

SYLLABUS OF A MODULE

Polish name of a module	Termodynamika obiegów cieplnych
English name of a module	Thermodynamic Cycles
ISCED classification - Code	0715
ISCED classification - Field of study	<i>Mechanics and metal trades</i>
Languages of instruction	<i>English</i>
Level of qualification:	2
Number of ECTS credit points	5
Examination:	<i>EW</i>
Available in semester:	A

Number of hours per semester:

Lecture	Exercises	Laboratory	Seminar	E-learning	Project
30	30	0	0	0	0

MODULE DESCRIPTION

MODULE OBJECTIVES

- O1. Students know theory of thermodynamic cycles fundamentals.
- O2. Students acquire skills in thermodynamic cycle calculations.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Fundamentals of mathematics and thermodynamics.
2. Fundamentals of thermal machinery principles.
3. Capability of using source literature.
4. Data analysis and presentation of results.

LEARNING OUTCOMES

- LO 1 – The student possesses knowledge on thermodynamic cycles
- LO 2 – The student possesses knowledge on fundamentals of thermal machinery
- LO 3 – The student has ability to calculate various thermodynamic cycles.

MODULE CONTENT

Type of classes – lecture	Number of hours
Lec 1 – Introduction to thermodynamic cycles. Review of thermodynamics.	2
Lec 2 – Classification of thermodynamic cycles in thermal machinery. Energy balance.	2

Thermodynamic parameters. Carnot cycle.	
Lec 3 – Fundamentals of internal combustion engines. Real and theoretical thermodynamic process. Otto cycle. Diesel cycle. Sabathe-Seilinger cycle. Overexpanded cycle. Design and practical implementations.	6
Lec 4 – Gas turbines. Brayton cycle.	2
Lec 5 – Introduction to steam engines and steam turbines. Power systems applications.	2
Lec 6 - Fundamentals of Clausius-Rankine cycle. H-S and T-S diagrams.	2
Lec 7 - Analysis of Clausius-Rankine cycle with various options. Secondary reheating and regenerative heating in the steam power plant.	4
Lec 8 – Waste heat recovery systems. Applications in use.	4
Lec 9 – Other machinery for heat and power generation. Renewable energy. Geothermal and solar systems. Nuclear power plants.	4
Lec 10 – Heat pumps. Refrigerators.	2
Sum	30
Type of classes – tutorials	Number of hours
Tut 1-2 – Introduction to several computational tools for thermodynamic calculations.	4
Tut 3 – Calculations and Carnot cycle analysis.	2
Tut 4 – Calculations and analysis of Otto cycle.	2
Tut 5 - Calculations and analysis of Diesel cycle.	2
Tut 6 – Calculations and analysis of Sabathe-Seilinger cycle.	2
Tut 7 - Calculations and analysis of overexpanded cycle.	2
Tut 8-10 – Modeling IC engine thermodynamic cycle based on the 0-D model for heat release.	6
Tut 11-13 - Modelling Clausius-Rankine cycle and its analysis.	6
Tut 14 – Analysis of waste heat recovery systems applications to thermal machinery.	2
Tut 15 – Calculations of the heat pump thermodynamic cycle.	2
Sum	30

TEACHING TOOLS

1. – Lecture with the use of multimedia presentations
2. – Tutorials of thermodynamic cycles calculation
3. – Instructions to classes
4. – Own codes and commercial software

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE)

F1. - assessment of the ability to apply the acquired knowledge while doing the exercises
F2. - evaluation of reports on the implementation of exercises covered by the curriculum
F3. - assessment of activity during classes
S1. - assessment of the ability to solve the problems posed and the manner of presentation obtained results - pass mark *
S2. - assessment of mastery of the teaching material being the subject of the lecture - exam

*) in order to receive a credit for the module, the student is obliged to attain a passing grade in all classes as well as in achievement tests.

STUDENT'S WORKLOAD

L.p.	Forms of activity	Average number of hours required for realization of activity
1. Contact hours with teacher		
1.1	Lectures	30
1.2	Tutorials	30
1.3	Laboratory	0
1.4	Seminar	0
1.5	Project	0
1.6	Examination	3
Total number of contact hours with teacher:		68
2. Student's individual work		
2.1	Preparation for tutorials and tests	10
2.2	Preparation for laboratory exercises, writing reports on laboratories	0
2.3	Preparation of project	0
2.4	Preparation for final lecture assessment	0
2.5	Preparation for examination	10
2.6	Individual study of literature	7
Total number of hours of student's individual work:		27
Overall student's workload:		95
Overall number of ECTS credits for the module		5 ECTS
Number of ECTS points that student receives in classes requiring teacher's supervision:		2.52 ECTS
Number of ECTS credits acquired during practical classes including laboratory exercises and projects:		1.2 ECTS

BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Cengel Y, Boles M, Thermodynamics: An Engineering Approach, McGraw-Hill Education; 8 edition, 2014
2. Moran JN, Shapiro HN, Principles of Engineering Thermodynamics, John Wiley & Sons Inc, 2015
3. Mayhew Y, Rogers GFC, Mayhew YR, Engineering Thermodynamics : Work and Heat Transfer, Longman, Pearson Education Limited, 1996

MODULE COORDINATOR (NAME, SURNAME, E-MAIL ADDRESS)

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