

PROGRAMME OF EDUCATION

FACULTY: MECHANICAL AND POWER ENGINEERING

MAIN FIELD OF STUDY: MECHANICAL ENGINEERING AND MACHINE BUILDING

in area of technical science

EDUCATION LEVEL: 2nd level, Master of Science

FORM OF STUDIES: full-time

PROFILE: general academic

SPECIALIZATION: **POWER ENGINEERING MACHINES AND DEVICES**

LANGUAGE OF STUDY: polish

Content:

1. Assumed educational effects – attachment no. 1
2. Programme of studies – attachment no. 2

Faculty Council Resolution of 30.09.2015

In effect since 01.10.2015

PROGRAMME OF STUDIES

1. Description

<i>Number of semesters: 3</i>	<i>Number ECTS points necessary to obtain qualifications: 90</i>
<p><i>Prerequisites (particularly for second-level studies):</i> Admission requirements (particularly in the case of the second cycle) degree qualifications and competence to continue education in college secondary education: knowledge of mathematics, physics and chemistry, enabling understanding of the fundamentals of mechanics, materials and principles of construction machinery, mechanical knowledge, strength of materials and construction of foundations, enabling the understanding and design of the basic machine components, the ability to use to formulate and solve engineering tasks analytical methods, simulation and experimental knowledge of fluid flow including all thermal processes, knowledge of the record structure using 2D CAD 3D and ability to communicate in English, and the presentation and documentation of the experiment, and the presentation and documentation of a project tasks.</p>	<p><i>Upon completion of studies graduate obtains</i> <i>professional degree of: Master of Science</i> 2nd level qualifications</p>
<p><i>Possibility of continuing studies: 3rd level doctoral studies</i></p>	<p><i>Graduate profile, employability:</i> Graduate, employment opportunities: Graduates have the knowledge and skills in the following areas: engineering, design, manufacture and operation of machines and manufacturing systems and environmental technologies and safety. It is ready to use creative methods and technologies supporting the design, manufacture and operation of the equipment and the choice of materials engineering, management and development of production in industrial and process control, research in research institutes, management design companies in the field of construction machinery and technological processes of doing business. It has the necessary knowledge and skills in the design, testing and operation of machines and devices that generate low temperatures, corresponding to $-35\text{ }^{\circ}\text{C}$ in cooling and in the range of 120 K ($-153\text{ }^{\circ}\text{C}$) fractions of</p>

	Kelvin in cryogenics, including for the technology, science and medicine. He knows a foreign language at level B2 + and a second foreign language at A1 or A2 level.
<i>Indicate connection with University's mission and its development strategy:</i>	The programme of education is consistent with the mission of the University in the transfer of knowledge and skills to maintain high quality of education and the development of creative, critical and tolerant personality of students by developing and nurturing a strong sense of academic community based on communication and social rights of students and employees.

2. Fields of science and scientific disciplines to which educational effects apply: technical science

3. Concise analysis of consistency between assumed educational effects and labour market needs: The expected increase in education provide engineering competencies gained on the first level of education, especially in terms of knowledge and skills, with particular emphasis on creativity in solving specific technical problems. The training program equips graduates with the attributes thus enabling him to adapt to the rapidly changing requirements of the labor market.

4. List of education modules:

4.1. List of obligatory modules:

4.1.1. List of basic sciences modules

4.1.1.1. Mathematics module

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	MSN0616	Modelling and Optimization	1					K2MBM_W04	15	60	2	1	T	E			PD	Ob
2	MSN0616	Modelling and Optimization		2				K2MBM_U03	30	60	2	1,5	T	Z		P	PD	Ob
Total			1	2					45	120	4	2,5						

4.1.1.2. Physics module

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	MSN0462	Mechanics Analytical	2					K2MBM_W03	30	60	2	1	T	Z			PD	Ob
Total			2						30	60	2	1						

Altogether for basic sciences modules:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes ¹
lec	cl	lab	pr	sem				
3	2				75	180	6	3,5

¹BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

²Traditional – enter T, remote – enter Z

³Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

⁴University-wide course /group of courses – enter O

⁵Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

⁶KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

⁷Optional – enter W, obligatory – enter Ob

4.1.2. List of main-field-of-study modules

4.1.2.1. Obligatory main-field-of-study module

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	MSN1363	Modern Engineering Materials	1					K2MBM_W02	15	30	1	0,5	T	Z			K	Ob
2	MSN1363	Modern Engineering Materials			1			K2MBM_U02	15	30	1	0,75	T	Z		P	K	Ob
3	MSN1363	Modern Engineering Materials					1	K2MBM_U06	15	30	1	0,75	T	Z		P	K	Ob
4	MSN0530	Mechatronics and Control Systems	2					K2MBM_W01	30	90	3	1,5	T	E			K	Ob
5	MSN0530	Mechatronics and Control Systems			2			K2MBM_U01	30	60	2	1,5	T	Z		P	K	Ob
6	MSN1492	Integrated Production Systems	2					K2MBM_W06	30	60	2	1	T	Z			K	Ob
7	MSN1492	Integrated Production Systems			1			K2MBM_U05	15	30	1	0,75	T	Z		P	K	Ob
8	MSN1560	Diploma Seminar					2	K2MBM_U06 K2MBM_U07 K2MBM_K01 K2MBM_K03 K2MBM_K04 K2MBM_K05	30	60	2	1,5	T	Z		P	K	Ob
Total			5		4		3		180	390	13	8,25						

Altogether (for main-field-of-study modules):

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes ¹
lec	cl	lab	pr	sem				
5		4		3	180	390	13	8,25

¹BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

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³Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

⁴University-wide course /group of courses – enter O

⁵Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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⁷Optional – enter W, obligatory – enter Ob

4.2. List of optional modules:

4.2.1. List of general education modules

4.2.1.1. Liberal-managerial subjects module (min. 5 ECTS points):

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	HSN100400BK	Humanities Course	1					K2MBM_W07 K2MBM_K02	15	60	2	1	T	Z	O		KO	W
2	ZSN100400BK	Management Course	2					K2MBM_W08 K2MBM_K05	30	90	3	1,5	T	Z	O		KO	W
Total			3						45	150	5	2,5						

4.2.1.2. Foreign languages module (min. 3 ECTS points):

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	JZL100655BK	Foreign Language (continue) B2+ level		1				K2MBM_U08	15	30	1	0,75	T	Z	O	P	KO	W
2	JZL100710BK	Foreign Language (second), any level		3				K2MBM_U09	45	60	2	1,5	T	Z	O	P	KO	W
Total				4					60	90	3	2,25						

4.2.1.1. Sporting classes module (min. 1 ECTS points):

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	WFW010000BK	Sporting Classes		1				K2MBM_K06	15	15	1	1	T	Z	O		KO	W
Total				1					15	15	1	1						

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²Traditional – enter T, remote – enter Z

³Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

⁴University-wide course /group of courses – enter O

⁵Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

⁶KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

⁷Optional – enter W, obligatory – enter Ob

Altogether for general education modules:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes ¹
lec	cl	lab	pr	sem				
3	5				120	255	9	5,75

4.2.2. List of main-field-of-study modules

4.2.2.1. Technical safety module (min. 3 ECTS points):

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
		Technical Safety:																
1	MSN0033	Failure Analysis of Machine and Devices	2					K2MBM_W05	30	60	2	1	T	Z			K	W
	MSN0033	Failure Analysis of Machine and Devices			1			K2MBM_U04	15	30	1	0,75	T	Z		P	K	W
	MSN0034	Failure Analysis of Machine and Devices	2					K2MBM_W05	30	60	2	1	T	Z			K	W
	MSN0034	Failure Analysis of Machine and Devices			1			K2MBM_U04	15	30	1	0,75	T	Z		P	K	W
		Total	2		1				45	90	3	1,75						

4.2.2.2. Individual master of science project module (min. 6 ECTS points):

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	MSN1534	Master Individual Student Project				6		K2MBM_U07 K2MBM_K01 K2MBM_K04 K2MBM_K05	90	180	6	1	T	Z		P	K	W
		Total				6			90	180	6	1						

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²Traditional – enter T, remote – enter Z

³Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

⁴University-wide course /group of courses – enter O

⁵Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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⁷Optional – enter W, obligatory – enter Ob

4.2.2.3. Master of science diploma dissertation module (min. 20 ECTS points):

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes ¹			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	MSN1610	Master Thesis						K2MBM_U07 K2MBM_K01 K2MBM_K04 K2MBM_K05		600	20	4	T	Z		P	K	W
Total									600	20	4							

Altogether for main-field-of-study modules:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes ¹
lec	cl	lab	pr	sem				
2		1	6		135	870	29	6,75

¹BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

²Traditional – enter T, remote – enter Z

³Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z – enter in brackets the final course form (lec, cl, lab, pr, sem)

⁴University-wide course /group of courses – enter O

⁵Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

⁶KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

⁷Optional – enter W, obligatory – enter Ob

4.2.3. List of specialization modules

4.2.3.1. Specialization subjects module (min. 33 ECTS points)

No	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form ² of course/group of courses	Way ³ of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK class ¹ es			university-wide ⁴	practical ⁵	kind ⁶	type ⁷
1	MSN0300	Boiler's Design and Equipment	1					S2MUE_W01	15	30	1	0,5	T	E			S	W
2	MSN0300	Boiler's Design and Equipment				2		S2MUE_U06	30	60	2	1,5	T	Z		P	S	W
3	MSN0670	Burners and Furnaces	1					S2MUE_W02	15	30	1	0,5	T	Z			S	W
4	MSN0670	Burners and Furnaces				1		S2MUE_U07	15	30	1	0,75	T	Z		P	S	W
5	MSN0850	Special Pumps	2					S2MUE_W03	30	60	2	1	T	Z			S	W
6	MSN0950	Pipelines and Armature	2					S2MUE_W04	30	60	2	1	T	Z			S	W
7	MSN0981	Thermal Engines	1					S2MUE_W05	15	30	1	0,5	T	Z			S	W
8	MSN0981	Thermal Engines				1		S2MUE_U08 K2MBM_K04	15	30	1	0,75	T	Z		P	S	W
9	MSN1320	Turbines for Gas-steam Systems	2					S2MUE_W06	30	60	2	1	T	E			S	W
10	MSN1320	Turbines for Gas-steam Systems		1				S2MUE_U09	15	30	1	0,75	T	Z		P	S	W
11	MSN1310	Turbines and Hydroelectric Power Plants	2					S2MUE_W07	30	60	2	1	T	Z			S	W
12	MSN1310	Turbines and Hydroelectric Power Plants		1				S2MUE_U10	15	30	1	0,75	T	Z		P	S	W
13	MSN1260	Hydraulic Transport	1					S2MUE_W08	15	30	1	0,5	T	Z			S	W
14	MSN1260	Hydraulic Transport			1			S2MUE_U11	15	30	1	0,75	T	Z		P	S	W
15	MSN0070	Investigation of Hydraulic Machinery	1					S2MUE_W09	15	30	1	0,5	T	Z			S	W
16	MSN0070	Investigation of Hydraulic Machinery			2			S2MUE_U01	30	60	2	1,5				P	S	
17	MSN0220	Utilization of Power Engineering Devices and Machines	2					S2MUE_W11	30	60	2	1	T	E			S	W
18	MSN0220	Utilization of Power Engineering Devices and Machines		1				S2MUE_U02	15	30	1	0,75	T	Z		P	S	W
19	MSN0290	Constructions Types of the Special Turbines	2					S2MUE_W11	30	60	2	1	T	Z			S	W
20	MSN0290	Constructions Types of the Special Turbines		1				S2MUE_U03	15	30	1	0,75	T	Z		P	S	W
21	MSN0330	Boilers and Small Power	2					S2MUE_W12	30	60	2	1	T	Z			S	W
22	MSN0330	Boilers and Small Power		1				S2MUE_U04	15	30	1	0,75	T	Z		P	S	W
23	MSN1270	Mechanical and Pneumatically Transportation of Grainy Materials	1					S2MUE_W13	15	30	1	0,5	T	Z			S	W
24	MSN1270	Mechanical and Pneumatically Transportation of Grainy Materials		1				S2MUE_U05 K2MBM_K04	15	30	1	0,75	T	Z		P	S	W
Total			20	6	3	3	1		495	990	33	19,75						

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⁴University-wide course /group of courses – enter O

⁵Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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⁷Optional – enter W, obligatory – enter Ob

Altogether for specialization modules:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes ¹
lec	cl	lab	pr	sem				
20	6	3	3	1	495	990	33	19,75

4.3. Diploma dissertation module

Type of diploma dissertation	magister	
Number of diploma dissertation semesters	Number of ECTS points	Code
1	20	MSN1610
Character of diploma dissertation		
Experimental/project/ literature survey		
Number of BK¹ ECTS points	4	

5. Ways of verifying assumed educational effects

Type of classes	Ways of verifying assumed educational effects
lecture	examination, final test
class	progress test, final test, tasks valuating
laboratory	pretest, report from laboratory
project	project defence
seminar	participation in discussion, topic presentation, essay
diploma dissertation	prepared diploma dissertation

- 6. Total number of ECTS points, which student has to obtain from classes requiring direct academic teacher-student contact (enter total of ECTS points for courses/groups of courses denoted with code BK¹)**
44 ECTS

7. Total number of ECTS points, which student has to obtain from basic sciences classes

Number of ECTS points for obligatory subjects	6
Number of ECTS points for optional subjects	0
Total number of ECTS points	6

8. Total number of ECTS points, which student has to obtain from practical classes, including laboratory classes (enter total number of ECTS points for courses/group of courses denoted with code P)

Number of ECTS points for obligatory subjects including laboratory classes and projects	7 4
Number of ECTS points for optional subjects including: laboratory classes and projects diploma dissertation	44 13 20
Total number of ECTS points	51

9. Minimum number of ECTS points, which student has to obtain doing education modules offered as part of university-wide classes or other main field of study (enter number of ECTS points for courses/groups of courses denoted with code OG)
9 ECTS points

10. Total number of ECTS points, which student may obtain doing optional modules (min. 30% of total number of ECTS points)
71 ECTS points (79 %)

11. Range of the diploma exam

1. Theoretical problems

- 1.1. Przemiany i obiegi termodynamiczne (pravo- i lewobieżne), praca przemiany i obiegu
- 1.2. Równania zachowania w teorii i projektowaniu maszyn energetycznych
- 1.3. Przepływy ze sprężaniem i z rozprężaniem, oderwanie warstwy przyściennej
- 1.4. Siły aerodynamiczne na profilu i metody ich wyznaczania teoria pojedynczego stopnia
- 1.5. Równanie podstawowe i równanie główne maszyny przepływowej – interpretacja
- 1.6. Sprawność stopnia i grupy stopni maszyny przepływowej
- 1.7. Rola rodzajów wymiany ciepła w elementach maszyn i urządzeń
- 1.8. Obliczenia ciepłno-przepływowe urządzeń energetycznych (kocioł, wymiennik, ...)
- 1.9. Czynniki dwufazowy – liczby kryterialne w procesach fluidyzacji i transportu

1.10. Współpraca elementów układu przepływowego (szeregowa, równoległa)

2. Construction and technological problems

- 2.1. Materiały konstrukcyjne stosowane w budowie maszyn i urządzeń energetycznych
- 2.2. Podstawowe przypadki wytrzymałości elementów maszyn i urządzeń
- 2.3. Związek kinematyki przepływu w stopniu maszyny z konstrukcją układu łopatkowego
- 2.4. Specjalne konstrukcje kotłów i komór spalania
- 2.5. Specjalne konstrukcje maszyn wirnikowych
- 2.6. Moc graniczna turbiny parowej – sposoby jej podwyższania oraz wpływ na konstrukcję
- 2.7. Rodzaje uszczelnień, obliczanie dławicy labiryntowej
- 2.8. Zasady projektowania maszyny jedno- i wielostopniowej, znaczenie wyróżników
- 2.9. Konstrukcje i zasada działania parowników kotłów na parametry nadkrytyczne
- 2.10. Konstrukcje i obliczenia przenośników mechanicznych i pneumatycznych

3. Operational problems

- 3.1. Rola charakterystyki przepływowej w doborze i eksploatacji maszyny energetycznej
- 3.2. Główne problemy związane z rozruchem i odstawianiem maszyn i urządzeń
- 3.3. Regulacja maszyn i urządzeń, podstawowe rodzaje regulatorów
- 3.4. Systemy monitoringu i akwizycji danych, czujniki i przetworniki analogowo-cyfrowe
- 3.5. Zjawisko pełzania i zmęczenie niskocyklowe elementów
- 3.6. Diagnostyka maszyn i urządzeń (cieplno-przepływowa, wibracyjna, termowizja)
- 3.7. Urządzenia transportu mechanicznego, hydraulicznego i pneumatycznego elektrowni
- 3.8. Typowe i nietypowe zjawiska w eksploatacji maszyn i urządzeń (kawitacja, pompaż, ..)
- 3.9. Możliwości ograniczania negatywnego oddziaływania elektrowni na środowisko
- 3.10. Rola elektrowni wodnych w systemie elektroenergetycznym

12. Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular modules

<i>No.</i>	<i>Course code</i>	<i>Name of course</i>	<i>Crediting by deadline of... (number of semester)</i>
	Faculty Council Resolution No 4/D/2008 of 19.09.2008	The condition for admission the student to the execution of the <i>master thesis</i> module is to pass all subjects in plan of studies in the semester prior to the semester of graduation	

13. Plan of studies (attachment no. 1)