

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Designing of subassemblies of cars		Code 1010614161010613059
Field of study Mechanical Engineering	Profile of study (general academic, practical) (brak)	Year /Semester 3 / 6
Elective path/specialty Motor Vehicles and Tractors	Subject offered in: Polish	Course (compulsory, elective) obligatory
Cycle of study: First-cycle studies	Form of study (full-time, part-time) part-time	
No. of hours Lecture: 14 Classes: - Laboratory: - Project/seminars: 10		No. of credits 3
Status of the course in the study program (Basic, major, other) (brak)		(university-wide, from another field) (brak)
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 2 67% 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:		
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 gear 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 of 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, WPS, 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