# STUDY MODULE DESCRIPTION FORM

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|---|---|---|
| Name of the module/subject<br>**DESIGN OF ROAD VEHICLE SUBASSEMBLIES** | | Code<br>**1010611161010613059** |
| Field of study<br>**Mechanical Engineering** | Profile of study (general academic, practical)<br>**(brak)** | Year /Semester<br>**3 / 6** |
| Elective path/specialty<br>**Motor Vehicles and Tractors** | Subject offered in:<br>**Polish** | Course (compulsory, elective)<br>**obligatory** |
| Cycle of study:<br>**First-cycle studies** | Form of study (full-time,part-time)<br>**full-time** | |
| No. of hours<br>Lecture: **2** Classes: **-** Laboratory: **-** Project/seminars: **1** | | No. of credits<br>**3** |
| Status of the course in the study program (Basic, major, other)<br>**(brak)** | (university-wide, from another field)<br>**(brak)** | |
| Education areas and fields of science and art<br>**technical sciences**<br>**Technical sciences** | | ECTS distribution (number and %)<br>**2 66%**<br>**1 33%** |

## Responsible for subject / lecturer:

Marek Maciejewski
email: marek.maciejewski@put.poznan.pl
tel. 61 665 27 75
Faculty of Machines and Transport
ul. Piotrowo 3, 60-965 Poznań

## Prerequisites in terms of knowledge, skills and social competencies:

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|---|---|---|
| 1 | **Knowledge** | Basic knowledge from the range of technical drawing, construction of machines, road vehicle construction, and theory of car movement. Familiarity with fundamental principles of conducting the strength and fatigue analyses. |
| 2 | **Skills** | Understanding the basic principles of design. Ability of adapting the computational process to the performed task, the choice and using relations from the scope of calculations of traction, geometrical structures, strength and fatigue. Usage of the spreadsheet. |
| 3 | **Social competencies** | Determining the hierarchy and the schedule of tasks during designing the standard mechanical structures. Ability of the identification of problems and settling computational-structural dilemmas. Self-reliance. |

## Assumptions and objectives of the course:

Communicating for students the fundamental information about designing the car systems and their components, and especially designing methods of power transmission systems and their elements, designing methods for thinwalled (shell and framed) car supporting systems, and also designing methods for steering, suspension and braking systems.

## Study outcomes and reference to the educational results for a field of study

### Knowledge:

1. Knows ways of the selection and configuration of driving systems according to the type, size and tasks of the vehicle - [K1A_W08]
2. Has a knowledge about design of subassemblies and elements of power transmission systems in motor vehicles - [K1A_W10]
3. Knows principles and algorithms for calculating the strength and the material selection for elements of power transmission systems - [K1A_W24]
4. Knows principles of determining the kinematic and dynamic parameters for systems and subassemblies of vehicles - [-]
5. Has knowledge about designing the other (than the power train) car systems and mechanisms - [-]

### Skills:

1. Is able to design elements, subassemblies and vehicles fulfilling the relevant geometric, strength, fatigue and functional requirements - [K1A_U08]
2. Knows to match standardized parts and assemblies - [K1A_U11]
3. Knows to select construction materials for elements, properties of their surface layers, fits of collaborative parts - [K1A_U16]
4. In case of alternative solutions, can choose the optimum solution - [K1A_U23]

### Social competencies:

1. Is able independently to define priorities in the design of a power transmission system and other car systems and mechanisms - [K1A_K02]
2. Is able to cooperate with other people which simultaneously project other vehicle systems - [K1A_K04]
3. Understands the need of applying the solutions which ensure a road safety and environmental protection - [-]

## Assessment methods of study outcomes

Written examination of lecture material, and credit project classes on the basis of results of the personal project task.

## Course description

Power transmission systems for passenger cars, delivery vans and trucks. Classification of power transmission systems in passenger cars. Designing the disc clutches - algorithms to compute the clutch disc geometry, disc clutch and (coil and conical central) pressure springs durability. Types of mechanical gearboxes. Selection of the basic parameters: the centre distance, the reference diameter and the width of toothed-wheel rim, number of teeth, the helix angle and the angle of obliquity, the centre distance change coefficient, the working normal module, the addendum, and the geat tooth modifications. The addendum modification coefficients and the centre distance. The diameters of cylindrical gear. Accuracy classes. Materials. Heat treatment. The strength and fatigue life of cylindrical gear pair in vehicle power transmission systems. Safety factors. The circumferential force. The check of tooth strength: for fatigue bending at tooth root, and for pitting at pitch diameter. Taking into consideration of variable load levels. Synchromesh units: synchronization torque, synchronization point and thermal loads. The synchronizers with blocking rings and their shortcomings. The inertial (Porsche-type) synchronisers. Fatigue life of rolling bearings in gearboxes. Average and equivalent loads. Tooth forces: circumferential, radial and longitudinal (axial). The bearing loads: transverse and longitudinal ones. The bearing selection the comparison od basic and adjusted rating life with required life. Live axles with hypoid and bevel final drives. Selection of the basic parameters for crown wheel and pinion of the final drive. Fatigue life of rolling bearings in final drive. Half shafts: assumed loads and the calculation of half shaft strength. Design methods for thin-walled (shell and framed) vehicle body systems. Car Suspension - choice of geometry. Analysis of the kinematics of vehicle suspension. Suspension stabilization - selection and calculation. Analysis of suspension dynamics: the selection of the stiffness and damping. Calculation of leaf springs, coil springs, pneumatic springs and telescopic shock absorbers. Classification of braking systems. Hydraulic braking systems: calculation of drum and disc brakes, and brakeforce controllers. Compressed air (pneumatic) brake systems: calculation of valves and brake chambers. Selection of the air compressor and compressed air reservoirs. Calculation of drum and disc brakes for compressed air brake systems. The steering systems: kinematic relationships and calculations for the dependent and independent suspension front suspension. Power steering.

## Basic bibliography:

1. Jaśkiewicz Zb., Projektowanie układów napędowych pojazdów samochodowych, WKiŁ, Warszawa, 1982
2. Jaśkiewicz Zb., Wąsiewski A., Układy napędowe pojazdów samochodowych: obliczenia projektowe, OWPW, Warszawa, 2002
3. Poradnik inżyniera samochodowego (red. Jaśkiewicz Zb.), WKiŁ, 1990
4. Reński A., Budowa samochodów: układy hamulcowe i kierownicze oraz zawieszenia, OWPW, Warszawa, 2004
5. Rusiński E.: Zasady projektowania konstrukcji nośnych pojazdów samochodowych, OWPW, Wrocław, 2002
6. Stańczyk T.L., Lomako D., Komputerowe obliczenia zespołów samochodów i ciągników, WPŚ, Kielce, 2004

## Additional bibliography:

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| 1. Participation in lectures | 30 |
| 2. Lecture consultation | 1 |
| 3. Preparation for the egzam | 15 |
| 4. Admission to the egzamination | 1 |
| 5. Participation in project classes | 15 |
| 6. Drawing up the report on project tasks | 20 |
| 7. Project consultations | 2 |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 84 | 3 |
| Contact hours | 49 | 2 |
| Practical activities | 35 | 1 |