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: **PROCESS SYSTEMS ENGINEERING**

LANGUAGE OF STUDY: polish

Content:

Faculty Council Resolution of 30.09.2015

In effect since 01.10.2015

PROGRAMME OF STUDIES

1. Description

*Number of semesters:*3	*Number ECTS points necessary to obtain qualifications:* 90
Prerequisites (particularly for second-level studies): 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.	*Upon completion of studies graduate obtains* *professional degree of:* Master of Science 2nd level qualifications
Possibility of continuing studies: 3rd level doctoral studies	*Graduate profile, employability:* 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. Graduate has knowledge and skills in the design, testing and operation of equipment and systems for process engineering unit operations such as filtration, sedimentation, mixing, air pollution control, rectification,

	crystallization, extraction and adsorption. Graduate is able to control the processes of production and processing of substances including fuel, raw materials, water, food, pharmaceuticals and waste. He knows a foreign language at level B2 + and a second foreign language at A1 or A2 level.
Indicate connection with University's mission and its development strategy:	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

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
[2]Traditional – enter T, remote – enter Z
[3]Exam – 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)
[4]University-wide course /group of courses – enter O
[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – 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

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
[2]Traditional – enter T, remote – enter Z
[3]Exam – 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)
[4]University-wide course /group of courses – enter O
[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – 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						

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
[2]Traditional – enter T, remote – enter Z
[3]Exam – 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)
[4]University-wide course /group of courses – enter O
[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – 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]
1		Technical Safety:																
	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						

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
[2]Traditional – enter T, remote – enter Z
[3]Exam – 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)
[4]University-wide course /group of courses – enter O
[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – 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

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
[2]Traditional – enter T, remote – enter Z
[3]Exam – 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)
[4]University-wide course /group of courses – enter O
[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – 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 umer 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	MSN0271	Computer Control of Engineering Projects	1					S2IAP_W03	15	30	1	0,5		Z			S	W
2	MSN0271	Computer Control of Engineering Projects			2			S2IAP_U03	30	60	2	1,5		Z		P	S	W
3	MSN0280	Construction and Utilization of Process Apparatus	1					S2IAP_W02	15	30	1	0,5		Z			S	W
4	MSN0280	Construction and Utilization of Process Apparatus				2		S2IAP_U02	30	60	2	1,5		Z		P	S	W
5	MSN0351	Crystallization and Crystallizers	2					S2IAP_W06	30	60	2	1		Z			S	W
6	MSN0351	Crystallization and Crystallizers			1			S2IAP_U08	15	30	1	0,75		Z		P	S	W
7	MSN0600	Mixing and Mixers				1		S2IAP_U05	15	30	1	0,75		Z		P	S	W
8	MSN0600	Mixing and Mixers					1	S2IAP_U06	15	30	1	0,75		Z		P	S	W
9	MSN0651	Dynamic Operations in Process Engineering	2					S2IAP_W01	30	60	2	1		E			S	W
10	MSN0651	Dynamic Operations in Process Engineering			2			S2IAP_U01	30	60	2	1,5		Z		P	S	W
11	MSN1230	Thermodynamics in Process Engineering	1					S2IAP_W04	15	30	1	0,5		E			S	W
12	MSN1230	Thermodynamics in Process Engineering		1				S2IAP_U04	15	30	1	0,75		Z		P	S	W
13	MSN1410	Heat Exchangers and Evaporators	1					S2IAP_W05	15	30	1	0,5		Z			S	W
14	MSN1410	Heat Exchangers and Evaporators			1			S2IAP_U07	15	30	1	0,75		Z		P	S	W
15	MSN0421	Suspension Separation Methods and Apparatus	1					S2IAP_W10	15	30	1	0,5		Z			S	W
16	MSN0421	Suspension Separation Methods and Apparatus		1				S2IAP_U13	15	30	1	0,75		Z		P	S	W
17	MSN0825	Property Measurements of Solutions, Suspensions and Granular Materials	2					S2IAP_W09	30	60	2	1		Z			S	W
18	MSN0825	Property Measurements of Solutions, Suspensions and Granular Materials			2			S2IAP_U12	30	60	2	1,5		Z		P	S	W
19	MSN0654	Thermo-diffusional Operations in Process Engineering	2					S2IAP_W07	30	60	2	1		E			S	W
20	MSN0654	Thermo-diffusional Operations in Process Engineering			2			S2IAP_U09	30	60	2	1,5		Z		P	S	W
21	MSN0654	Thermo-diffusional Operations in Process Engineering				1		S2IAP_U10	15	30	1	0,75		Z		P	S	W
22	MSN0880	Complex Design of Process Engineering Systems	2					S2IAP_W08	30	60	2	1		Z			S	W
23	MSN0880	Complex Design of Process Engineering Systems				1		S2IAP_U11	15	30	1	0,75		Z		P	S	W
		Total	15	2	10	5	1		495	990	33	21						

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
[2]Traditional – enter T, remote – enter Z
[3]Exam – 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)
[4]University-wide course /group of courses – enter O
[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – enter W, obligatory – enter Ob

Altogether for specialization modules:

Total umer 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				
15	2	10	5	1	495	990	33	21

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 BK[1] 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 BK[1])
45,25 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	7
including laboratory classes and projects	4
Number of ECTS points for optional subjects	49
including:	
laboratory classes and projects	24
diploma dissertation	20
Total number of ECTS points	56

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. The movement of particles in a fluid and sedimentation velocity
1.2. The filtration process, the basic equation, filtration under constant pressure
1.3. Calculation of heat exchangers: the temperature distribution, heat flow balance equation
1.4. Calculation of power of mixing. The intensity of mixing
1.5. The penetration and mass transfer
1.6. Simple distillation, calculation of the composition of the distillate
1.7. The theoretical number of shelves in the rectification column
1.8. Balance calculations in the processes of adsorption and desorption
1.9. Theoretical background of the crystallization process

1.10. The essence of the adsorption process
1.11. Characteristics of granular materials, the definitions of particle sizes and shape coefficients

2. Construction and technological problems

2.1. Design types of sedimentation units
2.2. Filtration systems
2.3. Hydrocyclones and cyclones, design and principle of operation
2.4. Design and principle of operation of centrifuges
2.5. Liquid mixers, design, types of mixers
2.6. Design types of heat exchangers
2.7. Evaporators, design types and principle of operation
2.8. Crystallizers, design types and principle of operation
2.9. Scrubbers, with shelves and scrubbing media
2.10. Air pollution control systems

3. Operational problems

3.1. The method of determining the size distribution of granular materials
3.2. Cooperation of solid–liquid separation units (filters, hydrocyclones, sedimentation tanks)
3.3. Compensation of thermal expansion in heat exchangers
3.4. Optimal filtration time
3.5. Preparation of suspensions in mixers
3.6. Two phase flow gas-liquid through packed column
3.7. Selection of the gas velocity in the column with shelves
3.8. The choice of crystallization method and the type of the crystallizer
3.9. Application of absorption-desorption processes
3.10. Application of adsorption process in industry

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

No.	*Course code*	*Name of course*	*Crediting by deadline of... (number of semester)*
	Faculty Council Resolution No 4/D/2008 of 19.09.2008	The condition for admission the student to the execution of the *master thesis* 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)