, inverters
- U3.E3 Motor control unit
- U3.E4 Hybrid control systems
- U3.E5 Energy transformation systems
- U3.E6 Transmission systems
- **U.4 Energy Storage Systems**
 - U4.E1 Battery systems
 - U4.E2 Battery management systems
 - U4.E3 Fuel cells
- **U.5 Life Cycle Management**
 - U5.E1 Product life cycle
 - U5.E2 Life Cycle Management and Business Models

From the technical perspective, there are several electric powertrain concepts being used and developed nowadays (see Fig. below):

- Battery Electric Vehicle (BEV),
- Hybrid Electric Vehicle (HEV),
- Range Extender Electric Vehicle (REV),
- Fuel Cell Electric Vehicle (FCEV),
- In Wheel Concept of an Electric Vehicle (IWEV)



ISCN is a certified training partner of VDA-QMC and iNTACS for Automotive SPICE.

<http://www.intacs.info/index.php/component/weblinks/category/122-training-organisation>

The project partners are a certified training body of the ECQA (European Certification and Qualification Organisation) Certified Electric Powertrain Engineer.

<http://www.ecqa.org>



The course is based on a joined development of the ECEPE consortium, and the skill card was reviewed by leading Tier 1 companies in the Soqrates group (www.soqrates.de) such as ZF Friedrichshafen AG, Continental Automotive AG, Hella KG, etc.

The online training will be held in the EuroSPI Academy platform, which is maintained by SCN. All partners contribute to the EuroSPI conference series. A white paper has been published in the EuroSPI SPRINGER book series.

<https://academy.eurospi.net/>

<https://2021.eurospi.net/>

Electric Powertrain Engineer Course

In this 5 days training course the attendees get introduced to the different architectural concepts of electric powertrains. The participants will participate actively be involved in case studies and elaborate on the concepts of an electric powertrain architecture.

The approach of „Learning by Doing“ is used to elaborate different forms of electric powertrains, analyze advantages and disadvantages, do a safety analysis and elaborate questions concerned with motor control.

The training modules are based on the skills set structure.

- **Training Module U.1 Introduction**
 - o Lecture U1.E1 ePowertrain Engineer
 - o Lecture U1.E2 Product life cycle
 - o Lecture U1.E3 Product homologation and standards
 - o Lecture U1.E4 Embedded automotive systems

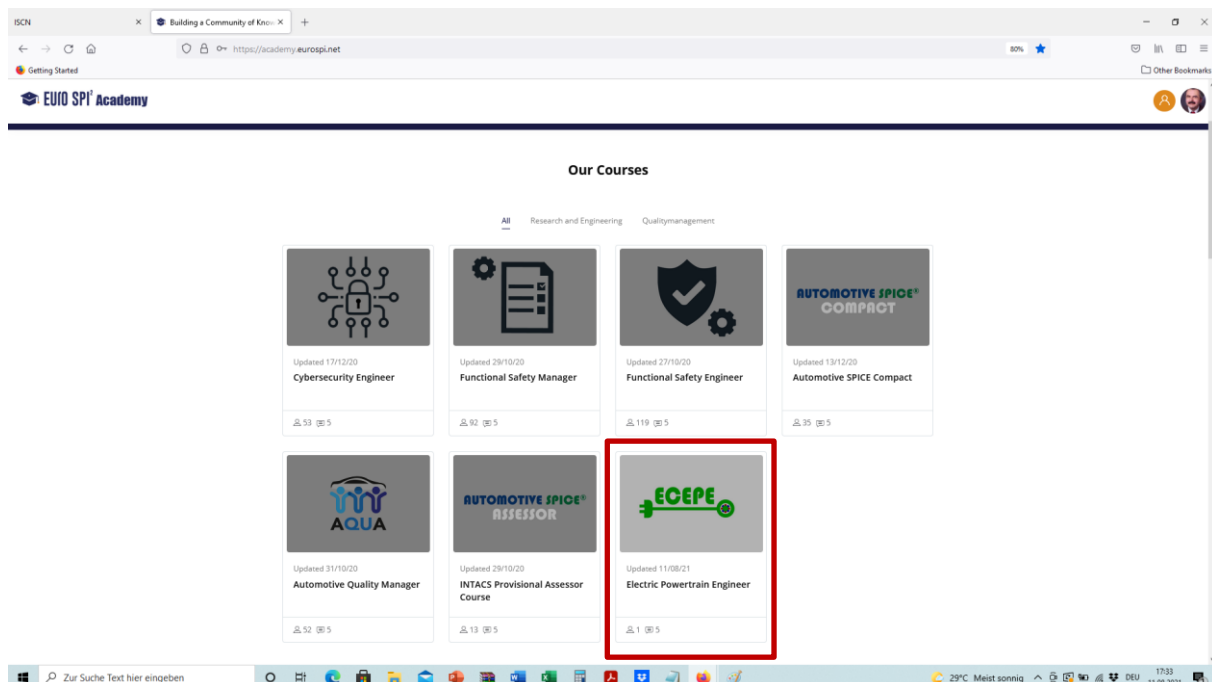
- Lecture U1.E5 ePowertrain Architecture
- **Training module U.2 System engineering (Function-based-Development)**
 - Lecture U2.E1 Function-Based Development
 - Lecture U2.E2 Functional Safety Aspects + Exercise
 - Lecture U2.E3 Cyber Security aspects + Exercise
- **Training module U.3 Propulsion systems**
 - Lecture U3.E1 eMotor
 - Lecture U3.E2 Power electronics, inverters
 - Lecture U3.E3 Motor control unit + Interactive Session for Exercise
 - Lecture U3.E4 Hybrid control systems
 - Lecture U3.E5 Energy transformation systems + Exercise
 - Lecture U3.E6 Transmission systems + Exercise
- **Training module U.4 Energy Storage Systems**
 - Lecture U4.E1 Battery systems + Exercise
 - Lecture U4.E2 Battery management systems + Exercise
 - Lecture U4.E3 Fuel cells + Exercise
- **Training module U.5 Life Cycle Management**
 - Lecture U5.E1 Product life cycle
 - Lecture U5.E2 Life Cycle Management and Business Models + Interactive Discussion

Resources

ECEPE Materials

The course materials and lectures are online available on the EuroSPI Academy platform. The materials will be provided latest till 10.9.2021.

<https://academy.eurospi.net/>



- Select the course Electric Powertrain Engineer (is accessible from June 2021)
- Register

- You will receive an email and need to confirm by clicking the link in your email.
- Then you can login
- You need the enrollment key **-will be provided -**

Generic Course Schedule

The training plan for the week is based on the unit structure of the skills set and the size of the teaching elements / lectures.

Time	Monday	Tuesday	Wednesday	Thursday	Friday
08.00-12.00	Training Module U.1 Introduction	Training module U.2 System engineering	Training module U.3 Propulsion systems	Training module U.4 Energy Storage Systems	Training module U.4 Energy Storage Systems
13.00-17.00	Training module U.2 System engineering	Training module U.3 Propulsion systems	Training module U.3 Propulsion systems	Training module U.4 Energy Storage Systems	Training module U.5 Life Cycle Management

A more detailed schedule for the 5 days can be found below:

	#Slides	Exercise	Presentatio n in mins	Exercise in mins	Who	Hours without coffee breaks
Training Module U.1 Introduction (available 4 hours.)						
Lecture U1.E1 ePowertrain Engineer	15	no	30		TUG	
Lecture U1.E2 Product life cycle		no			TUG	
Lecture U1.E3 Product homologation and standards	39	no	60		TUS	
Lecture U1.E4 Embeded automotive systems	26	no	60		TUG	
Lecture U1.E5 ePowertrain Architecture	12	no	30		ISCN	3
Training module U.2 System engineering (Function-based-Development) (available 8 hours)						
Lecture U2.E1 Function-Based Development	24	no	60		ISCN	
Lecture U2.E2 Functional Safety Aspects + Exercise	40	yes	90		90 ISCN	
Lecture U2.E3 Cyber Security aspects + Exercise	26	yes	60		90 TUG	6,5
Training module U.3 Propulsion systems (available 12 hours)						
Lecture U3.E1 eMotor	51	no	90		VSB/TUO	
Lecture U3.E2 Power electronics, inverters	35	no	60		VSB/TUO	
Lecture U3.E3 Motor control unit + Interactive Session for Exercise	38	yes	90		90 ISCN/TUG	
Lecture U3.E4 Hybrid control systems	39	no	90		VSB/TUO	
Lecture U3.E5 Energy transformation systems + Exercise	28	no	60		TUS	
Lecture U3.E6 Transmission systems + Exercise	42	yes	90		90 TUS	11
Training module U.4 Energy Storage Systems (available 12 hours)						
Lecture U4.E1 Battery systems + Exercise	16	no	30		90 VSB/TUO	
Lecture U4.E2 Battery management systems + Exercise	26	no	60		TUG	
Lecture U4.E3 Fuel cells + Exercise	28	no	60		TUS	4
Training module U.5 Life Cycle Management (available 4 hours)						
Lecture U5.E1 Product life cycle	8	no	60		HSD	
Lecture U5.E2 Life Cycle Management and Business Models + Interactive Discussion	45	yes	60		60 HSD	3

Training – 27.9.-1.10.2021

The training plan for the week is based on the unit structure of the skills set and the size of the teaching elements / lectures.

Time	27.09.2021	28.09.2021	29.09.2021	30.09.2021	01.10.2021
08.00-12.00	Training Module U.1 Introduction	Training module U.2 System engineering	Training module U.3 Propulsion systems	Training module U.4 Energy Storage Systems	Training module U.4 Energy Storage Systems
13.00-17.00	Training module U.2 System engineering	Training module U.3 Propulsion systems	Training module U.3 Propulsion systems	Training module U.4 Energy Storage Systems	Training module U.5 Life Cycle Management

MS Teams Links

Will be provided

This course is based on practical Automotive examples from electric powertrain examples.