



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Technical components and economics of transport

### Course

Field of study

Aerospace Engineering

Area of study (specialization)

Safety and Management of Aviation

Air Transport

Level of study

Form of study

Year/Semester

3/5

Profile of study

general academic

Course offered in

polish

Requirements

elective

### Number of hours

Lecture

90

Laboratory classes

30

Other (e.g. online)

Tutorials

15

Projects/seminars

### Number of credit points

12

### Lecturers

Responsible for the course/lecturer:

dr inż. Szymon Fierek

email: [szymon.fierek@put.poznan.pl](mailto:szymon.fierek@put.poznan.pl)

tel. 616652716

prof. dr hab. inż. Krzysztof Wiślocki

email: [krzysztof.wislocki@put.poznan.pl](mailto:krzysztof.wislocki@put.poznan.pl)

tel. 61 665 22 40

Wydział inżynierii Lądowej i Transportu

ul. Piotrowo 3, 60-965 Poznań

Responsible for the course/lecturer:

dr inż. Damian Frąckowiak

email: [damian.frackowiak@put.poznan.pl](mailto:damian.frackowiak@put.poznan.pl)

tel. 61 665 2054

Wydział Inżynierii Mechanicznej

ul. Piotrowo 3, 60-965 Poznań

### Prerequisites

Knowledge: The student has basic knowledge about economic phenomena, including the market mechanism and the specifics of making economic decisions by market entities. The student has basic knowledge in the field of mechanics, physics, chemistry, technical drawing, strength of machine construction materials, fluid mechanics, basics of automation and electrical engineering.



**Skills:** The student is able to integrate obtained information, analyze phenomena occurring in the environment, draw conclusions, formulate and justify opinions. The student knows how to explain the essence of processes and phenomena occurring in internal combustion engines, shows technical thinking, reading and understanding of construction drawings, associating cause-and-effect relationships in mechanics, physics, chemistry. The student is able to solve simple problems in the field of fluid mechanics and the basics of machine construction

**Social competences** The student is able to work independently, search for information in the literature, knows the principles of discussion and work in a group, taking different roles in it. The student is able to determine the priorities important in solving the tasks set before him. The student demonstrates independence in solving problems, gaining and improving acquired knowledge and skills. The student shows interest and motivation to learn about contemporary technical solution

### Course objective

The aim of the course is to provide students with information on the general structure of flow and piston internal combustion engines and the functioning of modern engines and the essence of differences between its various types. Explanation of the physical and thermodynamic foundations of piston heat engines, knowledge of the structure, principles of hydraulics and pneumatics, and knowledge of the basic propulsion and control systems. Explanation of the nature and course of individual components of primary (chemical) energy conversion into mechanical energy. Indication of the basic design and functional features of individual components and systems of internal combustion engines. Explanation of the possibilities to shape and control the required performance characteristics of internal combustion engines. In addition, the purpose of the subject is also to deepen knowledge of the specifics of the transport sector and the behavior of transport companies and the economics of their operation.

### Course-related learning outcomes

#### Knowledge

1. Has basic knowledge necessary to understand social, economic, legal and other non-technical conditions of engineering activities - [K1A\_W24]
2. Has general knowledge of vehicle drives useful for formulation and solving simple engineering tasks - [K1A\_W14]
3. Knows the basic methods, techniques and ways of describing internal combustion engines - [K1A\_W18]
4. Has detailed knowledge of internal combustion engine solutions - [K1A\_W21]
5. Has basic knowledge in the field of fluid mechanics focused on hydraulic and pneumatic drives - [K1A\_W04]
6. Has basic knowledge in the field of construction and functioning of hydraulic and pneumatic drives and systems constituting the area of the foundations of machine construction - [K1A\_W13]



### Skills

1. Has the ability to self-study using modern teaching tools, such as remote lectures, websites and databases, teaching programs, electronic books - [K1A\_U03]
2. Is able to use formulas and tables, technical and economic calculations using a spreadsheet and running a simple relational database - [K1A\_U05]
3. Is able to use analytical and experimental methods to formulate and solve tasks related to internal combustion engines in vehicles - [K1A\_U02]
4. Is able to obtain information from literature, identify them and formulate conclusions specific to engines - [K1A\_U01]
5. Is able to plan and conduct engine experiments - [K1A\_U07]
5. Is able to plan and perform measurements in hydraulic and pneumatic systems as well as interpret results and draw conclusions - [K1A\_U07]
6. Can draw freehand basic elements and diagrams of hydraulic and pneumatic systems in accordance with the principles of technical drawing, according to European standards - [K1A\_U12]
7. Is able to design a technology for the implementation of a simple hydraulic and pneumatic system - [K1A\_U14]

### Social competences

1. Is able to interact and work in a group, taking on various roles in it - [K1A\_K03]
2. Is able to properly set priorities for the implementation of the task specified by himself or other - [K1A\_K04]
3. Understands the need and knows the possibility of continuous training, knows the need to acquire new knowledge for professional development - [K1A\_K01]
4. Is able to think and act in an entrepreneurial way, make decisions, act for the development of the employer and society - [K1A\_K07]
5. Is aware of the transfer of acquired knowledge to the public, makes efforts to understand this information - [K1A\_K08]

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam, final test, calculation exercises, laboratory exercises

Exercises - assessment of students' activity during classes and presentations on the issues discussed .

Lectures - average taking into account the activity of students during classes and written credit from processed material.



## Programme content

1. Entities of the transport market. Types of transport entities. Competition models on the market transport.
2. Strategies on the transport market. Division of strategies. Typical strategies of transport companies road, LTS sector and air transport.
3. Impact on the functioning of regulatory economy processes.
4. Cooperation and capital concentration in the transport sector (strategic alliances, mergers, acquisitions)
5. Economic problems of the development of transport enterprises in Poland in the context of transformation related to functioning on the common European market.
6. Prospects for market development. Opportunities and threats for the development of partial markets in the sector transport.
7. The principle of operation of a piston internal combustion engine and basic components.
8. Division of engines and their application.
9. Comparative cycle, types and analysis.
10. Theoretical cycle and real cycle.
11. Process parameters in real circulation.
12. Basics of thermal calculations.
13. Engine operating indicators.
14. Characteristics of internal combustion engines.
15. Heat balance.
16. Rules for creating the mixture and regulating the load.
17. Division of combustion systems and their design features.
18. Combustion process.
19. Working principle, construction and characteristic features of two-stroke engines.
20. Trends and development directions in internal combustion engines.
21. Operating principles of fluid drives, basic parameters, characteristics, properties.
22. Applications of hydraulic drives. Elements of hydraulic systems: pumps, valves, engines, actuators, batteries.



23. Control and regulation of hydraulic drives. Hydrostatic systems: volumetric, throttling, proportional.
24. Torque converter, hydrostatic transmission.
25. Hydraulic servo drives.
26. General principles for the design of hydraulic systems.
27. Structure of the pneumatic drive and control system.
28. Actuating and controlling elements of pneumatic systems.
29. Basic pneumatic drive and control systems.
30. General principles for the design of pneumatic control and drive systems

Classes:

- 1 Costs structure of transport companies. Cost of production of transport services total and unit transport cost calculations. The efficiency of transport services, the mechanism of concessions.
- 2 Prices of transport services. Principles and rules of pricing the transport services . Factors that impact on prices. Methods of pricing - contracts and tariff. Calculation of fees according to the rates and tariffs.
- 3 Leasing of transport means: Calculation of fees for rental - modal approach.
- 4 Purchase of transport means: Calculation of the cost of purchases including the projected income, the average variable cost of producing the services and interest rates.
- 5 Depreciation in transport companies: Types of depreciation. The concept of depreciation. Methods of calculating depreciation - linear method and degressive method

### Teaching methods

Informative lecture (conventional) (information transfer in a systematic way) - may have course (propedeutic) or monographic (specialist)

Exercise method (subject exercises, exercises) - in the form of auditorium exercises

(applying the acquired knowledge in practice - it can take on a different nature: solving cognitive tasks or training psychomotor skills; transforming conscious activity into a habit through repetition).

Laboratory (experiment) method (students conduct experiments independently)

### Bibliography

Basic

1. Ciesielski M., Szudrowicz A., *Ekonomika Transportu*, Wydawnictwo Akademii Ekonomicznej w Poznaniu, Poznań 2001.1.



2. Kowalewicz A.: Doładowanie silników spalinowych. Politechnika Radomska 1998 r.
3. Kozłak A., Ekonomika transportu. Teoria i praktyka gospodarcza. Wydawnictwo Uniwersytetu Gdańskiego. Gdańsk, 2008
4. Liberadzki B. (red), Mindur L., Uwarunkowania rozwoju systemu transportowego Polski, Wydawnictwo Instytutu Technologii Eksploatacji, Warszawa -Radom 2006
5. Mendyk E.: Ekonomika i organizacja transportu. WSzL, Poznań 2002.
6. Mysłowski J.: Doładowanie silników spalinowych. WKiŁ, Warszawa 2002 r.
7. Osiecki A.: Hydrostatyczny napęd maszyn?. WNT, Warszawa , 2004.
8. Rychter T., Teodorczyk A.: Teoria silników tłokowych. WKiŁ, Warszawa 2006, ss. 270
9. Stajniak M., Hajdul M., Foltyński M., Krupa A., Transport i spedycja, Biblioteka Logistyki, Poznań 2005.
10. Stryczek St.: Napęd hydrostatyczny ? elementy. WNT, Warszawa, 2003.
11. Szenajch W.: Napęd i sterowanie pneumatyczne?. WNT, Warszawa, 2003. Button K. J., 1993. Transport Economics. Publisher Edward Elgar; 2nd edition. Cheltenham Glos1.
12. Wiślocki K.: Systemy doładowania szybkoobrotowych silników spalinowych. WKiŁ, Warszawa 1992, ss. 356

#### Additional

1. Zinner K.: Aufladung von Verbrennungsmotoren, Springer-Verlag, I-IV Auflage, -1985
2. Watson N., Janota M.: Turbocharging the internal combustion engines, The MacMillan Press Ltd., London 1982
3. Pucher H.: Aufladung von Verbrennungsmotoren. Kontakt und Studium, B. 133, Expert Verlag 1985
4. Hiereth H., Prenninger P.: Aufladung von Verbrennungskraftmaschinen. Springer Verlag, 2003

#### Breakdown of average student's workload

	Hours	ECTS
Total workload	300	12,0
Classes requiring direct contact with the teacher	225	9,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	75	3,0

<sup>1</sup> delete or add other activities as appropriate