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MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY "KHARKIV POLYTECHNIC INSTITUTE"

CURRICULUM

APPROVED BY

educational and professional program

Sustainable and Renewable Energy: Electrical and Microelectronics Engineering

Rector of NTU "KhPI" **for the training** **second (master`s) level** (higher education level) **in the field of knowledge** **14, 15** **Electrical Engineering, Automation and Instrument Engineering** (Knowledge field code and title)

_____ **Yevgen SOKOL** **by specialty** - **141, 153** **Electric Power Engineering, Electrical Engineering and Electromechanics, Micro- and Nanosystem Technology**

Qualification **Master of electric power engineering and microelectronics**

Period of study **1 year 9 months**
on the basis of **bachelor's degree**

"___"_____ 2021

Form of Training **full-time**

I. Education process schedule

Cours	September				October				November					December				January					February				March				April				May					June					July					August				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1																	T	V	E	E	E	V																	T	E	E	E	V	V	V	V	V	V	V	V	V	V
2																	T	V	E	E	E	V	P	P	P	P	P	P	Q	Q	Q	Q	Q	Q	Q	Q	D	D														

Legend: Theoretical study; **E** Exam Session; **P** Practice; **Q** Preparation of qualification work; **T** Test week; **V** Vacation; **D** Defending of qualification work

II. Consolidated budget time (in weeks)

Course	Theoretical study	Exam Session	Practice	Attestation	Preparation of qualification project (work)	Vacation	Total
1	32	8				12	**52**
2	16	4	6	2	8	2	**38**
Total	**48**	**12**	**6**	**2**	**8**	**14**	**90**

III. Practice

Type of practice	Duration (in weeks)	Semester
Research	**6**	**4**

IV. Attestation

Measures	Number of ECTS credits	Semester
Preparation of qualification work	**15,0**	**4**
Defending of qualification work	**4,0**	**4**
Proficiency examination		

V. EDUCATION PROCESS PLAN

Number in order	Name of academic discipline	Semester distribution			Number of ECTS credits	Number of hours						Distribution of classroom hours per a week and ECTS credits per a semester								Department
							Classroom					1 course				2 course				
								including				Semesters				Semesters				
												1		2		3		4		
												Number of weeks in the semester								
												20		20		20		16		
		Exams	Tests	Individual tasks		Total amount	Total	Lectures	Laboratory works	Practical studies	Independent work	Classroom hours	ECTS credits	Classroom hours	ECTS credits	Classroom hours	ECTS credits	Classroom hours	ECTS credits	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	29
1	**Obligatory educational components**				**83,0**	**2490,0**	**720,0**	**368,0**	**80,0**	**272,0**	**1770,0**	**17,0**	**22,0**	**13,0**	**16,0**	**15,0**	**15,0**		**30,0**	
1.1	**General training**				**8,0**	**240,0**	**80,0**	**16,0**		**64,0**	**160,0**	**4,0**	**6,0**	**1,0**	**2,0**					
GT 1	**Intellectual Property**		1	R	3,0	90,0	32,0			32,0	58,0	2,0	3,0							**325**
GT 2	**Innovative entrepreneurship and management of startup projects**		1	R	3,0	90,0	32,0	16,0		16,0	58,0	2,0	3,0							**202**
GT 3	**Language in scientific and pedagogical communication**		2	R	2,0	60,0	16,0			16,0	44,0			1,0	2,0					**310**
1.2	**Professional training**				**38,0**	**1140,0**	**560,0**	**336,0**	**64,0**	**160,0**	**580,0**	**12,0**	**14,0**	**11,0**	**12,0**	**12,0**	**12,0**			
PT1	**Labor and professional safety**		2	R	3,0	90,0	32,0	16,0		16,0	58,0			2,0	3,0					**131**
PT2	**Power electronics for renewable energy systems**	1		C	5,0	150,0	64,0	48,0	16,0		86,0	4,0	5,0							**128**
PT3	**Physical materials science of semiconductor devices**	1		R	5,0	150,0	64,0	48,0		16,0	86,0	4,0	5,0							**168**
PT4	**Properties and modern research methods of semiconductor devices**	1		R	4,0	120,0	64,0	32,0	16,0	16,0	56,0	4,0	4,0							**167**
PT5	**Physical bases of technology for micro- and nanoelectronics**	2		C	4,0	120,0	64,0	32,0	16,0	16,0	56,0			4,0	4,0					**167**
PT6	**Design of renewable energy generation and energy storage systems**	2		C	5,0	150,0	80,0	48,0		32,0	70,0			5,0	5,0					**130**
PT7	**Relay protection&automation systems and safe operation of renewable energy plants**	3		C	4,0	120,0	64,0	32,0	16,0	16,0	56,0					4,0	4,0			**131**
PT8	**Design and development of renewable energy systems**	3		C	4,0	120,0	64,0	32,0		32,0	56,0					4,0	4,0			**167**
PT9	**Smart Grids technologies and power system digitalization**	3		R	4,0	120,0	64,0	48,0		16,0	56,0					4,0	4,0			**130**
1.3	**Scientific training**				**37,0**	**1110,0**	**80,0**	**16,0**	**16,0**	**48,0**	**1030,0**	**1,0**	**2,0**	**1,0**	**2,0**	**3,0**	**3,0**		**30,0**	
ST1	**Command project work**		1	CW	2,0	60,0	16,0			16,0	44,0	1,0	2,0							**167**
ST2	**Command project work**		2	CW	2,0	60,0	16,0			16,0	44,0			1,0	2,0					**130**
ST3	**Scientific research work**	3		SRW	3,0	90,0	48,0	16,0	16,0	16,0	42,0					3,0	3,0			**167/130**
ST4	**Scientific research practice**		4		11,0	330,0					330,0								11,0	**167/130**
ST5	**Attestation**	4			19,0	570,0					570,0								19,0	**167/130**
2	**Optional educational components**				**37,0**	**1110,0**	**480,0**	**256,0**	**64,0**	**160,0**	**630,0**	**7,0**	**8,0**	**12,0**	**14,0**	**11,0**	**15,0**			
2.1	**Profile training**				20,0	600,0	256,0	128,0	48,0	80,0	344,0			8,0	10,0	8,0	10,0			
2.1.1	**Profiled discipline package 01 "Power Plant Engineering"**				20,0	600,0	256,0	128,0	48,0	80,0	344,0			8,0	10,0	8,0	10,0			
OP1.1	**Virtual power plants**	2		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0			4,0	5,0					**130**
OP1.2	**Electricity transmission systems**	2		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0			4,0	5,0					**131**
OP1.3	**Management of renewable energy projects**	3		C	5,0	150,0	64,0	32,0		32,0	86,0					4,0	5,0			**130**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	29
OP1.4	**Computer simulation of energy storage system operating modes**	3		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0					4,0	5,0			**130**
2.1.2	**Profiled discipline package 02 "Solar Energy Engineering"**				20,0	600,0	256,0	128,0	64,0	64,0	344,0			8,0	10,0	8,0	10,0			
OP2.1	**Semiconductor solar cells**	2		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0			4,0	5,0					**167**
OP2.2	**Development of the modern solutions and methods of certification of solar cells**	2		C	5,0	150,0	64,0	32,0		32,0	86,0			4,0	5,0					**167**
OP2.3	**Combined conversion of solar energy**	3		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0					4,0	5,0			**167**
OP2.4	**Computer modeling and design of solar energy systems**	3		C	5,0	150,0	64,0	32,0	32,0		86,0					4,0	5,0			**167**
2.2	**Optional student disciplines of the profile preparation according to the list (the list 1 is attached)**				**17,0**	**510,0**	**224,0**	**128,0**	**16,0**	**80,0**	**286,0**	**7,0**	**8,0**	**4,0**	**4,0**	**3,0**	**5,0**			
	Total for education period				**120,0**	**3600,0**	**1200,0**	**624,0**	**144,0**	**432,0**	**2400,0**	**24,0**	**30,0**	**25,0**	**30,0**	**26,0**	**30,0**		**30,0**	
	Hours per week											24,0		25,0		26,0				
	Number of exams											4		5		5		1		
	Number of tests											4		3		2		1		
	Number of course projects (works))											1		1						
	Numbers of disciplines per semester											6,0		8,0		7,0		1,0		

Individual tasks	
C	Calculated task
CG	Calculated and graphic task
R	Report
CP	Course project
CW	Course work
SRW	Scientific research work

Approved by the Academic Council of NTU "KhPI"

PROTOCOL №__4___ from _27.05.2022

Vice-rector of Scientific-and-Pedagogical Work

_____**Gennadyi KHRYPUNOV**
Signature Full name

Head of the educational program SUSTAINABLE AND RENEWABLE ENERGY. ELECTRICAL AND MICROELECTRONICS ENGINEERING

_____**Kostiantyn MAKHOTILO**
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_____**Roman TOMASHEVSKYI**
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_____**Oleksandr LAZURENKO**
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name of department

_____**Oleksiy LARIN**
Signature Full name

Head of the Department of Micro- and nanoelectronics
name of department

_____**Roman ZAITSEV**
Signature Full name

List 1 Optional student disciplines of the profile training

Number in order	Name of academic discipline	Semester distribution			Number of ECTS credits	Number of hours						Distribution of classroom hours per a week and ECTS credits per a semester								Department
							Classroom					1 course				2 course				
								including				Semesters				Semesters				
												1		2		3		4		
												Number of weeks in the semester								
												20		20		20		16		
		Exams	Tests	Individual tasks		Total amount	Total	Lectures	Laboratory works	Practical studies	Independent work	Classroom hours	ECTS credits	Classroom hours	ECTS credits	Classroom hours	ECTS credits	Classroom hours	ECTS credits	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	29
2.2	**Optional student disciplines of the profile training**																			
OPT1.1	**Electric part of power stations and substations in renewable powered systems**	1		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0	4,0	5,0							**130**
OPT1.2	**Transients in renewable powered systems**	1		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0	4,0	5,0							**130**
OPT2.1	**Renewable energy distribution system engineering**		1	C	3,0	90,0	48,0	32,0		16,0	42,0	3,0	3,0							**130**
OPT2.2	**Power facilities operation and operating modes in renewable powered systems**		1	R	3,0	90,0	48,0	32,0		16,0	42,0	3,0	3,0							**130**
OPT2.3	**Solid-state physics**		1	R	3,0	90,0	48,0	32,0	16,0		42,0	3,0	3,0							**167**
OPT2.4	**Design of mechatronic systems**		1	C	3,0	90,0	64,0	32,0	32,0		26,0	4,0	3,0							**129**
OPT1.3	**Programmable micro- and nanosystems**	1		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0	4,0	5,0							**167**
OPT1.4	**Computer modeling of physical and technological processes of micro- and nanoelectronics**	1		C	5,0	150,0	64,0	32,0	16,0	16,0	86,0	4,0	5,0							**167**
OPT3.1	**Products of micro- and nanoelectronics**	2		C	4,0	120,0	64,0	32,0	16,0	16,0	56,0			4,0	4,0					**167**
OPT3.2	**Mathematical problems of renewable powered systems**	2		C	4,0	120,0	64,0	32,0	16,0	16,0	56,0			4,0	4,0					**130**
OPT3.3	**Optimization problems of power engineering**	2		C	4,0	120,0	64,0	32,0		32,0	56,0			4,0	4,0					**130**
OPT3.4	**Forecasting of energy consumption and generation**	2		C	4,0	120,0	64,0	48,0		16,0	56,0			4,0	4,0					**130**
OPT3.5	**Thermographic inspection of photovoltaic systems**	2		C	4,0	120,0	64,0	32,0	16,0	16,0	56,0			4,0	4,0					**130**
OPT4.1	**Thin film photoelectric converters**	3		C	5,0	150,0	48,0	32,0		16,0	102,0					3,0	5,0			**167**
OPT4.2	**Ecological aspects of power industry**		3	C	5,0	150,0	48,0	32,0		16,0	102,0					3,0	5,0			**130**
OPT4.3	**Energy policy and energy marketing**		3	C	5,0	150,0	48,0	32,0		16,0	102,0					3,0	5,0			**130**
OPT4.4	**Energy management in renewable powered systems**	3		C	5,0	150,0	48,0	32,0		16,0	102,0					3,0	5,0			**130**