# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Advanced IT systems in vehicles [S2Elmob1-SSP>ZSTwP]

## Course

Field of study
Electromobility

Year/Semester
1/2

Area of study (specialization)
Car Onboard Systems

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

## Number of credit points

2,00

## Coordinators

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## Lecturers

## Prerequisites

Knowledge of the basics of electronics in the field of analog electronics, transmission lines, radio communication. Knowledge of standard ICT network models. Knowledge of basic topology concepts, ability to solve simple optimization tasks, taking into account collisions. Basic knowledge of organized and informal traffic rules (road, land, sea, space) and principles of designing proper and supporting infrastructure.

## Course objective

The aim of the course is to introduce the latest scientific and technical solutions regarding communication networks in vehicles. The vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle-to-everything (V2X) technologies presented here aim to provide communication models that can be used by vehicles in a variety of application contexts. The infrastructure currently being analysed is an ad-hoc mesh network with not only vehicles nodes, but all mobile and stationary devices equipped with wireless transceivers. The aim of the subject is to show the need for interaction between many connected nodes (vehicles and infrastructure), which involves the exchange of information by using appropriate discussed and analyzed communication protocols. The main objective of the course is to examine and evaluate systems, applications and communication protocols that will distinguish contemporary and future on-board and road infrastructure used by vehicles. As part of the project, students solve selected problems of telecommunications networks in an environment with vehicles. After completing the track, the student should be able to analyze and design a functional diagram of the ICT network in vehicles.

## Course-related learning outcomes

Knowledge:
Has extended and systematized knowledge in the field of designing algorithms and programming microcontrollers used in vehicles, as well as standards and the use of communication interfaces for exchanging data with vehicle components.
Has basic knowledge of data protection, IT system security, risk analysis and threat modeling in vehicle IT systems.

Skills:
Is able to design, manufacture and integrate ICT, electronic, power electronic and drive systems and systems intended for hybrid and electric vehicles, including traction vehicles.
Is able to integrate knowledge from various sources and related disciplines when formulating and implementing engineering projects.

Social competences:
He understands that in the field of technology, knowledge and skills devalue quickly, which requires constant supplementation.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:
Preparation for the final colloquium. Passing from 50% of points.
Project:
Final seminar in the form of presenting a solution to the problem solved during the project implementation, additional assessment of progress during project classes.

## Programme content

Intelligent transportation systems
Theory and application of vehicular networks
Vehicle-Infrastructure Cooperation
Inter-Vehicle Communications System
Vehicular network (VN) model
Mobile Ad Hoc Routing in the Context of Vehicular Networks
Evaluation of vehicular network models
Models for Traffic Flow and Vehicle Motion
Big Data collision analysis framework
Future trends and challenges in Inteligent Transport Systems

## Course topics

Intelligent transportation systems
Theory and application of vehicular networks

Vehicle-Infrastructure Cooperation
Inter-Vehicle Communications System
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## Teaching methods

Lecture:
Blackboard and multimedia with elements of hardware experiments.
Project:
Simulation experiments on emulated stations, final study of the selected problem.

## Bibliography

Basic:
Christoph Sommer, Falko Dressler, Vehicular Networking, Cambridge University Press, 2014, ISBN: 978-1107046719
Tao Zhang, Luca Delgrossi, Vehicle Safety Communications: Protocols, Security, and Privacy, John Wiley & Sons, Ltd, 2012 ISBN: 978-1118132722
Lukas Neckermann, Smart Cities, Smart Mobility: Transforming the Way We Live and Work, Troubadour Publishing Ltd, 2017, ISBN: 978-1788030540
Anand Paul, Naveen Chilamkurti, Alfred Daniel, Seungmin Rho, Intelligent Vehicular Networks and Communications, 2016, Elsevier, ISBN: 978-0128092668

Additional:
Dale Stacey, Aeronautical Radio Communication Systems and Networks, John Wiley & Sons, Ltd, 2008, ISBN: 9780470018590
Emilie Masson, Marion Berbineau, Broadband Wireless Communications for Railway Applications: For Onboard Internet Access and Other Applications, Springer International Publishing, 2017, ISBN: 978-3-319-47202-7
World Health Organization (WHO), World report on road traffic injury prevention.
https://www.who.int/publications-detail/world-report-on-road-traffic-injury-prevention

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 55 | 2,00 |
| Classes requiring direct contact with the teacher | 30 | 1,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 25 | 1,00 |