COURSE DESCRIPTION CARD – SPECIMEN

<table>
<tr><td colspan="10">Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Mechanical Engineering</td><td>Degree level and programme type</td><td>Bachelor's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6"></td><td>Study profile</td><td></td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Thermodynamics</td><td>Course code</td><td>IS-MER0032S</td></tr>
<tr><td>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">Getting by students understanding with in depth explanation of engineering thermodynamics, possessing skills for application of thermodynamic methods for analysis of practical problems, practical demonstration of measurement devices and methods for basic thermodynamic parameters and properties, measurements of energy balance for typical thermal machines.</td></tr>
<tr><td>Course content</td><td colspan="9">Lecture:
Basic principles (thermodynamic systems and thermodynamic quantities classification, function of state and function of process); Internal energy; Heat, specific heat, absolute (volumetric) and technical work of thermodynamic processes; Enthalpy; Perfect gases laws; Gas mixtures and real gases; First law of thermodynamics for open and closed systems; Thermodynamic processes for perfect gases; Thermodynamic cycles principles; Gas cycles; Entropy; Second law of thermodynamics; Exergy; Thermodynamics of wet vapour; Thermodynamics of humid air; Elementary issues of heat transfer; Basic principles of combustion processes
Classes:
Perfect gases calculation problems; Application of first law of thermodynamics for open and closed systems; Calculation problems of thermal processes for perfect gases; Simple analyses of gas cycles; Application of second law of thermodynamics; Using properties charts for simple calculation and parameters identification (for steam).
Laboratory:
Temperature measurements; pressure measurements; flow rate measurements; vapour refrigeration cycle identification of thermal performance and thermal parameters; heat exchangers – thermal balance and heat rate.</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,</td></tr>
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	problem solving, homework assignments. **Laboratory: experimentations in groups under supervision of a teacher, lab reports preparing, problems solving.**	
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 engineering thermodynamics,	M1_W06
LO2	Student performs basic calculations of thermodynamic problems	M1_W06, M1_U20
LO3	Student is able to do the elementary measurements of thermodynamic quantities	M1_W06, M1_U20
LO4	Student apply first and second law of thermodynamics in analysis of simple open and closed engineering 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. Moran M.J., ,Shapiro H.N., Boettner D.D., Bailey M., Fundamentals of Engineering Thermodynamics Wiley, 2011.** **3. Balmer R.T., Modern Engineering Thermodynamics - Textbook with Tables Booklet,**	

	Elsevier, 2011. **4. Rajput R.K., A Textbook of Engineering Thermodynamics, Firewall Media, 2010.** **5. Klein S., Nellis G., Thermodynamics, Cambridge University Press, 2012.**	
Supplementary references	**1. Rudramoorthy R. Thermal engineering, McGraw-Hill, 2003.** **2. Puri I., Kalyan A., Advanced Thermodynamics Engineering,CRC Press, 2011.** **3. van Ness H.C., Understanding Thermodynamics, Dover.**	
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.