ANNOTATION OF THE PROGRAM
Computer, network and information technology

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	41
4	Lectures, hours	0
5	Practical lessons, hours	0
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	18
8	Consultations, hours	3
9	Independent work, hours	67

External requirements

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*:
produces a strategy for solving the task
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
produces a strategy for solving the task	
1. -one. 2 2. Develops a strategy for solving the task	Laboratory works; Independent work
conducts analysis of the results	
2. OPK-2. 2 2. The analysis of the results obtained	Laboratory works; Independent work
uses modern information-communications for communication	
3. UK-4. 3 3. Uses modern information communications for communication	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: Computer and information technology				
1. Introduction to LabView.	2	4	1, 3	Introduction to LabView.
2. Creating a virtual periodic signal generator	2	4	1, 2, 3	Creating a virtual periodic signal generator
3. Creating an oscilloscope and signal generator in LabView	2	4	3	Creating an oscilloscope and signal generator in LabView
6. Application interaction	2	4	2	Application interaction
7. Calculation of electric field	2	4	1, 2, 3	Calculation of electric field
8. Designing a hardware and measuring complex based on data collection card.	4	8	1, 2, 3	Designing a hardware and measuring complex based on data collection card.
Didactic unit: Network technologies				
4. Transferring information using the TCP protocol	2	4	3	Transferring information using the TCP protocol
5. Information transmission using Shared Variable	2	4	3	Information transmission using Shared Variable

Literary sources

Main literature

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

3. National Instruments [Электронный ресурс] : сайт. - Режим доступа: http://russia.ni.com/. - Загл. с экрана.

4. https://e.lanbook.com/

5. http://www.iprbookshop.ru/

6. http://znanium.com/

Methodical support and software

Methodological support

1. Гридчин А. В. Информационные технологии. Специальные информационные технологии : учебно-методическое пособие / А. В. Гридчин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2020. - 54, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242607

2. Артюшенко В. В. Компьютерные сети и телекоммуникации : учебно-методическое пособие / В. В. Артюшенко, А. В. Никулин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2020. - 69, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242401

Specialized software

1 Scientific and Technical Computing Program Mathworks Matlab

2 SPECTRUM Software Micro-Cap

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

5 Wednesday graphic programming means of automating NI LabVIEW

ANNOTATION OF THE PROGRAM
Foreign language

Course: 1, semester ы : 1 2

		Semester	
№	**Kind of activity**	**1**	**2**
1	Total credits	2	2
2	Total hours	72	72
3	Total classes in the contact form, hours	40	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	36	36
8	Consultations, hours	2	4
9	Independent work, hours	32	30

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*:
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
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
uses modern information-communications for communication
is able to analyze and take into account the diversity of cultures in the intercultural interaction process; *regarding the following learning results*:
demonstrates the understanding of the characteristics of various cultures and Nations
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**

1. OPK-1. 1 1. To be able to formulate goals, objectives and main content of the research in a foreign language	Seminars; Independent work
presents the results of the work performed	
2. OPK-2. 3 3. To be able to represent the results of the study in the form of a report (presentation).	Seminars; Independent work
performs academic and professional Interaction, including in a foreign language	
3. UK-5. 1 1. Demonstrates an understanding of the characteristics of various cultures and nations	Seminars; Independent work
uses modern information-communications for communication	
4. UK-4. 3 3. It makes the use of foreign language sources, including industry dictionaries and reference books.	Seminars; Independent work
demonstrates the understanding of the characteristics of various cultures and Nations	
5. UK-5. 1 1. It has an idea of ??the features of academic communication in cross-cultural environment.	Seminars; Independent work
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	
6. MC-6. 1 1. Conditions to build strategies for speech activity in typical situations of academic communication.	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.	16	16	3, 5, 6	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	20	1, 4	to visit and studying reading, translation, discussion of read materials, the implementation of 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	26	26	2, 3, 4, 6	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	10	1, 2, 3, 4, 5, 6	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

1. ЭБС IPRbooks [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://www.iprbookshop.ru/. - Загл. с экрана.

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3. ЭБС IPRbooks [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://www.iprbookshop.ru/. - Загл. с экрана.

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3. ScienceDirect [Electronic resource] / Elsiver [Official website]. – [USA], 2016. – Mode of access: http://www.sciencedirect.com. – Title from screen.

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Methodical support and software

Methodological support

1. Камышева Е. Ю. English: non-resident instruction for Master Degree Students [Электронный ресурс] : электронный учебно-методический комплекс / Е. Ю. Камышева, Е. Т. Китова ; Новосиб. гос. техн. ун-т. - Новосибирск, [2018]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000239209. - Загл. с экрана.

2. Polyankina S. Y. Основы английской публичной речи [Электронный ресурс] : электронный учебно-методический комплекс / S. Y. Polyankina ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000213129. - Загл. с экрана.

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 power and electrical engineering

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	41
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	3
9	Independent work, hours	67

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*:
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 .
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

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	Lections; Seminars; Independent work
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
demonstrates the understanding of the characteristics of various cultures and Nations	

3. UK-5. 3 3. It has practical experience in analyzing philosophical and historical facts, the experience of assessing cultural phenomena.	Lections; Seminars; Independent work
builds social interaction, given the general and special different cultures and religions	
4. UK-5. 2 2. Lines social interaction, given the general and special different cultures and religions	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: Modern level of electric power industry				
1. State of world and domestic energy		2	1, 2, 3, 4	Analysis of the material lecture
2. Dissonances and contradictions in electric power industry		2	1, 2, 3, 4	Analysis of the material lecture
Didactic unit: Water Impurities and Water Quality Indicators.				
3. Traditional and alternative power sources		2	1, 2, 3	Comparison of the structures and plans for the development of generation
4. Unified National Electrical Network Branch of UES		2	1, 2, 3	Analysis of materials lectures
5. The role and differences of feed and distribution networks		2	1, 2, 3	Analysis of materials lectures
6. Wholesale and retail electricity wounds		2	1, 2, 3, 4	Analysis of matarial lectures
7. Intellectual Energy Systems and Smart Grid		2	1, 2, 3	Analysis of materials lectures
Didactic unit: Modern educational paradigm				
8. Central and decentralized management systems		2	1, 2, 3, 4	Analysis of materials lectures
9. Technological norms and rules The basis of the reliable operation of power systems		2	1, 2, 3, 4	Analysis of materials lectures

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Modern level of electric power industry				
1. The role and place of electric power industry	2	2	1, 2, 3	Identification of the main factors of the determination of the development of the electric power industry
2. System Effects from Energy Systems	2	2	1, 2, 3	Justification of the expedient creation of regional, unified and unified power systems.
Didactic unit: Water Impurities and Water Quality Indicators.				

3. Directions of technical progress in the production of electricity	2	2	1, 2, 3, 4	Detection and analysis of NTP achievements in terms of electricity production
4. Directions of technical progress in electricity transport	2	2	1, 2, 3, 4	Identification and analysis of NTP achievements in terms of electricity transport
5. Ways to improve the reliability and quality of power supply	2	2	1, 2, 3	Discussion of methods and means of improving the effects of electrical networks
6. Tasks of information support of monitoring and control systems in the electric power industry	2	2	1, 2, 3	Discussion of advantages and disadvantages from the introduction of microprocessor device Su
9. Methods and means of increasing the efficiency of power systems	2	2	1, 2, 3, 4	Discussion and substantiation of priority areas of development by Energy Systems
Didactic unit: Modern educational paradigm				
7. Controlled Mode Parameters and Management Systems Normal Modes	2	2	1, 2, 3	Systematization of the differences in local and system mode automatic
8. Automatic control systems and their role in the power system	2	2	1, 2, 3, 4	Detection of fundamental differences in centralized and decentralized management on the example of

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Modern level of electric power industry				
1. Analysis of world and domestic development trends of electric power industry		6	1, 2, 3, 4	Studying and analyzing foreign and found energy strategies for the development of energy
Didactic unit: Water Impurities and Water Quality Indicators.				
2. New in the technique and technology of electricity production		6	1, 2, 3, 4	Study of the General Scheme of Placing Electric Power Plant
3. Location and role of AC and DC networks in power systems		6	1, 2, 3, 4	Study and comparison of the advantages and disadvantages of a network of direct and alternating current
4. Small distributed generation and its role in the development of electric power industry		6	1, 2, 3, 4	Study of achievements on the introduction of small generation in the country and abroad
5. System of economic relations of subjects of electric power industry in the country and abroad		6	1, 2, 3, 4	Studying and identifying the relationship between the main technical and economic indicators of the subjects of the electric power industry

Literary sources

Main literature

1. ЭБС IPRbooks [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://www.iprbookshop.ru/. - Загл. с экрана.

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Additional literature

1. Китушин В. Г. Надежность энергетических систем. Ч. 1 : [учебное пособие] / В. Г. Китушин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2003. - 254 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000020379

2. Китушин В. Г. Энергетическая безопасность. Професссионально-терминологические и понятийные аспекты : учебное пособие [для ФЭН направления 521600 по дисциплинам "Экономика энергетики" и "Менеджмент в энергетике"] / В. Г. Китушин, Н. А. Лебединская, А. Н. Лемзин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2003. - 40 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000023720

Internet resources

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Methodical support and software

Methodological support

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Specialized software

1 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Innovation management

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	40
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	18
8	Consultations, hours	2
9	Independent work, hours	32

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
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

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; Laboratory works; Independent work
Participates in the management of the project at all stages of the life cycle	
2. UK-3. 2 2. Manages the team members to achieve the task	Lections; Laboratory works; Independent work
demonstrates the understanding of the principles of teamwork	

3. UK-3. 1 1. Demonstrates an understanding of the principles of teamwork	Lections; Laboratory works; Independent work
manages the team members to achieve the task	
4. UK-3. 2 2. To be able to: establish and maintain contacts that ensure successful work in the team; Apply the main methods and norms of social interaction to implement their role and interact within the team.	Lections; 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: Basic concepts of innovation				
1. Basics of innovation	2	2	1	1.1. Basic concepts in the field of innovation 1.2. Sources of innovative ideas 1.3. Classification of innovations and innovation 1.4. Innovation in the system of science
2. Major tendencies of global technological development	2	2	1, 2	2.1. The concept of manufacturing technology 2.2. Classification technologies 2.3. Evolution of technological instructions 2.4. Production Technology Development Trends 2.5. The role of the sphere of R & D in the modern economy 2.6. Driving Forces of Modern Economic Development 2.7. Positions of the Russian Federation in the markets of high-tech products 2.8. Characteristic of the Russian NTK.
Didactic unit: innovative process				
3. Innovative process and its structure	4	4	1	3.1. The concept of the innovation process 3.2. Stages of the innovation process 3.3. Tasks, principles and stages of R & D 3.4. Innovative (Research) project and its content 3.5. Treaty for the creation of scientific and technical products 3.6. Examination of innovative projects
Didactic unit: Protection of intellectual property objects				

4. Protection of intellectual property	4	4	1	4.1. Legal protection of intellectual property objects 4.2. Intellectual Property Patenting Systems 4.3. Procedure for Patenting Intellectual Property Objects in the Russian Federation 4.4. The procedure for international patenting of intellectual property 4.5. Intellectual property market
Didactic unit: Life cycles				
5. Life cycles of goods, enterprises, market, technology	2	2	2	5.1. S-shaped curve: General 5.2. Product life cycle 5.3. Life cycle of the company 5.4. Market life cycle 5.5. Life cycle technology
Didactic unit: Organizational forms of innovation				
6. Features of organizational forms of innovation	4	4	1, 2, 3, 4	6.1. Classification of innovative organizations 6.2. Strategies of the Celllers, Patients, Switches, Explainants 6.3. Features of small firms 6.4. Technopark structures - the basis of the venture business

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: innovative process				
1. Creating a project plan		4	2	Objective: Purchase the skills to create a structured project work schedule with MS Project
2. Planning resources and appointments for the project		4	1, 2, 3, 4	Purpose: Planning resources and destination for the project in the Microsoft Office Project environment
3. Project risks analysis		4	1, 2	Purpose: Mastering the Project Risk Analysis Methodology by Microsoft Office Project
4. Microsoft Excel Work Planning		6	2	Goal:. Examine some Microsoft Excel features (conditional formatting, input check, work with references and arrays, etc.), acquire the skills of using these tools to solve work planning tasks in the project organization

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2. ГОСТ Р 55347–2012. Системы управления проектированием. Руководство по менеджменту инноваций : национальный стандарт Российской Федерации : издание официальное : утвержден и введен в действие Приказом Федерального агентства по техническому регулированию и метрологии от 29 ноября 2012 г. № 1713-ст : введен впервые : дата введения 2014-01-01 / разработан АНО «Международная академия менеджмента и качества бизнеса». – Москва : Стандартинформ, 2014. – URL: http://gost.donses.ru/Data/547/54734.pdf (дата обращения: 26.02.2021). – Текст : электронный.

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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
Scientific - Methodical seminar

Course: 1, semester : 2

		Semester
№	**Kind of activity**	**2**
1	Total credits	2
2	Total hours	72
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	18
8	Consultations, hours	2
9	Independent work, hours	50

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
Selects the necessary research method to solve the task
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
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
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
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**

Selects the necessary research method to solve the task	
1. OPK-2. 1 1. Selects the necessary research method to solve the task	Seminars; Independent work
presents the results of the work performed	
2. OPK-2. 3 3. Represents the results of the work performed	Seminars; Independent work
performs academic and professional Interaction, including in a foreign language	
3. UK-4. 1 1. Carries out academic and professional interaction, including in a foreign language	Seminars; Independent work
translates academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language	
4. UK-4. 2 2. Translates academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language	Seminars; Independent work
demonstrates the understanding of the characteristics of various cultures and Nations	
5. UK-5. 3 3. It has practical experience in analyzing philosophical and historical facts, the experience of assessing cultural phenomena.	Seminars; Independent work
builds social interaction, given the general and special different cultures and religions	
6. UK-5. 2 2. Lines social interaction, given the general and special different cultures and religions	Seminars; Independent work
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	
7. UK-6. 1 1. Assesses its resources and their limits (personal, situational, temporary), they are optimally used to successfully fulfill the assigned task	Seminars; Independent work
determines the priorities of personal growth and ways to improve their own activities AMOOCOLINS	
8. UK-6. 2 2. Determines the priorities of personal growth and ways to improve their own activity on the basis of self-assessment	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: Methodological Fundamentals of Scientific Research				
1. Organization of research activities	2	2	1, 6, 7, 8	Practical lesson
2. Methods of conducting scientific research	4	4	1, 3, 5, 7, 8	Practical lesson
3. Mathematical modeling as a method of scientific research	4	4	1, 3, 4, 6, 7, 8	Practical lesson
Didactic unit: Scientific communications				
4. Presentation of scientific research results	4	4	1, 2, 3, 4, 5, 8	Practical lesson
5. Public speaking in scientific communication	4	4	2, 3, 4, 5, 6, 7	Practical lesson

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2. Патентные исследования при создании новой техники. Научно-исследовательская работа : [учебное пособие / Г. А. Шаншуров и др.] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2019. - 167, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000241596

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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 Creating reports for laboratory work. Microsoft Microsoft Office

3 Multi-Listed Simulation The AnyLogic Company AnyLogic PLE

4 Three-dimensional modeling Objects Asconce Compass 3D

5 Set of compilers, to develop programs in SI, C ++ languages, Fortran, including OpenMP Free Software Foundation parallel programming tool

ANNOTATION OF THE PROGRAM
Automatic regulation theory

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	49
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	8
7	of them in an active and interactive form, hours	18
8	Consultations, hours	3
9	Independent work, hours	59

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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
Formulates the technical task for the implementation of the project

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
Forms possible options for solving problems	
2. 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; Laboratory works; Independent work
Formulates the technical task for the implementation of the project	

3. PC-3.V / PR. 2 2. Formulates the technical task to implement the project	Seminars; Laboratory works; Independent work
forms design solutions for new objects	
4. PC-4.V / PR. 2 2. Forms design solutions for new objects	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: 3				
Didactic unit: Introduction				
1. Major terms, concepts and definitions: Control object (regulation), controlled (adjustable) values, control and perturbing effects, feedback. Principles of control (regulation): open, on deviation, by indignation. Control algorithms. Classification of automatic control systems (SAU) on various features. Tasks and features of automatic control theory (Tau)		1	1, 2	Listening and recording lectures
Didactic unit: Dynamic characteristics of linear SAU				
2. General principles for the preparation and linearization of SAU differential equations. Forms of recording equations. Typical impacts used in the Sau study (single jump, single pulse, harmonic signal). Representation of arbitrary signals using typical effects. Transitional, impulse transitional and gear ratios of elements and systems. Transmission functions according to control and exciting effects. Frequency characteristics in the usual and logarithmic scale The use of the principle of superposition and imposition in the study of linear sau.	2	3	1, 2	Listening and recording lectures
Didactic unit: thermal conductivity with stationary and non-stationary modes.				
3. Typical dynamic links: proportional, differentiating, integrating, aperiodic, forcing, second-order link, delay link. Methods for converting structural schemes. Transition from the system of differential equations to the structural scheme and back	1	3	1, 2	Listening and recording lectures

Didactic unit: Formalization of the simulation object				
4. The concept of stability. General conditions for the stability of systems by species of the roots of the characteristic equation. Methods for determining stability. Algebraic criterion of Gurvitsa. Frequency criteria Mikhailov and Nyquist. Determining stability reserves. Features of the Stability Stability of Systems with Loading Units	2	3	1, 2	Listening and recording lectures
Didactic unit: Quality of linear sau in transition Mode				
5. Main performance indicators and features of their research. Indirect quality research methods. Integral and frequency quality criterion. Analysis of quality by the location of the roots of the characteristic equation	1	3	1, 2	Listening and recording lectures
Didactic unit: Task for the synthesis of linear SAU				
6. Purpose Correction SAU. Setting the problem of synthesis and conditions of its solvability. Species of corrective devices	1	1	1, 2	Listening and recording lectures
Didactic unit: Digital Signals				
7. The simplest serial corrective devices: Introduction of an error derivative, an increase in the overall gain of the open circuit, the introduction of an integral from an error, an isopromic corrective device. Synthesis of serial corrective devices on logarithmic frequency characteristics	1	2	1, 2	Listening and recording lectures
Didactic unit: Parallel corrective devices				
8. The simplest parallel corrective devices: positive and negative tough feedback, inertial rigid feedback, flexible feedback, inertial flexible feedback. Synthesis of parallel corrective devices on logarithmic frequency characteristics	1	2	1, 2	Listening and recording lectures

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: thermal conductivity with stationary and non-stationary modes.				
9. Transitional and frequency characteristics of typical linear units of automatic control systems		2	2, 3, 4	Performance and protection of laboratory work

Didactic unit: Formalization of the simulation object				
8. Study of the Stability of Linear Automatic Control Systems		2	2, 3, 4	Performance and protection of laboratory work
Didactic unit: Digital Signals				
12. Synthesis of consecutive corrective devices		4	2, 3, 4	Performance and protection of laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Dynamic characteristics of linear SAU				
1. Differential equations saau	1	2	2, 3	Solving tasks
2. Dynamic characteristics of saau	1	2	2, 4	Solving tasks
Didactic unit: thermal conductivity with stationary and non-stationary modes.				
3. Structural schemes saau	2	3	1, 2, 3, 4	Solving tasks
Didactic unit: Formalization of the simulation object				
4. Criteria of SAU stability	1	3	2, 3, 4	Solving tasks
Didactic unit: Quality of linear sau in transition Mode				
7. Determining the quality of automatic control systems	1	2	1, 2, 3, 4	Solving tasks
Didactic unit: Digital Signals				
5. Synthesis of consecutive corrective devices	1	3	2, 4	Solving tasks
Didactic unit: Parallel corrective devices				
13. Synthesis of parallel corrective devices	2	3	1, 2, 3, 4	Solving tasks

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Methodical support and software

Methodological support

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Specialized software

1 Development of cross-platform applications Microsoft Visual Studio 2015

ANNOTATION OF THE PROGRAM

Systemic analysis in electric power industry

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	41
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	3
9	Independent work, hours	67

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
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
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
has The features of regional development and knows the specifics of the labor market in the field of professional activity.
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
analyzes the problem situation and makes it decomposition for individual tasks .	
1. Basic computer device at the level of the main components and blocks and their relationship	Lections; Seminars; Independent work
Forms possible options for solving problems	

2. forms possible problems of solving problems	Lections; Seminars; Independent work
Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.	
3. knows the specifics of socio-economic development and labor market in the field of professional activity in its region.	Lections; Seminars; Independent work
manages the team members to achieve the task	
4. manages the team members to achieve the goal	Lections; Seminars; Independent work
has The features of regional development and knows the specifics of the labor market in the field of professional activity.	
5. It has an idea of ??the features of the regomal development and knows the specifics of the labor market	Lections; Seminars; Independent work
demonstrates the understanding of the principles of teamwork	
6. Know the hardware and infrastructure platforms information technologies, species, appointment, architecture, methods for developing and administering software and hardware complexes of the object of professional activity	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: 3				
Didactic unit: Network services; model distributed information processing; Safety of information; Methods for assessing the effectiveness of information networks;				
1. Basics of system theory		2	1, 4, 6	lecture
2. Principles of system analysis		2	4, 6	lecture
3. Methodology of system analysis		2	2, 3	lecture
4. Data science as a modern stage of system analysis		2	2	lecture
Didactic unit: System analysis tools				
5. Systemic analysis in the electric power industry on the example of the project performed by the Nir		2	3, 5	lecture
6. Processing, analysis, data visualization		2	2, 5	lecture
7. Interpretation of computer modeling results		2	3, 5	lecture
8. Risks, risk management		2	1, 2	lecture
9. The system effect in the methods of artificial intelligence		2	3, 5	lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				

Didactic unit: Network services; model distributed information processing; Safety of information; Methods for assessing the effectiveness of information networks;				
1. Basics of system theory	2	2	1	practical lesson
2. Principles of system analysis	2	2	1, 2	practical lesson
3. Methodology of system analysis	2	2	2, 3, 4, 6	practical lesson
4. Data science as a modern stage of system analysis	2	2	2, 4, 6	practical lesson
Didactic unit: System analysis tools				
5. System analysis in power industry	2	2	3, 5	practical lesson
6. Processing, analysis, data visualization	2	2	2, 3, 4	practical lesson
7. Interpretation of computer modeling results	2	2	3, 5	practical lesson
8. Risks, risk management	2	2	1, 2, 5	practical lesson
9. The system effect in the methods of artificial intelligence	2	2	3, 6	practical lesson

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Network services; model distributed information processing; Safety of information; Methods for assessing the effectiveness of information networks;				
3. Methodology of system analysis		6	2, 3	practical lesson
Didactic unit: System analysis tools				
5. System analysis in power industry		6	3, 5	practical lesson
6. Processing, analysis, data visualization		6	2, 5	practical lesson
7. Risks, risk management		5	2, 3	practical lesson

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Specialized software

1 Mathcad Programming Language is an integrated programming system oriented to mathematical and engineering and technical calculations. PTC Mathcad

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

3 Scientific and Technical Computing Program Mathworks Matlab

ANNOTATION OF THE PROGRAM
Project management in power industry

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	40
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	18
8	Consultations, hours	2
9	Independent work, hours	32

External requirements

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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
Participates in the management of the project at all stages of the life cycle	
1. UK-3. 2 2. Manages the team members to achieve the task	Lections; Laboratory works; Independent work
demonstrates the understanding of the principles of teamwork	

2. UK-3. 1 1. Demonstrates an understanding of the principles of teamwork	Lections; Laboratory works; Independent work
manages the team members to achieve the task	
3. UK-3. 2 2. To be able to: establish and maintain contacts that ensure successful work in the team; Apply the main methods and norms of social interaction to implement their role and interact within the team.	Laboratory works; Independent work
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	
4. UK-6. 1 1. Assesses its resources and their limits (personal, situational, temporary), they are optimally used to successfully fulfill the assigned task	Laboratory works; Independent work
analyzes serial objects of professional activity	
5. PC-4.V / PR. 1 1. Analyzes serial objects of professional activity	Laboratory works

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. History of project management in Russia and abroad	0	1	2	1.1. Project management abroad 1.2. Evolution of project management in Russia 1.3. Prospects for project management system in Russia
2. The main provisions of the project management system	0	3	2	2.1. Concepts "Project", "Project Management", "Investment Project". Signs of the project 2.2. Classification of projects 2.3. Project environment 2.4. Project Life Cycle 2.5. Project participants 2.6. Organizational structures of project teams
3. Initiation Project	0	1	2	3.1. The concept and main processes of project initiation 3.2. Formation of the goals and objectives of the project 3.3. Expert assessment of alternative project options 3.4. Project design design
4. Project planning	0	2	2	4.1. Project planning tasks 4.2. The main stages of project planning 4.3. Optimization of network graphics (examples of solving problems)
5. Project implementation	0	2	2	5.1. Control of the subject area 5.2. Temporary Parameters Management 5.3. Financing and Cost Management 5.4. Quality management in the project 5.5. Management of human resources 5.6. Supplies and Contract Management

6. Completion of the project	0	1	2	6.1. Closing the project for the main functional areas 6.2. Documentary design of the completion of the project
7. Project management in energy	0	1	2	On the materials of the energy enterprise illustrate the main provisions of the project management system
8. Investment Design: Basic Concepts	0	1	1	8.1. The concept of investment 8.2. Classification of investments 8.3. Business Plan of the Investment Project 8.4. Accounting time factor when evaluating investment efficiency 8.5. Accounting for depreciation when evaluating investment efficiency
9. Evaluation of the effectiveness of investment projects	0	3	1	9.1. Types of effectiveness of investment projects 9.2. Evaluation of the financial consistency of investment projects 9.3. Simple methods of economic assessments 9.4. Complex (dynamic) methods of economic assessments 9.5. Ranking of investment projects
10. Discount rate calculation methods	0	1	1	10.1. Concept of discount rate 10.2. Approaches and methods for calculating the risk-free bet 10.3. Discount rate calculation methods
11. Evaluation of the effectiveness of investment projects with risk and uncertainty	0	1	1	11.1. The concept and essence of uncertainty and risk. Risk classification 11.2. Methods of quantitative and qualitative assessments of risks of investment projects 11.3. Methods of reducing risks
12. Evaluation of investment projects in power engineering	0	1	1	Review of the practice of assessing investment projects in the energy sector

Table 3.2

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

1. Development Plan MS Project	2	2	1, 2, 3, 4, 5	Task 1. Create a business plan "Expansion of the production of tools" Task 2. Creating a model of a company and an investment project Task 3. Analysis of the project feasibility Task 4. Project Efficiency Analysis Task 5. Construction of graphs Task 6. Creating reports
2. Development and analysis of projects in Project Expert	4	4	1, 2, 3, 4	Task 1. Creating a Business Plan "Auto Parts Manufacture" using a template Task 2. Analysis of the project feasibility Task 3. Project Efficiency Analysis Task 4. Construction of graphs Task 5 Analysis of investment projects using the WHAT-IF analysis program Task 6. Creation and analysis of the combined project "Expansion of production"
3. Development of a business plan by means of Alt-Invest amounts	4	4	1, 4	Task 1. Creating an investment project "Expansion of the production of tools" Task 2. Creating an investment project "Auto parts production" Task 3. Analysis of the project group
4. Calculation of the magnitude of capital investments on the project	4	4	1, 4	It is necessary to determine the cost of the project for the reconstruction of electrical networks by the method of enlarged indicators for the subsequent assessment of economic efficiency. In the process of reconstruction, the construction of new PS and LPP, dismantling the old
5. Determination of the estimated cost of reconstruction of the energy facility	4	4	1, 4, 5	Teach students to calculate the cost of reconstruction of the energy facility using PC "Gosstroysmet"

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Methodical support and software

Methodological support

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Specialized software

1 Microsoft Product Planning, Resource Management and Collaboration Microsoft Project Professional

2 Local Server Dmitry Dmitry Laboratory Denwer

3 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Elements of Automatic Devices

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	69
4	Lectures, hours	36
5	Practical lessons, hours	18
6	Laboratory studies, hours	8
7	of them in an active and interactive form, hours	18
8	Consultations, hours	5
9	Independent work, hours	75

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*:
produces a strategy for solving the task
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
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**
produces a strategy for solving the task	
1. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Laboratory works; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
2. PK-1.V / PR. 4 4. Solving professional tasks in enterprises and organizations of the profile industry of their region.	Seminars; Laboratory works; Independent work
Develops an experimental work plan	

3. PC-2.V / PR. 1 1. Develops an experimental work plan	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: Functional elements of devices of automatic and automated control in power industry, their characteristics for them requirements				
1. Objectives of discipline. The subject of discipline. The structure of the discipline. Her connection with other curriculum disciplines. The main features of the production process and distribution of electricity. Automatic production management system and distribution as a set of interacting information and control of automatic devices, computing and control machines. The main types of automatic devices. Functional algorithms and structural circuits of automatic devices. Input electrical signals of automatic devices coming from the primary measurement transducers of controlled objects. Functional elements of automatic devices.		0,5	1	Lecture
2. Purpose of the measuring part of automatic devices. Formation and comparison of signals as basic operations of the measuring part of the automatic device. The measuring part is as an interacting set of measuring transducers and comparison elements. The measuring body as an interacting set of measuring transducers with one comparison element. Measuring agencies of continuous and relay action. Their features.		0,5	1	Lecture
3. Classification of measuring organs by the number of influencing electrical values - carriers of input signals. The concept of characteristic values and the algorithm for the functioning of the measuring body. The concept of boundary points and lines. Structural circuits and boundary lines of measuring organs with one affecting value.		2	1	Lecture

4. Structural circuits and boundary lines of measuring organs with two affecting values. Determining the linear functions of the affecting values ??at the input of the comparison element to obtain the specified boundary lines. Characteristics of the response of the measuring organ of relay action in the complex plane of the characteristic value.		4	1	Lecture
Didactic unit: Passive and active converters of the parameters of the electric power system mode				
5. Linear measuring transducers of sinusoidal voltages and currents. General view of the linear conversion function of sinusoidal voltages and current in sinusoidal voltage and current.		2	1	Lecture
6. elements converting voltage into voltage, current to voltage, voltage in current and current in the current. Schemes for obtaining a given linear voltage or current function at the output of converters.		2	1	Lecture
7. Two-pole with a variable complex resistance. Voltage divisors. Signal transformers and autotransformers. Transreactors. Linear measuring converters based on operating amplifiers. Linear converters with specified gear ratios.		2	1	Lecture
8. Filters of symmetric components. Passive and active filters. Schemes and vector diagrams of reverse sequence voltage filter. Features of direct sequence voltage filters. Direct and reverse sequence current filters. Voltage filters and zero sequence current. Combined filters.		4	1	Lecture
9. Magnetic amplifiers. Features and scope. Controlled magnetic amplifier reactor. Throttle magnetic amplifier. Normal power supply voltage. Characteristic of control in the mode of free magnetization mode. Forced magnetization as a DC measurement transducer mode (signal transformer) mode.		2	1	Lecture
Didactic unit: Elements of the measuring and logical part of relay protection devices and automation of electric power systems				

10. Methods for comparing homogeneous information parameters. The comparison devices of the absolute value of the amplitude of the current with the specified value. Comparison devices of two sinusoidal values.		2	1	Lecture
11. Elements of comparison of analog signals. Schemes of comparison of the amplitude of one voltage (current) with a specified value. Time-pulse comparison schemes.		4	1	Lecture
12. Structural schemes of measuring relays with one and two affecting values. Electromechanical and semiconductor measuring relays. Electromechanical relay as a constructive associated set of interacting functional elements.		4	1	Lecture
13. Electromagnetic variable and voltage relays. Rotating and opposing moments. The magnetizing power of the relay, the power consumed under action, the current (voltage) of the operation and return the maximum and minimum relays, return coefficients; Methods for changing the current (voltage) of the triggering. Relay contacts and their characteristics. Vibration of contacts, ways to eliminate vibration.		4	1	Lecture
14. Semiconductor current relays (voltage), power directions, resistance. Their features. CONCLUSION: Using issues studied in this course, with further training.		3	1	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Passive and active converters of the parameters of the electric power system mode				
1. Modeling transient processes in a single current transformer	2	2	1, 2, 3	Laboratory work
Didactic unit: Elements of the measuring and logical part of relay protection devices and automation of electric power systems				
2. Research operation of the current relay type PCT-13	2	2	1, 2, 3	Laboratory work
3. Study of the operation of the comparison scheme of two electrical values in absolute value	2	2	1, 2, 3	Laboratory work

4. Research of radiant energy converters into electric.	2	2	1, 2, 3	Laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Passive and active converters of the parameters of the electric power system mode				
1. Definition of the conversion coefficients of the measuring organ of resistance when using the comparison scheme over the absolute value.	2	2	1, 2, 3	Practical occupation
2. Definition of the conversion of the measuring resistance organ when using a phase comparison scheme.	1	2	1, 2, 3	Practical lesson
3. Accounting for the final sensitivity of the comparison scheme in determining the transformation coefficients of measuring organs.	1	2	1, 2, 3	Practical lesson
4. calculation of symmetrical filter parameters Components made on passive elements	1	2	1, 2, 3	Practical lesson
5. Calculation of the parameters of filters of symmetric components performed on operating amplifiers	1	2	1, 2, 3	Practical lesson
Didactic unit: Elements of the measuring and logical part of relay protection devices and automation of electric power systems				
6. Definition of the parameters of a phase comparison scheme performed on operating amplifiers. Determining the parameters of the time-pulse comparison scheme.	2	4	1, 2, 3	Practical occupation
7. Determination of the parameters of the comparison scheme over the absolute value, made on operating amplifiers	2	4	1, 2, 3	Practical lesson

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Methodical support and software

Methodological support

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Specialized software

1 Microsoft Office Application Pack

2 Integrated Microsoft Visual Studio Community Development Wednesday 2017

3 Schedule Simulation Spectrum Software Micro-Cap (Microcap) 9.0.7.0

ANNOTATION OF THE PROGRAM
Automation of electric power systems

Course: 1, semester : 2

		Semester
№	**Kind of activity**	**2**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	61
4	Lectures, hours	36
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	83

External requirements

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
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
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**
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	
1. UK-6. 1 1. Assesses its resources and their limits (personal, situational, temporary), they are optimally used to successfully fulfill the assigned task	Lections; Seminars; Independent work

Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.	
2. PC-1.V / PR. 2 2. Know the specifics of socio-economic development and labor market in the field of professional activity in its region.	Lections; Seminars; Independent work
Develops an experimental work plan	
3. PC-2.V / PR. 1 1. Develops an experimental work plan	Lections; Seminars; Independent work
performs physical or mathematical experiments	
4. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Lections; Seminars; Independent work
uses automation tools when designing	
5. PC-3.V / PR. 3 3. Uses automation tools when designing	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: Work with inherited code.				
1. Objectives of discipline. The structure of the discipline. Basic concepts. The main stages of the electric power automation process. Technological automation, its purpose. Principles for building automatic control systems in power industry. Automatic control and automatic control devices. Characteristics of regulation.		2	1, 2	Lecture
Didactic unit: automatic control of technological processes on TPP, HPP and NPP				
2. Automatic adjustment of the rotational speed and active power generators		2	1, 2, 3	Lecture

3. Automatic switching on synchronous machines on parallel operation. Methods and conditions for switching on synchronous generators on parallel operation. Dynamic impacts when switching on synchronous generators by the method of accurate synchronization. Criteria for the permissibility of inclusion with a specified error angle. Automatic switching on synchronous generators in self-crynization method. Automatic inclusion of synchronous electric motors and synchronous compensators. Principles of constructing accurate synchronization devices. Semi-automatic synchronizer with a constant angle of advance. Automatic synchronizers with constant time of ahead. Microprocessor synchronizers with a matured arise angle.		4	1, 2, 5	Lecture
Didactic unit: Basics of Modern Presentations of the Theory of Complex Systems				
4. Automatic control of the power system in frequency and active power. Tasks and features of frequency control in the power system. GOST requirements to maintain frequency. The effect of frequency to work consumers of electricity. Frequency characteristics and regulating load effect. Frequency characteristics of electrical stations units. Basic requirements for automatic frequency control devices and active power (ArchM). Principles of optimal distribution of the active load between station aggregates. Automatic control of the frequency of rotation of turbines (primary regulation). Hydromechanical primary regulator. Electro-hydraulic regulators of rotation frequency.		4	1, 2, 3, 4, 5	Lecture

5. Parallel operation of aggregates equipped with automatic rotational speed controllers. The impact of statism of the characteristics of the frequency of rotation of the units on the frequency in the power system and the distribution of the active load between the aggregates of power plants. Secondary frequency control and active power. Astrictive frequency control in the power system with one power plant. Archm in many volatile characteristics. Archm using the integrated frequency deviation function. Automatic adjustment and restriction of overflows of active power over the power line. Automatic frequency control of the frequency and streams of active power in EES multiple frequency stations.		4	1, 2, 3, 4, 5	Lecture
Didactic unit: Automatic regulation of the parameters of the electric power system parameters				
6. Automatic control of the parameters of the mode of electric power systems. Automatic adjustment of excitation, voltage and reactive power of synchronous generators. Generator - as an object of regulation. Functions of automatic excitation regulators (ARV) generators in power systems. Relay excitation control with an electromasone excitation system. Current compound. Correction of voltage at a current compoundation. Functional diagram of an electromagnetic corrector. Phase compounding of synchronous machines. Controlled phase compoundation. ARV strong action. Laws of regulation and algorithm for the functioning of ARV strong action. Comparison of various types of ARV in stability and quality of regulation. Digital ARV strong action.		4	1, 2, 3, 4, 5	Lecture

7. Use of ARV to regulate voltage on power plants and to distribute reactive power between generators. Setting the method of reactive current generator, the operation of the generator in a block with a transformer, parallel operation of blocks on total tires. Principles of group management of the excitation of generators (GUV) of the power plant. GUV with central jet load distributor. The principle of performing the GB with the equalization of reactive loads by average value. Microprocessor voltage group control system.		4	1, 2, 3, 4, 5	Lecture
8. Automatic voltage control and reactive power flows in system-forming and distribution networks. GOST requirements for voltage quality. Methods for regulating voltage in electrical networks. Automatic regulation of the transformation coefficient of transformers and autotransformers with RPN. Automatic control of static capacitors batteries, static reactive power sources. Features of the ARV synchronous compensators and synchronous electric motors.		4	1, 2, 3, 4, 5	Lecture
Didactic unit: Basic principles for building an emergency mode				
9. General emergency automatics. Automatic re-inclusion (APV). Appointment, economic efficiency, scope and types of APF. Main technical requirements for APF devices. Joint work of APF devices and relay protection. Acceleration of relay protection during APF. Alternate ATF and ARB with increasing multiple Calculation Starts of the APV line with one-sided nutrition. Three-phase APV lines with double-sided power. Uninchronous APF, criteria for the admissibility of incommary and high-speed APF. ARB with waiting and catching synchronism. Features of tires and transformers. Single-phase automatic re-switching on (OAPU). Advantages, disadvantages, scope and OAPV functions performed. Election agencies of OAPV devices. Device scheme OAPV.		2	1, 2, 3, 4, 5	Lecture

10. Automatic power on the backup power (AVR). AVR appointment, scope. Requirements for AVR devices, basic principles of implementation. Starting devices of ABR, stress running organs, methods for ensuring a singleness of ABR. AURO Device Schemes, Calculation of AVR Settings		2	1, 2, 3, 4, 5	Lecture
11. Automatic frequency unloading (ACR). The assignment of ACR, the principles of execution of ACR. Ways to organize ACHRI and ACHRII. Additional category of unloading. Calculation of ACR. Automatic re-inclusion of consumers after ACH (CAPV). Schemes of ACR and Chape devices.		2	1, 2, 3, 4, 5	Lecture
Didactic unit: Organization in information I / O computers.				
12. Microprocessor integrated anti-emergency automation, its features. Microprocessor complexes of automatic anti-emergency automation devices. Microprocessor terminals of integrated anti-emergency automation.		2	1, 3, 4, 5	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: automatic control of technological processes on TPP, HPP and NPP				
1. Studying general approaches to building generator synchronization devices.	2	2	1, 3, 4, 5	Practical lesson
2. Calculation of the parameters for setting synchronizers with constant and with the calculated advance angle.	2	2	2, 3, 4, 5	Practical lesson
3. Study of circuits of automatic synchronizers with a calculated angle of ahead.	2	2	1, 3, 4, 5	Practical occupation
Didactic unit: Basic principles for building an emergency mode				
4. Calculation of the settings of the device for automatic power on the reserve.	2	2	3, 4, 5	Practical lesson
5. Automatic re-enable power lines.	4	4	3, 4, 5	Practical lesson

6. Justification of the admissibility of using the feed, BAPV on the line with double-sided power supply.	2	2	3, 4, 5	Practical lesson
7. Calculation of ACH	2	2	3, 4, 5	Practical occupation
8. Research of automatic frequency unloading	2	2	3, 4, 5	Practical lesson

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Methodical support and software

Methodological support

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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

ANNOTATION OF THE PROGRAM

Design and operation of relay protection devices

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	61
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	18
8	Consultations, hours	5
9	Independent work, hours	83

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 choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
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
Forms possible options for solving problems	
1. 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; Laboratory works; Independent work

Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.	
2. PC-1.V / PR. 2 2. Know the specifics of socio-economic development and labor market in the field of professional activity in its region.	Lections; Seminars; Laboratory works; Independent work
Develops an experimental work plan	
3. PC-2.V / PR. 1 1. Develops an experimental work plan	Lections; Seminars; Laboratory works; Independent work
performs physical or mathematical experiments	
4. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Lections; Seminars; Laboratory works; Independent work
forms design solutions for new objects	
5. PC-4.V / PR. 2 2. Forms design solutions for new objects	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: Relay protection of electrical networks				
1. Criteria for choosing type VL protection. Current protection of distribution networks.		2	1, 2, 3, 5	Lecture
2. Transverse differential protection Vl.	2	2	1, 2, 5	Lecture
3. Remote protection Vl.		2	1, 3, 5	Lecture
4. Current protection of the zero sequence.	2	2	1, 3, 5	Lecture
5. High-frequency lines protection	2	1	2, 4	Lecture
Didactic unit: Software designs				
6. Typical control schemes for the protection of high-voltage lines 110kV		2	1, 2, 3, 5	Lecture
7. Building current protection circuits made on the basis of a typical panel.		1	1, 2, 5	Lecture
8. Work of the regimen of a centralized level		1	1, 2, 5	Lecture
9. Autotransformer protection scheme 500/220 / 10		1	1, 2, 3	Lecture
10. Schemes of remote protection of autotransformers		1	1, 2, 3	Lecture
11. Lowing Transformer Protection Scheme		1	1, 2, 3	Lecture
12. Switch control circuit		2	1, 2, 5	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Relay protection of electrical networks				
1. Acquaintance with automatic design systems based on SolidWorks Electrical	1	4	1, 2, 4, 5	Laboratory work
2. Development of a scheme of primary connections of a specified object with indication of the locations of the RZa cabinets to TT and TN cores		4	1, 2, 4, 5	Laboratory work
3. Use of application programs for performing a thermal calculation.		4	2, 3, 4, 5	Laboratory work
4. Testing directional protection with RF blocking PDE-2802		6	2, 3, 4	Laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Software designs				
1. Lowing Transformer Protection Scheme	1	2	1, 2, 3, 5	Practical lesson
2. Building current protection circuits made on the basis of a typical panel.	1	2	1, 2, 3, 5	Practical lesson
3. Work of the regimen of a centralized level	1	2	1, 2, 3, 5	Practical lesson
4. Autotransformer protection scheme 500/220 / 10	2	2	1, 2, 3, 5	Practical lesson
5. Schemes of remote protection of autotransformers	2	2	1, 2, 3, 5	Practical lesson
6. Switch control circuit	1	2	1, 2, 3, 5	Practical occupation
7. Typical control schemes for the protection of high-voltage lines 110kV	3	6	1, 2, 4, 5	Practical lesson

Table 3.4

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Software designs				
1. Stages of design.		1	1, 2, 3, 4, 5	Independent work
2. Methods for reservation of short circuits in electrical networks		1	1, 2, 3, 4, 5	Independent work

3. Reservation devices of switches failures (level). Requirements for level.		2	1, 2, 3, 4, 5	Independent work
4. Control circuits by high-voltage switches.		2	1, 2, 3, 4, 5	Independent work
5. Far reservation of relay protection. His role, scope.		2	1, 2, 3, 4, 5	Independent work

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4. Релейная защита и автоматизация ЭЭС : методические указания к выполнению расчетно-графических и контрольных работ для ФЭН всех форм обучения по программе подготовки бакалавров по направлению "Электроэнергетика и Электротехника" / Новосиб. гос. техн. ун-т ; [сост.: А. В. Белоглазов, В. А. Давыдов, А. И. Щеглов]. - Новосибирск, 2014. - 50, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000199755

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Specialized software

1 Editor diagrams and block diagrams for Windows Microsoft Visio

2 Three-dimensional modeling Objects Asconce Compass 3D

3 Microsoft Visual Studio 2010

4 Performing a graphic part of the RHZ at the professional level Autodesk Autodesc AutoCAD

5 SolidWorks, Waltham, MassACHUSETTS USA SolidWorks

6 Creating reports for laboratory work. Microsoft Microsoft Office

ANNOTATION OF THE PROGRAM

Theory of reliability and diagnostics in relay protection and automation

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	51
4	Lectures, hours	18
5	Practical lessons, hours	26
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	5
9	Independent work, hours	57

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
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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
demonstrates knowledge of objects of professional activity

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
Forms possible options for solving problems	
1. 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
uses modern information-communications for communication	
2. UK-4. 3 3. Uses modern information communications for communication	Lections; Seminars; Independent work

demonstrates knowledge of objects of professional activity	
3. PC-3.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Seminars; Independent work
analyzes serial objects of professional activity	
4. PC-4.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Seminars; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results
Semester: 2			
Didactic unit: Relief in relay protection - Basic concepts and definitions .			
1. Basic concepts and definitions of reliability theory. Tasks associated with estimation of reliability in relay protection.		2	2
Didactic unit: Types of failures in relay protection			
2. The concept of a good and defective product. Failure and conditions for its occurrence. Classification of failures. Full and partial failures. Defects and accidents. Refuses parametric and catastrophic. Failures dependent and independent, stable and unstable. Graph of life element.		2	1
Didactic unit: redundancy and diagnostics in relay protection.			
3. Model functioning relay protection.		2	1, 4
Didactic unit: Methods for calculating reliability indicators			
4. Drawing up a formal description of the relay protection system and the calculation of reliability indicators. The method of "bounce tree".		2	1, 2, 3, 4
5. Methods for calculating reliability indicators. Logic-probabilistic method for calculating reliability indicators.		2	2, 3
6. Method of Markov chains. Method of simulation modeling the process of relay protection. Table-logical method.		2	2, 3
Didactic unit: Defining places of damage to air power transmission lines			
7. Methods and means of finding places of damage to air LPPs		2	1, 2, 3, 4
Didactic unit: Diagnostics of Relay Protection of Power Systems.			
8. Diagnostics of relay protection. Ways to increase reliability of Rza. Diagnostics of the logical part of relay protection.		2	2, 4
Didactic unit: Functional and test diagnostics of the logical part of relay protection.			
9. Functional and test diagnostics of the logical part of TZNP.		2	2, 3

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Relief in relay protection - Basic concepts and definitions .				

1. Elements of logical circuits of relay protection and automation of power systems.	2	2	3	Acquaintance with the principle of action of the main elements of logical chains of relay protection and automation of power systems, as well as with the basic concepts of relay chains theory. Image of contact and contactless schemes that implement the logic functions of the RZa.
Didactic unit: Methods for calculating reliability indicators				
2. Calculation of the indicators of reliability of the maximum current protection of the power line in the duty, external and internal KZ modes. Determination of single and complex indicators of reliability.	2	4	1, 2, 3, 4	Developing knowledge and skills on the calculations of the technological costs of elktropenergy when converting it and transfer to the consumer.
3. Logical-probabilistic method for calculating reliability indicators.	2	4	2, 4	Construction of the probabilistic polynomial algorithm. An example of calculating the validity of the maximum current protection of the LAP logic-probabilistic method.
4. Method of Markov chains.	2	4	4	Study of the flow of recovery of RZ devices. Building a graph of states and transitions. Compilation of a system of differential equations based on a graph of states and transitions for the RZ system. Solution of the system of differential equations by converting Laplace. Determining the functions of the unpretentiousness of the RZ system.
Didactic unit: Defining places of damage to air power transmission lines				
5. Determination of location Damage to power transmission values.	2	2	3, 4	Acquaintance with the principle of devices of fixing the parameters of the emergency mode. Determining the calculation to the place of damage on the power lines. Calculation of the scan area with the error of the instruments.
Didactic unit: Diagnostics of Relay Protection of Power Systems.				
6. Algorithms of work and structural diagrams of Du designed to diagnose RZa, signals at the control points of which are in the mode of protection duty unchanged by voltage value.	4	4	3, 4	Construction of diagnostic devices for RZa, signals at the control points of which are changed in duty mode.

7. Relay protection as a diagnostic system.	2	2	3, 4	Solving the tasks of the diagnostic system. Analysis of state space, primary and secondary signs of signs, algorithmic space. Studying channel transmission and processing channels. The task of diagnosis in the space of signs. Problems of diagnosis in the space of signs. Signs of own and general. Images of serviceable and faulty states of the object in the space of common features. Building boundaries separating state groups. An example of the evolution of the current protection of the line in terms of technical diagnostics. Algorithms for the work of certain types of relay protection in terms of diagnostics.
Didactic unit: Functional and test diagnostics of the logical part of relay protection.				
8. Test and functional diagnostics of relay protection devices.	2	4	3, 4	Diagnostics of the logical part of the speed protection of the zero sequence. Drawing up a defect table. Filling the test signals in duty and anxiety modes. Determination of effective checkpoints. Diagnostic device compilation less than 1 hour.

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Methodical support and software

Methodological support

1. Расчет дистанционной защиты линии электропередачи : методические указания по курсу "Релейная защита электрических сетей" для специальности "Релейная защита и автоматизация электроэнергетических систем" (140203) / Новосиб. гос. техн. ун-т ; [сост.: В. А. Давыдов, А. И. Щеглов]. - Новосибирск, 2012. - 24, [3] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000172505

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Specialized software

1 PTC Mathcad

2 Operating System Microsoft Windows

3 Microsoft Office Application Pack

4 Wednesday graphic programming means of automating NI LabVIEW

ANNOTATION OF THE PROGRAM

Interface devices with relay protection and automation object

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	61
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	18
8	Consultations, hours	5
9	Independent work, hours	83

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
produces a strategy for solving the task
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
demonstrates knowledge of objects of professional activity
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
produces a strategy for solving the task	
1. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Laboratory works; Independent work
Forms possible options for solving problems	

2. 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; Laboratory works; Independent work
performs physical or mathematical experiments	
3. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Seminars; Laboratory works; Independent work
demonstrates knowledge of objects of professional activity	
4. PC-3.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Seminars; Laboratory works; Independent work
forms design solutions for new objects	
5. PC-4.V / PR. 2 2. Forms design solutions for new objects	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: 3				
Didactic unit: Organization of structure Microprocessor devices. Input / output of discrete signals				
1. Introduction Objectives of discipline. The subject of discipline. The structure of the discipline. Her connection with other curriculum disciplines. BRS. Recommended literature.	0	0,5	1, 2	Lecture
2. Principles of information presentation in computing devices	0,5	2	1, 2, 5	Lecture
3. Types of signals. Discretization.	0	0,5	1, 2, 5	Lecture
4. Basics of programming work with external devices.	0	1	1, 2, 5	Lecture
5. The structure of the microevm.	0	1	1, 2, 5	Lecture
6. Reading and recording digital information on the data bus.	0	1	1, 2, 5	Lecture
7. Special purpose registers.	0	1	1, 2, 5	Lecture
Didactic unit: Disposal of analysis signals in real time				
8. Principles of constructing the DAC.	0,5	2	1, 2, 5	Lecture
9. Formation and output of analog signals in real time.	1	3	1, 2, 5	Lecture
Didactic unit: Entering analog signals in real time				
10. Principles of building ADC.	0,5	3	1, 2, 5	Lecture
11. Entering analog signals in real time.	0,5	3	1, 2, 5	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Organization of structure Microprocessor devices. Input / output of discrete signals				
1. input of discrete signals.	1	2	1, 2, 3, 4, 5	Laboratory work
2. Dispret signals.	2	2	1, 2, 3, 4, 5	Laboratory work
Didactic unit: Disposal of analysis signals in real time				
3. Formation and output of an analog signal signal of an arbitrary form without taking into account the real-time mode	2	2	1, 2, 3, 4, 5	Laboratory work
4. Formation and output of the periodic analog signal of the sinusoidal form	4	4	1, 2, 3, 4, 5	Laboratory work
Didactic unit: Entering analog signals in real time				
5. Enter and measure the values ??of analog signals	2	2	1, 2, 3, 4, 5	Laboratory work
6. Programming the functioning algorithm for digital current protection with a time delay (for example, MTZ with a constant or integral-dependent time).	4	6	1, 2, 3, 4, 5	Laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Organization of structure Microprocessor devices. Input / output of discrete signals				
1. Principles of information presentation in computing devices		4	1, 2, 3, 4, 5	Practical lesson
2. Programming work with external devices		4	1, 2, 3, 4, 5	Practical lesson
Didactic unit: Disposal of analysis signals in real time				
3. Formation and output of analog signals Real-time		4	1, 2, 3, 4, 5	Practical lesson
Didactic unit: Entering analog signals in real time				
12. Entering analog signals in real time		3	1, 2, 3, 4, 5	Practical lesson
13. Programming relay protection algorithms		3	1, 2, 3, 4, 5	Practical lesson

Table 3.4

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Organization of structure Microprocessor devices. Input / output of discrete signals				

1. Principles of information presentation in computing devices		2	1, 2, 4, 5	Independent study of theoretical material
2. methods for regulating the active and reactive transformer power		3	1, 2, 3, 4, 5	Independent study of theoretical material
3. Signal types, sampling.		2	1, 2, 4, 5	Independent study of theoretical material
4. Basics of programming work with external devices.		2	1, 2, 4, 5	Independent study of theoretical material
5. The structure of the microevm.		3	1, 2, 4, 5	Independent study of theoretical material
6. Reading and recording digital information on the data bus.		3	1, 2, 4, 5	Independent study of theoretical material
7. Special purpose registers.		2	1, 2, 4, 5	Independent study of theoretical material
Didactic unit: Disposal of analysis signals in real time				
8. Principles of constructing the DAC.		3	1, 2, 4, 5	Independent study of theoretical material
9. Formation and output of analog signals in real time.		3	1, 2, 4, 5	Independent study of theoretical material
Didactic unit: Entering analog signals in real time				
10. Principles of building ADC.		4	1, 2, 4, 5	Independent study of theoretical material
11. Entering analog signals in real time.		4	1, 2, 4, 5	Independent study of theoretical material
12. Data exchange in interrupt and direct access to memory.		4	1, 2, 4, 5	Independent study of theoretical material

Literary sources

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Methodological support

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5. Проектирование устройств сопряжения с объектом : методические указания и варианты заданий для курсовой работы по курсу "Устройства сопряжения с объектом" для 3 курса дневного отделения АВТФ (специальность 220201) / Новосиб. гос. техн. ун-т ; [сост.: А. Б. Жуков, С. В. Каменский]. - Новосибирск, 2006. - 23, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000052522

Specialized software

1 Operating System Microsoft Windows

2 Microsoft Office Application Pack

3 Scientific and Technical Computing Program Mathworks Matlab

4 Software Development System C ++ Codegear / Embarcadero Technologies C ++ Builder 2007 Professional R2

ANNOTATION OF THE PROGRAM

Relay protection of electric power systems

Course: 1, semester : 2

		Semester
№	Kind of activity	2
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	69
4	Lectures, hours	44
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	18
8	Consultations, hours	5
9	Independent work, hours	75

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
produces a strategy for solving the task
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
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
produces a strategy for solving the task	

1. -one. 2 2. Develops a strategy for solving the task	Lections; Laboratory works; Independent work
Forms possible options for solving problems	
2. 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; Laboratory works; Independent work
Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.	
3. PC-1.V / PR. 2 2. Know the specifics of socio-economic development and labor market in the field of professional activity in its region.	Lections; Laboratory works; Independent work
Develops an experimental work plan	
4. PC-2.V / PR. 1 1. Develops an experimental work plan	Laboratory works; Independent work
performs physical or mathematical experiments	
5. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Lections; Laboratory works; Independent work
uses automation tools when designing	
6. PC-3.V / PR. 3 3. Uses automation tools when designing	Lections; Laboratory works; Independent work
forms design solutions for new objects	
7. PC-4.V / PR. 2 2. Forms design solutions for new objects	Lections; 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: Basic information about electromagnetic owls Realship				
1. Requires for relay protection block generator-transformer. Features of relay protection of station elements of energy systems.		2	1, 2, 3	Lecture
Didactic unit: Primary measuring transducers. Models of electromechanical systems				
2. Primary measuring current transducers.		2	1, 2, 5, 7	Lecture
Didactic unit: Relay Protection Generator				
1. Calculation of settings for longitudinal differential protection of the generator.	2	2	1, 3, 6, 7	Lecture
2. Selecting the settings of the longitudinal differential protection of the generator on the basis of the SHE 1111-SHE terminal 1114	2	2	1, 3, 6, 7	Lecture
3. Protection against land in the winding of the generator stator		2	1, 3, 6, 7	Lecture
4. Protection against Generator Perrigation		2	1, 3, 6, 7	Lecture
4. Protection of synchronous generators.	2	4	1, 2, 3, 6, 7	Lecture

5. Protection against the loss of excitation of the generator		2	1, 3, 6, 7	Lecture
6. Protection against asynchronous generator mode	2	2	1, 3, 6, 7	Lecture
7. Backup remote protection of the generator from interphasis KZ	2	4	1, 3, 6, 7	Lecture
Didactic unit: Relay Protection of Transformers				
4. Protection of transformers, autotransformers and blocks.	2	4	1, 3, 6, 7	Lecture
8. Differential protection of the block transformer		2	1, 3, 6, 7	Lecture
9. Distribution of currents in the circuits of differential transformer protection with a "Star" winding circuit with a triangle with short circuits	2	2	1, 3, 6, 7	Lecture
10. Protection against external short circuits to the Earth.		2	1, 3, 6, 7	Lecture
11. Differential protection of the axis-free transformer voltage	2	2	1, 3, 6, 7	Lecture
12. Differentental protection of the transformer of own needs		2	1, 3, 6, 7	Lecture
Didactic unit: Protection of electric motors				
5. Protection of electric motors.	2	2	1, 3, 6, 7	Lecture
Didactic unit: Protection of the system of own needs power plants.				
6. Protection of the system of own needs power plants.		2	1, 3, 5, 6, 7	Lecture
Didactic unit: Protection of stations and substations				
7. Protection of stations and substations.		2	1, 3, 6, 7	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Relay Protection Generator				
2. Test protection block generator-transformer based on CE-1110m cabinet		6	1, 2, 3, 4, 5, 6, 7	Laboratory work
3. Test protection of synchronous generators		4	1, 2, 3, 4, 5, 6, 7	Laboratory work
Didactic unit: Relay Protection of Transformers				
1. Distribution of currents for differential transformer protection with a "Star / Triangle-11" winding circuit		4	1, 2, 3, 4, 5, 6, 7	Laboratory work
3. Testing the differential protection of the transformer based on the Terminal Sirius-T		4	1, 2, 3, 4, 5, 6, 7	Laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Basic information about electromagnetic owls Realship				
1. Turbogenerators with direct cooling of wiring windings		2	1, 3	Independent work
2. Transformers and autotransformers operating in a block with a generator		2	1, 3	Independent work
Didactic unit: Primary measuring transducers. Models of electromechanical systems				
3. Transitional modes of current transformers.		2	1, 3	Independent work
Didactic unit: Relay Protection Generator				
4. General principles of microprocessor terminals Protecting the main electrical equipment of power plants on the panels of the screen		1	1, 2, 3	Independent work
Didactic unit: Relay Protection of Transformers				
5. Differential Relay type DZT-21 and DZT-23		1	1, 2, 3	Independent work
6. Differential relay of type PCT-15 and PCT-23		1	1, 2, 3	Independent work
7. Microprocessor arrangements of the two-winding transformer "Sirius-T".		1	1, 2, 3	Independent work
8. Protection of the transformer of own needs (TSN)		1	1, 2, 3	Independent work
Didactic unit: Protection of electric motors				
9. Terminals of protection, automation, control and signaling of the BE2502A07xx electric motor		1	1, 2, 3	Independent work
10. Terminal Protection, automatics, switch control and motor alarm with a capacity of up to 5 MW type "Bresler-0107.25x"		2	1, 2, 3	Independent work
13. Calculation of setpoints Protect against interphase short circuits of the electric motor.		2	4, 6, 7	Independent work
14. Calculations of protection against earth closures in the stator engine winding		2	4, 6, 7	Independent work
Didactic unit: Protection of stations and substations				
11. Differential current protection of tires with braking		2	1, 2, 3	Independent work
12. Differential-phase protection of tires.		2	1, 2, 3	Independent work

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Main literature

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3. Щеглов А. И. Релейная защита электрических сетей : учебное пособие / А. И. Щеглов, А. В. Белоглазов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2015. - 142, [1] с. : ил., табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000216630

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

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4. https://e.lanbook.com/

5. ООО НПП «ЭКРА». Научно-производственное предприятие полного цикла : сайт. – Чебоксары, 2007– . – URL: https://ekra.ru/ (дата обращения: 15.02.2021). – Текст : электронный.

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Испытание дифференциальной защиты трансформатора : методические указания к лабораторным работам / Новосиб. гос. техн. ун-т ; [сост.: В. А. Давыдов, О. В. Танфильев]. - Новосибирск, 2016. - 33, [3] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233506

2. Испытание защит блока генератор-трансформатор на базе шкафа ШЭ1110М : методические указания к лабораторным работам по курсу "Релейная защита электрических станций" для магистрантов энергетического факультета по направлению "Электроэнергетика и электротехника" / Новосиб. гос. техн. ун-т ; [сост. О. В. Танфильев]. - Новосибирск, 2015. - 78, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000223049

3. Глазырин В. Е. Релейная защита электрических сетей [Электронный ресурс] : электронный учебно-методический комплекс / В. Е. Глазырин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000214532. - Загл. с экрана.

4. Глазырин В. Е. Расчет уставок микропроцессорной релейной защиты блока генератор-трансформатор : учебное пособие / В. Е. Глазырин, А. И. Шалин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2009. - 128, [1] с.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000090475

5. Испытание защит синхронных генераторов : методические указания к лабораторным работам по курсу "Релейная защита электроэнергетических систем" для 4 и 5 курсов ФЭН дневного и заочного отделений / Новосиб. гос. техн. ун-т ; [сост.: В. А. Давыдов, А. И. Щеглов]. - Новосибирск, 2008. - 30, [2] с. : ил., табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000081954

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7. Испытание микропроцессорного устройства защиты электродвигателей : методические указания к лабораторной работе для 4-5 курсов ФЭН всех форм обучения / Новосиб. гос. техн. ун-т ; [сост. И. П. Тимофеев]. - Новосибирск, 2007. - 65, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000067409

Specialized software

1 Scientific and Technical Computing Program Mathworks Matlab

2 Three-dimensional modeling Objects Asconce Compass 3D

3 Microsoft Visual Studio 2010

4 Performing a graphic part of the RHZ at the professional level Autodesk Autodesc AutoCAD

ANNOTATION OF THE PROGRAM
Anti-emergency automation

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	41
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	0
8	Consultations, hours	3
9	Independent work, hours	67

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
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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

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

Forms possible options for solving problems

1. 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; Independent work
uses modern information-communications for communication	
2. UK-4. 3 3. Uses modern information communications for communication	Lections; Independent work
Develops an experimental work plan	
3. PC-2.V / PR. 1 1. Develops an experimental work plan	Laboratory works; Independent work
performs physical or mathematical experiments	
4. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Laboratory works; Independent work
uses automation tools when designing	
5. PC-3.V / PR. 3 3. Uses automation tools when designing	Laboratory works; Independent work
forms design solutions for new objects	
6. PC-4.V / PR. 2 2. Forms design solutions for new objects	Lections; 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: Structure of the emergency automatic control system in the power system.				
1. Stages of possible development of the accident in the power system.	0	1	1, 2, 6	Lecture
2. The main subsystems of anti-emergency automation. Requirements for devices PA.	0	1	1, 2, 6	Lecture
3. Characteristics of the main types of control influences PA.	0	2	1, 2, 6	Lecture
Didactic unit: Systems of emergency automation systems.				
4. Automation of preventing stability (apne)	0	3	1, 6	Lecture
5. Automation of the liquidation of asynchronous regime (Alar)	0	4	1, 6	Lecture
6. Automation of the frequency reduction limit (AOCC)	0	2	1, 6	Lecture
7. Automation of frequency increase (AOPC)	0	1	1, 6	Lecture
8. Automation of voltage reduction limit (AOSN)	0	1	1, 6	Lecture
9. Structural scheme and features of selecting AOCT settings	0	2	1, 6	Lecture
10. Automation of equipment overload limit (AOPO)	0	1	1, 6	Lecture

Table 3.2

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

Semester: 2				
Didactic unit: Systems of emergency automation systems.				
1. The selection of the parameters of the Alar activation operating on the remote principle. Checking the correctness of its behavior in various emergency modes	0	9	3, 4, 5, 6	Laboratory work
2. Comprehensive checking of the parameters of the triggering of the cabinet PA with the AOC function	0	9	3, 4, 5, 6	Laboratory work

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Specialized software

1 Microsoft Office Application Pack

2 Scientific and Technical Computing Program Mathworks Matlab

3 Microsoft Windows operating system

ANNOTATION OF THE PROGRAM
Microcontrollers and Microprocessors

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	41
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	0
8	Consultations, hours	3
9	Independent work, hours	67

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
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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

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

Forms possible options for solving problems

1. 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; Independent work
uses modern information-communications for communication	
2. UK-4. 3 3. Uses modern information communications for communication	Lections; Independent work
Develops an experimental work plan	
3. PC-2.V / PR. 1 1. Develops an experimental work plan	Laboratory works; Independent work
performs physical or mathematical experiments	
4. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Laboratory works; Independent work
uses automation tools when designing	
5. PC-3.V / PR. 3 3. Uses automation tools when designing	Laboratory works; Independent work
forms design solutions for new objects	
6. PC-4.V / PR. 2 2. Forms design solutions for new objects	Lections; 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: Structure of the emergency automatic control system in the power system.				
1. Stages of possible development of the accident in the power system.	0	1	1, 2, 6	Lecture
2. The main subsystems of anti-emergency automation. Requirements for devices PA.	0	1	1, 2, 6	Lecture
3. Characteristics of the main types of control influences PA.	0	2	1, 2, 6	Lecture
Didactic unit: Systems of emergency automation systems.				
4. Automation of preventing stability (apne)	0	3	1, 6	Lecture
5. Automation of the liquidation of asynchronous regime (Alar)	0	4	1, 6	Lecture
6. Automation of the frequency reduction limit (AOCC)	0	2	1, 6	Lecture
7. Automation of frequency increase (AOPC)	0	1	1, 6	Lecture
8. Automation of voltage reduction limit (AOSN)	0	1	1, 6	Lecture
9. Structural scheme and features of selecting AOCT settings	0	2	1, 6	Lecture
10. Automation of equipment overload limit (AOPO)	0	1	1, 6	Lecture

Table 3.2

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

Semester: 2				
Didactic unit: Systems of emergency automation systems.				
1. The selection of the parameters of the Alar activation operating on the remote principle. Checking the correctness of its behavior in various emergency modes	0	9	3, 4, 5, 6	Laboratory work
2. Comprehensive checking of the parameters of the triggering of the cabinet PA with the AOC function	0	9	3, 4, 5, 6	Laboratory work

Literary sources

Main literature

1. Васильев В. В. Основы функционирования локальных устройств противоаварийной автоматики : учебное пособие / В. В. Васильев, И. П. Тимофеев ; Новосиб. гос. техн. ун-т. - Новосибирск, 2016. - 83, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233620

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Methodical support and software

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Specialized software

1 Microsoft Office Application Pack

2 Scientific and Technical Computing Program Mathworks Matlab

3 Microsoft Windows operating system

ANNOTATION OF THE PROGRAM

Technical means of dispatch and technological management

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	61
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	10
8	Consultations, hours	5
9	Independent work, hours	83

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
produces a strategy for solving the task
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
Formulates the technical task for the implementation of the project
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
produces a strategy for solving the task	
1. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Laboratory works; Independent work
Forms possible options for solving problems	
2. 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; Laboratory works; Independent work

Develops an experimental work plan	
3. PC-2.V / PR. 1 1. Develops an experimental work plan	Lections; Seminars; Laboratory works; Independent work
performs physical or mathematical experiments	
4. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Lections; Seminars; Laboratory works; Independent work
Formulates the technical task for the implementation of the project	
5. PC-3.V / PR. 2 2. Formulates the technical task to implement the project	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: 3				
Didactic unit: Ancient and Moscow Rus				
1. Objectives of discipline. The structure of the discipline. Basic concepts. The main stages of the process of television administration, telecision and telepensification in the electric power industry. Structural schemes of telemechanics systems. External information links of the dispatching item.		1	1, 2, 3, 5	Listening and recording lectures
Didactic unit: Information bases of management				
2. Message, information, signal, interference, coding. Nepomably-protective codes, noise immunity codes, codes with detection and correction of errors.		2	1, 2, 3, 5	Listening and recording lectures
Didactic unit: Types and quantitative characteristics of operational dispatching information				
3. Types of messages. Quantitative characteristics of information.		1	1, 2, 3	Listening and recording lectures
Didactic unit: Transformation of information, information carriers				
4. Quantization in level, time quantization. Information carriers: direct current, alternating current, radio wave, light pulses. Temporary, frequency and phase separation of signals.		2	1, 2, 3	Listening and recording lectures
Didactic unit: Signals as material information carriers, accuracy of transmission of operational dispatching information				
5. Transfer and reception of telemechanic signals. Modulation methods. Continuous modulation methods: amplitude, frequency, phase. Pulse modulation methods. Sources of interference, methods and technical means of combating interference.		2	1, 2, 3	Listening and recording lectures

Didactic unit: Technical means of collecting, transmitting and displaying operational Dispatching information				
6. Measuring current and voltage transducers. Measuring transducers of active and reactive power. Electronic counters of active and reactive energy. Displacement sensors. Temperature sensors. Communication channels on physical wire lines; communication channels on power supply lines; Radio communication channels; Communication channels for fiber optic cables. Sequential data transmission lines, computer networks. Devices display of operational dispatch information.		3	1, 2, 3, 4	Listening and recording lectures
Didactic unit: Evaluation of the effectiveness of an innovative project				
7. Presentation of information in telemechanics systems. Methods for presenting operational dispatching information, assessing the quality of information transfer. Means of information reproduction, information registration tools.		2	1, 2, 3, 4	Listening and recording lectures
Didactic unit: Microprocessor telecoms, data telework systems				
8. Analog-digital converters. Digital-analog converters. Organization of discrete entrances and outputs in telemechanics systems. The structure of data telework systems.		2	1, 2, 3, 4	Listening and recording lectures
Didactic unit: Automated control systems in power industry, functions and principles for constructing the ACS of energy facilities				
9. Principles for constructing telecommunication and telepensification systems. Principles of constructing telecision systems. The use of microcontrollers in the transmission systems of operational dispatcher information.		3	1, 2, 3	Listening and recording lectures

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Microprocessor telecoms, data telework systems				
1. Managing start and motor stopping		4	1, 2, 3, 4, 5	Studying Guidelines, Laboratory Performance
2. Engine protection from overload		4	1, 2, 3, 4, 5	Studying Guidelines, Laboratory Performance
Didactic unit: Automated control systems in power industry, functions and principles for constructing the ACS of energy facilities				

3. Construction of a telecision and television management system using a sequential data transmission line		5	1, 2, 3, 4, 5	Studying Guidelines, Laboratory Performance
4. Building a telecision and television management system with data transfer in a computer network		5	1, 2, 3, 4, 5	Studying Guidelines, Laboratory Performance

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Information bases of management				
1. Coding	2	6	1, 2, 3, 4, 5	Solving the tasks of the following types. - Converting a decimal number using non-compensated codes: binary, single-toothic, two-day. - converting decimal numbers using codes with error detection: with constant weight, with parity check, distribution, with a number of units, multiple three, with doubling elements, inverse; - Decimal transformation using codes with detection and error correction: Hamming, cyclic.
Didactic unit: Signals as material information carriers, accuracy of transmission of operational dispatching information				
2. Flowing signals. The accuracy of the transmission of telemechanical information.	2	4	1, 2, 3, 4, 5	Calculation of attenuation of signals for a given scheme. Calculation of the relative error of the transformation channel and information transmission. The choice of protection tools from interference of discrete and analog inputs and outputs. Drawing up a circuit diagram of collecting and displaying telemechanical information with interference protection.
Didactic unit: Technical means of collecting, transmitting and displaying operational Dispatching information				
3. Measuring transducers. Temperature sensors.	2	4	1, 2, 3, 4, 5	Calculation of input and output parameters of measuring transducers current, voltage, active and reactive power, counters of active and reactive energy, as well as thermocouples and thermistors. Calculation of load resistance to measuring transducers.
Didactic unit: Microprocessor telecoms, data telework systems				

4. Analog-digital converters	4	4	1, 2, 3, 4, 5	Calculation of the binary code of an analog-digital converter and the output value of the digital-analog converter according to the specified source data. Calculation of the maximum conversion time for various types of analog digital converters. Calculation of the relative error of converting various input signals.

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Methodical support and software

Methodological support

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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

ANNOTATION OF THE PROGRAM
Operational Dispatch Management

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	61
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	18
7	of them in an active and interactive form, hours	10
8	Consultations, hours	5
9	Independent work, hours	83

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
produces a strategy for solving the task
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
Formulates the technical task for the implementation of the project
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
produces a strategy for solving the task	
1. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Laboratory works; Independent work
Forms possible options for solving problems	
2. 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; Laboratory works; Independent work

Develops an experimental work plan	
3. PC-2.V / PR. 1 1. Develops an experimental work plan	Lections; Seminars; Laboratory works; Independent work
performs physical or mathematical experiments	
4. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Lections; Seminars; Laboratory works; Independent work
Formulates the technical task for the implementation of the project	
5. PC-3.V / PR. 2 2. Formulates the technical task to implement the project	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: 3				
Didactic unit: Ancient and Moscow Rus				
1. Objectives of discipline. The structure of the discipline. Basic concepts. The main stages of the process of television administration, telecision and telepensification in the electric power industry. Structural schemes of telemechanics systems. External information links of the dispatching item.		1	1, 5	Lecture
Didactic unit: Information bases of management				
2. Message, information, signal, interference, coding. Nepomably-protective codes, noise immunity codes, codes with detection and correction of errors.		2	1, 3	Lecture
Didactic unit: Types and quantitative characteristics of operational dispatching information				
3. Types of messages. Quantitative characteristics of information.		1	1, 2, 3	Lecture
Didactic unit: Transformation of information, information carriers				
4. Quantization in level, time quantization. Information carriers: direct current, alternating current, radio wave, light pulses. Temporary, frequency and phase separation of signals.		2	1, 4, 5	Lecture
Didactic unit: Signals as material information carriers, accuracy of transmission of operational dispatching information				
5. Transfer and reception of telemechanic signals. Modulation methods. Continuous modulation methods: amplitude, frequency, phase. Pulse modulation methods. Sources of interference, methods and technical means of combating interference.		2	1, 2	Lecture

Didactic unit: Technical means of collecting, transmitting and displaying operational Dispatching information				
6. Measuring current and voltage transducers. Measuring transducers of active and reactive power. Electronic counters of active and reactive energy. Displacement sensors. Temperature sensors. Communication channels on physical wire lines; communication channels on power supply lines; Radio communication channels; Communication channels for fiber optic cables. Sequential data transmission lines, computer networks. Devices display of operational dispatch information.		3	1, 2, 5	Lecture
Didactic unit: Evaluation of the effectiveness of an innovative project				
7. Presentation of information in telemechanics systems. Methods for presenting operational dispatching information, assessing the quality of information transfer. Means of information reproduction, information registration tools.		2	1, 3	Lecture
Didactic unit: Microprocessor telecoms, data telework systems				
8. Analog-digital converters. Digital-analog converters. Organization of discrete entrances and outputs in telemechanics systems. The structure of data telework systems.		2	1, 5	Lecture
Didactic unit: Automated control systems in power industry, functions and principles for constructing the ACS of energy facilities				
9. Principles for constructing telecommunication and telepensification systems. Principles of constructing telecision systems. The use of microcontrollers in the transmission systems of operational dispatcher information.		3	1, 5	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Microprocessor telecoms, data telework systems				
1. Managing start and motor stopping		4	1, 3, 4, 5	Laboratory work
2. Engine protection from overload		4	1, 2, 3, 4, 5	Laboratory work
Didactic unit: Automated control systems in power industry, functions and principles for constructing the ACS of energy facilities				

3. Construction of a telecision and television management system using a sequential data transmission line		5	1, 2, 3, 4	Laboratory work
4. Building a telecision and television management system with data transfer in a computer network		5	2, 3, 4, 5	Laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Information bases of management				
1. Coding	4	6	2, 3, 4	Practical lesson
Didactic unit: Signals as material information carriers, accuracy of transmission of operational dispatching information				
2. Flowing signals. The accuracy of the transmission of telemechanical information.	2	4	1, 2, 3, 4	Practical lesson
Didactic unit: Technical means of collecting, transmitting and displaying operational Dispatching information				
3. Measuring transducers. Temperature sensors.	2	4	2, 3, 4	Practicious occupation
Didactic unit: Microprocessor telecoms, data telework systems				
4. Analog-digital converters	2	4	2, 3, 4, 5	Practical occupation

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Methodical support and software

Methodological support

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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 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Modern Relay Protection Means

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	59
4	Lectures, hours	36
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	3
9	Independent work, hours	85

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
produces a strategy for solving the task
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
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
produces a strategy for solving the task	

1. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Independent work
Forms possible options for solving problems	
2. 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
Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.	
3. PC-1.V / PR. 2 2. Know the specifics of socio-economic development and labor market in the field of professional activity in its region.	Lections; Independent work
Develops an experimental work plan	
4. PC-2.V / PR. 1 1. Develops an experimental work plan	Lections; Seminars; Independent work
performs physical or mathematical experiments	
5. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Seminars; Independent work
uses automation tools when designing	
6. PC-3.V / PR. 3 3. Uses automation tools when designing	Seminars; Independent work
forms design solutions for new objects	
7. PC-4.V / PR. 2 2. 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: 3				
Didactic unit: Digital signal processing				
1. Introduction Objectives of discipline. The subject of discipline. The structure of the discipline. Her connection with other curriculum disciplines. BRS. Recommended literature.	0	2	1, 2, 3, 4	Lecture
2. Analog, discrete and digital signals. The discretization theorem (Kotelnikov Theorem), the frequency of Nyquist.	0	6	1, 2, 3, 4	Lecture
3. Digital filters. Digital signal filtering. The main characteristics of digital filters, types of digital filters. Use Matlab package tool for analyzing and synthesizing digital filters. The use of digital filters in modern digital ultrasound (isolating the harmonic groups in the current and voltage signals necessary for the functioning algorithms of the ultrasound; measurement of medium and active signals).	0	4	1, 2, 3, 4	Lecture
Didactic unit: Translation of traditional principles for the functioning of relay protection to modern digital equipment				

6. relay protection algorithms and their implementation on modern digital Technique. Construction of digital current, remote and differential protection.	2	12	1, 2, 3, 4	Lecture
Didactic unit: High-voltage electrical equipment Elemental Installations				
10. Relay protection algorithms based on new signal processing methods inaccessible analog technology. Methods of the theory of recognition of images in constructing algorithms of modern means of relay protection	2	12	1, 2, 3, 4	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Digital signal processing				
4. Principles of presenting information in computing devices: the use of a binary number system, the concept of bit, byte, machine word; The representation of the integers without taking into account the sign and taking into account the sign (direct, additional, reverse and offset codes), the representation of fractional numbers (formats with a fixed and floating point). Using a hexadecimal number system in microprocessor devices, its convenient connection with a binary number system.	2	4	1, 2, 4, 5, 6	Practical lesson
5. Digital filtering of signals. The main characteristics of digital filters, types of digital filters. Use Matlab package tool for analyzing and synthesizing digital filters. The use of digital filters in modern digital urzes (isolating the harmonic components in the current and voltage signals necessary for the functioning algorithms of the ultralo; measurement of the average and active signals).	2	4	1, 2, 4, 5, 6, 7	Practical lesson
Didactic unit: Translation of traditional principles for the functioning of relay protection to modern digital equipment				
7. Algorithms for functioning digital current protection. Digital current cut-offs, digital MTZ, digital current protection with integrally dependent time delay.	2	2	2, 4, 5, 6, 7	Practical lesson
8. Algorithms for functioning of digital remote protection	2	2	1, 2, 5, 6, 7	Practical lesson

9. Algorithm for the functioning of digital differential protection	2	2	1, 2, 5, 6, 7	Practical lesson
Didactic unit: High-voltage electrical equipment Elemental Installations				
11. Algorithms for recognition of internal and external short circuits for differential protection of concentrated objects (generators, transformers, tires, schinovki).	2	2	1, 2, 4, 5, 6, 7	Practical lesson
12. Algorithms for detuning a differential protection of transformers from the rolls of the magnetization current.	2	2	1, 2, 4, 5, 6, 7	Practical lesson

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Specialized software

1 Scientific and Technical Computing Program Mathworks Matlab

2 Operating System Microsoft Windows

3 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Modern automotive equipment

Course: 2, semester : 3

		Semester
№	**Kind of activity**	**3**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	59
4	Lectures, hours	36
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	3
9	Independent work, hours	85

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
produces a strategy for solving the task
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
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
produces a strategy for solving the task	

1. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Independent work
Forms possible options for solving problems	
2. 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
Knows the specifics of the socio-economic development and labor market in the field of professional activity in its region.	
3. PC-1.V / PR. 2 2. Know the specifics of socio-economic development and labor market in the field of professional activity in its region.	Lections; Independent work
Develops an experimental work plan	
4. PC-2.V / PR. 1 1. Develops an experimental work plan	Lections; Seminars; Independent work
performs physical or mathematical experiments	
5. PC-2.V / PR. 2 2. Performs physical or mathematical experiments	Seminars; Independent work
uses automation tools when designing	
6. PC-3.V / PR. 3 3. Uses automation tools when designing	Seminars; Independent work
forms design solutions for new objects	
7. PC-4.V / PR. 2 2. 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: 3				
Didactic unit: Digital signal processing				
1. Introduction Objectives of discipline. The subject of discipline. The structure of the discipline. Her connection with other curriculum disciplines. BRS. Recommended literature.	0	2	1, 2, 3, 4	Lecture
2. Analog, discrete and digital signals. The discretization theorem (Kotelnikov Theorem), the frequency of Nyquist.	0	6	1, 2, 3, 4	Lecture
3. Digital filters. Digital signal filtering. The main characteristics of digital filters, types of digital filters. Use Matlab package tool for analyzing and synthesizing digital filters. The use of digital filters in modern digital ultrasound (isolating the harmonic groups in the current and voltage signals necessary for the functioning algorithms of the ultrasound; measurement of medium and active signals).	0	4	1, 2, 3, 4	Lecture
Didactic unit: Legal bases of BC				

6. Algorithms for the functioning of automation of power systems and their implementation on modern digital technology.	2	12	1, 2, 3, 4	Lecture
Didactic unit: Algorithms of Laplace transformation.				
10. Automatic functioning algorithms based on new signal processing methods inaccessible analog technology. Methods of the theory of recognition of images in the construction of algorithms of modern means of automation.	2	12	1, 2, 3, 4	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Digital signal processing				
4. Principles of presenting information in computing devices: the use of a binary number system, the concept of bit, byte, machine word; The representation of the integers without taking into account the sign and taking into account the sign (direct, additional, reverse and offset codes), the representation of fractional numbers (formats with a fixed and floating point). Using a hexadecimal number system in microprocessor devices, its convenient connection with a binary number system.	2	4	1, 2, 4, 5, 6	Practical lesson
5. Digital filtering of signals. The main characteristics of digital filters, types of digital filters. Use Matlab package tool for analyzing and synthesizing digital filters. The use of digital filters in modern digital urzes (isolating the harmonic components in the current and voltage signals necessary for the functioning algorithms of the ultralo; measurement of the average and active signals).	2	4	1, 2, 4, 5, 6, 7	Practical lesson
Didactic unit: Legal bases of BC				
7. Corner measurement at accurate synchronization of generators.	2	2	2, 4, 5, 6, 7	Practical lesson
8. The principle of functioning digital apne.	2	2	1, 2, 5, 6, 7	Practical lesson
9. The principle of functioning of digital ACHR.	2	2	1, 2, 5, 6, 7	Practical lesson
Didactic unit: Algorithms of Laplace transformation.				

11. Frequency measurement in digital means of accurate automatic synchronization and ACHR.	2	2	1, 2, 4, 5, 6, 7	Practical lesson
12. The principle of functioning of digital Alar.	2	2	1, 2, 4, 5, 6, 7	Practical lesson

Literary sources

Main literature

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2. Багинский Л. В. Основные особенности продольных дифференциальных защит электрооборудования электростанций и подстанций : учебное пособие / Л. В. Багинский ; Новосиб. гос. техн. ун-т. - Новосибирск, 2005. - 66, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000051409

Internet resources

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

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4. https://e.lanbook.com/

5. http://www.iprbookshop.ru/

6. http://znanium.com/

Methodical support and software

Methodological support

1. Современные средства релейной защиты : методические указания к выполнению расчетно-графического задания для всех форм обучения по программе магистерской подготовки "Автоматика энергосистем", направление 13.04.02 (140400.68) "Электроэнергетика и электротехника" / Новосиб. гос. техн. ун-т ; [сост. М. А. Купарев]. - Новосибирск, 2015. - 28, [3] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000218169

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Specialized software

1 Scientific and Technical Computing Program Mathworks Matlab

2 Operating System Microsoft Windows

3 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM

Application packages for calculating short circuits

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	59
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	18
8	Consultations, hours	3
9	Independent work, hours	85

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
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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

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

Forms possible options for solving problems

1. forms possible problems of solving problems	Seminars; Laboratory works; Independent work
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	
2. estimates its resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	Seminars; Laboratory works; Independent work
Develops an experimental work plan	
3. Develops an experimental work plan	Seminars; Laboratory works; Independent work
performs physical or mathematical experiments	
4. performs physical or mathematical experiments	Seminars; Laboratory works; Independent work
uses automation tools when designing	
5. How the heat transfer on the steps of the turbine is distributed.	Seminars; Laboratory works; Independent work
analyzes serial objects of professional activity	
6. to conduct a business correspondence in a foreign language; read and understand the literature towards training with a dictionary and without a dictionary; Extract from the literature on professional communication with significant information and conduct its analytic syntactic processing	Seminars; Laboratory works; Independent work
forms design solutions for new objects	
7. Equivalent forms of mathematical description of linear, nonlinear and special SAU	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:				
1. Test scheme. Preparation of source data. Calculation of the parameters of the substitution scheme. Presentation of the scheme in a graphic editor. Calculation of various types of damage in an application for calculating the CZ currents	1	8	1, 3, 4, 5	Laboratory work
2. the creation of a mathematical model of the electric station in the AWP SRWA package. Calculation of the components of the CW currents to determine the parameters of the operation of the RZ blocks of the blocks generator transformer	1	16	2, 3, 4, 5, 6, 7	Laboratory work
3. Creating a mathematical model of the EES site in the AWP CRPS package. The calculation of the components of the CW currents to determine the parameters of the response of RZ devices of the line	1	12	1, 2, 3, 4, 5	Laboratory work

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit:				
1. General provisions	2	2	2, 6, 7	Practical lesson
2. Schemes of replacement	2	4	1, 6	Practical lesson
3. Vector charts	2	2	1, 6	Practical lesson
4. Guidelines for calculating CZ currents	2	2	1, 3, 6	Practical lesson
5. Description and appointment of a package of AWP SRES	1	1	3, 5	Practical lesson
6. Presentation of EES objects in AWP CRH	2	2	1, 3, 4, 6	Practical lesson
7. Working with a graphic editor	2	2	3, 4, 5	Practical lesson
8. Working with an application for calculating CZ currents	2	3	1, 3, 4, 5, 7	Practical lesson

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Релейная защита электроэнергетических систем : программа курса, задания на контрольные и курсовые работы и методические указания (специальности 140203, 140204) / Новосиб. гос. техн. ун-т ; [сост.: В. А. Давыдов, А. И. Щеглов]. - Новосибирск, 2011. - 43, [1] с. : табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000163871

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Specialized software

1 Microsoft Office Application Pack

2 Three-dimensional modeling Objects Asconce Compass 3D

3 PTC Mathcad

4 Microsoft Windows operating system

ANNOTATION OF THE PROGRAM

Training Practice: Introductory practice in the direction

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	59
4	Lectures, hours	0
5	Practical lessons, hours	18
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	18
8	Consultations, hours	3
9	Independent work, hours	85

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
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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
forms design solutions for new objects
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

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

Forms possible options for solving problems

1. forms possible problems of solving problems	Seminars; Laboratory works; Independent work
evaluates their resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	
2. estimates its resources and their limits (personal, situational, temporary), optimally use them to successfully fulfill the assigned task	Seminars; Laboratory works; Independent work
Develops an experimental work plan	
3. Develops an experimental work plan	Seminars; Laboratory works; Independent work
performs physical or mathematical experiments	
4. performs physical or mathematical experiments	Seminars; Laboratory works; Independent work
uses automation tools when designing	
5. How the heat transfer on the steps of the turbine is distributed.	Seminars; Laboratory works; Independent work
analyzes serial objects of professional activity	
6. to conduct a business correspondence in a foreign language; read and understand the literature towards training with a dictionary and without a dictionary; Extract from the literature on professional communication with significant information and conduct its analytic syntactic processing	Seminars; Laboratory works; Independent work
forms design solutions for new objects	
7. Equivalent forms of mathematical description of linear, nonlinear and special SAU	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: Project management processes				
1. Test scheme. Preparation of source data. Calculation of the parameters of the substitution scheme. Presentation of the scheme in a graphic editor. Calculation of various types of damage in an application for calculating the CZ currents	1	8	1, 3, 4, 5	Laboratory work
2. the creation of a mathematical model of the electric station in the AWP SRWA package. Calculation of the components of the CW currents to determine the parameters of the operation of the RZ blocks of the blocks generator transformer	1	16	2, 3, 4, 5, 6, 7	Laboratory work
3. Creating a mathematical model of the EES site in the AWP CRPS package. The calculation of the components of the CW currents to determine the parameters of the response of RZ devices of the line	1	12	1, 2, 3, 4, 5	Laboratory work

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: synchronization in sleep				
1. General provisions	2	2	2, 6, 7	Practical lesson
2. Schemes of replacement	2	4	1, 6	Practical lesson
3. Vector charts	2	2	1, 6	Practical lesson
4. Guidelines for calculating CZ currents	2	2	1, 3, 6	Practical lesson
Didactic unit: Project management processes				
5. Description and appointment of a package of AWP SRES	1	1	3, 5	Practical lesson
6. Presentation of EES objects in AWP CRH	2	2	1, 3, 4, 6	Practical lesson
7. Working with a graphic editor	2	2	3, 4, 5	Practical lesson
8. Working with an application for calculating CZ currents	2	3	1, 3, 4, 5, 7	Practical lesson

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

3. RZA.ORG.UA. Все о релейной защите : сайт. – 2021. – URL: https://rza.org.ua/ (дата обращения: 27.01.2021). – Загл. с экрана. – Режим доступа: свободный. – Текст : электронный.

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

7. http://znanium.com/

Methodical support and software

Methodological support

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2. Расчет дистанционной защиты линии электропередачи : методические указания по курсу "Релейная защита электрических сетей" для специальности "Релейная защита и автоматизация электроэнергетических систем" (140203) / Новосиб. гос. техн. ун-т ; [сост.: В. А. Давыдов, А. И. Щеглов]. - Новосибирск, 2012. - 24, [3] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000172505

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4. Фролова Е. И. Прикладные пакеты программ для расчета токов коротких замыканий [Электронный ресурс] : электронный учебно-методический комплекс / Е. И. Фролова, О. В. Танфильев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2016]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233571. - Загл. с экрана.

Specialized software

1 Microsoft Office Application Pack

2 Three-dimensional modeling Objects Asconce Compass 3D

3 PTC Mathcad

4 Microsoft Windows operating system

ANNOTATION OF THE PROGRAM
technological automation of electrical stations

Course: 1, semester : 2

		Semester
№	**Kind of activity**	**2**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	41
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	0
8	Consultations, hours	3
9	Independent work, hours	103

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*:
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
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
forms design solutions for new objects
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
1. Forms the objectives and objectives of the study	Lections; Independent work
analyzes the problem situation and makes it decomposition for individual tasks .	
2. Basic computer device at the level of the main components and blocks and their relationship	Lections; Independent work

Forms possible options for solving problems	
3. forms possible problems of solving problems	Lections; Seminars; Independent work
Develops an experimental work plan	
4. Develops an experimental work plan	Lections; Seminars; Independent work
forms design solutions for new objects	
5. Equivalent forms of mathematical description of linear, nonlinear and special SAU	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: TPPs and NPPs as technological systems for the production of electro-, heat energy.				
1. Test automation. Test costs. Quality of software product. Test phases. Test planning. Types of testing. Approaches to the development of tests. Documentation and support tests. Assessment of test quality.	1	2	1, 2, 5	Listening and recording lectures, discussion of decisions for new objects
2. Automatic adjustment of generator excitation	1	2	1, 2, 5	Listening and recording lectures, discussion of decisions for new objects
3. Automatic start and stop of units	1	2	2, 3, 5	Listening and recording lectures, discussion of decisions for new objects
4. Technological protection of aggregates	1	2	2, 4, 5	Listening and recording lectures, discussion of decisions for new objects
5. Electric power supply systems of industrial enterprises and energy distribution systems. Structure of power supply systems of industrial enterprises. Electric power supply schemes of industrial enterprises. Transformer substations. Convertive substations. Switchgear. Constructive execution of electrical networks.	1	2	2, 4, 5	Listening and recording lectures, discussion of decisions for new objects
6. Control of the auxiliary equipment of the unit	1	2	3, 4, 5	Listening and recording lectures, discussion of decisions for new objects
Didactic unit: Group regulation of power				
7. Group control of the active power of hydroelectric power supply	1	2	1, 3, 5	Listening and recording lectures, discussion of decisions for new objects

8. Algorithm for calculating derivatives from the Fisher Information Matrix according to the input components for stochastic models of linear stationary continuous discrete systems.	1	2	1, 3, 5	Listening and recording lectures, discussion of decisions for new objects
9. Group regulation of voltage and reactive power	1	2	1, 3, 5	Listening and recording lectures, discussion of decisions for new objects

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: TPPs and NPPs as technological systems for the production of electro-, heat energy.				
1. Test automation. Test costs. Quality of software product. Test phases. Test planning. Types of testing. Approaches to the development of tests. Documentation and support tests. Assessment of test quality.	2	4	3, 4, 5	Solving tasks
2. Automatic adjustment of generator excitation	2	4	3, 4, 5	Solving tasks
3. Automated control systems for hydraulic units	1	2	3, 4, 5	Solving tasks
4. Electric power supply systems of industrial enterprises and energy distribution systems. Structure of power supply systems of industrial enterprises. Electric power supply schemes of industrial enterprises. Transformer substations. Convertive substations. Switchgear. Constructive execution of electrical networks.	1	2	3, 4, 5	Solving tasks
Didactic unit: Group regulation of power				
5. Group control of active power on hydroelectric power supplies	2	3	3, 4, 5	Solving tasks
6. Group regulation of voltage and reactive power	2	3	3, 4, 5	Solving tasks

Literary sources

Main literature

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2. Глазырин Г. В. Теория автоматического регулирования : [учебное пособие] / Г. В. Глазырин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 167, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000237078

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4. https://e.lanbook.com/

5. http://www.iprbookshop.ru/

6. http://znanium.com/

Methodical support and software

Methodological support

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Specialized software

1 Creating reports for laboratory work. Microsoft Microsoft Office

2 Scientific and Technical Computing Program Mathworks Matlab

3 Development of cross-platform applications Microsoft Visual Studio 2015

ANNOTATION OF THE PROGRAM

relay protection algorithms and their software implementation

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	40
4	Lectures, hours	0
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	2
8	Consultations, hours	2
9	Independent work, hours	68

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*:
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*:
produces a strategy for solving the task
can be planned and implementing physical or mathematical experiments, Interpret and present the results of scientific research in the form of articles or patents; *regarding the following learning results*:
Develops an experimental work plan
performs physical or mathematical experiments

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
Determines the sequence of solving problems	
1. determines the sequence of solving problems	Seminars; Independent work
produces a strategy for solving the task	
2. produces a strategy for solving the task set	Seminars; Independent work
conducts analysis of the results	

3. An analysis of the results obtained	Seminars; Independent work
Develops an experimental work plan	
4. Develops an experimental work plan	Seminars; Independent work
performs physical or mathematical experiments	
5. performs physical or mathematical experiments	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: Software Review				
1. Software for solving electric power problems		2	2	Practical lesson
2. Calculation of load and emergency modes	1	1	1, 5	Practical lesson
3. A brief analysis of the existing software		1	2	Practical lesson
Didactic unit: Overview of the MP devices of RZIA devices and algorithms implemented in them				
4. Overview of the complex of used MP devices of RZa and algorithms		2	3, 4	Practical lesson
Didactic unit: Structural MP Scheme Devices of RZ				
5. Structural diagram of MP device RZa		1	4	Practical lesson
Didactic unit: Mathematical apparatus for recording RZA algorithms				
6. Mathematical apparatus for recording RZIA algorithms	1	2	1, 5	Practical lesson
7. Features of the record of algorithms of measuring organs		2	3	Practical lesson
Didactic unit: Calculation of the power characteristics of electrical engineering installations				
8. Realization of complex functional dependencies		2	1	Practical lesson
9. Algorithms of orthogonalization algorithms for instant values ??		4	1, 5	Practical lesson
10. Fourier algorithm		1	3, 5	Practical lesson
11. Algorithms for the allocation of emergency components		2	3, 5	Practical lesson
12. Current relay algorithms		2	3, 5	Practical lesson
13. Direction relay algorithms Power		4	2, 3, 5	Practical lesson
14. Relay algorithms Resistance		6	1, 3, 5	Practical lesson
15. The algorithms of the differential protection of the generator		4	1, 3, 4, 5	Practical lesson

Literary sources

Main literature

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

3. Типовые функции цифровых устройств противоаварийной автоматики ФСМ, ФТКЗ, АЧР, ЧАПВ, ЧДА, КПР, САОН, АОПО, АРПМ [Электронный ресурс] : стандарт организации. СТО 56947007- 33.040.20.204-2015 ; дата введения: 03.11.2015. – [Москва] : ФСК ЕЭС, 2015. – www.fsk-ees.ru/upload/docs/STO_56947007-33.040.20.204-2015.pdf. – Загл. с экрана.

4. https://e.lanbook.com/

5. http://www.iprbookshop.ru/

6. http://znanium.com/

Methodical support and software

Methodological support

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2. Автоматическая частотная разгрузка : методические указания к выполнению лабораторной работы для магистрантов направления 13.04.02 (140400.68) "Электроэнергетика и электротехника" по курсу "Автоматика энергосистем" / Новосиб. гос. техн. ун-т ; [сост. И. П. Тимофеев]. - Новосибирск, 2015. - 27, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221502

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Specialized software

1 Creating reports for laboratory work. Microsoft Microsoft Office

2 Development of cross-platform applications Microsoft Visual Studio 2015

3 Software Simulation Software Installation Complex MANITOBA HYDRO INTERNATIONAL LTD PSCAD