COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Mechanical Engineering</td><td colspan="2">Degree level and programme type</td><td>Bachelor's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6"></td><td colspan="2">Study profile</td><td></td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Thermal Engineering</td><td colspan="2">Course code</td><td>FME-00272S</td></tr>
<tr><td colspan="2">Course type</td><td></td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>summer</td></tr>
<tr><td>30</td><td>15</td><td>15</td><td></td><td></td><td></td><td></td><td>No. of ECTS credits</td><td>5</td></tr>
<tr><td>Entry requirements</td><td colspan="9">Mathematics I, Engineering Mechanics</td></tr>
<tr><td>Course objectives</td><td colspan="9">To provide the students with knowledge of basic principles of thermal engineering, basic definitions and fundamental principles; to obtain an understanding of problems associated with energy conversions to develop skills for understand and identify basic processes with thermal engineering systems and to use them for analysis of practical problems, also a training in practical skills of engineering measurements for thermal and flow parameters.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture:
First and second laws of thermodynamics in application to thermal systems; Energy and exergy efficiency of energy conversion; Thermodynamics of wet vapour; Steam power generation systems; Gas power generation systems; Combustion engines cycles; Compression refrigeration systems; Basic principles of air-conditioning and heat pumps; Basic principles of cryogenic systems
Classes:
using of properties charts; calculations of steam Rankine cycles problems; calculations of Brayton cycle problems; calculations of Linde cycle problems; calculations of combustion engines cycles problems
Laboratory:
Heat exchangers - Thermal characteristics, heat transfer coefficient, Air heating - testing of the air heaters, Energy conversion - monitoring of the electric steam boiler operation; Compression refrigeration system - coefficient of performance, cycle identification</td></tr>
<tr><td>Teaching methods</td><td colspan="9">Regular lectures: regular lectures with presentations
Regular classes: blackboard classes, work in groups, discussion, homework assignments
Self- study under supervision: tutorial sessions with worked examples, discussion, problem solving, homework assignments.
Laboratory: experimentations in groups under supervision of a teacher, lab reports preparing, problems solving.</td></tr>
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Assessment method	**Lecture - written and oral exam; classes – calculation of simple problems evaluation; laboratory classes – pre-lab tests, lab reports evaluation**	
Symbol of learning outcome	**Learning outcomes**	**Reference to the learning outcomes for the field of study**
LO1	Student describes with understanding basic concepts of thermal engineering terms, definitions, and fundamental principles,	M1_W06
LO2	Student performs basic calculations of energy conversion problems in thermal systems	M1_W06, M1_U20
LO3	Student is able to do the elementary measurements of quantities applied in thermal systems	M1_W06, M1_U20
LO4	Student apply first and second law of thermodynamics in analysis of simple power engineering, refrigeration and heat pump systems	M1_W06, M1_U11
LO5		
LO6		
Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**
LO1	written exam	L
LO2	written exam, in-class tests, pre-lab tests, lab reports grading	L, C, LC
LO3	written exam, in-class tests, pre-lab tests, lab reports grading	L, C, LC
LO4	written exam, in-class tests, pre-lab tests, lab reports grading	L, C, LC
LO5		
LO6		
Student workload (in hours)		**No. of hours**
Calculation	lecture attendance or self-study	30
	participation in classes or self study	15
	participation in laboratory classes	5 ÷ 15
	preparation for classes and laboratory classes	20 ÷ 30
	working on reports	5 ÷ 10
	participation in student-teacher sessions related to the classes	40 ÷ 50
	preparation for and participation in exams/tests	10
	TOTAL:	**155**
Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	**45-60**	**5**
Student workload – practical activities	**55-80**	
Basic references	**1. Çengel Y.A., Boles M.A., Thermodynamics. An Engineering Approach, McGraw-Hill Book, 2015.** **2. Rajput R.K., Thermal Engineering, Laxmi Publications, 2010.** **3. Whitman W.C., Johnson W.M., Tomczyk J.A., Silberstein E., Refrigeration and Air Conditioning Technology, 7th Edition, Delmar, Cengage Learning, 2013** **4. Althouse A.D., Turnquist C.H., Bracciano A.F., Braciano C.C., Bracciano G.M.,**	

	Modern Refrigeration and Air Conditioning, 19th Ed. The Goodheart-Willcox Company, Inc.	
Supplementary references	**1. Rudramoorthy R. Thermal engineering, McGraw-Hill, 2003.** **2. Trott A.R., Welch T., Refrigeration and Air-Conditioning, 3rd edition, Butterworth-Heinemann, 2000** **3. Hundy G.F., Trott A.R., Welch T., Refrigeration and Air-Conditioning, 4rd edition, Butterworth-Heinemann, 2008**	
Organisational unit conducting the course	**Department of Machinery Design and Thermal Engineering, Bialystok University of Technology**	**Date of issuing the programme**
Author of the programme	**Dariusz Butrymowicz**	**2019-03-21**

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar

Please notice!
Depending on number of students enrolled for the subject hours of tuition are as follows (for each 30 hours given in course description card):
1 – 2 students - 5 hours of tuition hours;
3 – 4 students - 8 hours of tuition;
5 – 6 students - 11 hours of tuition;
7 – 8 students - 15 hours of tuition;
9 and more students - hours of tuition given by a teacher as regular classes.