CURRICULUM
OF THE INTERNATIONAL EDUCATIONAL PROGAM IN A FOREIGN LANGUAGE
13.04.01_03 «THERMAL POWER PLANTS»
BY MAJOR 13.04.01 «HEAT POWER ENGENEERING AND THERMAL ENGINEERING»

Table 1 – Contents and structure of the curriculum by the IEP «Thermal Power Plants»

Course Code	Course or discipline	Workload (academic hours)	Cred-its	Form of classes, academic workload (academic hours)	Form and semester of attestation
B1.B Basic component					
B1.**B**.1	English for Technical Communication	108	3.0	Semester 1: Practical classes – 36 h; Semester 2: Practical classes – 36 h; Independent work – 9 h	semester 1 – control test, academic assessment; semester 2 – control test, exam
B1.**B**.2	History and Philosophy of Science	54	1.5	Practical classes – 36 h; Independent work – 18 h	semester 2 – academic assessment
B1.**B**.3	International Standards of Production Management	90	2.5	Practical classes – 36 h; Independent work – 27 h	semester 3 – academic assessment, exam
B1.**B**.4	Modeling of Process Ingineering	90	2.5	Practical classes – 36 h; Independent work – 18 h	semester 1 – exam
B1.**B**.5	Modern Energy Technologies	90	2.5	Practical classes – 36 h; Independent work – 18 h	semester 2 – exam
B1.**B**.6	Energy Efficiency and Energy Saving in Industry	90	2.5	Practical classes – 18 h; Independent work – 45 ч	semester 3 – report, academic assessment, exam
B1.**B**.7	Modes of Operation of Thermal Power Plants	90	2.5	Lectures – 18 h; Practical classes – 18 h; Independent work – 27 h	semester 3 – course paper, exam
B1.B Elective component					
B1.B.OD Compulsory Disciplines					
B1.V.**OD**.1	Innovation Management in Industry	108	3.0	Practical classes – 36 h; Independent work – 45 ч	semester 3 – control test, course paper, exam
B1.V.**OD**.2	Power Machines. Turbines	126	3.5	Lectures – 18 h; Practical classes – 36 h; Independent work – 36 h	semester 1 – academic assessment, exam
B1.V.**OD**.3	Combined Cycle Power Plants	108	3.0	Lectures – 18 h; Practical classes – 18 h; Independent work – 72 ч	semester 3 – academic assessment
B1.V.**OD**.4	Numerical Methods in	126	3.5	Lectures – 18 h;	semester 1 –

	Heat and Mass Transfer			Practical classes – 54 ч; Independent work – 18 h	computational graphics, academic assessment, exam
B1.V.**OD**.5	Steam Boilers	126	3.5	Practical classes – 36 h; Independent work – 54 ч	semester 1 – course paper, exam
B1.V.**OD**.6	Pump Equipment of Power Plants	72	2.0	Practical classes – 36 h; Independent work – 36 h	semester 2 – course paper, academic assessment
B1.V.**OD**.7	Thermal Power Plants	108	3.0	Practical classes – 36 h; Independent work – 36 h	semester 2 – course paper, exam
B1.V.**OD**.8	Energy Efficient HVAC Systems	72	2.0	Practical classes – 36 h; Independent work – 36 h	semester 2 – academic assessment
B1.V.**OD**.9	Electrical Machines	90	2.5	Lectures – 18 h; Practical classes – 18 h; Independent work – 54 ч	semester 1 – academic assessment
B1.V.**OD**.10	Mathematical Physics	90	2.5	Lectures – 18 h; Practical classes – 36 h; Independent work – 36 h	semester 1 – academic assessment
B1.V.**OD**.11	Waste Heat Recovery Techniques	126	3.5	Lectures – 18 h; Practical classes – 36 h; Independent work – 45 ч	semester 3 – academic assessment
B1.V.DV Elective disciplines:					
B1.V.DV1					
1	Energy Efficient Buidings and Structures	90	2.5	Lectures – 18 h; Practical classes – 18 h; Independent work – 54 ч	semester 2 – academic assessment
2	Energy Audit of Buildings and Construction	90	2.5	Lectures – 18 h; Practical classes – 18 h; Independent work – 54 h	semester 2 – academic assessment
	Total	90	2.5	Lectures – 18 h; Practical classes – 18 h; Independent work – 54 h	
B1.V.DV2					
1	Renewable Energy: Resources and Technologies	108	3.0	Practical classes – 36 h; Independent work – 72 h	semester 2 – computational graphics, academic

					assessment
2	Modern Problems of Science and Industry in Energy Sector	108	3.0	Practical classes – 36 h; Independent work – 72 h	semester 2 – computational graphics, academic assessment
	Total	108	3.0	Practical classes – 36 h; Independent work – 72 ч	
B1.V.DV3					
1	Network Problems and Electrical Systems Technology	54	1.5	Lectures – 18 h; Laboratory works – 18 h; Independent work – 18 h	semester 3 – academic assessment
2	High Voltage Technique	54	1.5	Lectures – 18 h; Laboratory works – 18 h; Independent work – 18 h	semester 3 – academic assessment
	Total	54	1.5	Lectures – 18 h; Laboratory works – 18 h; Independent work – 18 h	
B1.V.DV4					
1	Modern Energy Problems	162	4.5	Practical classes – 36 h; Independent work – 90 ч	semester 2 – exam
2	Bioenergy Technology Solutions	162	4.5	Practical classes – 36 h; Independent work – 90 ч	semester 2 – exam
	Total	162	4.5	Practical classes – 36 h; Independent work – 90 ч	
B2. Practice					
B2.U	Educational Practice	54	1.5	1 week	semester 4 – academic assessment
B2.N	Scientific and Research Work	846	23.5	semester 9 – 5 weeks; semester A – 3 weeks; semester B – 6 weeks	semester 1, 2, 3 – academic assessment
B2.**P**.1	Professional Practice (Internship in Industry)	216	6.0	semester A – 3 weeks; semester C – 1 week	semester 2 – exam; semester 4 – academic assessment
B2.**P**.2	Scientific and Research Practice	594	16.5	11 weeks	semester 4 – academic assessment
B2.**P**.3	Pre-diploma Practice	162	4.5	3 weeks	semester 4 – exam

B3. State final examination					
B3	State Final Examination	270	7.5		State exam, Master's thesis defense – semester 4
	Total hours of Master's special training	4320	120.0		
FTD. Additional Elective Courses					
FTD.1	Computer Technologies in Science and Industry	72	2.0	Practical classes – 36 h; Independent work – 36 h	semester 1 – academic assessment
FTD.2	Theory of Hydrostatic Machines	72	2.0	Lectures – 18 h; Practical classes – 18 h; Independent work – 36 h	semester 1 – academic assessment
FTD.3	Modeling of Vaporization Processes	72	2.0	Lectures – 18 h; Practical classes – 18 h; Independent work – 9 h	semester 2 – exam
FTD.4	Energy Systems Engineering	36	1.0	Practical classes – 36 h	semester 2 – academic assessment with a grade
FTD.5	Turbine-Driven Compressors	108	3.0	Lectures – 18 h; Practical classes – 36 h; Independent work – 27 h	semester 3 – exam
	Total hours of Master's special training (with additional elective courses)	4680	130,0		

Courses (modules) - 2052 hours (57 ECTS)
Educational Practice – 54 hours (5 ECTS)
Scientific and Research Work – 846 hours (23,5 ECTS)
Professional Practice – 216 hours (6 ECTS)
Scientific and Research Practice – 594 hours (16,5 ECTS)
Pre-diploma Practice – 162 hours (4,5 ECTS)
State Final Examination – 270 hours (7,5 ECTS)

List of abbreviations:

B1. – courses (modules)
B1.B – courses of basic component
B1.V – courses of elective component
B1.V.OD – compulsory courses of elective component
B1.V.DV – elective courses of elective component
B2. – practice
B2.U – educational practice
B2.P – professional practice
B2.N – research work
B3. – state final examination

1. Academic calendar schedule

Month	September					October				November				December				January					February				March				April				May					June					July				August			
Date	1 - 7	8 - 14	15 - 21	22 - 28	29 - 5	6 - 12	13 - 19	20 - 26	27 - 2	3 - 9	10 - 16	17 - 23	24 - 30	1 - 7	8 - 14	15 - 21	22 - 28	29 - 4	5 - 11	12 - 18	19 - 25	26 - 1	2 - 8	9 - 15	16 - 22	23 - 1	2 - 8	9 - 15	16 - 22	23 - 29	30 - 5	6 - 12	13 - 19	20 - 26	27 - 3	4 - 10	11 - 17	18 - 24	25 - 31	1 - 7	8 - 14	15 - 21	22 - 28	29 - 5	6 - 12	13 - 19	20 - 26	27 -2	3 - 9	10 - 16	17 - 23	24 - 31
Week	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
I																		E	E	E	V	V																	E	E	E	P	P	P	V	V	V	V	V
II																		E	E	E	V	V	U	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	Th	Th	Th	Th	S	V	V	V	V	V	V	V	V

2. Summary program

		Year 1			Year 2			Total
		term 1	term 2	Total	term 1	term 2	Total	
	Theoretical training	12 4/6	14 2/6	**27**	11 2/6		**11 2/6**	38 2/6
E	Examination term	3	3	**6**	3		**3**	9
	Scientific and Research Work (distributed)	5 2/6	3 4/6	**9**	6 4/6		**6 4/6**	15 4/6
P	Professional Practice		3	**3**		15	**15**	18
Th	Preparation of Mster Thesis					4	**4**	4
S	State final exams and/or defense of thesis					1	**1**	1
V	Vacations	2	5	**7**	2	8	**10**	17
Total		23	29	**52**	23	29	**52**	104

Table 2 – Correlation of results and objectives of the educational program

Objectives of the educational program	**Results of the educational program**	**Elements of the curriculum** (courses, internship, projects and etc.
Objective 1. Development of design and project skills in the field of power engineering and heat engineering	6. Ability and willingness to work with a variety of software systems in the field of solving calculation problems in the energy sector, including readiness to conduct technical calculations for projects, feasibility and functional-cost analysis of the effectiveness of design solutions; ability to evaluate the technical level of designed objects or technological schemes	**B**1.**V**.4; **B**1.**V**.7; **B**1.V.**OD**.4; **B**1.V.**OD**.5; **B**1.V.**OD**.6; **B**1.V.**OD**.7
Objective 2. Development of scientific research skills in the field of power engineering and heat engineering	2. Readiness for research work as a part of an international group with English as a working language ; ability to use profound theoretical and practical knowledge for the task; 4. Ability and readiness to analyze the existing domestic and foreign technologies of electric and thermal energy production; 7. The ability to learn new research methods independently, to change scientific and industrial profile of their professional activities; 8. Ability to analyze and systematize experimental data; ability to present, submit and report the results of the work performed	**B**1.**B**.1; **B**1.**B**.5; **B**1.**B**.6; **B**.1.V.**OD**.9; **B**1.V.**OD**.10; **B**1.V.**OD**.11; **B**1.V.ДВ.2; **B**1.V.ДВ.4; **B**2.U; **B**2.N; **B**2.**P**.2
Objective 3. Development of organizational and administrative skills for the enterprises of energy complex	3. The ability and readiness to manage projects and teamwork within the set of research objectives; ability to take initiative, to assume full responsibility for decisions within the framework of professional competence; 11. Readiness to determine production needs in fuel and energy resources, to prepare foundation of technical upgrading, development of energy facilities, reconstruction and modernization of enterprises; readiness for justification of measures on energy saving, development of norms of consumption, calculation of production energy needs	**B**1.**B**.3; **B**1.**B**.7; **B**1.V.**OD**.1; **B**1.V.**OD**.5; **B**1.V.**OD**.7; **B**.1.V.**OD**.8; **B**1.V.**OD**.11; **B**1.V.DV.1; **B**1.V.DV.3

Objective 4. Development of skills of production and technological activity at the enterprises of the energy complex	5. The ability and readiness to use modern research methods to carry out technical tests on the pilot plant and at the existing power facilities; 6. Ability and readiness to work with a variety of software systems in the field of solving calculation problems in the energy sector, including readiness to conduct technical calculations on projects, feasibility and functional-cost analysis of the effectiveness of design solutions; ability to evaluate the technical level of designed objects or technological schemes; 10. Readiness to ensure smooth operation, proper operation, repair and modernization of power, heat engineering and thermal technological equipment; 11. Readiness to determine production needs in fuel and energy resources, to prepare foundation of technical upgrading, development of energy facilities, reconstruction and modernization of enterprises; readiness for justification of measures on energy saving, development of norms of consumption, calculation of production energy needs	**B**1.**B**.4; **B**1.**B**.5; **B**1.**B**.6; **B**1.**B**.7; **B**1.V.**OD**.2; **B**1.V.**OD**.3; **B**1.V.**OD**.4; **B**1.V.**OD**.5; **B**1.V.**OD**.6; **B**1.V.**OD**.7; **B**1.V.**OD**.8; **B**1.V.**OD**.11; **B**1.V.DV.1; **B**1.V.DV.3; **B**2.U; **B**2.**P**.1; **B**2.**P**.2; **B**2.**P**.3
Objective 5. Development of skills of a qualified presentation scientific and technical information in oral and written forms, including in a foreign language.	1. Ability to work with technical literature in English, including using modern information technologies; ability to independently acquire and apply new knowledge and skills; 8. Ability to analyze and systematize experimental data; ability to present, submit and report the results of the work performed 9. Ability and readiness to prepare scientific publications based on the results of research in Russian and English languages in leading industry journals , including databases WOS and Scopus	**B**1.**B**.1; **B**2.H; **B**2.**P**2; **B**3
Objective 6. Development of skills of pedagogical activity, readiness for postgraduate education.	1. Ability to work with technical literature in English, including using modern information technologies; ability to independently acquire and apply	**B**1.**B**.1; **B**1.**B**.2; **B**1.**B**.5; **B**2.U; **B**2.N; **B**2.**P**2; **B**3

	new knowledge and skills ; 8. Ability to analyze and systematize experimental data; ability to present, submit and report the results of the work performed; 9. Ability and readiness to prepare scientific publications based on the results of research in Russian and English languages in leading industry journals, including databases WOS and Scopus; 12. Readiness for pedagogical activity in the field of professional training	

Competence of graduates

At the end of training within the framework of the educational program graduates should acquire the following competences:

1. Ability to work with technical literature in English, including using modern information technologies; ability to independently acquire and apply new knowledge and skills;

2. Readiness for research work as a part of an international group with English as a working language; ability to use profound theoretical and practical knowledge for the task;3. The ability and readiness to manage projects and teamwork within the set of research objectives; ability to take initiative, to assume full responsibility for decisions within the framework of professional competence;

4. Ability and readiness to analyze the existing domestic and foreign technologies of electric and thermal energy production;

5. The ability and readiness to use modern research methods to carry out technical tests on the pilot plant and at the existing power facilities;

6. Ability and readiness to work with a variety of software systems in the field of solving calculation problems in the energy sector, including readiness to conduct technical calculations on projects, feasibility and functional-cost analysis of the effectiveness of design solutions; ability to evaluate the technical level of designed objects or technological schemes;

7. The ability to learn new research methods independently, to change scientific and industrial profile of their professional activities;

8. Ability to analyze and systematize experimental data; ability to present, submit and report the results of the work performed;

9. Ability and readiness to prepare scientific publications based on the results of research in Russian and English languages in leading industry journals, including databases WOS and Scopus;

10. Readiness to ensure smooth operation, proper operation, repair and modernization of power, heat engineering and thermal technological equipment;

11. Readiness to determine production needs in fuel and energy resources, to prepare foundation of technical upgrading, development of energy facilities, reconstruction and modernization of enterprises; readiness

for justification of measures on energy saving, development of norms of consumption, calculation of production energy needs;

12. Readiness for pedagogical activity in the field of professional training

The formulated clearly defined learning outcomes are achievable provided that students comply with the curriculum of the educational program in good faith.