1	Modern Problems of Electric Power and Electrical Engineering
2	Computer, Networks and Information Technologies
3	Foreign Language
4	Management of Innovations
5	Research and Methodology Workshop
6	Problems of Energy Saving in Electrical Engineering Complexes
7	History and Methodology of Research and Production (in Electric Engineering, Electromechanics and Electrical Technologies)
8	Philosophy
9	Modern Issues of Electric Traction
10	Automatic Traction Drive
11	Electromagnetic Compatibility of Electric Transport Devices
12	Traction control systems
13	Renewable Energy Sources
14	Modeling of Electric Transport Systems
15	Experiment Planning Theory
16	Microprocessor Control Systems for Electric Vehicles
17	Transport Logistics and Passenger Transportation Management
18.1	Secondary Power Sources for Vehicles
18.2	Energy Storage Units in Electric Transport Complex
19.1	Autonomous Electric Vehicles
19.2	Hybrid vehicles
20	Educational Practice: Practice of Obtaining Primary Skills while Working with Software in the Context of Professional Sphere
21	Educational Practice: Practice of Obtaining Primary Skills in Research Work
22	Industrial Practice: Project Practice
23	Manufacturing Practice: Technological Practice
24	Pre-Graduation Training: Research Activity
25	Preparation for and Taking the State Examination
26	Scientific Cognition Methods
27	Patenting

Course: 1, semester : 2

		Semester
	Kind of activity	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	43
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	36
8	Consultations, hours	5
9	Independent work, hours	65

External requirements

is able to formulate the objectives and objectives of the study, identify priorities for solving problems, Choosing evaluation criteria; *regarding the following learning results*:
Forms the decision-making criteria
can apply Modern research methods, evaluate and present the results of the work performed; *regarding the following learning results*:
conducts analysis of the results
Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Forms possible options for solving problems
produces a strategy for solving the task

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

Forms the decision-making criteria	
1. OPK-1. 3 3. Formulates the decision criteria	Lections; Seminars
analyzes the problem situation and makes it decomposition for individual tasks .	
2. UK-1. 1 1. Analyzes the problem situation and makes it a decomposition into separate tasks.	Lections; Seminars; Independent work
produces a strategy for solving the task	

3. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Independent work
Forms possible options for solving problems	
4. UK-2. 1 1. To know: types of resources and restrictions for addressing professional tasks; Basic methods for evaluating different ways to solve problems; current legislation and legal norms regulating professional activities.	Lections; Seminars; Independent work
conducts analysis of the results	
5. OPK-2. 2 2. The analysis of the results obtained	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Structure and organization of the central processor device.				
1. The significance and role of electrical sciences in modern life	2	2	1, 4, 5	Lecture
2. Modern electric power industry	2	2	3, 4	Lecture
Didactic unit: Problems of electrical sciences and industries				
3. Modern classification of electrical sciences	2	2	3, 4, 5	Lecture
4. Analysis of thermal working conditions of electrical systems	2	2	1, 2, 3	Lecture
5. Problems in the field of scientific research of physical processes in modern electrical technologies	2	2	3, 4	Lecture
Didactic unit: Achievements of Russian and Novosibirsk scientists and enterprises In the field of electrical engineering				
6. Systemic tasks of electrical technological installations for waste disposal, economical power sources, new electrical technological devices based on plasma, radiation and laser power sources		2	2, 4	Lecture
7. Analysis of integrated problems of research, selection and operation of electrical and electronic devices	2	2	3, 4, 5	Lecture
Didactic unit: Tacogenerators.				
8. Higher Electrical Education	2	2	2, 4	Lecture
Didactic unit: Radiation				
9. Problems of creating a mass adjustable electric drive, high-precision AC electric drives predicted electric drives	2	2	2, 4	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Problems of electrical sciences and industries				
1. The history of the development of world electrical engineering	2	1	2, 4, 5	Seminar lesson with the discussion of the economic, environmental and scientific and technical aspects of a given topic
2. Analysis of complex systems in parts. Thermal conditions of the electrotechnical equipment	2	1	2, 4	Seminar occupation with the discussion of specific examples of the specified analysis principle
Didactic unit: Achievements of Russian and Novosibirsk scientists and enterprises In the field of electrical engineering				
3. Systemic tasks of electrical technological installations for waste disposal	2	2	4, 5	Seminar lesson with the discussion of economic, environmental and scientific and technical aspects of a given topic
4. Systemic tasks of electrical sciences for cost-effective power sources, new electrical engineering devices based on plasma, radiation and laser sources	2	2	4, 5	Seminar lesson with the discussion of the economic, environmental and scientific and technical aspects of a given topic
5. Systemic tasks of electrical sciences of new electrical engineering devices based on plasma, radiation and laser sources	2	2	2, 4, 5	Seminar lesson with the discussion of the economic, environmental and scientific and technical aspects of a given topic
6. Analysis of comprehensive problems of using electrical and electronic apparatuses	2	2	2, 4	Seminar lesson with the discussion of the economic, environmental and scientific and technical aspects of a given topic
Didactic unit: Tacogenerators.				
7. Search for literature on a given topic in Russian thematic catalogs and scientific and technical journals	2	2	2, 3	Work on the Internet with Russian thematic catalogs
8. Search for literature on a given topic in foreign thematic catalogs and scientific and technical journals	2	2	1, 2, 3, 4	Work on the Internet with foreign thematic catalogs
Didactic unit: Radiation				
9. Innovative infrastructure of the Novosibirsk region	2	2	4, 5	Round table with discussion of the effectiveness of the functioning of the innovative infrastructure of the Novosibirsk region
10. Innovative infrastructure of NSTU.	2	2	2, 3, 4	Round table with a discussion, rope of interaction with innovative NSTU infrastructure

Literary sources

Main literature

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3. Электротехнологические установки и системы. Теплопередача в электротехнологии. Упражнения и задачи : учебное пособие для вузов по специальности 140605 "Электротехнологические установки и системы", направления подготовки 140600 "Электротехника, электромеханика и электротехнологии" / [В. С. Чередниченко и др.] ; под ред. В. С. Чередниченко, А. И. Алиферова. - Новосибирск, 2011. - 570 с. : схемы, табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000162819. - Парал. тит. л. англ..

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Methodical support and software

Methodological support

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

Course: 1, semester : 2

		Semester
	Kind of activity	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	44
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	30
8	Consultations, hours	6
9	Independent work, hours	64

External requirements

Associates to apply modern communicative technologies, including in foreign language (s), for academic and professional interaction; *regarding the following learning results*:
uses modern information-communications for communication

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

uses modern information-communications for communication	
1. UK-4. 3 3. Uses modern information communications for communication	Seminars; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	**Active forms, hours**	**Hours**	**Links to learning results**	**Learning activities**
Semester: 2				
Didactic unit: Information technology and information processing				
2. Information technology and information processing	2	4	1	Obtaining information technology skills for information processing

5. Collective information technology	4	4	1	Ability to apply cloud technologies for collective activities
Didactic unit: Processing experimental data				
3. Programming discrete tasks		4	1	Solving optimization tasks using Mathcad environment
Didactic unit: Necrocomputers and networks				
1. Boltzmann car, her model	3	3	1	Boltzmann machine and modeling
4. Information coding algorithms	3	3	1	Study of information coding algorithms

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Information technology and information processing				
1. Information technology and information processing	3	3	1	Examples of information technology and information processing
2. Work in Mathcad, Matlab	2	2	1	Receiving work skills in Mathcad, Matlab
Didactic unit: Automated design system				
3. Basic functions of computer support and production systems	5	5	1	Know the basic functions of computer support and production systems
4. Work in automatic design systems	6	6	1	Mastering the principle of operation of the CAD on the example of T-FLEX, ANSYS
Didactic unit: Theory of information, encoding and protection of information				
5. Development of information coding algorithms	2	2	1	Writing coding programs in high-level programming languages

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Information technology and information processing				
1. Information technologies for solving electrical and electric power problems		22	1	Application of information technologies for solving electrical and electric power problems
Didactic unit: Automated design system				
2. Basics of designing tasks of electrical engineering and energy		22	1	Develop skills solving problems of designing electrical engineering and energy

Literary sources

Main literature

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Methodical support and software

Methodological support

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Specialized software

1 Scientific and Technical Computing Program Mathworks Matlab
2 PTC Mathcad
3 Software Complex for Modeling Technological Processes in Micro and Nanoelectric Ansys 11.0 ANSYS INC ANSYS ACADEMIC MECHANICAL HPC

Course: 1, semester   : 1 2

	Kind of activity	Semester	
		1	**2**
1	Total credits	2	2
2	Total hours	72	72
3	Total classes in the contact form, hours	42	42
4	Lectures, hours	0	0
5	Practical lessons, hours	36	36
6	Laboratory studies, hours	0	0
7	of them in an active and interactive form, hours	10	10
8	Consultations, hours	4	4
9	Independent work, hours	30	30

External requirements

Associates to apply modern communicative technologies, including in foreign language (s), for academic and professional interaction; *regarding the following learning results*:
performs academic and professional Interaction, including in a foreign language
translates academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
performs academic and professional Interaction, including in a foreign language	
1. UK-4. 1 1. To be able to communicate in typical situations of academic communication in a foreign language	Seminars; Independent work
translates academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language	
2. UK-4. 2 2. To be able to translate academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities

Semester: 1				
Didactic unit:				
1. Scientific contacts.	10	16	1	Modeling dialogues in typical situations of academic communication; Registration of business letters in sample. Studying speech cliches necessary for academic communication in oral and writing. The study of cross-cultural features of communication in the academic sphere. Reading, translation, auditation, execution of lexico-grammatical tasks.
2. Scientific direction of the master's program. Scientific research work of a master's study.		20	1, 2	Viewing and studying, translation, discussion of read materials, performing lexico-grammatical tasks. Preparation and speech design of statements on the topic "Master's program". Preparation for interview.
Semester: 2				
Didactic unit:				
1. Academic presentation	10	26	1	Study of the features of the academic presentation: viewing video materials, studying expert recommendations. Setting goals. Studying the audience (conducting an interactive survey). Study of strategies and tactics of academic presentation; study of the structure of the presentation; rhetorical techniques of public speech. Preparation and presentation of speeches on a given topic. Forming estimation, mutual evaluation, self-analysis.
2. Training and participation in the International Scientific Conference.		10	2	Reading, translation, analysis of materials on the topic of scientific research using various strategies, translation of vocational-oriented materials. Study of the structure of the scientific article. Study of the characteristics of the scientific style of speech in relation to the genre of scientific article. Preparation of publication for the conference, preparation of the report.

Literary sources

Main literature

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Methodical support and software

Methodological support

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

Innovation management

Course: 2, semester : 3

	Kind of activity	Semester
		3
1	Total credits	2
2	Total hours	72
3	Total classes in the contact form, hours	25
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	5
9	Independent work, hours	47

External requirements

can apply Modern research methods, evaluate and present the results of the work performed; *regarding the following learning results*:
presents the results of the work performed
is able to manage the project at all stages of its life cycle; *regarding the following learning results*:
Participates in the management of the project at all stages of the life cycle
can organize and manage the work of the team, developing a command strategy to achieve the goal; *regarding the following learning results*:
demonstrates the understanding of the principles of teamwork
manages the team members to achieve the task
are able to determine and implement priorities of their own activities and how to improve self-assessment; *regarding the following learning results*:
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

presents the results of the work performed	
1. Features of preparing the presentation and speeches to investors	Seminars; Independent work
Participates in the management of the project at all stages of the life cycle	

3. own methods of conducting typical hydrodynamic calculations of hydromechanical equipment and pipelines	Independent work
5. Risk management techniques ion projects	Independent work
6. conduct identification and assessment of innovative risk	Seminars; Independent work
7. identify, evaluate, monitor and manage the risks of the innovation project	Seminars; Independent work
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	
8. estimates its resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	Seminars; Independent work
manages the team members to achieve the task	
9. Calculate the flow part of the turbine of a given power.	Seminars; Independent work
Participates in the management of the project at all stages of the life cycle	
13.To be able to evaluate the investment attractiveness of the project, taking into account the stage of its implementation and the type of investor	Seminars; Independent work
demonstrates the understanding of the principles of teamwork	
14. to know the principles of organization of research and design work	Independent work
manages the team members to achieve the task	
15.To be able to organize project work, develop and control resource-temporal design indicators	Independent work
Participates in the management of the project at all stages of the life cycle	
16. to know the methodology for developing projects and programs, including construction, reorganization, restructuring and reengineering of business processes	Independent work
demonstrates the understanding of the principles of teamwork	
17. on the features of the project team for project purposes	Seminars; Independent work
manages the team members to achieve the task	
18. Features of the development and planning of an innovative project	Seminars; Independent work
19. The main operational indicators of various types of transformers and electrical machines ;	Seminars; Independent work
20. apply various methods Search for design solutions and innovative ideas	Independent work
Participates in the management of the project at all stages of the life cycle	
21. Methods for evaluating the effectiveness and selection of innovative projects	Seminars; Independent work
26.On an assessment of the effectiveness of innovative projects	Seminars; Independent work
27. to evaluate the effectiveness of the innovation project using several methods for the design of electrical apparatus in accordance with the technical specifications and regulatory and technical documentation, taking into account the requirements of the requirements	Seminars; Independent work
manages the team members to achieve the task	
29. based on the decomposition chart develop an organizational and management model of the enterprise's activities	Seminars; Independent work
30. Design business processes according to IDEF0 methodology	Seminars; Independent work
Participates in the management of the project at all stages of the life cycle	
32.Features of managing the implementation of innovative projects	Independent work
33. use professional vocabulary and special terminology in oral and written speech In a foreign language	Independent work
34. on the intensity of innovative development of the industry	Independent work
35. to determine the trends of promising innovative technologies	Independent work
36. Methods for evaluating the effectiveness and selection of innovative projects	Independent work
37. to evaluate the effectiveness of the innovation project using several methods for the design of electrical apparatus in accordance with the technical specifications and regulatory and technical documentation, taking into account the requirements of the requirements	Independent work

38. on the methods of finding innovative ideas	Independent work
39. The main operational indicators of various types of transformers and electrical machines ;	Independent work
40. On the history of the development of various types of energy sources including hybrid sources and their use on transport	Independent work
41. On the peculiarities of marketing activities on new products and services	Seminars; Independent work
42.Sources of financing innovation and the current state of the innovative infrastructure of the region and Russia	Independent work
43. On the principles of the organization of multi-milk and multiprocessor systems	Seminars; Independent work
44. Develop a complex marketing mix for a new Product	Seminars; Independent work
45. to know the criteria for the effectiveness of production and technological processes	Seminars; Independent work
manages the team members to achieve the task	
46. To be able to motivate the feasibility of the decision taken	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Matrix storage formats Slava Large dimension.				
1. Acquaintance team. Teaming training. Command fulfillment of tasks for the search for design solutions using the development toolkit for creativity. Definition of the concept of an innovative project	6	6	1, 17, 18, 7, 8, 9	Participation in training
Didactic unit: Determination of the dimensions of the movement.				
2. Marketing Project	4	4	41, 44	Practical lesson. Development of a research plan, collection of information, settlement
Didactic unit: Project planning				
3. Project Planning: Definition of the list of works, hierarchical structure of works, critical path, construction of a network schedule, Ganta chart, Development of a liability matrix	2	2	19, 29, 30, 43, 9	Practical lesson. Execution of the "Planning" section for the Innovative Project developed
Didactic unit: Financial substantiation of the project				
4. Financial and economic substantiation of the project. Innovative risks	2	2	21, 26, 27, 45, 46, 6, 7	Practical lesson. Selection of information, settlement
Didactic unit: Physical Phenomena in electrical apparatus				
5. Preparation Presentations Startpa	4	4	1, 13, 46	Preparation of speech

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ANNOTATION OF THE PROGRAM
Scientific - Methodical seminar

Course: 1, semester   : 1 2

	Kind of activity	Semester	
		1	**2**
1	Total credits	1	1
2	Total hours	36	36
3	Total classes in the contact form, hours	13	13
4	Lectures, hours	0	0
5	Practical lessons, hours	8	8
6	Laboratory studies, hours	0	0
7	of them in an active and interactive form, hours	2	1
8	Consultations, hours	3	3
9	Independent work, hours	23	23

External requirements

is able to formulate the objectives and objectives of the study, identify priorities for solving problems, Choosing evaluation criteria; *regarding the following learning results*:
Determines the sequence of solving problems
can apply Modern research methods, evaluate and present the results of the work performed; *regarding the following learning results*:
Selects the necessary research method to solve the task
are able to determine and implement priorities of their own activities and how to improve self-assessment; *regarding the following learning results*:
determines the priorities of personal growth and ways to improve their own activities AMOOCOLINS

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

Selects the necessary research method to solve the task	
1. to be able to critically evaluate the modern achievements of science and technology, increase their own erudition and systematize the knowledge gained	Seminars; Independent work
2. To be able to calculate the effectiveness of innovative projects	Seminars; Independent work
3. to know the features of the functioning of the objects of professional activity	
Determines the sequence of solving problems	

4. To be able to apply the resulting theoretical and practical knowledge to solve topical tasks	Seminars; Independent work
determines the priorities of personal growth and ways to improve their own activities AMOOCOLINS	
5. to be able to evaluate the accuracy of the results obtained, to interpret and execute the results obtained for subsequent approbation	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Conducting patent information search				
1. Analysis of the level of technical achievements in the study area	1	2	1	Conducting patent information and technical documentation
2. Ways of improving technical systems	1	2	1	Discussion on this issue under the guidance of the teacher
Didactic unit: Evaluation and interpretation of research results				
3. Determination of technical and economic indicators of the underlying technical object		4	2, 4	Speeches of students in the form of a presentation and discussion on this issue
Semester: 2				
Didactic unit: Means of obtaining scientific results				
4. World experience in conducting scientific research		2	2, 4	Discussion on the issue of modern scientific methods and means of obtaining scientific knowledge
5. The role of experimental studies in verifying the reliability of theoretical provisions		2	4, 5	Speeches of students in the form of a presentation on their own scientific results and a discussion under the guidance of the teacher
Didactic unit: Registration of scientific results				
6. Presentation of the result of scientific research	1	4	1, 5	Speeches of students in the form of a presentation and discussion on this issue

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Course: 2, semester : 3

	Kind of activity	Semester 3
1	Total credits	2
2	Total hours	72
3	Total classes in the contact form, hours	24
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	10
8	Consultations, hours	4
9	Independent work, hours	48

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

Alasticized and synthesize objects of professional activity	
1. PC-2.V / PR. 2 2. Capacked to analize and synthesize objects of professional activity	Seminars; Independent work
2. PC-3.V / those. 1 1. It is capable of developing measures to efficient use of energy and raw materials	Seminars; Independent work

Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
3.PC-3.V / Those. 3 3. It is able to determine the calculators of the functioning of technological equipment and technological equipment systems of the objects of professional activity	Seminars; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
4. PC-4.V / those. 2 2. Conditions to solve professional tasks in enterprises and organizations of the profile industry of their region.	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: The concept of energy saving and energy efficiency				
1. The concept of energy saving and energy efficiency		1	3	Study of energy saving and energy efficiency
Didactic unit: Energy audit				
2. Energy Audit Organization	1	2	3, 4	Study of the principles of the organization of energy audit
Didactic unit: Innovative industry development				
1. Tool Methods and Energy Efficiency Control Means		2	4	Studying and use of tool methods and energy efficiency controls
Didactic unit: Objects of control				
3. Electrical systems and complexes as energy efficiency control objects		2	1, 4	Determination of research objects to control energy efficiency
Didactic unit: Methods of increasing energy energy efficiency				
2. Methods for improving the energy efficiency of primary energy sources	1	2	2, 3, 4	Study of methods for improving the energy efficiency of primary energy sources
3. Application of non-traditional energy sources	2	2	2, 3, 4	Overview of the use of non-traditional energy sources
Didactic unit: Methods for increasing energy conversion energy efficiency				
4. Methods of increasing energy efficiency conversion of energy from the source	1	1	1, 2	Studying the methods of increasing energy efficiency of energy conversion from the source
5. Methods of increasing energy efficiency conversion of energy from the consumer	1	1	1, 2	Study of the methods of increasing energy efficiency of energy conversion from the consumer
Didactic unit: Methods of increasing energy energy efficiency				
6. Methods for increasing energy efficiency transmission of electrical energy	1	1	1, 2	Study of the methods of increasing energy efficiency transmission of electrical energy
7. Methods for improving the energy efficiency of non-electrical energy transmission		1	1, 2	Studying methods for improving energy efficiency transmission of non-electrical energy

Didactic unit: Methods of improving the energy efficiency of industry facilities and housing and communal shop				
4. Methods for improving the energy efficiency of housing and communal services	1	1	3, 4	Study of methods for improving the energy efficiency of housing and communal facilities
8. Methods for improving the energy efficiency of industrial facilities	1	1	3, 4	Study of methods for improving the energy efficiency of industrial facilities
Didactic unit: Methods of increasing energy efficiency of transport objects				
9. Methods for improving the energy efficiency of transport objects	1	1	3, 4	Study of methods for improving the energy efficiency of transport objects

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Legislation of the Russian Federation in the field of energy saving				
1. Study of the legislation of the Russian Federation in the field of energy saving		6	2, 3	Study of the legislation of the Russian Federation in the field of energy saving
Didactic unit: Non-traditional energy sources				
2. Application and development of non-traditional energy sources		8	1, 2	Studying the application and development of non-traditional energy sources

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Methodical support and software

Methodological support

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Theory of special control systems

Course: 1, semester : 1

		Semester
	Kind of activity	**1**
1	Total credits	2
2	Total hours	72
3	Total classes in the contact form, hours	24
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	4
9	Independent work, hours	48

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Forms possible options for solving problems
produces a strategy for solving the task
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
develops and analyzes generalized solutions to solving the problem

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

analyzes the problem situation and makes it decomposition for individual tasks .	
1. ability to formulate objectives and objectives of research, identify priorities for solving problems, choose and create evaluation criteria	Seminars; Independent work
produces a strategy for solving the task	
2. to know the principle of operation and build standard blocks of digital automation of mechatronic modules and systems	Seminars; Independent work
Forms possible options for solving problems	
3. Know the heuristic methods for solving the technical tasks	Seminars; Independent work
analyzes the problem situation and makes it decomposition for individual tasks .	

4. to be able to evaluate the accuracy of the results obtained, to interpret and execute the results obtained for subsequent approbation	Seminars; Independent work
produces a strategy for solving the task	
5. to know the criteria of intellectual property objects	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
6. To be able to build tables of comparable analysis of objects of technology	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: General concepts, the main stages of the development of science and technology				
1. Introduction Goals and Course Objectives Number of electrical engineering Mass use of electrical engineering achievements Evolution of electrical engineering and electric power industry	2	2	1, 2	The tasks of the course, the volume and methodology of the study. The origins of electrostatics and magnetism. industrial Revolution.
1. The origins of electrostatics and electromagnetism	4	4	1, 3, 5	Studying the history of the progression of science and technology
2. Noise of electrical engineering as science, Faraday and Maxwell	2	2	4, 5, 6	Studying the history of the creation of the theory of electromagnetic field Maxwell, criticism of Einstein's essential theory and the creation of "relativity theory"
3. Study of the evolution of the development of electrical engineering and electric power industry	2	3	4	Study of the evolution of electric drives from group to individual, and from them to mechatronics
Didactic unit: Elements of system analysis in electrical engineering				
4. System analysis and system approach. Presentation of the object as part of the system and systemic hierarchy.	2	2	4, 5, 6	Study of the hierarchy of systems and training of hierarchical models
5. Forecasting behavior of systems	2	2	2, 3, 4	Training in the construction of phenomenological models of systems
6. Optimization of structures and systems	2	2	3, 5	Learning to search for optimal solutions by various methods: brainstorming, morphological analysis, expert methods.
7. Search for optimal solution TRIZ methods	2	1	3, 4, 6	Learning to search for optimal solution TRIZ methods

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				

Didactic unit: General concepts, the main stages of the development of science and technology				
1. The main stages of the development of science and technology		9	4, 5	Studying the history of the development of science and technology
Didactic unit: Elements of system analysis in electrical engineering				
2. Systemic analysis in electrical engineering		5	2, 4, 5	Study of system theory, as a methodological basis for solving problematic creative tasks
3. Euristic methods for solving technical tasks		5	5, 6	Study of the basic concepts of TRIZ and solving problems of optimization of structures and systems

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Methodical support and software

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology
2 Microsoft Office Application Pack

Course: 1, semester : 1

	Kind of activity	Semester
		1
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	45
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

is able to analyze and take into account the diversity of cultures in the intercultural interaction process; *regarding the following learning results*:
builds social interaction, given the general and special different cultures and religions
demonstrates the understanding of the characteristics of various cultures and Nations
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
develops and analyzes generalized solutions to solving the problem

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

develops and analyzes generalized solutions to solving the problem	
1. about the concepts, methods and means of the theory of information processes and systems	Lections; Seminars; Independent work
2. systemic periodization of the history of science and technology	Lections; Seminars; Independent work
3. Definition of science and scientific rationality, the difference between science from other spheres of culture, determining the concept of information and information society	Lections; Seminars; Independent work
4. The subject and object of philosophy, the difference between scientific philosophy from the unscientific, the content of the philosophical approach and the need for philosophical vision of the world	Lections; Seminars; Independent work
builds social interaction, given the general and special different cultures and religions	

5. On the process of evolution of scientific knowledge	Lections; Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
6. on the main concepts of science	Lections; Seminars; Independent work
demonstrates the understanding of the characteristics of various cultures and Nations	
7. On the main methodological concepts of modern science	Lections; Seminars; Independent work
8. Methodological concepts of science and technology, general patterns of their relationships	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
9. On the content of the philosophical theory of knowledge, the nature of philosophical problems, philosophical understanding and explanation	Lections; Seminars; Independent work
10. on the basic methods of scientific knowledge	Lections; Seminars; Independent work
builds social interaction, given the general and special different cultures and religions	
11. On our own to put problem questions on the course	Lections; Seminars; Independent work
12. own programming skills to solve project tasks	Lections; Seminars; Independent work
demonstrates the understanding of the characteristics of various cultures and Nations	
13. Types and classification of innovative risks	Lections; Seminars; Independent work
14. to reasonably represent the socio-humanitarian problems of science as an integral part of the culture	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: History of philosophy and science				
1. Philosophy and science of antiquity era. Philosophy and science of the era of Gothic.	2	2	3, 5	Drawing up a lecture constipation
3. Philosophy and science of the Renaissance. Filosophy and science of the Epoch of Enlightenment.	2	2	1	Drawing up a lecture constipation
4. Philosophy and science of the era of classicism.	1	1	1	Drawing up a lecture constipation
5. Philosophy and science of the modern era.	1	1	1	Drawing up a lecture constipation
Didactic unit: Synergistic Paradigm Modern Natural science.				
6. Synergetic status in the knowledge system. Synergetics - the core of postnoclastic science. Hermeneutic methods of knowledge in natural science. The use of a synergistic approach in the social sphere.	2	2	6	Drawing up a lecture constipation
Didactic unit: Genesis SGN				

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
7. Sociocultural backgrounds of the sciences on society and man. Prehistory and history of the SGN.	2	2	13, 2	Drawing up a lecture constipation
8. The specifics of the object and the subject of the SGN difference from natural science.	1	1	12, 2, 5	Drawing up a lecture constipation
9. Socio-cultural functions of the SGN.	1	1	12, 2, 4, 5, 9	Drawing up a lecture constipation
Didactic unit: Traditional and technogenic civilization.				
10. Values of human existence and man-made world. Scenarios of technical evolution and prospects for the development of technogenic civilization	2	2	1, 11, 6	Drawing up a lecture constipation
12. Traditionalism and technical progress, their interaction in the historical perspective. Equipment of post-industrial society and the semantic values of life.	1	1	1, 5, 6	Drawing up a lecture constipation
Didactic unit: The problem of a person in modern philosophy.				
13. The role of man-made factors in its formulation and decision. Technical environment and alienation of man, ways to overcome the alienation.	1	1	1, 14, 2, 5, 6	Drawing up a lecture constipation
14. Modern psychophysiological and humanitarian problems of human and technical interaction.	1	2	10, 11, 3, 4, 6	Drawing up a lecture constipation
Didactic unit: Genesis SGN				
.			7	

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: History of philosophy and science				
1. The subject of philosophy of science. The place and role of scientific rationality in culture. The main directions, schools and stages Historical development of philosophy of science. Structure and types of rationality.	2	2	1, 3, 4, 5	Reports and discussions
Didactic unit: Teaching about Genesis				
2. Monster and pluralistic concepts of being, self-organization of being. Philosophical doctrine of matter. The concept of material and ideal. Space, time, movement and development. Determinism and intenerismism.	2	2	2, 5, 6	Reports and discussions

Didactic unit: Synergistic Paradigm Modern Natural science.				
3. Dynamic and statistical patterns. Scientific, philosophical and religious paintings of the world	2	2	4, 6	Reports and discussions
Didactic unit: Genesis SGN				
4. Man and nature, science and technology. Place science and technology in public life. The concept of man-made civilization. Formational and civilization concept of social development	2	3	12, 2	Reports and discussions
Didactic unit: Traditional and technogenic civilization.				
5. Man and historical process, personality and mass. Scientific picture of the world and the meaning of human being. Philosophy of science and intercultural dialogue. Ways of Evolution and the possibility of human mind	1	2	11, 12, 5	Reports and discussions
Didactic unit: The problem of a person in modern philosophy.				
6. Science as a cultural sphere. Theoretical systematization of knowledge of reality. Items and ways of knowledge: accurate, natural, socially humanitarian, technical. Study of objective reality based on the method of scientific analysis	1	2	7, 8	Reports and discussions
Didactic unit: Criteria for selecting tests				
7. Modern science concept. Cognition, creativity, practice. Scientific and ratio of science with other areas of knowledge. Rational and irrational in cognitive activity. The problem of truth. Reality, thinking, logic and language	1	2	10, 9	Reports and discussions
Didactic unit: Scientific and unscientific knowledge				
8. Criteria. The structure of scientific knowledge, its methods and forms. Growth of scientific knowledge. Philosophy of Science and Technology	1	2	10, 2	Reports and discussions
Didactic unit: Global problems of modernity				

9. Scientific revolutions and changing types of rationality. The theory of science as a methodological concept of systematization and a logically agreed response to the problems of philosophy of science. The concept of scientific and technological progress. Socio - Natural, Cultural and Moral Development of Human Civilization	1	1	13, 14	Reports and discussions

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Main literature

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Methodical support and software

Methodological support

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Modern problems of electric traction

Course: 1, semester : 1

	Kind of activity	Semester 1
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	45
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
develops and analyzes generalized solutions to solving the problem
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

develops and analyzes generalized solutions to solving the problem	
1. PC-1.V / PR. 2 2. Develops and analyzes generalized solutions to the problem	Lections; Seminars; Independent work
Alasticized and synthesize objects of professional activity	
2. PC-2.V / PR. 2 2. Capacked to analize and synthesize objects of professional activity	Lections; Seminars

3. PC-3.V / those. 1 1. It is capable of developing measures to efficient use of energy and raw materials	Lections; Seminars; Independent work
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
4. PC-3.V / those. 2 2. Determines the modes of operation of technological equipment and technological equipment systems of occupational objects	Lections; Seminars

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results
Semester: 1			
Didactic unit: Principles of comprising computer			
1. Problems of choosing an effective traction drive and electrical vehicle propellers (ETS)		4	1, 3
Didactic unit: EXT control problems based on impulse and digital equipment.			
2. EXCHANCE PROBLEMS ETS based on impulse and digital technology		4	4
Didactic unit: Intraido-electrical power networks to tension 0.38 square meters.			
3. Saving and energy conversion issues for ETS		3	3
Didactic unit: Improving the efficiency of using electrical energy in electric traction systems			
4. Improving the efficiency of electrical energy in electrical traction systems		4	1, 2
Didactic unit: Prospects for the development of autonomous and hybrid ETS			
5. Prospects for the development of autonomous and hybrid ETS		3	1

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Principles of comprising computer				
1. Comparative analysis of traction actuators with various types of electrical machines and drivers.	3	3	1, 3	Performing a comparative analysis of the properties of traction drives with various types of electrical machines and drivers.
Didactic unit: EXT control problems based on impulse and digital equipment.				
2. Estimation of circuit solutions for ETS control systems based on modern NGN and digital technology.	4	4	1, 4	Estimation of circuit solutions for ETS control systems based on modern NGN and digital technology.
Didactic unit: Intraido-electrical power networks to tension 0.38 square meters.				

3. Comparative analysis of the conversion devices and supply of energy to the current collectors ETS. Prospects for the development of current conversation systems.	3	3	1, 3	Comparative analysis of the conversion devices and supply of energy to the current collectors ETS. Prospects for the development of current conversation systems.
Didactic unit: Improving the efficiency of using electrical energy in electric traction systems				
4. Evaluation of the energy characteristics of the electrical trans-port system and ways to increase the efficiency of electricity use.	4	4	1, 2	Following the evaluation of the energy characteristics of the electric trans port and ways to improve the efficiency of electricity use.
Didactic unit: Prospects for the development of autonomous and hybrid ETS				
5. Scientific and technical assessment of the prospects for the development of autonomous and hybrid ETS.	4	4	1, 3	Assessment of the prospects for the development of autonomous and hybrid ETS.

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

Course: 1 2, semester   : 2 3

	Kind of activity	Semester	
		2	**3**
1	Total credits	4	4
2	Total hours	144	144
3	Total classes in the contact form, hours	63	64
4	Lectures, hours	18	18
5	Practical lessons, hours	18	18
6	Laboratory studies, hours	18	18
7	of them in an active and interactive form, hours	12	18
8	Consultations, hours	7	8
9	Independent work, hours	81	80

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results***:**
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results***:**
develops and analyzes generalized solutions to solving the problem
is able to find compromise solutions
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results***:**
Alasticized and synthesize objects of professional activity
can create mathematical models of objects Professional activities

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

is able to find compromise solutions	
1. PC-1.V /ETC. 1 1. Able to find compromise solutions	Lections; Seminars; Laboratory works; Independent work
develops and analyzes generalized solutions to solving the problem	
2. PC-1.V / PR. 2 2. Develops and analyzes generalized solutions to the problem	Lections; Seminars; Independent work

can create mathematical models of objects Professional activities	
3. PC-2.V / PR. 1 1. Creating Mathematical Models of Professional Objects	Lections; Seminars; Independent work
Alasticized and synthesize objects of professional activity	
4. PC-2.V / PR. 2 2. Capacked to analize and synthesize objects of professional activity	Lections; Seminars; Laboratory works; Independent work
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
5. PC-3.V / those. 2 2. Determines the modes of operation of technological equipment and technological equipment systems of occupational objects	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Purpose, Structure and basic elements of traction electric drive.				
1. Classification of traction electric drives.		2	1, 2	Features of the working conditions of the traction electric drive.
Didactic unit: Automatic control systems for traction electric drives.				
2. Structural scheme of automatic control systems. Management principles.		6	3	Classification of automatic control systems. Classification of automatic control systems (SAU) by electrical appliance (EPS).
Didactic unit: ECERGETIC BALANCE, ECERGETIC Efficiency.				
3. Typical functional circuits of automatic control systems (SAR) EPS.		6	3, 4	Functional elements of SAR EPS: Specifying, intermediate, sensors, control objects, executive and control elements.
Didactic unit: Structural schemes SAR.				
4. Structural circuits and transfer functions of open and closed SAR.		2	4, 5	Structural circuits and gear ratios SAR EPS.
Didactic unit: Synthesis of SAR.				
5. General characteristics of synthesis tasks and correction principles.		2	2, 3, 4, 5	Features of SAR EPS synthesis. Principles of auto science EPS: appointment and scope; principles of optimal EPS control; Algorithms and automatic control programs for EPS in thrust modes, eleg, braking; Reliability of avtovology systems.
Semester: 3				
Didactic unit: Modeling the mechanical part of the electric drive of vehicles.				
6. Requirements for traction characteristics of vehicles.		4	1, 2, 3, 5	Recalculation of the electromagnetic moment of the engine by virtue of the thrust on the wheel rim.
Didactic unit: Electromechanical characteristics of an asynchronous engine.				

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
7. The effect of frequency and voltage on the form of a high speed characteristic.		4	3, 5	Engine starting methods, selection of numerical start-up characteristics to ensure a given acceleration (torque).
Didactic unit: Construction of power inverters voltage schemes.				
8. Features of the joint key management of the three-phase bridge inverter.		4	2, 4	Principle of operation of a single-phase voltage inverter: the range of output voltages, the formation of control signals on the key, selection of circuit solutions and parameters of the filtering devices, the frequency ranges of the output voltage and key switching.
Didactic unit: Basics Vector control of asynchronous electric drive.				
9. Vector control area.		4	1, 5	Presentation of voltages and currents in the vector form, key switching sequences.
Didactic unit: Basic concepts and definitions of discipline				
10. Electromechanical characteristics of the synchronous motor.		2	4, 5	Comparative analysis of the main types of electric motors. Methods for controlling the engine with permanent magnets.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: ECERGETIC BALANCE, ECERGETIC Efficiency.				
1. Typical functional circuits of automatic control systems (SAR) EPS.		18	1, 4	Functional elements of SAR EPS: Specifying, intermediate, sensors, control objects, executive and control elements.
Semester: 3				
Didactic unit: Automatic control systems for traction electric drives.				
2. AC motor vector control.		18	1	Vector control.

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Modeling the mechanical part of the electric drive of vehicles.				
1. Typical functional circuits of automatic control systems (SAR) EPS.	4	6	1, 3, 4	Functional elements of SAR EPS: Specifying, intermediate, sensors, control objects, executive and control elements.
Didactic unit: Automatic control systems for traction electric drives.				
2. Structural circuits and gear ratios SAR EPS.	2	6	3, 4	Structural circuits and transfer functions of open and closed SAR.

Didactic unit: Synthesis of SAR.				
3. Synthesis SAR EPS with nonlinear links.	6	6	2, 3, 4, 5	Features of SAR EPS synthesis. Principles of auto science EPS.
Semester: 3				
Didactic unit: Modeling the mechanical part of the electric drive of vehicles.				
4. Recalculation of the electromagnetic moment of the engine by virtue of the thrust on the wheel rim.	6	6	2	The effect of traction transmission on the traction characteristics of the vehicle.
Didactic unit: Construction of power inverters voltage schemes.				
5. Range of output voltages, generating control signals on the key, selection of circuit solutions and filtering device parameters, output voltage frequency bands and key switching.	6	6	3, 5	Features of the joint key management of the three-phase bridge inverter.
Didactic unit: Basic concepts and definitions of discipline				
6. Vector control area.	6	6	1	Presentation of voltages and currents in the vector form, key switching sequences.

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Specialized software

1 Microsoft Office Application Pack

2 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

3 Development of cross-platform applications Microsoft Visual Studio 2015

Course: 2, semester : 3

	Kind of activity	Semester 3
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	27
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	10
8	Consultations, hours	7
9	Independent work, hours	81

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
1. Know the types of electromagnetic interference of electrified railway transport	Seminars; Independent work
2. Know the basic information about electromagnetic compatibility	Seminars; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	

3. to be able to determine the main parameters of the electromagnetic compatibility of electrical devices Transportation	Seminars; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
4. Know the natural sources of electromagnetic radiation	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Basic principles of control of a synchronous engine with permanent magnets.				
1. Search and study of guests for electromagnetic compatibility in relation to the topic of dissertation work	2	2	1, 2, 3	Search and study of guests for electromagnetic compatibility using the Internet in relation to the topic of dissertation work and reporting
1. Basic concepts. Terms and Definitions		1	1, 2	Discussion of the basic concepts of electromagnetic compatibility (terms and definitions)
2. Classification of sources of electromagnetic radiation		1	1, 2	Search and definition of types of sources of electromagnetic radiation of electrical transport systems
3. Natural sources of electromagnetic radiation		1	1, 4	Discussion of the effects of electromagnetic radiation from natural sources
Didactic unit: Electromagnetic oscillations				
6. Sources of electromagnetic interference. Estimated models and substitution schemes		1	1	Studying the calculated models and schemes for replacing the sources of electromagnetic interference (induced interference of the contact network. Magnetic effect of the contact network. Effect of traction network on the power line)
8. Power supply voltage quality	5	5	3	Study of the forms of stress curves to obtain a harmonic composition, the non-symmetry coefficient in the Mathcad environment
Didactic unit: Influence of electromagnetic radiation per person				
9. Biophysics interaction. Electromagnetic radiation of industrial frequency. Static electricity discharges. Electrostatic field		1	1, 2	Calculation and determination of the main parameters of electromagnetic radiation of high and ultra-high frequencies, radiation of industrial frequency. Static electricity discharges. Electrostatic field
Didactic unit: Problems of electromagnetic compatibility of static rectifiers and auxiliary network of alternating current				

9. Problems of electromagnetic compatibility of static rectifiers and AC power supply	3	6	1, 3	Calculation of the basic parameters of multipuls rectifiers (4, 8, 12, 24), taking into account non-ammometry and non-velocidal stresses of the supply network

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Specialized software

1 PTC Mathcad

Course: 1, semester : 2

	Semester
Kind of activity	**2**
1 Total credits	3
2 Total hours	108
3 Total classes in the contact form, hours	45
4 Lectures, hours	0
5 Practical lessons, hours	36
6 Laboratory studies, hours	0
7 of them in an active and interactive form, hours	20
8 Consultations, hours	7
9 Independent work, hours	63

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
is able to find compromise solutions
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
can create mathematical models of objects Professional activities

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

is able to find compromise solutions	
1. PC-1.V /ETC. 1 1. Able to find compromise solutions	Seminars; Independent work
can create mathematical models of objects Professional activities	
2. PC-2.V / PR. 1 1. Creating Mathematical Models of Professional Objects	Seminars; Independent work

Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
3.PC-3.V / Those. 3 3. It is able to determine the calculators of the functioning of technological equipment and technological equipment systems of the objects of professional activity	Seminars; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
4. PC-4.V / those. 2 2. Conditions to solve professional tasks in enterprises and organizations of the profile industry of their region.	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Requirements for control systems				
1. Technical requirements for control systems for traction electric drive.		2	1, 4	Practical lesson. Topics Classes: The main functions of the electrotransport management system. Features of the working conditions of control systems on the rolling stock.
2. Structural schemes of control systems of traction electric drive. Elemental database control systems for traction electric drives.		2	1, 4	Practical lesson. Topics Classes: Structural schemes of control systems of traction electric drive. Essential elements. Elemental base of traction control systems: microcontrollers, sensors, actuators, communications, elements of the human and machine interface. Structure of the power key management system. Purpose of SPP drivers, breach chains, protection signals and feedback.
Didactic unit: Microcontrollers in control systems				
3. The main technical characteristics of microcontrollers used in electrical transport control systems. Differences of microcontrollers of different manufacturers.		2	3, 4	Practical lesson. Topics Classes: The overall characteristics of modern microcontrollers. The speed of microcontrollers. Processor command systems in RISC and CISC architectures with reference to microcontrollers. Memory. Types of entrances and exits, ADC, DAC. Communication interfaces. Timers. AVR microcontrollers (ATMEL), PIC (Microchip), STM32 (ARM), ESP8266 and others.

4. Basics of programming language controllers. Methods for downloading programs in a microcontroller. Methods for setting the operating frequency of microcarters.	2	2	3, 4	Practical lesson. Topics Classes: The basics of the high-level controller programming language on the example of the controller of the selected manufacturer. Methods for downloading programs in a microcontroller. Programmers, debug board. Methods of clocking microcontrollers. Methods for setting the operating frequency of microcontrollers. FUUMA and settings registers.
Didactic unit: Regulator position				
5. The main modes of vehicle movement. Determining the requirements for traction drive methods of traction calculations.		4	2, 3	Practical lesson. Topics Classes: Calculation of speed and acceleration, thrust and braking forces, the moment, the power of the traction electric motor. Determination of the voltage and current of the winding of the traction motor, its magnetic flux of excitation. Features of controlling the speed of traction electric motors of independent excitation in modern impulse control systems.
Didactic unit: Strengthening the controller output signals. Semiconductor devices.				
6. Discrete output signals. Power load control using bipolar transistors operating in key mode.	2	4	1, 3	Practical lesson. Topics Classes: Characteristic voltages and currents of signals of electrical equipment. Ways to enhance control signals. Calculation of bipolar transistor in key mode. Methods for choosing bipolar transistors.
7. Open control systems for traction electric motor	2	4	1, 2, 3, 4	Practical lesson. Topics Classes: Principle of action of the pulse reduced voltage converter. Determining the basic parameters of the elements of the stress converter diagram. Comparison of types of power keys, application area, selection technique. Features of applications of power semiconductor keys in various types of traction electrical equipment. Causes of preemptive use of voltage control transistors. Checking semiconductor overheating devices at a given operating frequency.

8. Silest semiconductor keys drivers	2	4	1, 2, 3, 4	Practical lesson. Topics Classes: Purpose of semiconductor keys drivers. Main circuits applied in drivers for IGBT and MOSFET transistors. Examples of the simplest drivers for low-frequency keys. Methods for selecting serial drivers for power semiconductor devices.
9. Management of power semiconductor keys with a microcontroller	2	2	1, 2, 3, 4	Practical lesson. Topics Classes: Device and principle of the microcontroller timers. Basics of programming timers. Implementation of latitude-pulse modulation with a variable filling coefficient. Open control system for the speed of the traction electric motor.
Didactic unit: Feedback in control systems				
10. Realization of feedback systems on microcontrollers	2	2	1, 2, 4	Practical lesson. Topics Classes: Types of input signals. Analog-digital microcontroller converters: device, principle of operation, main characteristics. Programming ADC microcontrollers.
11. Closed Traction Electric Motor Control Systems	2	2	1, 2, 3, 4	Practical lesson. Topics Classes: Functional schemes for controlling the speed of the traction electric motor with feedback over the current and speed. Features of the implementation of the control system with an increase in the speed and EMF motor. Calculation of the coefficients of the PID-regulator of the speed. Software implementations of the speed control speed control system and speed speed.
Didactic unit: Use of microcontrollers in control systems				
12. Interfaces and communication protocols in electrical transport control systems	2	2	1, 4	Practical lesson. Topics Classes: Basic interfaces and communication protocols. Examples of implementing SPI and UART interfaces. Methods for encoding information, constructing signal oscillograms in the specified interfaces. Overview of i2c, CAN, Modbus typical protocols and others.

13. Man-machine interface in driving electric drive control systems	2	2	1, 4	Practical lesson. Topics Classes: Equipment for the implementation of the human and machine interface used in modern electronics and electric transport. Types of indicator screens, principle of operation, connection methods with a microcontroller. Software implementation of data output on the screen. Connecting the keyboard to the microcontroller.
14. Distributed traction electric drive control systems	2	2	1, 3, 4	Practical lesson. Topics Classes: Architecture of distributed control systems for electrical vehicles. Principles of distribution of tasks between system elements. Software implementation of data exchange between microcontrollers. Implementing an example of a distributed control system.

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Methodical support and software

Methodological support

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2. Мятеж С. В. Цифровые и микропроцессорные системы управления электрическим транспортом [Электронный ресурс] : электронный учебно-методический комплекс / С. В. Мятеж ; Новосиб. гос. техн. ун-т. - Новосибирск, [2016]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233437. - Загл. с экрана.

Specialized software

1 Package for modeling energy systems MathWorks Matlab Simpowersystem

2 PTC Mathcad

3 Creating reports for laboratory work. Microsoft Microsoft Office

Renewable energy sources

Course: 1, semester : 2

		Semester
	Kind of activity	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	42
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	20
8	Consultations, hours	4
9	Independent work, hours	66

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Able to develop methods and conduct studies of professional activities

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
1. U5. To be able to formulate the criteria for evaluating the effectiveness and quality of energy conversion	Seminars; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	

2. U1. To be able to apply modern methods of design, calculations and modeling electrical complexes and their components	Laboratory works; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
3. Z4. Knowing the main achievements in the area of ??circuitry solutions of energy transducers	Seminars; Independent work
Able to develop methods and conduct studies of professional activities	
4. U2. To be able to analyze the power installation schemes and calculate the parameters of the devices	Seminars; Laboratory works; Independent work
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
5. Z2. Know the current methods of evaluating the methods of energy conversion from the point of view of efficacy and quality	Seminars; Laboratory works; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
6. Z1. Know the criteria for the energy efficiency of electrical objects and systems	Seminars; Laboratory works; Independent work
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
7. Skill formulation Formulate research principles, find, compare, evaluate software research methods	Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Sources using water streams				
1. Sources using water streams	4	4	2	Sources using water streams
Didactic unit: Sources using the energy of air flows.				
2. Sources using airflow energy.	2	4	4	Sources using airflow energy.
Didactic unit: Sources using solar energy.				
3. Sources using solar energy.		4	7	Sources using solar energy.
Didactic unit: Energy batteries.				
4. Energy batteries.		6	5, 6	Energy batteries.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Purpose, scope and classification of renewable energy sources.				

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
1. Structural schemes, methods and means of converting energy of renewable sources to other types, including electrical.		4	1, 6	A brief description of the element base of transducers included in the power installations: electrical machines, parameters and characteristics of semiconductor devices (transistors, thyristors, diodes, etc.), capacitors, chokes.
Didactic unit: Sources using water streams				
2. Structural schemes, layout solutions, principle of operation of hydroelectric power plants, tidal hydroelectric power plants, flood hydroelectric power plants operating on temperature drops.	2	2	1	Structural schemes, layton solutions, principle of operation of hydroelectric power plants.
Didactic unit: Sources using the energy of air flows.				
3. Vane wind power plants.	4	4	1, 4	Structural schemes, WEU converters, principle of operation. The main energy relations.
Didactic unit: Sources using solar energy.				
4. Photoelectric converters.	4	4	3	Power plants like "Sun Tower". Solar power plants with stirling engine
Didactic unit: Energy batteries.				
5. Combined batteries.	2	2	5	Electrochemical batteries. Electromagnetic batteries. Hydraulic batteries.
Didactic unit: Basics of designing converters on renewable energy sources.				
6. Calculation of energy installations.	2	2	3, 5, 6	Calculation of wind power plants. Calculation of power plants on solar panels. Calculation of autonomous energy installations.

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Purpose, scope and classification of renewable energy sources.				
1. Structural schemes, layout solutions, principle of operation of power plants operating in various types of renewable energy sources.		4	1, 3, 4	Have an idea of the revolving energy sources.
Didactic unit: Sources using water streams				
2. Damic hydroelectric power plants.		6	3, 4	Structural schemes, layton solutions, principle of operation of hydroelectric power plants. The main energy relations.
Didactic unit: Sources using the energy of air flows.				
3. Classification of wind power plants (VEU).		6	3, 4	The main energy relations.

Didactic unit: Energy batteries.				
4. Electrochemical batteries.		4	3, 4	Alkaline, acid, lithium-ion batteries.

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Main literature

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Methodical support and software

Methodological support

1. Основы преобразования энергии : методические указания к проведению практических занятий для ФМА специальностей "Электрический транспорт", "Автоматизация технологических процессов и производств" / Новосиб. гос. техн. ун-т ; [сост.: А. И. Андреев, В. В. Бирюков]. - Новосибирск, 2013. - 45, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000185162

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

Modeling Electric Transport Systems

Course: 1, semester : 1

		Semester
	Kind of activity	**1**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	81
4	Lectures, hours	0
5	Practical lessons, hours	36
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	36
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Alasticized and synthesize objects of professional activity
can create mathematical models of objects Professional activities

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

Alasticized and synthesize objects of professional activity	
1. Know the basic methods of processing experienced data and experimental research results	Seminars; Laboratory works; Independent work
can create mathematical models of objects Professional activities	
2. to be able to identify the parameters of physical models based on the similarity theorems to fulfill experimental studies	Seminars; Laboratory works; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	

3. To be able to evaluate the accuracy of the results of experimental studies and interpret interpretation	Seminars; Laboratory works
can create mathematical models of objects Professional activities	
4. Know the main components of the architecture of mobile platforms	Seminars; Laboratory works; Independent work
5. to be able to build mathematical models of control objects and automatic control systems (SAU)	Seminars; Laboratory works; Independent work
Alasticized and synthesize objects of professional activity	
6. Know the system of computer mathematics and simulation	Seminars; Laboratory works; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
7. use computer mathematics and apply imitation modeling programs for independent scientific research	Seminars; Independent work
can create mathematical models of objects Professional activities	
8. forms design solutions for new objects	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Image characteristics				
3. Computer Mathematics Application Packages	4	8	1, 2, 3, 4, 5, 6	Study of modern packages of applied computer mathematics
Didactic unit: Implementing simulation mechanisms, programming				
7. Solving research tasks with the use of imitation modeling	6	12	1, 2, 3, 4, 5, 6	Improving work skills in imitation modeling
8. Random events and processes in the electrical transport system	2	12	1, 2, 3, 4, 5, 6	Study of challenges of random processes in the system "Electric transport" with computer mathematics systems
9. Analytical and imitation models, imitation mechanisms	4	4	1, 2, 3, 4, 5, 6	Studying methods for solving mathematical models by analytical pathway and method of organizing imitation

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: direct methods of solving a slope with matrices given in tape and profile formats.				
1. The main stages of modeling and their characteristics	2	4	1, 2, 3, 4, 5, 6, 7, 8	Drawing up a meaningful description of the object of the electrical transport system, its formalization and the task of Iso-information in the model

2. Descriptions of electrical transport system objects, its formalization and setting of source information in the model	4	8	1, 2, 3, 4, 5, 6, 7, 8	Studying the features of the technology of developing models of the hierarchical system of electrical transport
Didactic unit: Image characteristics				
4. Mathematical description of objects and processes of electrical transport. Tasks for analyzing and synthesis in modeling	2	4	1, 2, 3, 4, 5, 6, 7, 8	Description of the original object with mathematical means. Formalization of the modeling object, task of source information and analysis of modeling results
Didactic unit: Criteria for adequacy in physical and mathematical modeling				
5. Similarity models, physical, analog; Forecast modeling, similarity theorems. Elements of similarity theory. Washing modeling	4	4	1, 2, 3, 4, 5, 6, 7, 8	Development of skills to determine the main properties of the original object, fixing the consequences of the similarity of the likeness, the concept of self-interest
6. Solution of research objectives on the topic "Electromechanical analogies"	6	12	1, 2, 3, 4, 5, 6, 7, 8	Improving analog modeling skills on the example of electromechanical analogies
Didactic unit: Implementing simulation mechanisms, programming				
10. Studing a research task on an algorithmic language on a computer	2	4	1, 2, 3, 4, 5, 6, 7, 8	Improving imitation algorithms and programming skills to solve research tasks

Literary sources

Main literature

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2. Шорников Ю. В. Компьютерное моделирование динамических систем : [учебное пособие] / Ю. В. Шорников, Д. Н. Достовалов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 65, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000236114

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1. Плохов А. В. Определение механических свойств материалов [Электронный ресурс] : лабораторный практикум / А. В. Плохов, А. И. Попелюх, Н. В. Плотникова // Новосибирский государственный технический университет : портал. - 1994-2018. - Режим доступа: https://ciu.nstu.ru/WebInput/persons/931/edu_actions/pcources/konspekt_lekciiy_. - Загл. с экрана.

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4. http://www.iprbookshop.ru/

5. http://znanium.com/

Methodical support and software

Methodological support

1. Моделирование электротранспортных систем : программа курса, задание на курсовые работы с методическими указаниями для 4-5 курсов дневного и заочного отделений специальности 180700 "Электрический транспорт" / Новосиб. гос. техн. ун-т ; [сост. В. И. Сопов]. - Новосибирск, 2004. - 25 с.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000029568

2. Моделирование систем электрического транспорта : лабораторный практикум для магистрантов по направлению 13.04.02 - "Электроэнергетика и электротехника" и аспирантов по направлению 13.06.01 - "Электро- и теплотехника" / Новосиб. гос. техн. ун-т ; [сост.: С. В. Мятеж, М. Е. Вильбергер]. - Новосибирск, 2017. - 19, [3] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000235161

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Specialized software

1 Microsoft Visual Studio 2010
2 Scientific and Technical Computing Program Mathworks Matlab

ANNOTATION OF THE PROGRAM
Experimental planning theory

Course: 1, semester : 1

		Semester
	Kind of activity	**1**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	47
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	36
8	Consultations, hours	9
9	Independent work, hours	61

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
produces a strategy for solving the task
Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

analyzes the problem situation and makes it decomposition for individual tasks .	
1. UK-1. 1 1. Analyzes the problem situation and makes it a decomposition into separate tasks.	Lections; Seminars; Independent work
produces a strategy for solving the task	
2. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars
3. PC-3.V / those. 1 1. It is capable of developing measures to efficient use of energy and raw materials	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Principles of experiment planning				
1. Extreme experiment. FULL FACTORY EXPERIMENT	4	4	1	Teaching the Fundamentals of Experiment Planning
Didactic unit: Mathematical description of the processes of energy conversion in technological machines with an electric drive				
3. Drawing up mathematical plans for experiments for power models	4	4	1	PFE with midpoint. Fractional factory experiment
6. Search Optimum Using Simplex Plan	2	2	1	Teaching the Plan Method Teaching
Didactic unit: Statistical processing of experimental data				
7. Correlation analysis - ranking and screening insignificant factors	4	4	2	Learning receiving factors ranking and screening insignificant factors
8. Regression analysis, verification of adequacy of empirical models on the criteria of Fisher and Student	4	4	1	Training to compile empirical regression models and verifying the adequacy of models

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Principles of experiment planning				
4. Factor experiment. Construction of PFE matrices for linear models	5	5	1	Training methodology for constructing matrices plan PFE
5. Drawing up mathematical plans for experiments for power models	5	5	2	Training Metrix Mode Experiment Plan
Didactic unit: Mathematical description of the processes of energy conversion in technological machines with an electric drive				
6. Mathematical planning of experiments for power models	5	5	1	Training of comprehensive mathematical plans
7. Fractional factory experiment	3	3	1, 3	Training of fractional experiment matrices

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Principles of experiment planning				
2. Compilation of Matrix PFE Linear Model		8	3	Compilation of Matrix PFE Linear Model
Didactic unit: Mathematical description of the processes of energy conversion in technological machines with an electric drive				
4. PFE with midpoint. DFE		5	1	Education to drawing up PFE plans with an average dot and fractional factory experiment

5. Search for optimum by the method of steep ascent on the gradient (Boxing Wilson)		5	3	Optimum search methods
6. Full factor experiment with medium dot. Fractional factory experiment		5	1, 3	Training of DFE plans
7. Search Optimum by the method of steep climb		5	1, 3	Training of the method of steep climb by gradient
8. Search Optimum Using Simplex Plan		5	1, 3	Learning Optimum Search Using Simplex Plan
Didactic unit: Statistical processing of experimental data				
9. Regression analysis		14	1	Training to compile regression empirical models

Literary sources

Main literature

1. Порсев Е. Г. Организация и планирование экспериментов : учебное пособие / Е. Г. Порсев ; Новосиб. гос. техн. ун-т. - Новосибирск, 2010. - 152, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000146033

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Internet resources

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Methodical support and software

Methodological support

1. Порсев Е. Г. Магистерская диссертация : учебно-методическое пособие / Е. Г. Порсев ; Новосиб. гос. техн. ун-т. - Новосибирск, 2013. - 32, [1] с.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000185133

Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

Course: 1, semester : 1

	Kind of activity	Semester 1
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	81
4	Lectures, hours	18
5	Practical lessons, hours	36
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	10
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
Forms possible options for solving problems
Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
1. Z2. Know standards, methodological and regulatory materials in the field of design and operation of electrotechnical complexes	Lections; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	

2. Z4. To know the principles of construction and organization of control systems based on industrial controllers	Lections; Seminars; Laboratory works; Independent work
Forms possible options for solving problems	
3. Z2. Know the criteria for the effectiveness of production and technological processes	Lections; Seminars; Laboratory works; Independent work
Alasticized and synthesize objects of professional activity	
4. Z1. Own the methods of analysis and synthesis of logic circuits and cybernetic devices	Lections; Seminars; Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Systems On microcontrollers and pls				
1. Systems on microcontrollers and pliz		4	1, 2, 4	Technological cycle of microprocessor systems. Quasiaparallel processes in microprocessor control systems. Features of control systems on microcontrollers and Plis.
Didactic unit: Microcontrollers				
2. MCS-51 microcontrollers		4	1, 2, 4	Features of architecture The structure of the microcontroller Addressing methods and command system Interrupt system I / O ports
3. AVR family microcontrollers		4	2, 3	Features of architecture The structure of the microcontroller Addressing methods and command system Interrupt system I / O ports
4. Microcontrollers of the PIC family		4	1, 2	Features of architecture The structure of the microcontroller Addressing methods and command system Interrupt system I / O ports
Didactic unit: Plis				
5. Plush		2	2, 4	Main types and Farce families Max + Plusii Design System AHDL language

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Microcontrollers				
1. Development of systems on microcontrollers.	4	4	2, 4	Dejections of microcontrollers. Studying architecture and principles of debugging on the example of the STK-600 complex.

2. Dejections of microcontrollers. Alphanumeric indicating LCD modules based on the HD44780 controller.	2	4	2, 4	Acquisition of practical skills of conjugation of microcontrollers with indicating devices
Didactic unit: Problems of Functioning and Development of Power Systems				
3. Programmable relays. Ladder Diagram language in microprocessor systems.	2	4	2, 4	Using the LD language for programming microcontrollers.
4. Systems based on the Zelio Logic SR3 relay.	2	6	3, 4	Studying the structure of the intellectual relay. Programming the simplest operations.

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Systems On microcontrollers and pls				
1. Development of systems on microcontrollers and Plis		6	2, 4	Studying architecture and principles of debugging on the example of the STK-600 complex.
6. Programmable Relay Zelio Logic		10	2, 3	Program Development for Zelio Logic.
Didactic unit: Microcontrollers				
2. AVR family microcontrollers		10	2, 4	Development of software for microcontrollers of the AVR family.
3. MCS-51 microcontrollers		10	2, 4	Software development for microcontrollers of the MCS-51 family.

Table 3.4

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Systems On microcontrollers and pls				
1. Microprocessor control systems design standards		28	1, 3, 4	Independent study of standards and norms of designing cryoprocessor systems

Literary sources

Main literature

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Internet resources

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Methodical support and software

Methodological support

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

Transport logistics and the organization of passenger traffic

Course: 1, semester : 1

		Semester
	Kind of activity	**1**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	64
4	Lectures, hours	18
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	10
8	Consultations, hours	8
9	Independent work, hours	80

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Determines the modes of operation of technological equipment and systems of technological equipment of professional activities
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.
Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

Determines the modes of operation of technological equipment and systems of technological equipment of professional activities	
1. PC-3.V / those. 2 2. Determines the modes of operation of technological equipment and technological equipment systems of occupational objects	Lections; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	

2.PC-3.V / Those. 3 3. It is able to determine the calculators of the functioning of technological equipment and technological equipment systems of the objects of professional activity	Lections; Independent work

Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.

3. PC-4.V / Those. 1 1. Know the specifics of socio-economic development and labor market in the field of professional activity in its region.	Lections; Seminars; Independent work

knows how to solve professional tasks in enterprises and in the profile industry organizations His region.

4. PC-4.V / those. 2 2. Conditions to solve professional tasks in enterprises and organizations of the profile industry of their region.	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: General characteristics of species of urban passenger transport				
1. Classification of modes of transport	1	2	4	Study of species of urban passenger transport
2. Comparative characteristics of the transport ability of types of GPT	2	2	4	Definition of sustainable ability. The agreed capability of the types of GPT.
Didactic unit: The throughput of the elements of the transport system				
3. Calculation of driving capacity	1	1	1, 3	Calculation of driving capacity
4. Calculation of the bandwidth of the stopping point	1	1	1, 3	Calculation of the bandwidth of the stopping point
5. Calculation of bandwidth intersection	1	1	1, 3	Calculation of bandwidth intersection
6. Calculation of the bandwidth of a section with a heavy profile path	1	1	1, 3	Calculation of the bandwidth of a section with a heavy profile path
Didactic unit: Mobility.				
7. Potential and realizable mobility		1	2, 3	Definition and interrelation of potential and implemented mobility
8. Total mobility and traffic mobility		1	1, 2, 3	Determination of the share of accounting transport mobility in general mobility
Didactic unit: Principles of designing transport networks				
9. Selection of modes of transport		1	2, 3, 4	Selection of modes of transport
10. Principles of Planning Elements of the Street Road Network	0	2	1, 3	Street road planning
11. Calculation of the number of transport and transfers	0	1	3	Calculation of the number and distribution of transport and transfers
Didactic unit: Routing and route systems.				
12. Routing principles	1	1	1, 2, 3, 4	Study of routing principles

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
13. Transfer and principles for environmental planning		1	3	Calculation of the coefficient of transformation and time transplantation, the calculation of the difficulty of the message
Didactic unit: Classification and principles of constructing modern video systems				
14. The regularity of the movement and methods of controlling trains		1	2, 3	Study of the regularity criteria. Timing. Study of movement control methods.
15. Control traffic. Methods for recovering disturbed movement.		1	2, 3	Studying the principles regulation of movement and methods for restoring disturbed movement.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: General characteristics of species of urban passenger transport				
1. Calculation of the transport ability of the GPT	2	8	3, 4	Calculation of the transport ability of types of GPT
Didactic unit: DC machines				
2. Building a histogram of passenger traffic	0	8	3	Building histograms
Didactic unit: Survey of passenger traffic and transportation.				
3. Methods and means of survey of passenger traffic		10	3	Conducting personnel surveys
4. Methods and Means of Mobility Survey		10	3	Survey of mobility

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: General characteristics of species of urban passenger transport				
1. Studying the planning characteristics of the rolling stock of GPT		10	4	Studying the planning characteristics of the rolling stock of GPT
Didactic unit: DC machines				
2. Building a cartogram of passenger traffic		8	3	Building cartograms
Didactic unit: single-phase low-power rectifiers				
3. Calculation of train intensity		2	3, 4	Calculation of train intensity
4. Calculation of capacity, preparation of trains		2	3, 4	Calculation of capacity, preparation of trains
5. Calculation of trains in motion and online train park		8	3, 4	Calculation of trains in motion and online train park
Didactic unit: Schedule.				
6. Types of train timetables		10	4	Drawing up train track charts on the route

7. Train schedule on the route		10	3	Drawing up a graph of motion. Coordination of trains of different routes in a common area.

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Main literature

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Methodological support

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2. Никулин М. Ю. Теория пассажирских перевозок и транспортная логистика [Электронный ресурс] : электронный учебно-методический комплекс / М. Ю. Никулин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000235940. - Загл. с экрана.

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Specialized software

1 Web Server Apache Software Foundation Apache

2 Modeling transport networks and calculation of passenger traffic PTV PTV Vissim

ANNOTATION OF THE PROGRAM
Sources of secondary power supply of vehicles

Course: 1, semester : 2

	Kind of activity	Semester 2
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	42
4	Lectures, hours	0
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	20
8	Consultations, hours	4
9	Independent work, hours	66

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
Forms possible options for solving problems
Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
develops and analyzes generalized solutions to solving the problem
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

Alasticized and synthesize objects of professional activity	
1. Modern world trends and historical genesis of various types of secondary sources of energy.	Seminars; Independent work
2. Select the parameters of the elements of electronic devices schemes	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	

3. Principles of work and the main characteristics of the most common types of drives and energy converters.	Seminars; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
4. Conduct calculations of the sources of the secondary power supply in order to implement the transportation of electrical vehicles	Seminars; Independent work
5. Build communication, taking into account the individual characteristics of the participants	Seminars; Independent work
Forms possible options for solving problems	
6. Different circuitry solutions of energy converters with secondary power supply sources on the electrical composition.	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
7. to conduct a reasonable choice of sources of secondary power supply For various types of electrical vehicles and possible modes of operation.	Seminars; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
8. Calculate electromagnetic processes In the various modes of functioning of energy converters with integrated secondary power sources.	Seminars; Independent work
9. Various methods for estimating the energy intensity of secondary power supply sources	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Course objectives and basic concepts				
1. Topic 1.1 Goals and Course Tasks; Stages of the historical development of sources of secondary power supply (IVE) vehicles.	2	2	1, 2	Goals and objectives of the course; Examples of use in various fields of technology and vehicles.
2. Topic 1.2 Modern condition and prospects for the use of secondary power sources in electrical vehicles.		2	1, 2	The use of secondary power sources in electrical vehicles and prospects for their use in the XXI century. in electrical transport complexes and systems
Didactic unit: General issues of the use of secondary power sources on transport Means.				
3. Topic 2.1 The main characteristics of the sources of the secondary power supply of vehicles.		2	6, 8	HEE characteristics depending on the type and type of vehicle and the scope of the source.
4. Topic 2.2 Using the sources of secondary power supply and the task according to their use on the electrically metropolitan composition.	2	2	1, 6	Various modes of electrical vehicles.

5. Topic 2.3 Unconventional and renewable energy sources. Hydrogen power. Intellectual networks		4	1, 2, 3	Prerequisites for the creation and purpose of the development of "smart" networks (Smart Grid). Solar, wind and other types of non-radiation energy sources. The instability of the production of renewable energy sources and the introduction of IV in the energy seal, energy storage systems.
6. Topic 2.4. Development of traction power supply systems		2	3, 7	Charging stations and electrotransport connection points. Integration of sources and systems of secondary power supply and renewable energy sources into the system of traction power supply.
7. Topic 2.5 Application of IVE in the system of own needs.		2	1, 3, 6	The history of the development of energy sources to ensure their own needs. Energobalance and the share of energy consumption of comfort chains and their own needs in the total balance of electrical machinery. Change in power consumption depending on the season.
Didactic unit: Transformative vehicle converting devices				
8. Topic 3.1 Electric Energy Converters.		2	1, 2, 7, 9	Scope of electrical energy converters on ETS. Classification of electrical energy converters on ETS. Features and modes of operation of converters on ETS. Requirements for electrical energy converters on ETS.
9. Topic 3.2 Circuit solutions of energy converters.	2	2	2, 6	Circuit solutions, two- and four-channel electrical energy converters. Work principles. Features of solutions, ways to change the voltage in DC power supply systems. Comparison of scheme solutions, basic principles of their choice.
Didactic unit: various types of drives E Nergia (capacitive and other species).				
10. Topic 4.1 Electrochemical energy storage devices in traction drives of electrical vehicles; Circuit solutions.	2	2	3, 6, 9	Advantages and disadvantages. Work principles. External Features of ECNE (Energy Electrochemical Drives). Acquaintance with the principles of choosing scheme decisions of installations using NE. The achieved technological level and promising areas of research.
Didactic unit: Different types of energy storage devices (electromechanical)				

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
11. Topic 4.2 Electromechanical Energy Drives (EMNE); Examples of use and various circuitry solutions in transport systems.	2	2	3, 6, 7	Operational features; External characteristics of EMNE. Work principles. Examples of use, features of operation and various EMNE circuit solutions in transport systems.
Didactic unit: Work with databases in Android				
12. Topic 4.3 Capacitive energy drives and capacitors based on a double electric layer. Examples of use and circuitry solutions.	2	2	3, 6, 7, 9	Main characteristics; Comparison of ENE with other types of energy storage. Examples of use on EPS. The achieved technological level and promising areas of research.
13. Theme 4.4 superconducting, hybrid and types of accumulative devices. Examples of use and circuitry solutions.		2	3, 7, 9	Areas of use; examples of using; scheme solutions; The distribution of energy between the components of the Grie parts.
Didactic unit: Power supply system				
14. Theme 5.1 Charging stations for electrical composition, equipped with combined energy sources.	2	2	7, 8, 9	Determining the required power of the charging station. Selection of energy sources for installation on a charging station. Electric energy buffering and the calculation of the energy drive as part of the charging station.
15. Topic 5.2 Types of EPS, regimes of maintenance and requirements for IV	2	2	4, 6, 7, 8, 9	Electrically metropolitan composition. Requirements for impulse converters when installing on EPS. Modes of operation of pulse converters.
16. Topic 5.3 Calculation of the accumulative device in the dependence of the types of electrical composition and maintenance modes.	2	2	5, 6, 7, 8, 9	Calculations of energy consumption in various modes of electrical machinery: the calculation of energy in the mode of electrical braking; Bufferization of energy in the motion cycle; Energy in the autonomous cycle of electrically metropolitan composition (thrust mode). Set the maximum starting currents.
17. Topic 5.4 Designing the circuitry solutions of an electric vehicle with a traction drive operating from IV.	2	2	6, 8	Analysis and selection of circuitry solutions, calculation of the parameters of the schema elements.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: General issues of the use of secondary power sources on transport Means.				
1. Independent study and circuitry solutions of energy converters with IV.		6	2, 3	Independent study of IVE types and circuitry solutions.

Literary sources

Main literature

1. ЭБС IPRbooks [Электронный ресурс] : электронно-библиотечная система. -
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Methodical support and software

Methodological support

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Specialized software

1 Microsoft Office Application Pack
2 Microsoft Office Application Pack
3 Calculator of the cost and timing of the project and its stages according to the COCOMO
COCOMO® II.2000.4 methodology
4 Microsoft Office Application Pack

Energy drives in the electric transport complex

Course: 1, semester : 2

		Semester
	Kind of activity	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	42
4	Lectures, hours	0
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	20
8	Consultations, hours	4
9	Independent work, hours	66

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
Forms possible options for solving problems
Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
develops and analyzes generalized solutions to solving the problem
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

develops and analyzes generalized solutions to solving the problem	
1. On the problems and prospects for using energy drives in the electric transport complex and on electrical vehicles	Seminars; Independent work
Alasticized and synthesize objects of professional activity	

2. Principles of work and the main characteristics of the most common types of energy storage facilities	Seminars; Independent work
3. to calculate the energy intensity of the energy intensity of energy in order to implement the autonomous stroke mode; To optimize the mass boiler indicators of the drives of the drives	Seminars; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
4. Conduct the calculations of the buffer cumulative device, which allows to reduce the peaks of power consumption or accumulate electric braking energy	Seminars; Independent work
Alasticized and synthesize objects of professional activity	
5. Calculate electromagnetic processes In electrical drives with energy drives and electrical transport complexes, equipped with devices for energy accumulation	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
6. various options for circuit solutions of electrical vehicles including accumulative devices	Seminars; Independent work
Alasticized and synthesize objects of professional activity	
7. Conduct and justify the choice of the type of energy drive when designing it for various types of electric vehicles	Seminars; Independent work
Forms possible options for solving problems	
8. Methods for estimating the energy intensity of cumulative Devices	Seminars; Independent work
9. On the history of the development of various types of energy storage and applying them in various fields of technology; On the prospects for the development of various types of energy storage devices	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Course objectives and basic concepts				
1. Topic 1.1 Goals and Course Tasks; Stages of the historical development of energy drives in various fields of technology and vehicles.		2	1, 9	Goals and objectives of the course; Stages of the historical development of various types of energy storage and application in different fields of technology, sub-regions of the electrical transport complex and on vehicles.
2. Topic 1.2 Modern global trends in the use of accumulative devices in electrical vehicles. Prospects for the use of various types of accumulative elements.	1	2	1, 9	The current state of the use of accumulative devices in electrical vehicles. Prospects for the use of various types of accumulative elements in the electrical transport complex and on vehicles. Technologies of intelligent networks.
Didactic unit: General issues of use of energy drives				

3. Topic 2.1 Methods for determining the energy intensity of the cumulative device depending on the type and type of vehicle.	1	2	5, 6	Calculation of energy intensity of the cumulative device depending on the type and type of vehicle.
4. Theme 2.2 of the tasks performed by the energy storage device in the traction power supply system and on the electrically metropolitan composition (EPS)	1	2	6, 9	autonomous move; partial recharge mode when moving along the route; Accumulating energy of electric braking; NE application for own needs
5. Topic 2.3 The use of energy storage devices in systems of electricity supply; Solved basic tasks.	1	2	5, 9	Reducing the peaks of consumption in traction networks. Possible options for placing NE in traction power supply systems (traction substation; interfiner zone; stopping point)
6. Topic 2.4 Synthesis of systems on renewable energy sources (renewable) and cumulative devices	1	2	1, 9	Schemechnical solutions for the use of renewable reservoir and NE in electrical transport complexes, analogs of application in various fields of technology. Advantages and restrictions.
Didactic unit: Electrochemical energy storage devices				
7. Topic 3.1 Electrochemical energy storage.	1	2	2, 8	Advantages and disadvantages. External characteristics (Energy Electrochemical Drives) EHNE. Comparison of EKNE various types: lead; alkaline; Lithium and others. Developments in the field of new types of ECNE.
8. Topic 3.2 Features of the use of EHNE in the systems of traction power supply and drives of electrical transport. Circuit solutions.	2	2	2, 6, 7	Acquaintance with the principles of choosing scheme decisions of installations using NE.
Didactic unit: Electromechanical drives Energone				
9. Topic 4.1 Comparison of Energy Electromechanical Drives (EMNE) with other types of drives.		1	2, 7	The operational features of this type of energy storage. External characteristics of EMNE.
10. Topic 4.2 Examples of use and various EMNE circuit solutions in transport systems.		1	2, 6	Examples of use and various EMNE circuit solutions in transport systems.
Didactic unit: Capacitive energy drives				
11. Topic 5.1 Capacitive energy drives.	1	1	2, 6	Main characteristics and examples of use.
12. Topic 5.2 Drives on the basis of "classic" capacitors and based on the capacitors of the double electric layer.	2	2	2, 6, 7, 8	Comparison of ENE with other types of energy storage. Characteristics of EANE. Examples of applying this type of EPS drives.
Didactic unit: Energy storage devices: Pneumatic; inductive; superconducting; hybrid species				

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
13. Topic 6.1 Pneumatic and hydroaccumulators		1	2, 7	Application area. Main characteristics. Advantages and disadvantages. Examples of application, including in electrical transport complexes.
14. Topic 6.2 Inductive and superconducting		1	2, 7	Application area. Main characteristics. Advantages and disadvantages. Examples of application, including in electrical transport complexes.
15. Topic 6.3 Hybrid types of accumulative devices.		1	2, 7, 8	Application areas, circuit solutions, energy distribution between the components of the Grie parts.
Didactic unit: Ranking				
16. Topic 7.1 Main classification requirements for the choice of energy drive when designing its electrical transport complex.	2	2	5, 7, 8	1. Selecting the EPS type and modes of its operation. 2. Determination of the Subsystem of the Electric Transport Complex (EC) Installation of the Accumulative Block (the traction power supply system / electro-separation composition of the EPS). 3. Selecting the type of energy storage.
17. Topic 7.2 Algorithm for the choice of NE 7.2.1 The calculation of the main parameters of the energy storage in the power supply system; 7.2.2 Calculation of the main parameters of NE for use on EPS.	3	4	3, 5, 6, 7, 8	Calculation of the basic parameters of the accumulative device: a) for autonomous ETS; b) to accumulate the energy of recovery; c) to smooth peaks in the traction power supply system
18. Topic 7.3 EPS traction and energy calculation.	3	4	4, 5, 6, 7, 8	Power balance when driving EPS. Calculation of power consumption in various modes of movement: traction; braking.
19. Topic 7.4 Design of the electrical circuit of a traction power supply system or vehicle equipped with energy storage.	1	2	5, 6	Analysis and selection of circuit solutions, calculation of the parameters of the schema elements.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: General issues of use of energy drives				
1. Independent study of various types and types of energy storage		12	1, 2	Detailed analysis of various NE: characteristics; modes of operation; restrictions; Experience in ETC.

Literary sources

Main literature

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3. eLIBRARY.RU (Научная электронная библиотека РФФИ) [Электронный ресурс]. – [Россия], 1998. – Режим доступа: http://(www.elibrary.ru). – Загл. с экрана.

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6. http://www.iprbookshop.ru/

7. http://znanium.com/

Methodical support and software

Methodological support

1. Штанг А. А. Моделирование тягового привода в Simulink [Электронный ресурс] : учебно-методическое пособие / А. А. Штанг, А. В. Мятеж, М. В. Ярославцев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221609. - Загл. с экрана.

2. Обучающая система "Электронный лектор" : методические указания для преподавателей / Новосиб. гос. техн. ун-т ; [сост.: А. А. Штанг, М. В. Ярославцев]. - Новосибирск, 2017. - 13, [3] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000235425

Specialized software

1 Microsoft Office Application Pack

2 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

3 Package for modeling energy systems MathWorks Matlab Simpowersystem

Course: 2, semester : 3

		Semester
	Kind of activity	**3**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	42
4	Lectures, hours	0
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	20
8	Consultations, hours	4
9	Independent work, hours	66

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials

Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
develops and analyzes generalized solutions to solving the problem

to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Able to develop methods and conduct studies of professional activities
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**
1. Z1. Know the main modes of operation of electrical transport complexes and their effect on overall energy consumption	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
2. Euristic methods of solving technical problems	Seminars; Independent work
3. U6. Be able to calculate the parameters of devices that are part of the energy installations of vehicles	Seminars; Independent work

Able to develop methods and conduct studies of professional activities	
4. Z3. Know the main circuitry and layout solutions of vehicles, their distinctive features, advantages and disadvantages	Seminars; Independent work
Alasticized and synthesize objects of professional activity	
5. U6. To be able to use elementary algorithm and programming skills in one of the high-level languages ??as a means of software modeling of the studied objects and processes	Seminars; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
6. Z3. Know the features of the mode of functioning of electrical complexes and their effect on energy consumption	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Technological components and use of electrical materials such as components of the electricity , electrical and radio-electronic equipment.				
1. Features of the working conditions and requirements for various types of autonomous transport. Structural schemes of electric drives.	4	4	1, 6	Examine the appointment, scope and classification of autonomous transport.
Didactic unit: Power loss in elements of the power supply system.				
2. Transport thermal motors. Thermodynamic cycles of piston thermal motors. Characteristics of diesel engines, gas turbine must-houses. Systems of automatic control of the thermal engine. Features of regulating gas turbine installation.	4	8	1, 2	Get information on primary energy sources of autonomous vehicles: characteristics and applications.
Didactic unit: Secondary energy sources (electromechanical drives Energone)				
3. Permanent and AC generators.	4	10	2	Requirements for characteristics of generators. Excitation systems for convex and hyperbolic characteristics of the generator. Joint operation of the thermal engine and generator.
Didactic unit: System analysis				
4. Permanent and AC transmissions control systems.	4	10	3, 4	Combined regulation of the diesel generator and traction engines.
Didactic unit: Chains of control and protection				
5. Electric heat engine start, heat motor controller control.	4	4	5	Management of traction electric motors. Protection of equipment.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities

Semester: 3				
Didactic unit: Power loss in elements of the power supply system.				
3. Primary autonomous energy sources		6	3	Primary autonomous energy sources
Didactic unit: Secondary energy sources (electromechanical drives Energone)				
2. Secondary sources of autonomous transport		8	3	Secondary sources of autonomous transport
Didactic unit: System analysis				
1. Principles for constructing automatic control systems, SAR generator, combined heat engine control and generator.		10	4	Transmission of variable-constant and alternating current.

Literary sources

Main literature

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2. http://elibrary.nstu.ru/

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Methodical support and software

Methodological support

1. Автономные электротранспортные средства : программа, задания и методические указания к изучению курса и выполнению расчетно-графических заданий студентами электромеханического факультета специальности 140606 "Электрический транспорт" / Новосиб. гос. техн. ун-т ; [сост. В. В. Бирюков]. - Новосибирск, 2014. - 21, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000212874

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack

Hybrid vehicles

Course: 2, semester : 3

	Semester
Kind of activity	**3**
1 Total credits	3
2 Total hours	108
3 Total classes in the contact form, hours	42
4 Lectures, hours	0
5 Practical lessons, hours	36
6 Laboratory studies, hours	0
7 of them in an active and interactive form, hours	20
8 Consultations, hours	4
9 Independent work, hours	66

External requirements

Able to develop activities On the efficient use of energy and raw materials in the field of electrical transport complexes; *regarding the following learning results*:
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials
Capacitive to choose serial and design new professional activity objects; *regarding the following learning results*:
develops and analyzes generalized solutions to solving the problem
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Able to develop methods and conduct studies of professional activities
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	**Forms of organizing classes**

Alasticized and synthesize objects of professional activity	
1. On the fuel and energy resources.	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
2. about nature and characteristic properties of chemical bonds, types of chemical reactions	Seminars; Independent work
Able to develop methods and conduct studies of professional activities	

3. Calculate electromagnetic processes in the electric drives of the GTS and the energy distribution in various parts of the energy installations	Seminars; Independent work
4. to conduct energy-intensive calculations Energy drives in order to implement the autonomous stroke mode	Seminars; Independent work
5. Calculate buffer storage device, allowing to reduce Piquitics of power consumption or accumulate energy in electrical braking mode	Seminars; Independent work
6. to calculate the primary source of energy of the hybrid vehicle; DVS power determination	Seminars; Independent work
Able to develop methods and conduct studies of professional activities	
7. To be able to conduct and justify the choice of energy drive when designing it for various types of electrical vehicles	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
8. various options for the circuit solutions of hybrid electrical vehicles	Seminars; Independent work
Able to identify the functions of the functioning of technological equipment and technological equipment systems of professional activities are able to develop measures to effectively use of energy and raw materials	
9. Principles of operation and the main characteristics of the most common types of energy and autonomous storage facilities. Power sources	Seminars; Independent work
develops and analyzes generalized solutions to solving the problem	
10. to select various configurations of hybrid energy installations with energy storage devices of various types and autonomous power preinsists	Seminars

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Course objectives and basic concepts				
1. Topic 1.1 Goals and Course Tasks; Stages of historical development of hybrid vehicles.		2	1, 2	Goals and objectives of the course; Stages of historical development of energy drives in various fields of technology and vehicles; The development of hybrid sources of energy in the composition of electric vehicles.
2. Topic 1.2 The current state of the use of storage devices in electrical vehicles. Prospects for use in hybrid electrical engineers.		2	1, 2	The current state of the use of various types of hybrid power plants in electrical vehicles. Prospects for the use of various types of accumulative elements in transport systems.
Didactic unit: General issues of device and design of GTS				
4. Topic 2.1 Basic schemechnical solutions for the execution of power energy installations In hybrid electric vehicles (GTS)		2	3, 7, 8	Energy installation schemes: sequential; parallel; Mixed. Energy approach to the issue of substantiation of the main components of the hybrid energy installation of the vehicle.

5. Topic 2.2 Methods for determining the energy intensity of NE and PE power depending on the type and type of vehicle.	2	2	3, 8	Methods for determining the energy intensity of the cumulative device depending on the type and type of vehicle.
6. Topic 2.3 Tasks performed by NE and Pie on the vehicle	1	2	1, 8	Autonomous move; Accumulating energy of electric braking; Reducing peak load in power supply networks.
Didactic unit: Primary sources of GTS Energy				
7. Topic 3.1 Modern Development of Primary Energy Sources GTS		3	1, 2	Various types of primary energy sources (PE) GTS: diesel generators, gas turbine generators, fuel cells and other promising solutions
8. Topic 3.2 Primary Energy Sources GTS		2	1, 10, 8, 9	Conditions and modes of FE operation. Requirements for PE. Principles and methods of designing PIE. Alignment of various types of Pie GTS.
Didactic unit: Auxiliary electrical equipment of typical vehicles.				
9. Topic 4 Comparison of Energy Electromechanical Drives (EMNE) with other types of drives. Examples of use and various EMNE circuit solutions in transport systems.		2	7, 8, 9	The operational features of this type of energy storage. External characteristics of EMNE. Examples of use and various EMNE circuit solutions in transport systems.
Didactic unit: Secondary energy sources (electrochemical energy storage)				
10. Topic 5 Electrochemical energy storage. Features of the use of ECNE in traction drives of electrical transport. Circuit solutions.	2	3	10, 8, 9	Advantages and disadvantages. External characteristics (Energy Electrochemical Drives) EHNE. Acquaintance with the principles of choosing scheme decisions of installations using NE.
Didactic unit: Secondary energy sources (Capacitive energy drives)				
11. Topic 6. Capacitive energy drives. Drives on the basis of "classic" capacitors and based on double electric layer capacitors.	2	2	10, 7, 8, 9	Main characteristics and examples of use. Comparison of ENE with other types of energy storage. Characteristics of EANE. Examples of applying this type of EPS drives.
Didactic unit: Secondary sources of Energy (Hybrid types of storage devices)				
12. Topic 7.1 Hybrid types of accumulative devices.		1	10, 7, 9	Application areas, circuit solutions, energy distribution between the components of the Grie parts.
Didactic unit: Calculation of the parameters of the hybrid energy installation of an electric vehicle				
13. Topic 7.2 Main classification requirements for the choice of energy storage with its design for electrical composition.	2	2	3, 7	Selection of types of NE for EPS.

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
14. Topic 7.3 Calculation of peak power, dynamic factor of GTS.	1	1	6, 8	Calculation of the power of PIE GTS, taking into account the peak power of the buffer drive of the energy, the thinning of the NE type.
15. Topic 7.4 Calculation of Pie.	1	1	3, 6, 8, 9	Calculation of averaged power of the primary energy source. Clarification of the type of Pie.
16. Topic 7.5 GTS.	2	2	5, 6, 7, 8	Maintenance modes. Establishing restrictions and construction of traction characteristics.
17. Topic 7.6 The calculation of the forces of resistance to the movement of the GTS.	1	1	3, 4, 5, 6	Calculation of resistance forces: rolling; from wonds; from interaction with air medium; Resistance overclocking.
18. Topic 7.7 Calculation of a buffer cumulative device.	2	2	3, 5, 7, 8	Energy calculation in electrical braking mode. Calculation of a buffer cumulative device. The energy exchange between the primary source of energy and the traction engine.
19. Topic 7.9 Calculation of the main parameters of the energy drive to implement the autonomous stroke.	2	2	4, 7, 8, 9	Calculation of the main parameters of the energy storage for implementating autonomous stroke.
20. Topic 7.10 Design of the electrical circuit of the vehicle by a combined energy setting.	2	2	3, 8	Selection of circuit solutions, calculation of the parameters of the schema elements.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: General issues of device and design of GTS				
1. Independent study of types of NE and Pie		6	2, 9	Independent study of energy storage types

Literary sources

Main literature

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Methodical support and software

Methodological support

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3. Щуров Н. И. Теория электрической тяги : Учебное пособие / Н. И. Щуров; Новосиб. гос. техн. ун-т. - Новосибирск, 2004. - 98 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000031434

Specialized software

1 Microsoft Office Application Pack

2 Development of cross-platform applications Microsoft Visual Studio 2015

3 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

Course: 2, semester : 3

	Kind of activity	Semester 3
1	Total credits	1
2	Total hours	36
3	Total classes in the contact form, hours	22
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	10
8	Consultations, hours	2
9	Independent work, hours	14

External requirements

is able to formulate the objectives and objectives of the study, identify priorities for solving problems, Choosing evaluation criteria; *regarding the following learning results*:
Forms the decision-making criteria
can apply Modern research methods, evaluate and present the results of the work performed; *regarding the following learning results*:
Selects the necessary research method to solve the task
Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
Forms possible options for solving problems

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

1. OPK-1. 1 1. Formulates the objectives and objectives of the study	Seminars; Independent work
Forms the decision-making criteria	
2. OPK-1. 3 3. Formulates the decision criteria	Seminars
Forms possible options for solving problems	
3. UK-2. 1 1. To know: types of resources and restrictions for addressing professional tasks; Basic methods for evaluating different ways to solve problems; current legislation and legal norms regulating professional activities.	Seminars

Selects the necessary research method to solve the task	
4. OPK-2. 1 1. Selects the necessary research method to solve the task	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Basic scientific paradigms.				
1. Science Philosophy and Scientific Cognition Methodology	1	2	1, 3, 4	The seminar discusses issues: Science as a kind of knowledge and social institution. Scientific communities. Science as a form of culture, its position in the cultural system. Democipation of spheres (demarcation) of science, philosophy and religion. The concept of the scientific picture of the world and the scholar paradigm. The identity of the scientist: a psychological and socio-cultural portrait.
2. Empirical level of scientific knowledge	1	2	1, 2, 3, 4	The seminar discusses issues: Registration of the first theoretical model of science. O. Kont and the birth of the philosophical school of positivism: the conceptual basis for the emergence of the first theoretical models of science. The idea of three stages of the intellectual evolution of a person: religious, metaphysical and positive. Model of science K. Popper and the principle of falsificationism. The concept of research programs I. Lakatos. Methodological anarchism P. Faye-slave. The theory of scientific revolutions T. Kuna.
3. Systematization and summarized experience. Specificity of empirical concepts and laws	1	2	1, 3, 4	The seminar discusses issues: Antique science. Science in the Middle Ages. Classical science of the era of the new time.

4. Methods of theoretical research	1	2	1, 3, 4	The seminar discusses issues: The formation of the paradigm of the non-classic science (1920s - 1970s) in connection with the change in ideas about matter in electrodynamics and quantum physics. The theory of relativity A. Einstein on the space and time and the quantum-relativistic picture of the world of non-alcohol science. Postno-classical paradigm: science in the conditions of post-industrial general and the culture of postmodern (since the 1970s). Self-consciousness of post-advertising science in culture. Antiscentism. Self-organization in nature and synergic picture of the world.
Didactic unit: TCP / IP network and administering them.				
5. The role of models in knowledge. System approach in modern science.	3	6	1, 3, 4	The seminar discusses issues: Evolution of the development of synergetics and risomic. Synergetics is the general theory of self-heal. Riseliness - Science of Oso-Bass form activities.
6. Basic laws of development and general methodological problems of scientific knowledge	3	4	1, 3, 4	The seminar discusses issues: Synergetics and modern scientific knowledge. Genesis of the subject of synergeti ki. The specificity of the concept of synergetics. Specific features of synergetics methods. The place and role of synergetics in the system of scientific knowledge. Synergetics in the context of Kul-tours.

Literary sources

Main literature

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dditional literature

1. Культурология : теория и история культуры : учебник / [Е. Я. Букина и др. ; отв. ред. Е. Я. Букина] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2010. - 341 с.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000125869

2. Хрестоматия по культурологии : учебное пособие / [Е. Я. Букина и др.] ; Новосиб. гос. техн. ун-т ; [отв. ред. Е. Я. Букина]. - Новосибирск, 2008. - 146, [1] с.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000083340

Internet resources

1. Андреев Г. И. Основы научной работы и методология диссертационного исследования : монография / Г. И. Андреев, В. В. Барвиненко, В. С. Верба, А. К. Тарасов – Санкт-Петербург : Изд-во Лань, 2012. – 296 с. // Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://e.lanbook.com/books/element.php?pl1_id=28348. - Загл. с экрана

2. http://elibrary.nstu.ru/

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4. http://www.iprbookshop.ru/

5. http://znanium.com/

Methodical support and software

Methodological support

1. Колеватов В. А. Методология и история науки и техники : учебно-методическое пособие / В. А. Колеватов, Е. Я. Букина, С. И. Чудинов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2011. - 49, [2] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000153645

2. Хрестоматия по методологии, истории науки и техники : учебно-методическое пособие / [авт.-сост.: Е. Я. Букина, Е. В. Климакова] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2011. - 205, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000157793

3. Специфика понятийного аппарата синергетики : методическое пособие для магистрантов / Новосиб. гос. техн. ун-т ; [сост. Е. Я. Букина]. - Новосибирск, 2012. - 30 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000176261

Specialized software

1 Microsoft Office Application Pack
2 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology
3 Microsoft Office Application Pack

Patent learning

Course: 1, semester : 2

		Semester
	Kind of activity	**2**
1	Total credits	3
2	Total hours	108
3	Total classes in the contact form, hours	29
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	0
8	Consultations, hours	9
9	Independent work, hours	79

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Associates to apply modern communicative technologies, including in foreign language (s), for academic and professional interaction; *regarding the following learning results*:
uses modern information-communications for communication
to plan and put the research tasks, choose experimental work techniques, Interpret and submit research results; *regarding the following learning results*:
Alasticized and synthesize objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes

analyzes the problem situation and makes it decomposition for individual tasks .	
1. UK-1. 1 1. Analyzes the problem situation and makes it a decomposition into separate tasks.	Seminars; Independent work
uses modern information-communications for communication	
2. UK-4. 3 3. Uses modern information communications for communication	Seminars; Independent work
Alasticized and synthesize objects of professional activity	
3. PC-2.V / PR. 2 2. Capacked to analize and synthesize objects of professional activity	Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit:				
1. Innovative process and stages of creating new techniques	2	2	1	Training in distinguishing innovation activities when creating new equipment
2. The concept of intellectual property and organizational provision of public administration in the field of intellectual property protection		2	2	Teaching the basics of protection of intellectual property
3. Registration of patent rights to industrial property		6	1, 3	Teaching the foundations of the application for inventions
4. Contract and licenses for industrial property		2	1, 3	Training elements of licensed transmission rights
5. Heuristic methods for solving technical tasks: brainstorming, morphological analysis, expert methods, TRIZ.		6	1, 2, 3	Training elements of the theory of solutions of inventive tasks

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit:				
2. Protection of industrial property		25	3	Training Protection of Industrial Property
3. Protection of industrial property		15	1, 2, 3	Study of the methodology for issuing applications
1. Euristic methods for solving technical tasks		39	1	Study of the theory of solutions of inventive tasks

Literary sources

Main literature

1. Шаншуров Г. А. Патентные исследования при создании новой техники. Инженерное творчество : [учебное пособие] / Г. А. Шаншуров ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 113, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234359

dditional literature

1. Медунецкий, В. М. Содержание и структура патентных исследований / В. М. Медунецкий. — Санкт-Петербург : Университет ИТМО, 2015. — 48 с. — ISBN 2227-8397. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/68134.html (дата обращения: 26.02.2021). — Режим доступа: для авторизир. пользователей

Internet resources

1. Федеральная служба по интеллектуальной собственности : Роспатент [Электронный ресурс] : официальный сайт. - Режим доступа: http://www.rupto.ru/. - Загл. с экрана.

2. http://elibrary.nstu.ru/

3. https://e.lanbook.com/

4. http://www.iprbookshop.ru/

5. http://znanium.com/

Methodical support and software

Methodological support

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Specialized software

1 Calculator of the cost and timing of the project and its stages according to the COCOMO COCOMO® II.2000.4 methodology

2 Microsoft Office Application Pack