COURSE DESCRIPTION CARD - SYLLABUS

Course name

Supercharging the Internal Combustion Engines

Course

Field of study

Mechanical and Automotive Engineering

Year/Semester

1/2

Area of study (specialization)

Hybrid powertrain systems

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

15

Projects/seminars

0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

prof. dr hab. inż. Krzysztof Wisłocki

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tel. 61-6652240

Wydział Inżynierii Lądowej i Transportu

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Responsible for the course/lecturer:

Filip Szwajca, ME, Doctoral Student

Prerequisites

Completion of basic courses in mechanics, physics, thermodynamics, technical drawing, theory of IC engines

Course objective

Teaching the students of foundamentals, definitions and principles of supercharging in combustion engines as of the method of power concentration incresing in combustion engines. Student are getting familiar with possible methods of supercharging and their restrictions; systematization od charging methods and charging control. Describing and explonation of full-load characteristic shaping by application of the variety of charging control systems. Teaching the variants of turbocharging control. Disscution on various constructions of super- and turbocharging. Students learn the foundamentals of

mathematical modelling of charging process, inlet air cooling and energetic balance for various supercharging systems.

Course-related learning outcomes

Knowledge

Has extended knowledge of mathematics in the field of numerical methods used in optimization tasks, computer simulation, linear algebra, interpolation and approximation.

Has a basic knowledge of the mechanics of solids and discrete systems with many degrees of freedom, mathematical modeling of physical and mechanical systems based on d'Alembert's principle and Lagrange's equations, mathematical description of materials using constitutive equations.

Has extended knowledge in the field of computer science, concerning computer programming and engineering calculation programs in the field of computer simulation of physical systems.

Skills

Can plan and carry out experimental research of specific processes taking place in machines and routine tests of a working machine or a vehicle from a selected group of machines.

Is able to carry out basic measurements of mechanical quantities on the tested working machine with the use of modern measuring systems.

Is able to use the acquired knowledge in the field of thermodynamics and fluid mechanics to simulate thermodynamic processes in technological systems of machines, using specialized computer programs.

He can design the technology of exploitation of a selected machine with a high degree of complexity.

Social competences

He is ready to critically assess his knowledge and received content.

Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on its own.

Is ready to fulfill professional roles responsibly, taking into account the changing social needs, including:

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written or oral egzamination, semestral work, computing exercisses.

Programme content

Definition and target of application of supercharging in internal combustion engines. Systematization of supercharging systems and their applications. Historical description of supercharging.Features and properties of supercharging systems. Restrictions of supercharging. Theoretical and real cycles in supercharged engines. Non-compressor supercharging: basics and fields of application. Variable geomtry turbocharging: princiles and practical applications. Mechanical-driven supercharging: Roots-blower, G-charger and others. Constant-pressure tubocharging and pulse-charging. Multistage- and

sequential turbocharging. Problems with turbocharging control. Engine full-load characteristic shaping by charging pressure control. Pronciples and design of combined turbocharging. Unconventional systems of supercharging: Comprex, Hyperbar, Differential system. Engines with Power-turbine. System Superthermal. Charged air cooling: principles and systems. Turbocooling. Main features of selected elements of charged engines. Turbocharging in low-speed marine-type engines. Fuel consumption and toxic compound pollution vs. charging pressure and temperature. Computational adjustment of turbocharger to the engine.

Teaching methods

1. Lectures including multimedia presentations. 2. Computing exercises.

Bibliography

Basic

1. Wisłocki K.: Systemy doładowania szybkoobrotowych silników spalinowych. WKiŁ, Warszawa 1992, ss. 356.

2. Kowalewicz A.: Doładowanie silników spalinowych. Politechnika Radomska 1998 r.

3. Zinner K.: Aufladung von Verbrennungsmotoren, Springer-Verlag, I-IV Auflage, -1985

4. Watson N., Janota M.: Turbocharging the internal combustion engines, The MacMillan Press Ltd.,London 1982.

Additional

1. Mysłowski J.: Doładowanie silników spalinowych. WKiŁ, Warszawa 2002 r.

2. Pucher H.: Aufladung von Verbrennungsmotoren. Kontakt und Studium, B. 133, Expert Verlag 1985.

3. Hiereth H., Prenninger P.: Aufladung von Verbrennungskraftmaschinen. Springer Verlag,2003.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	45	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate