COURSE DESCRIPTION CARD - SYLLABUS

Course name
Road vehicles construction [S1MiTPM1>BPD]

Course

Field of study
Materials and technologies for automotive industry

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

dr inż. Filip Szwajca
filip.szwajca@put.poznan.pl

dr hab. inż. Wojciech Cieślik
wojciech.cieslik@put.poznan.pl

prof. dr hab. inż. Ireneusz Pielecha
ireneusz.pielecha@put.poznan.pl

Lecturers

Prerequisites

The student has basic knowledge of technology and the laws of physics. The student is able to integrate information obtained, interpret it, draw conclusions.

Course objective

To provide students with information on the construction and operation of road vehicle systems, assemblies and mechanisms as well as internal combustion engines and hybrid drive components

Course-related learning outcomes

Knowledge:
Has a basic knowledge of engineering design, in particular technological and material design in the automotive industry. Has knowledge of technical devices and systems and their principles of operation

in the area of automotive industry.

Skills:
Be able to analyse, evaluate and solve technical problems of the automotive industry applying knowledge from the field of materials science and technology. Can assess the suitability of standard methods and tools for solving simple engineering tasks of a practical nature specific to materials and technologies of the automotive industry and select and apply appropriate methods and tools.
Be able to identify and formulate simple engineering problems of a practical nature, characteristic of the automotive industry, including in particular the selection of materials and technologies for the manufacture of specific parts of vehicles including with the use of computer assisted design.

Social competences:
He/she is able to interact, think and act in an entrepreneurial manner and work in a group, assuming different roles in it.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired in the lecture is verified by a written colloquium.
Compulsory individual reports from laboratory classes. Final credit of laboratory classes.

Programme content

Construction and principle of operation of the basic systems of motor vehicles (power train, braking system, steering system, running gear). Bodywork of motor vehicles (universal and specialised). Driving safety and comfort systems. Vehicle lighting.

Course topics

1. Power transmission system. Automotive clutches. Gearboxes. Drive shafts and joints. Main transmissions and differentials. Drive wheel half-shafts and hubs.
2. Braking system. Types of brake systems. General construction and principle of operation of the braking system. Drum brakes. Disc brakes. Brake actuation mechanisms. Hydraulic service brake actuation mechanism. Electro-hydraulic and electro-mechanical brake actuation mechanism. Pneumatic brake actuation mechanism for trucks and buses. Electro-pneumatic brake actuation mechanisms. Parking brake actuators. Brake force distribution systems. Endurance brakes.
3. Steering system. Steadiness of car movement. Types of steering systems. Structure of the steering system. Steering mechanism. Steering mechanism. Power steering mechanisms. Special steering systems. Active steering systems.
4. Driving system. Vehicle vibrations and their effect on driving comfort and safety. Suspension system. Types of vehicle suspensions. Suspensions with steel spring elements. Suspensions with rubber and plastic spring elements. Suspensions with pneumatic spring elements. Hydropneumatic suspensions. Active electromagnetic suspensions. Semi-active suspensions with adjustable damping. Wheels. Construction and types of tyres. Tyre designations. Tyre requirements. Rims.
5. Vehicle bodies. Bodywork division. Bodywork construction. Universal and specialised utility bodies. Refrigerated vehicles. Bulk material transport vehicles. Special truck bodies.
6. Body equipment. Refrigeration and air-conditioning equipment.
7. Safety (active and passive) and comfort systems. Vehicle lighting. Legal requirements, types of lighting, varieties and characteristics of different light sources.
8. Division of combustion engines and their development trends. Conventional and low-emission fuels
9. Components of combustion engines and their materials. Internal combustion engine systems: crank-system; injection; intake; outlet et al. Modern materials in the construction of engine components
10. Division of hybrid powertrains: functional and structural; solutions.
11. Construction of hybrid powertrain: hybrid propulsion design, operating strategy.
12. Hybrid propulsion solutions in passenger cars, trucks and buses
13. HV and EV batteries.
14. Elements of electric powertains and their cooling.
15. Fuel cells: solutions, structure, operation.
Laboratory:
1. Construction and operation of gearboxes.

2. Air and hydraulic brakes on vehicles.
3. Construction of the steering system.
4. Basic components of the suspension system.
5. Refrigeration bodies.
6. Refrigeration and air conditioning equipment.
7. Vehicle lighting.
8-9. Assembly and disassembly of the combustion engine
10. Testing engine operating parameters
11. Emission test of an internal combustion engine
12. Analysis of the hybrid powertrain
13. Operating conditions of the hybrid powertains
14. Types of fuel cells and their structure
15. Analysis of fuel cell operating conditions

Teaching methods

Lecture with multimedia presentation.
Laboratory classes: performance of tasks given by the instructor - practical exercises.

Bibliography

Basic:
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Luft S., Podstawy budowy silników. WKŁ, Warszawa 2009
Kowalewicz A., Wybrane zagadnienia samochodowych silników spalinowych. Wydawnictwo WSI, Radom 1996.
Kneba Z., Makowski S., Zasilanie i sterowanie silników. WKŁ, Warszawa 2004
Gajek A., Juda Z., Czujniki, WKŁ, Warszawa 2008
Merkisz J., Pielecha I.: Układy mechaniczne pojazdów hybrydowych. Wydawnictwo Politechniki Poznańskiej, Poznań 2015.
Merkisz J., Pielecha I.: Układy elektryczne pojazdów hybrydowych. Wydawnictwo Politechniki Poznańskiej, Poznań 2015

Additional:
Heising B., Ersoy M.: Chassis Handbook. Vieweg + Teubner Verlag, Wiesbaden, 2011
Meywerk M.: Vehicle dynamics. John Wiley & Sons Ltd, Chichester, 2015
Combustion Engines Magazine, www.combustion-engines.eu

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50