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	45
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	7
9	Independent work, hours	63

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*:
analyzes the problem situation and makes it decomposition for individual tasks .
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

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.	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.	Laboratory works; Independent work
conducts analysis of the results	

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

Literary sources

Main literature

1. Кобылянский В. Г. Сетевые информационные технологии [Электронный ресурс] : конспект лекций / В. Г. Кобылянский ; Новосиб. гос. техн. ун-т. - Новосибирск, [2021]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243628. - Загл. с экрана.

2. Манусов В. З. Применение методов искусственного интеллекта в задачах управления режимами электрических сетей Smart Grid : [монография] / В. З. Манусов, Н. Хасанзода, П. В. Матренин. - Новосибирск, 2019. - 238, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000241039. - Доп. тит. л., огл. англ..

Additional literature

1. Баран Е. Д. Измерения в LabVIEW : учебное пособие / Е. Д. Баран, Ю. В. Морозов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2010. - 161 с. : ил., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000142341. - В вып. дан. авт.: Баран Ефим Давыдович (!).

2. Григоркин Б. О. Информационно-измерительная техника и электроника [Электронный ресурс]. Часть 2 : электронный учебно-методический комплекс / Б. О. Григоркин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000152078. - Загл. с экрана.

Internet resources

1. National instruments: test, measurement and embedded system [Electronic resource]. – USA : National Instruments Corp., 2011. – Mode of access: http://www.ni.com/. – Title from screen.

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	42	41
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	4	3
9	Independent work, hours	30	31

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
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
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

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
presents the results of the work performed	
1. 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	
2. UK-4. 1 1. Held communication skills in typical situations of academic communication.	Seminars; Independent work

translates academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language	
3. UK-4. 2 2. To be able to translate academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language	Seminars; Independent work
uses modern information-communications for communication	
4. UK-4. 3 3. To be able to use foreign language sources of professional information (including sectoral dictionaries and reference books).	Seminars; Independent work
demonstrates the understanding of the characteristics of various cultures and Nations	
5. UK-5. 1 1. To have an idea of ??the features of academic communication in cross-cultural environment.	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	2, 5	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	3, 4	Viewing and studying, translation, discussion of read materials, performing lexico-grammatical tasks. Preparation and speech design of statements on the topic "Master's program". Preparation for interview.
Semester: 2				
Didactic unit:				

1. Academic presentation	26	26	1, 2	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	3, 4	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.

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

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

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

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

Additional literature

1. Каракчиева В. Л. Академическая презентация. Academic Presentation : [учебное пособие] / В. Л. Каракчиева, О. Г. Орлова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2020. - 90, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243466

Internet resources

1. Английский язык. Аннотирование и реферирование научного текста : электронный учебно-методический комплекс / М. Н. Гордеева, О. С. Атаманова, К. В. Пиоттух, Ю. В. Ридная, Н. А. Сапченко / - Новосиб. гос. техн. ун-т, 2017. - URL: http://dispace.edu.nstu.ru/didesk/course/show/7432.- Режим доступа для авторизованных пользователей.

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

3. КиберЛенинка [Электронный ресурс] : науч. электрон. б-ка. - Режим доступа: http://http: www.rsl.ru.- Загл. с экрана.

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

5. Academic writing style [Electronic resource] // Centre for Academic Success. Study Guides: Writing. - Steve Gould, 2011. - Mode of access: http://library.bcu.ac.uk/learner/writingguides/1.20.htm. - Title from screen.

6. Linking words and phrases [Electronic resource] // Linking words. - Mode of access: https://www.dlsweb.rmit.edu. au/lsu/content/4_writingskills/writing_tuts/linking_LL/ linking3.html/ - Title from screen.

7. Elsievir [Electronic resource] : website, 2020. - Mode of access: https://www.elsevier.com/. - Title from screen.

8. http://www.iprbookshop.ru/

9. Academic presentations: teaching presentation skills to foreign students [Electronic resource] : video file // LLAS: Centre for Languages, Linguistics and Area Studies. - LLAS, 2016. - Mode of access: https://www.llas.ac.uk/video/6097. - Title from screen.

10. ScienceDirect [Electronic resource]. - Elsevier, 2020. - Mode of access: https://www.sciencedirect.com/. - Title from screen.

11. http://znanium.com/

12. Writing an Abstract [Electronic resource] // Writing Centre of the University of Adelaide. - 2015. - Mode of access: Adelaidehttp://webcache.googleusercontent.com/search?q=cache:88vezuFjumYJ:https://www.adelaide.edu.au/writingcentre/learning_guides/learningGuide_writingAnAbstract.pdf&gws_rd=cr&ei=ZfimVp_fHIaksAHy57igBQ. - Title from screen.

13. Abstracts [Elrctronic resource] // The Writing Centerat UNC Chapel Hill. - The Writing Center at UNC Chapel Hill, 2014. - Mode of access: http://writingcenter.unc.edu/handouts/abstracts. - Title from screen.

14. Phrases for conversations [Electronic resource] // ESL gold: Great Resources For Teaching & Learning English. - Mode of access: http://www.eslgold.com/speaking/phrases.html. - Title from screen.

15. Мультитран [Электронный ресурс]: электронный словарь. - Режим доступа: http://www.multitran.ruю - Загл. с экрана.

Methodical support and software

Methodological support

1. 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.

2. 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.

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	45
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	7
9	Independent work, hours	63

External requirements

is able to 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 .
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

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
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	Lections; Seminars; Independent work
uses modern information-communications for communication	
4. UK-4. 3 3. Uses modern information communications for communication	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. Удалов С. Н. Возобновляемые источники энергии : учебное пособие для вузов по направлению подготовки 140400 - "Электроэнергетика и электротехника", модуль "Электроэнергетика" / С. Н. Удалов. - Новосибирск, 2014. - 457, [1] с., [6] л. ил. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000184901

2. Ушаков, В. Я. Современные проблемы электроэнергетики : учебное пособие / В. Я. Ушаков. — Томск : Томский политехнический университет, 2014. — 447 c. — ISBN 978-5-4387-0521-5. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/34715.html (дата обращения: 16.02.2021). — Режим доступа: для авторизир. пользователей

3. Формирование механизмов устойчивого развития экономики промышленных предприятий : монография / [В. А. Титова и др.] ; под ред. В. А. Титовой ; Новосиб. гос. техн. ун-т. - Новосибирск, 2010. - 189, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000156216

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

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. http://znanium.com/

5. Электротехнический-портал.рф [Электронный ресурс]: электротехнический портал для студентов ВУЗов и инженеров. - Электротехнический портал, 2017. - Режим доступа: http://xn----8sbnaarbiedfksmiphlmncm1d9b0i.xn--p1ai/home.html. - Загл. с экрана.

6. Современные проблемы науки и образования [Электронный ресурс] : электрон. науч. журн. – Режим доступа: http://elibrary.ru/title_about.asp?id=11941. – Загл. с экрана

7. ПАО «Россети» : сайт. – Москва, 2021. – URL: https://www.rosseti.ru/ (дата обращения: 19.02.2021). – Текст : электронный.

Methodical support and software

Methodological support

1. Боруш О. В. Общая энергетика [Электронный ресурс] : электронный учебно-методический комплекс / О. В. Боруш ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000157076. - Загл. с экрана.

2. Русина А. Г. Режимы электрических станций и электроэнергетических систем : [учебное пособие по направлению подготовки "Электроэнергетика и электротехника"] / А. Г. Русина, Т. А. Филиппова. - Новосибирск, 2016. - 398, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000220184

3. Лыкин А. В. Энергосбережение и энергоаудит на предприятиях энергетики [Электронный ресурс] : электронный учебно-методический комплекс / А. В. Лыкин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000157214. - Загл. с экрана.

4. Китушин В. Г. Экономика энергетических рынков [Электронный ресурс] : электронный учебно-методический комплекс / В. Г. Китушин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000157186. - Загл. с экрана.

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	43
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	5
9	Independent work, hours	29

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

Literary sources

Main literature

1. ЭБС Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 1993. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

2. ЭБС Znanium.com [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2011. - Режим доступа: http://znanium.com. - Загл. с экрана.

3. Чиркова И. Г. Оценка инвестиционной привлекательности производственных предприятий в инновационной экономике : учебное пособие / И. Г. Чиркова, М. А. Тихончук ; Новосиб. гос. техн. ун-т. - Новосибирск, 2020. - 64, [3] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242671

Additional literature

1. Кириллов Ю. В. Экономико-математические модели оценки эффективности инвестиционных и инновационных проектов : монография / Ю. В. Кириллов, А. В. Кравченко, Е. В. Драгунова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2019. - 153 с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242118

2. Спиридонова Е. В. Фандрайзинг для инноваций [Электронный ресурс] : электронный учебно-методический комплекс / Е. В. Спиридонова ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234509. - Загл. с экрана.

Internet resources

1. ГОСТ Р 56261-2014 Инновационный менеджмент. Инновации. Основные положения (Переиздание). – Текст : электронный / АО «Кодекс». Электронный фонд правовой и нормативно-технической документации : сайт. – 2021. – URL: http://docs.cntd.ru/document/1200118633 (дата обращения: 12.02.2021).

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.

3. http://elibrary.nstu.ru/

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

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

6. http://znanium.com/

Methodical support and software

Methodological support

1. Стародубцева О. А. Контрольный тест [Электронный ресурс] : контролирующие материалы / О. А. Стародубцева ; Новосиб. гос. техн. ун-т. - Новосибирск, [2014]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000208364. - Загл. с экрана.

2. Васильева М. В. Лабораторные работы по дисциплине «Управление проектами» [Электронный ресурс] : сборник задач и упражнений / М. В. Васильева ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000214379. - Загл. с экрана.

3. Яцко В. А. Управление проектами. Разработка бизнес-плана средствами Альт-Инвест [Электронный ресурс] : учебно-методическое пособие / В. А. Яцко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222642. - Загл. с экрана.

4. Стародубцева О. А. Управление инновациями [Электронный ресурс] : электронный учебно-методический комплекс / О. А. Стародубцева ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 1 электрон. опт. диск (CD-ROM). - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000237310. - Свидетельство о регистрации № 23274.

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	30
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	10
9	Independent work, hours	42

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
Forms the decision-making criteria
can apply Modern research methods, evaluate and present the results of the work performed; *regarding the following learning results*:
conducts analysis of the results
presents the results of the work performed
Selects the necessary research method to solve the task
Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .

Requirements for the results of mastering the discipline

The results of the study of the discipline	Forms of organizing classes
1. OPK-1. 1 1. Formulates the objectives and objectives of the study	Seminars; Independent work
Determines the sequence of solving problems	
2. OPK-1. 2 2. Determines the sequence of solving problems	Seminars; Independent work

Forms the decision-making criteria	
3. OPK-1. 3 3. Formulates the decision criteria	Seminars; Independent work
analyzes the problem situation and makes it decomposition for individual tasks .	
4. UK-1. 1 1. Analyzes the problem situation and makes it a decomposition into separate tasks.	Seminars; Independent work
Selects the necessary research method to solve the task	
5. OPK-2. 1 1. Selects the necessary research method to solve the task	Seminars; Independent work
conducts analysis of the results	
6. OPK-2. 2 2. The analysis of the results obtained	Seminars; Independent work
presents the results of the work performed	
7. OPK-2. 3 3. Represents the results of the work performed	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: Methodology of scientific research				
1. Methodological basis for scientific research	2	2	1, 5	practical lesson
2. Research methods	2	2	1, 2, 5	practical lesson
3. Systematization and analysis of scientific data	2	2	2, 3, 5, 6	practical lesson
4. The main stages of scientific research	2	2	1, 2, 3, 5	practical lesson
5. Approbation and registration of scientific work	2	2	2, 6, 7	practical lesson
Didactic unit: Selection and decision-making in energy				
6. Theoretical foundations of obtaining heuristic estimates	2	2	1, 2, 4, 6, 7	practical lesson
7. Receiving and entertaining heuristic information in management	2	2	3, 5, 6	practical lesson
8. General rules and procedure for conducting diagnostic examinations	2	2	1, 2, 3, 4, 5, 6, 7	practical lesson
9. Multipurpose management in power engineering	2	2	1, 2, 3, 4, 5, 6, 7	practical lesson

Literary sources

Main literature

1. Аманжолова Б. А. Научная работа магистрантов : учебное пособие / Б. А. Аманжолова, Е. В. Хоменко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2016. - 97 с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000227444

2. Методология и практика научно-исследовательской работы : учебно-методическое пособие / составитель Н. Н. Колосова. — Персиановский : Донской ГАУ, 2020. — 41 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/148548 (дата обращения: 16.02.2021). — Режим доступа: для авториз. пользователей.

Additional literature

1. Миронов В. В. Выполнение и оформление выпускных квалификационных работ : учебное пособие / В. В. Миронов, Н. А. Подъякова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2014. - 86 с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000208836

2. Курбанов, С. А. Методы и методология научных исследований : учебно-методическое пособие / С. А. Курбанов, Д. С. Магомедова. — Махачкала : ДагГАУ имени М.М.Джамбулатова, 2020. — 31 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/162216 (дата обращения: 16.02.2021). — Режим доступа: для авториз. пользователей.

Internet resources

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

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

3. Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

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

5. Федеральные государственные образовательные стандарты высшего образования [Электронный ресурс]. – Режим доступа: http://fgosvo.ru/. – Загл. с экрана.

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Секретарев Ю. А. Выбор и принятие решений в электроэнергетике : [учебное пособие] / Ю. А. Секретарев, Я. В. Панова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 93, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000239592

2. Казанская О. В. Системный анализ и выбор решений [Электронный ресурс] : электронный учебно-методический комплекс / О. В. Казанская ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222581. - Загл. с экрана.

Specialized software

Использование специализированного программного обеспечения для изучения дисциплины не требуется

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	48
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	10
9	Independent work, hours	60

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*:
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency
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.
To be able to analyze the activities of enterprises and organizations of the profile industry of their 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
To be able to analyze the activities of enterprises and organizations of the profile industry of their region	
4. To be able to analyze the activities of enterprises and organizations of the profile industry of their region	Lections; Seminars; Independent work
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency	
5. Applies methods for analyzing options, develop and search for compromise solutions with an assessment of the project implementation efficiency	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	lecture
2. Principles of system analysis		2	1, 2	lecture
3. Methodology of system analysis		2	2, 3	lecture
4. Data science as a modern stage of system analysis		2	2, 4	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, 4, 5	lecture
6. Processing, analysis, data visualization		2	2, 5	lecture
7. Interpretation of computer modeling results		2	3, 4, 5	lecture
8. Risks, risk management		2	1, 2, 5	lecture
9. The system effect in the methods of artificial intelligence		2	3, 4, 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	practical lesson
4. Data science as a modern stage of system analysis	2	2	2, 4	practical lesson
Didactic unit: System analysis tools				
5. System analysis in power industry	2	2	3, 4, 5	practical lesson
6. Processing, analysis, data visualization	2	2	2, 5	practical lesson
7. Interpretation of computer modeling results	2	2	3, 4, 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, 4, 5	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		4	2, 3	practical lesson
Didactic unit: System analysis tools				
5. System analysis in power industry		4	3, 4, 5	practical lesson
6. Processing, analysis, data visualization		4	2, 5	practical lesson
7. Risks, risk management		4	4, 5	practical lesson

Literary sources

Main literature

1. Тимофеева А. Ю. Вероятностные основы методов и алгоритмов анализа данных : [учебное пособие] / А. Ю. Тимофеева, Е. А. Хайленко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2020. - 80, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242576

2. Черняков М. К. Моделирование и проектирование производственных процессов и систем : [учебное пособие] / М. К. Черняков ; Новосиб. гос. техн. ун-т. - Новосибирск, 2020. - 92, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243123

3. Любченко В. Я. Применение математического моделирования в задачах электроэнергетики : [учебное пособие] / В. Я. Любченко, С. В. Родыгина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 68, [3] с.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000238853

Additional literature

1. Манусов В. З. Применение методов искусственного интеллекта в задачах управления режимами электрических сетей Smart Grid : [монография] / В. З. Манусов, Н. Хасанзода, П. В. Матренин. - Новосибирск, 2019. - 238, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000241039. - Доп. тит. л., огл. англ..

2. Применение методов искусственного интеллекта в задачах технической диагностики электрооборудования электрических систем : [монография / В. З. Манусов и др. ; под общ. ред. В. З. Манусова]. - Новосибирск, 2020. - 444, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242675. - Доп. тит. л., огл. англ..

3. Программные системы статистического анализа. Обнаружение закономерностей в данных с использованием системы R и языка Python : [учебное пособие / В. М. Волкова и др.] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 72, [1] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234496

4. Управление производственными системами : конспект лекций : [учебное пособие / В. И. Мамонов и др.] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 74, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000239297

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. http://znanium.com/

5. Электронно-библиотечная система НГТУ [Электронный ресурс] : электронно-библиотечная система. – [Россия], 2011. – Режим доступа: http://elibrary.nstu.ru/. – Загл. с экрана.

6. Системный оператор Единой энергетической системы [Электронный ресурс] : сайт. - Режим доступа: http://so-ups.ru/. - Загл. с экрана.

7. IEEE Xplore Digital Library [Electronic resource] : Electronic Library. – 2021. – Mode of access: https://ieeexplore.ieee.org/Xplore/home.jsp. – Title from screen.

8. Бондаренко А. А. Теория технических систем : учеб. пособие / А. А. Бондаренко – Днепропетровск : Нац. горный ун-т, 2004. – 103 с. – Режим доступа: http://aabondarenko.narod.ru/knigi.html. – Загл. с экрана.

9. ГОСТ Р ИСО 9000-2015. Системы менеджмента качества. Основные положения и словарь[Электронный ресурс]. - Введ. 2015-11-01. - Режим доступа: http://docs.cntd.ru/document/1200124393. - Загл. с экрана.

Methodical support and software

Methodological support

1. Шегал Б. Р. Системный анализ [Электронный ресурс] : электронный учебно-методический комплекс / Б. Р. Шегал ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234060. - Загл. с экрана.

2. Балаганский И. А. Прикладной системный анализ (ЭУМК) [Электронный ресурс] : электронный учебно-методический комплекс / И. Ф. балаганский ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243342. - Загл. с экрана.

3. Коробейников С. М. Прикладной системный анализ [Электронный ресурс] : электронный учебно-методический комплекс / С. М. Коробейников ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234885. - Загл. с экрана.

4. Мезенцев Ю. А. Теория систем и системный анализ [Электронный ресурс] : электронный учебно-методический комплекс / Ю. А. Мезенцев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000235463. - Загл. с экрана.

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
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	66
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	10
9	Independent work, hours	42

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*:
Formulates the objectives and objectives of the study
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. 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; Laboratory works; Independent work
Formulates the technical task for the implementation of the project	

3. element base of modern computers.	Seminars; Laboratory works; Independent work
Formulates the objectives and objectives of the study	
4. forms design solutions for new objects of professional activities	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		6	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		6	2, 3, 4	Performance and protection of laboratory work
Didactic unit: Digital Signals				
12. Synthesis of consecutive corrective devices		6	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 problems for drawing up, linearization and transformation of SAU differential equations
2. Dynamic characteristics of saau	1	2	2, 4	Solving tasks to determine the transfer and transitional functions of various control objects
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

Literary sources

Main literature

1. 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

2. Шойко В. П. Автоматическое регулирование в электрических системах : [учебное пособие] / В. П. Шойко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 193, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000238444

Additional literature

1. Глазырин Г. В. Теория автоматического регулирования : учебное пособие / Г. В. Глазырин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2014. - 167, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000202915

2. Востриков А. С. Задача синтеза в теории регулирования : учебное пособие / А. С. Востриков ; Новосиб. гос. техн. ун-т. - Новосибирск, 2011. - 103, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000157816

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. Проект «РЗА» : современная релейная защита и цифровые технологии в энергетике : сайт. – 2014 – .– URL: https://pro-rza.ru/ (дата обращения: 26.01.2021). – Загл. с экрана. – Режим доступа: свободный. – Текст : электронный.

5. http://znanium.com/

6. Комиссарчик В. Ф. Автоматическое регулирование технологических процессов : учебное пособие [Электронный ресурс] / В. Ф. Комиссарчик. – Тверь: Изд-во ТГТУ, 2001. – 247 с. – Режим доступа: http://fit.tstu.ru:8080/jspui/bitstream/123456789/10198/1/%D0%9A%D0%BE%D0%BC%D0%B8%D1%81%D1%81%D0%B0%D1%80%D1%87%D0%B8%D0%BA%20%D0%92.%D0%A4.%20-%20%D0%90%D0%B2%D1%82%D0%BE%D0%BC%D0%B0%D1%82%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%BE%D0%B5%20%D1%80%D0%B5%D0%B3%D1%83%D0%BB%D0%B8%D1%80%D0%BE%D0%B2%D0%B0%D0%BD%D0%B8%D0%B5%20%D1%82%D0%B5%D1%85%D0%BD%D0%BE%D0%BB%D0%BE%D0%B3%D0%B8%D1%87%D0%B5%D1%81%D0%BA%D0%B8%D1%85%20%D0%BF%D1%80%D0%BE%D1%86%D0%B5%D1%81%D1%81%D0%BE%D0%B2,%202001.pdf. – Загл. с экрана.

Methodical support and software

Methodological support

1. Глазырин Г. В. Теория автоматического управления [Электронный ресурс] : электронный учебно-методический комплекс / Г. В. Глазырин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2013]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000180706. - Загл. с экрана.

2. Французова Г. А. Расчет и исследование системы регулирования динамическим объектом : учебно-методическое пособие / Г. А. Французова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2019. - 42, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000240663

Specialized software

1 Development of cross-platform applications Microsoft Visual Studio 2015

ANNOTATION OF THE PROGRAM

Design and operation of power supply systems

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	85
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	18
8	Consultations, hours	11
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 .
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
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.
To be able to analyze the activities of enterprises and organizations of the profile industry of their 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. to know the methods for calculating the power supply systems	Lections; Seminars; Laboratory works; Independent work
demonstrates knowledge of objects of professional activity	
2. to know the principles of construction and specific electrical network elements, the structural execution of air and Cable power lines	Lections; Independent work

knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
3. To be able to calculate the parameters of the reference schemes of elements of power supply systems; Calculate CC currents in the power supply system	Lections; Seminars; Independent work
demonstrates knowledge of objects of professional activity	
4. to know the range of electronic components manufactured by industry.	Lections; Seminars; Laboratory works; Independent work
analyzes serial objects of professional activity	
5. To be able to develop self-learning skills on practical examples to improve technical systems using non-standard solutions	Lections; Independent work
To be able to analyze the activities of enterprises and organizations of the profile industry of their region	
6. can be able to exploit and select equipment of electric power systems and networks	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: 3				
Didactic unit: Design of electrical networks, including selection of circuit solutions, parameters of the main electrical equipment.				
1. General principles for designing power supply systems	0	2		The main terms, design stages, definition of equipment parameters in the design process.
2. The overall characteristics of the transmission and distribution systems of electrical energy. Simulation of electrical elements.	0	2	4	Basic concepts, terms, definitions; characteristics of the electrical energy transmission system; rated voltages of feeding networks; characteristics of the distribution systems of electrical energy; System of transmission and distribution of electrical energy.
Didactic unit: Constructive performance of power supply systems				
3. Principles of structural performance of the power line.	0	2	2	Features Building feed networks, structural elements VL, selection of wire sections.
4. Cable power lines. Toppers 6-35 square meters.	0	2	2	Constructive features and methods of laying CL 6-35 kV, features of CL 110-220 kV, selection of cable sections. Tackings 6-35 sq.: Design, scope, selection of cross-section of tires and conductive wires.
Didactic unit: Schemes of transmission systems and distribution of electrical energy. Schemes of distribution devices.				
5. Basics of constructing transmission and distribution of electrical energy systems. Methods for connecting substations to the electrical network.	0	2	3, 6	Requirements for electrical networking schemes; network designs; Methods for connecting substations to the electrical network.

6. Typical schemes of distribution devices (RU).	0	2	3, 6	High and medium voltage switchgear (RU VN and RU CH); Low voltage switchgear (RU NN).
Didactic unit: Structures, Schemes GPP and CHP, main electrical equipment, operation modes and constructive execution.				
7. Heat electric centers (CHP). Power supply according to the diagrams of deep inputs.	0	2	6	Structural schemes of CHP; power supply circuit with CHP. Schemes of deep inputs: goals, features, power sources, execution schemes.
Didactic unit: Calculations of the main modes and regulation of voltage				
8. Tasks for calculating and analyzing the established electrical network modes. The overall formulation and characteristics of the task of technical and economic calculations.	0	2	1, 5	Determining the parameters of the working steady mode. The task of choice in technical and economic calculations; Main economic indicators, choosing the optimal power option.
Didactic unit: frequency control.				
9. Indicators and quality rates of electricity. Frequency control; Automatic frequency unloading.	0	2	4	The level of frequency and voltage in the electric power system (EES): indicators and quality rates of electricity; Basic formulas. Frequency rationing, influence of the frequency of ED, static characteristics in terms of frequency, primary and secondary regulation. Principle of operation and category ACR, Chapes.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Design of electrical networks, including selection of circuit solutions, parameters of the main electrical equipment.				
1. Analysis of power consumption power consumption systems.	2	8	1, 4	Construction of the power supply scheme, the calculation of the original mode, the construction of graphs of the Near and the calculation of their parameters, the calculation of the mode for the maximum load time
2. Compensation of reactive power.	2	8	4	In the circuits of the electrical network, select the power of the capacitor battery and select the locations of their installation to reduce the reactive power over the lines and transformers.
Didactic unit: Constructive performance of power supply systems				
3. Determination of optimal expansion points of electrical networks	2	8	4	Determination of optimal dispersion points of electrical networks.

Didactic unit: Schemes of transmission systems and distribution of electrical energy. Schemes of distribution devices.				
4. Selection of the transmission and distribution of electrical energy	2	8	6	Learn how to choose the distribution network schemes
Didactic unit: Structures, Schemes GPP and CHP, main electrical equipment, operation modes and constructive execution.				
5. Choice of main equipment GPP	2	4	6	Application of the conditions for choosing and verifying the main equipment of the GPP

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Constructive performance of power supply systems				
1. Determining the parameters of the schemes for replacement of electrical network elements (VL).	1	2	3	Calculation of the specific parameters of air lines with different location of wires. Constructing the dependences of the specific parameters of the VL for various sections of the wires.
Didactic unit: Schemes of transmission systems and distribution of electrical energy. Schemes of distribution devices.				
2. Determining the parameters of the schemes for replacing electrical network elements (transformers).	1	2	3	Determination of parameters of substitution schemes for power transformers and autotransformers of single-phase and three-phase versions.
Didactic unit: Calculations of the main modes and regulation of voltage				
3. Calculation of the steady transmission line mode with a different method of setting the source data.	1	3	4	It is required to perform electrical calculation of the power line and determine the structural parameters of the VL: the cross-section of the wires, the number of chains and the length of the power supply lines.
4. Calculation of the steady network mode containing several intermediate loads.	1	3	4	Perform the calculation of the installed network mode in which the load power is specified in nodes and the voltage of the balancing station (base voltage). The network mode calculation is performed in relation to its equivalent substitution scheme, the parameters of which are defined earlier.
5. Calculation of the steady regime of a closed electrical network.	1	3	4	It is required to determine the parameters of the installed electrical network mode with double-sided power.

6. Calculation of the electrical network mode containing various nominal voltages.	1	2	1, 4	Calculate the operating modes of a network of two nominal stresses, the sections of which are related to the TDN-16000/110 transformer.
Didactic unit: frequency control.				
7. Calculation of voltage deviations on consumer tires in maximum and minimum load modes. Building deviation chart.	2	3	4	It is necessary to characterize the difference between the actual voltage in the steady mode of operation of the power supply system from its nominal value.

Literary sources

Main literature

1. Родыгина, С. В. Проектирование и эксплуатация систем электроснабжения. Проектирование СЭС : учебное пособие / С. В. Родыгина. — Новосибирск : НГТУ, 2016. — 64 с. — ISBN 978-5-7782-3076-7. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/118119 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

2. ЭБС Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 1993. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

3. Родыгина, С. В. Проектирование и эксплуатация систем электроснабжения. Передача, распределение, преобразование электрической энергии : учебное пособие / С. В. Родыгина. — Новосибирск : НГТУ, 2017. — 72 с. — ISBN 978-5-7782-3341-6. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/118101 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

4. Филиппова Т. А. Энергетические режимы электрических станций и электроэнергетических систем : [учебник] / Т. А. Филиппова. - Новосибирск, 2007. - 297 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000068745

Additional literature

1. Русина, А. Г. Режимы электрических станций и электроэнергетических систем : учебное пособие / А. Г. Русина, Т. А. Филиппова. — Новосибирск : НГТУ, 2016. — 400 с. — ISBN 978-5-7782-2695-1. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/118099 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

2. Филиппова Т. А. Энергетические режимы электрических станций и электроэнергетических систем : [учебник] / Т. А. Филиппова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2005. - 297 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000032665

3. Гужов Н. П. Системы электроснабжения : [учебник] / Н. П. Гужов, В. Я. Ольховский, Д. А. Павлюченко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2007. - 257 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000080191. - Инновационная образовательная программа НГТУ "Высокие технологии".

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. http://znanium.com/

5. Родыгина, С. В. Проектирование и эксплуатация систем электроснабжения. Передача, распределение, преобразование электрической энергии : учебное пособие / С. В. Родыгина. – Новосибирск : Изд-во НГТУ, 2017. – 72 с. – Текст : электронный // AvidReaders.ru : сайт. – URL: https://avidreaders.ru/book/proektirovanie-i-ekspluataciya-sistem-elektrosnabzheniya-peredacha.html (дата обращения: 15.02.2021).

6. Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

Methodical support and software

Methodological support

1. Электроснабжение потребителей и режимы. Лабораторный практикум : учебно-методическое пособие / составители В. М. Завьялов [и др.]. — Томск : ТПУ, 2017. — 122 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/106740 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

2. Родыгина С. В. Проектирование и эксплуатация систем электроснабжения : учебно-методическое пособие / С. В. Родыгина, Д. А. Павлюченко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 45, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000236136

3. Родыгина С. В. Проектирование и эксплуатация СЭС [Электронный ресурс] : электронный учебно-методический комплекс [для ЗО] / С. В. Родыгина ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221652. - Загл. с экрана.

4. Проектирование и эксплуатация систем электроснабжения : методические указания к выполнению расчетно-графического задания "Проектирование и эксплуатация СЭС" для ФЭН направления магистерской подготовки 13.04.02 "Электроэнергетика и электротехника" / Новосиб. гос. техн. ун-т ; [сост.: С. В. Родыгина, Д. А. Павлюченко]. - Новосибирск, 2016. - 30, [1] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000229165

5. Электропитающие системы и электрические сети : методические указания к выполнению лабораторных работ для ФЭН (специальность 140211 - Электроснабжение) / Новосиб. гос. техн. ун-т ; [сост.: Д. А. Павлюченко, С. В. Хохлова]. - Новосибирск, 2006. - 51 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000059931

6. Электропитающие системы и электрические сети : методические указания к выполнению расчетно-графического задания для ФЭН (специальность 140211 "Электроснабжение" / Новосиб. гос. техн. ун-т ; [сост. Д. А. Павлюченко, С. В. Хохлова]. - Новосибирск, 2007. - 26, [1] с. : табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000070194

Specialized software

1 Microsoft Office Application Pack

2 on the analysis of electro-energy systems NEPLAN AG NEPLAN 360 Web Student Version

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	45
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	7
9	Independent work, hours	27

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
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
has an idea of ??regional development features and knows the specifics Professional Labor Market
To be able to analyze the activities of enterprises and organizations of the profile industry of their region

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
has an idea of ??regional development features and knows the specifics Professional Labor Market	
5. PC-1.V / PR. 3 3. It has an idea of ??the peculiarities of regional development and knows the specifics of the labor market in the field of professional activity	Laboratory works
To be able to analyze the activities of enterprises and organizations of the profile industry of their region	
6.PC-1.V / PR. 4. To be able to analyze the activities of enterprises and organizations of the profile industry of their region	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, 6	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, 6	Teach students to calculate the cost of reconstruction of the energy facility using PC "Gosstroysmet"

Literary sources

Main literature

1. Преображенская Т. В. Управление проектами : [учебное пособие] / Т. В. Преображенская, М. Ш. Муртазина, А. А. Алетдинова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 121, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000238156

2. Чернов С. С. Управление проектами в энергетике [Электронный ресурс] : электронный курс лекций / С. С. Чернов ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 1 электрон. опт. диск (CD-ROM). - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000237307. - Свидетельство о регистрации № 23275.

3. Васильева М. В. Лабораторные работы по дисциплине «Управление проектами» [Электронный ресурс] : сборник задач и упражнений / М. В. Васильева ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000214379. - Загл. с экрана.

Additional literature

1. Межов И. С. Инвестиции: оценка эффективности и принятие решений : [учебник] / И. С. Межов, С. И. Межов. - Новосибирск, 2018. - 379 с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000238200

2. Дронова Ю. В. Экономическое обоснование проектов в энергетике : [учебное пособие] / Ю. В. Дронова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 143, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000237465

Internet resources

1. PMBOK. Guide and Standards : сайт / Project Management Institute. – 2021. – URL: https://www.pmi.org/pmbok-guide-standards (дата обращения: 15.02.2021). – Текст : электронный.

2. ГОСТ Р 58305-2018. Система менеджмента проектной деятельности. Проектный офис : национальный стандарт Российской Федерации : издание официальное : утвержден и введен в действие Приказом Федерального агентства по техническому регулированию и метрологии от 13 декабря 2018 г. № 1101-ст : введен впервые : дата введения 2019-06-01 / разработан АНО «Центр оценки и развития проектного управления» [и др.]. – Москва : Стандартинформ, 2018. – URL: https://pmufa.ru/assets/st/%D0%93%D0%9E%D0%A1%D0%A258305-2018.pdf (дата обращения: 26.02.2021). – Текст : электронный.

3. ГОСТ Р 54869-2011. Проектный менеджмент. Требования к управлению проектом : национальный стандарт Российской Федерации : издание официальное : утвержден и введен в действие Приказом Федерального агентства по техническому регулированию и метрологии от 22 декабря 2011 г. № 1582-ст : введен впервые : дата введения 2012-09-01 / разработан АНО «Центр стандартизации управления проектами». – Москва : Стандартинформ, 2012. – URL: http://gostrf.com/normadata/1/4293797/4293797785.pdf (дата обращения: 26.02.2021). – Текст : электронный.

4. http://elibrary.nstu.ru/

5. https://e.lanbook.com/

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Яцко В. А. Управление проектами. Разработка бизнес-плана средствами Project Expert [Электронный ресурс] : учебно-методическое пособие / В. А. Яцко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222638. - Загл. с экрана.

2. Баранова И. В. Оценка эффективности проектов и программ [Электронный ресурс] : электронный учебно-методический комплекс / И. В. Баранова, Е. В. Ходжич ; Новосиб. гос. техн. ун-т. - Новосибирск, [2019]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000239902. - Загл. с экрана.

3. Карпович А. И. Проектный анализ [Электронный ресурс] : электронный учебно-методический комплекс / А. И. Карпович ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000236223. - Загл. с экрана.

4. Яцко В. А. Инвестиции [Электронный ресурс] : электронный учебно-методический комплекс / В. А. Яцко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2019]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000240642. - Загл. с экрана.

5. Яцко В. А. Управление проектами. Разработка и анализ группы проектов средствами Project Expert 6 Holding [Электронный ресурс] : учебно-методическое пособие / В. А. Яцко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222641. - Загл. с экрана.

6. Яцко В. А. Управление проектами. Разработка бизнес-плана средствами Альт-Инвест [Электронный ресурс] : учебно-методическое пособие / В. А. Яцко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222642. - Загл. с экрана.

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
Optimization of power supply 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	82
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	18
8	Consultations, hours	8
9	Independent work, hours	62

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Forms possible options for solving problems
produces a strategy for solving the task
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency
Can plan and perform physical and mathematical research, interpret and submit results in the form of articles or Patents; *regarding the following learning results*:
Interprets and presents results in the form of articles or patents
performs physical and mathematical research.

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; Laboratory works; Independent work
produces a strategy for solving the task	
2. -one. 2 2. Develops a strategy for solving the task	Lections; Seminars; Laboratory works; Independent work

Forms possible options for solving problems	
3. UK-2. 1 1. To know: types of resources and restrictions for addressing professional tasks; Basic methods for evaluating different ways to solve problems; current legislation and legal norms regulating professional activities.	Lections; Seminars; Laboratory works; Independent work
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency	
4. PC-3.V / PR. 3 3. Applies methods for analyzing options, develop and search for compromise solutions with an assessment of the project implementation efficiency	Lections; Seminars; Laboratory works; Independent work
performs physical and mathematical research.	
5. PC-4.V / PR. 2 2. Performs physical and mathematical studies	Lections; Seminars; Laboratory works; Independent work
Interprets and presents results in the form of articles or patents	
6. PC-4.V / PR. 3 3. Interprets and represents results in the form of articles or patents	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: 2				
Didactic unit: General formulation of the optimization problem				
1. Setting the problem of optimizing the modes of electric power systems		2	2, 5, 6	
Didactic unit: Methods of linear programming				
2. General characteristics of linear programming methods		2	2, 5	
3. Typical linear programming tasks. Graphic method for solving linear programming tasks.		2	1, 2, 5, 6	
4. Simplex-Method Solution of Linear Programming Problem		2	1, 2, 5, 6	
Didactic unit: Nonlinear programming methods				
5. General characteristics of nonlinear programming methods		2	1, 2, 5, 6	
6. The method of loafing factor of Lagrange and its use in engineering practice.		2	1, 2, 5	
7. Setting the task of compensation of reactive power. Solving the problem using nonlinear programming methods.		2	1, 2, 3, 4	Setting the task of compensation of reactive power. Solving the problem using nonlinear programming methods.
8. Optimization of power system modes for active and reactive power using nonlinear programming methods		2	1, 2, 5	
9. Complex optimization of power system modes using a gradient optimization method. Accounting restrictions in optimization tasks.		2	1, 2, 3, 4, 5	

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Methods of linear programming				
1. Models and methods of linear programming in the tasks of the electric power industry		8	1, 2, 5, 6	Performing a computing experiment on a computer
5. Implementation of the Graphic and Simplex Method of Linear Programming		4	1, 2, 3, 5	Implementation of the Graphic and Simplex Method of Linear Programming in Microsoft Excel
Didactic unit: Nonlinear programming methods				
2. Nonlinear programming methods for solving problems optimization of power systems		8	1, 2, 3, 5, 6	Performing a computing experiment on a computer
3. Optimization of the mode of the electrical network by active power.		8	1, 2, 3, 5, 6	Performing a computing experiment on a computer
6. Implementation of reactive power compensation models		8	1, 2, 3, 4, 5	Realization of yamodel and methods for compensating reactive power into sparing networks SES

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Methods of linear programming				
1. Mathematical models of typical linear programming tasks. The algorithm for the formation of a mathematical model for the substantive formulation of the optimization problem.	2	2	1, 2, 4, 6	The formation of a mathematical model for the substantive formulation of the optimization problem.
2. Graphic Method Solution of Linear Programming Problem	2	2	1, 2, 6	Solving linear programming tasks using a graphical method
3. Simplex-Method Solution of Linear Programming Problem	2	2	1, 2, 6	Study of the simplex method algorithm
Didactic unit: Nonlinear programming methods				
4. Mathematical models and methods of nonlinear programming and their application in power management modes management tasks	2	2	1, 2, 4, 5, 6	Solving tasks on the topic of practical classes.
5. The optimal distribution of the active power between the CHP with the help of nonlinear programming methods	2	2	1, 2, 3, 5	Independent work under the guidance of the teacher
6. Optimization of the mode of reactive power using nonlinear programming methods	2	2	1, 2, 3, 4, 5	Independent work under the guidance of the teacher

7. Compensation of reactive power based on nonlinear programming methods	4	4	1, 2, 3, 4, 5	Independent work under the guidance of the teacher
8. The use of gradient optimization methods in the tasks of the electric power industry. Accounting for restrictions.	2	2	1, 2, 5	Solving tasks on the topic of practical classes.

Literary sources

Main literature

1. Любченко В. Я. Оптимизация систем электроснабжения. Задачи линейного и нелинейного программирования : учебное пособие / В. Я. Любченко, С. В. Родыгина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2020. - 88, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242633

2. Филиппова Т. А. Оптимизация режимов электростанций и энергосистем : учебник для энергетических специальностей / Т. А. Филиппова, Ю. М. Сидоркин, А. Г. Русина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 355 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000237744

3. Русина А. Г. Режимы электрических станций и электроэнергетических систем : [учебное пособие по направлению подготовки "Электроэнергетика и электротехника"] / А. Г. Русина, Т. А. Филиппова. - Новосибирск, 2016. - 398, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000220184

Additional literature

1. Филиппова Т. А. Оптимизация режимов электростанций и энергосистем : учебник для энергетических специальностей / Т. А. Филиппова, Ю. М. Сидоркин, А. Г. Русина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2016. - 355 с. : ил., схемы, табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000222724

2. Русина А. Г. Режимы электрических станций и электроэнергетических систем : [учебник] / А. Г. Русина, Т. А. Филиппова. - Новосибирск, 2014. - 398, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000202820

3. Лыкин А. В. Электрические системы и сети : [учебник] / А. В. Лыкин. - Новосибирск, 2017. - 361, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233296

Internet resources

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

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

3. Электронно-библиотечная система НГТУ [Электронный ресурс] : электронно-библиотечная система. – [Россия], 2011. – Режим доступа: http://elibrary.nstu.ru/. – Загл. с экрана.

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

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

6. http://znanium.com/

Methodical support and software

Methodological support

1. Оптимизация в электроэнергетических системах : учебно-методическое пособие / [А. Г. Русина и др.] Новосиб. гос. техн. ун-т. - Новосибирск, 2015. - 154, [1] с. : схемы, табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000216624

2. Любченко В. Я. Методы оптимизации [Электронный ресурс] : электронный учебно-методический комплекс / В. Я. Любченко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2012]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000208143. - Загл. с экрана.

3. Методы оптимизации в задачах электроэнергетики : методические указания для выполнения контрольных работ по дисциплине "Методы оптимизации в СЭС" для ФЭН заочной формы обучения] / Новосиб. гос. техн. ун-т ; [сост. В. Я. Любченко, Д. А. Павлюченко]. - Новосибирск, 2008. - 45, [3] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000088399

Specialized software

1 PTC Mathcad

2 Microsoft Office Application Pack

ANNOTATION OF THE PROGRAM
Autonomous systems Power Supplies

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	64
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	8
9	Independent work, hours	80

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency
Formulates the objectives and objectives of the study
Able to formulate technical tasks and use automation tools when designing professional activities; *regarding the following learning results*:
uses automation tools when designing

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; Independent work
2. to know the methods of calculation and basic regulatory documents for the design of autonomous power supply systems based on the base Constantly sources of energy.	Lections; Seminars; Laboratory works; Independent work
uses automation tools when designing	

3. PC-2.V / PR. 3 3. Uses automation tools when designing	Lections; Seminars; Laboratory works; Independent work
4. to be able to apply mathematical methods of multi-criteria search solutions to justify the options for autonomous electrical supply of objects	Lections; Seminars; Independent work
5. Know Mathematical Models of Calculation of Work and Transitional Characteristics	Lections; Seminars; Laboratory works; Independent work
6. Know the main units and methods for measuring electrical, magnetic and non-electrical values ??	Lections; Seminars; Laboratory works; Independent work
analyzes serial objects of professional activity	
7. To be able to develop applied software for calculations on clusters and metacompitters using techniques, methods and languages. Parallel programming	Lections; Seminars; Laboratory works; Independent work
8. PC-3.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Seminars; Independent work
Formulates the objectives and objectives of the study	
9. To be able to identify the necessary resources to implement the design problems	Lections; Seminars; Laboratory works; Independent work
10. PC-3.V / PR. 2 2. Forms design solutions for new objects of professional activity	Seminars; Independent work
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency	
11. Know the basic methods of multicriterial search for solutions	Lections; Seminars; Laboratory works; Independent work
12. PC-3.V / PR. 3 3. Applies methods for analyzing options, develop and search for compromise solutions with an assessment of the project implementation efficiency	Seminars; Independent work
13. To be able to use the methods of a feasibility study of project decisions	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: 2				
Didactic unit: Introductory PART				
1. main types of autonomous power supply systems and modern trends of their development	0	2	1, 2	Acquaintance with the designs and principle of compressors, pumps and fans
Didactic unit: Evaluation of potential energy resources of the area				
2. Evaluation of the hydrological resources of the region and the level of insolation	0	2	2, 7	obtaining information on the hydrological characteristics of the river and determination based on their energy potential of this river.
Didactic unit: Constructive elements of autonomous systems of power supply				
3. Photoelectric converters	2	2	1, 11, 2, 3, 5, 7, 8	Study of the types of photoelectric transducers, their technical characteristics, as well as the power supply systems based on them
4. Small hydropower. Water sinking structures and hydrotherbins MGES	0	2	2, 5, 7	Studying the features of the application of stability criteria for analyzing linear pulse systems

5. Generators and stabilization systems of output parameters	2	2	13, 2, 5, 7	Study of the main types of generators and the use of them in various options for autonomous power supply systems, as well as the analysis of modern systems. Stabilization of the weekend parameters
6. Fuel autonomous electrical installations (DES, GPU, GTU, BiodeS)	0	2	13, 2, 5, 7	Main types of fuel electrical installations for autonomous power supply, their classification and specifications.
7. Electricity accumulation systems and semiconductor transducers	0	2	13, 2, 5, 7	Studying the principle of operation and classification of electro-chemical energy accumulators. Studying types of inverter rectifier systems. Conditions for their choice.
Didactic unit: Modes of autonomous power supply systems				
8. Management of the working modes of autonomous systems	2	2	11, 2, 5, 6, 7, 9	Studying established and transient modes of operation of autonomous systems consisting of several sources of electricity of various types
Didactic unit: Technical Economic substantiation of options				
9. Technical and economic comparison of autonomous options Power supply systems	2	2	11, 13, 4, 7	Feasibility study of the autonomous power supply system

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Modes of autonomous power supply systems				
1. Simulation modeling of autonomous electrosal import systems I am in Matlab Simulink	0	9	11, 2, 5, 6, 7, 9	Imitation modeling of autonomous power supply systems in the MATLAB Simulink environment. Laboratory protection
Didactic unit: Technical Economic substantiation of options				
2. Conducting technical and economic calculations based on the software product "HOMER"		9	13, 3, 9	Calculation and comparison of the effectiveness of several options for autonomous power supply systems for a specific area

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Evaluation of potential energy resources of the area				

1. Calculation of hydrological characteristics of rivers	0	2	10, 2, 3, 7, 8	Calculation of the hydrological characteristics of the river based on the characteristics of the analog river
2. Calculation of the level of insolation into an arbitrary oriented surface	2	2	7	Definition of the average daily and mid-hour insolation values ??on an arbitrary oriented surface during the year
Didactic unit: Constructive elements of autonomous systems of power supply				
3. Calculation of the settled power of small hydroelectric power supply	2	2	13, 2, 3, 5, 7	Study of the Metal Power Calculation Methods and Annual Electricity Generation Maja HPP
4. Calculation of DES power with a buffer energy storage	0	2	10, 12, 13, 2, 3, 5, 7, 8	Calculation of the parameters of the diesel station, block of batteries and inverter block
5. Designing an autonomous photoelectric system for power supply of the building	0	2	10, 11, 12, 2, 3, 7	Select type and number of photopanels for coating a household consumer load
Didactic unit: Modes of autonomous power supply systems				
6. Power balance in the autonomous power supply system	4	4	10, 11, 12, 2, 3, 5, 6, 7, 9	Calculation of the established system-based modes based on DES and IGP
Didactic unit: Technical Economic substantiation of options				
7. Calculation of cost and technical and economic comparison of options for autonomous power supply systems	2	4	11, 13, 4, 9	calculation of the cost of electricity for various options for power supply of the object

Literary sources

Main literature

1. Удалов С. Н. Возобновляемые источники энергии : учебное пособие для вузов по направлению подготовки 140400 - "Электроэнергетика и электротехника", модуль "Электроэнергетика" / С. Н. Удалов. - Новосибирск, 2014. - 457, [1] с., [6] л. ил. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000184901

2. Гидроэнергетика : [учебное пособие для вузов по направлению подготовки 140200 - "Электроэнергетика"] / Т. А. Филиппова [и др.] ; Новосиб. гос. техн. ун-т. - Новосибирск, 2012. - 619 с. : ил., табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000167796

Additional literature

1. ГЭС : искусство управления : [монография / А. Г. Русина и др. ; под ред. А. Г. Русиной]. - Новосибирск, 2019. - 224, [1] с., [2] л. ил. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242222. - Доп. тит. л., огл. англ..

2. Гужов Н. П. Системы электроснабжения : [учебник] / Н. П. Гужов, В. Я. Ольховский, Д. А. Павлюченко. - Новосибирск, 2015. - 257 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221990

Internet resources

1. Обухов С. Г. Микрогидроэлектростанции : курс лекций к магистерской программе «Возобновляемые источники энергии» [Электронный ресурс] / С. Г. Обухов. – Томск, 2009. – 63 с. – Режим доступа : http://portal.tpu.ru/SHARED/s/SEROB/uchebrab3/Tabdists3/kons_l_microges.pdf. – Загл. с экрана.

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

3. ИНСЭТ : проектирование, серийное изготовление и монтаж мини ГЭС и микро ГЭС [Электронный ресурс] : сайт. - Режим доступа: http://www.inset.ru/r/index.htm. - Загл. с экрана.

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

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

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Проектирование и эксплуатация установок нетрадиционной и возобновляемой энергетики : методические указания к выполнению лабораторных работ для ФЭН (специальности 140202 - Нетрадиционные и возобновляемые источники энергии и 140211 - Электроснабжение) / Новосиб. гос. техн. ун-т ; [сост.: С. Н. Удалов, В. Г. Шальнев, Н. В. Зубова]. - Новосибирск, 2011. - 72, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000153891

2. Автономные системы электроснабжения : контрольные задания и методические указания к их выполнению для магистрантов очного и заочного отделений направления 13.04.02 "Электроэнергетика и электротехника" / Новосиб. гос. техн. ун-т ; [сост.: С. В. Митрофанов, Н. В. Зубова]. - Новосибирск, 2017. - 72, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234484

3. Организация самостоятельной работы студентов Новосибирского государственного технического университета : методическое руководство / Новосиб. гос. техн. ун-т ; [сост.: Ю. В. Никитин, Т. Ю. Сурнина]. - Новосибирск, 2016. - 19, [1] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234042

Specialized software

1 Development of cross-platform applications Microsoft Visual Studio 2015

ANNOTATION OF THE PROGRAM
Management of power supply systems

Course: 1, semester : 1

		Semester
№	**Kind of activity**	**1**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	49
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	11
9	Independent work, hours	95

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 .
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
uses automation tools when designing
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
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; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	

2. PC-1.V / PR. 2 2. Solving professional tasks in enterprises and organizations of the profile industry of their region.	Lections; Seminars; Independent work
demonstrates knowledge of objects of professional activity	
3. PC-2.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Independent work
uses automation tools when designing	
4. PC-2.V / PR. 3 3. Uses automation tools when designing	Lections; Seminars; Independent work
analyzes serial objects of professional activity	
5. PC-3.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results
Semester: 1			
Didactic unit: Object management.			
1. Concept management object. Characteristics of the stages of solving management task.	0	2	1
2. Types of management: manual, automatic (SAU), automated (ACS). Characteristics of the features of the specified types of management.	0	2	1
Didactic unit: Automated control of the power supply system.			
3. Composite parts of an automated system of suspension: technical support (MA), information support (IO), mathematical support (MO), software (software).	0	1	1, 3, 4
4. Structural technical support scheme of automated power management system: Sensors of the operation of the SES operation mode, telemechanic system, computer network. Principles for constructing sensors of the SES operation mode parameters.	0	2	1, 3, 4, 5
5. Principles of constructing telemechanics systems. The structural scheme and the principle of operation of the computer.	0	2	1, 3, 4, 5
Didactic unit: Solutions in the conditions of uncertainty			
6. Calculation of electricity loss in elements of the power supply system (power lines, transformers). Analysis of the impact of the parameters of the electrical network and the parameters of the operation of the electrical network by the magnitude of the electricity loss.	0	1	2
7. Compensation of reactive power in the SES. Alignment of electric load graphs as a factor Reducing electricity losses in the SES.	0	3	2
Didactic unit: Electricity quality.			
8. Properties of voltage characterizing the quality of electricity, and their nominal numerical values.	0	1	
9. Electricity quality indicators in accordance with GOST 32144-2013 and their valid values. Voltage regulation in the power supply system.	0	2	
10. Management of SES operation modes in order to improve the shape of the voltage curve in the electrical network nodes. Symmetrization of SES operation modes.	0	2	2

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Solutions in the conditions of uncertainty				
1. Calculation of electricity loss	4	4	2	Practical lesson
2. Compensation of reactive power.	2	2	2	Practical lesson
3. Alignment of the electrical load schedule of the enterprise.	2	2	2, 4	Practical lesson
Didactic unit: Electricity quality.				
4. Evaluation of voltage deviation	2	2	2, 4	Practical lesson
5. Voltage regulation.	6	6	2, 4	Practical lesson
6. Evaluation and improvement of the shape of the voltage curve.	2	2	2, 4	Practical lesson

Literary sources

Main literature

1. Гужов Н. П. Системы электроснабжения : [учебник] / Н. П. Гужов, В. Я. Ольховский, Д. А. Павлюченко. - Новосибирск, 2015. - 257 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221990

2. Ситуационное управление энергетическими объектами и процессами электроэнергетической системы / [Ю. А. Секретарев и др.]. - Новосибирск, 2007. - 306 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000066909

Additional literature

1. Вопросы управления эксплуатационными режимами промышленных систем электроснабжения с собственными источниками электрической энергии : монография / А. В. Малафеев, А. В. Варганова, Е. А. Панова, О. В. Газизова. — Магнитогорск : МГТУ им. Г.И. Носова, 2019. — 257 с. — ISBN 978-5-9967-1652-4. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/162481 (дата обращения: 22.02.2021). — Режим доступа: для авториз. пользователей.

2. Управление режимами систем электроснабжения железных дорог на основе технологий интеллектуальных сетей (smart grid) : монография / Г. О. Арсентьев, Ю. Н. Булатов, А. В. Крюков, А. П. Куцый. — Иркутск : ИрГУПС, 2019. — 412 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/157881 (дата обращения: 22.02.2021). — Режим доступа: для авториз. пользователей.

Internet resources

1. Цифро-аналоговые и аналого-цифровые преобразователи [Электронный ресурс] : методические указания к лабораторной работе / сост. Е. А. Бехтенев. - Новосибирск : Изд-во НГУ, 2015. - Режим доступа: http://www.inp.nsk.su/students/radio/2015/TSANI/lab3-2015.pdf. - Загл. с экрана.

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

3. eLIBRARY.RU (Научная электронная библиотека РФФИ) [Электронный ресурс]. – [Россия], 1998 – 2016. – Режим доступа: http://elibrary.ru. – Загл. с экрана.

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

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

6. http://znanium.com/

Methodical support and software

Methodological support

1. Управление режимами систем электроснабжения : задание и методические указания к выполнению расчетно-графической работы по дисциплине "Управление режимами систем электроснабжения" для магистрантов факультета энергетики по направлению 13.04.02 - "Электроэнергетика и электротехника", профиль - "Системы электроснабжения и управление ими" / Новосиб. гос. техн. ун-т ; [сост. Н. П. Гужов]. - Новосибирск, 2018. - 12, [3] с.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000238820

2. Гужов Н. П. Электроснабжение [Электронный ресурс] : электронный учебно-методический комплекс [для студентов очной формы обучения] / Н. П. Гужов ; Новосиб. гос. техн. ун-т. - Новосибирск, [2014]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000207663. - 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
Intelligent power supply systems

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	66
4	Lectures, hours	18
5	Practical lessons, hours	36
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	18
8	Consultations, hours	10
9	Independent work, hours	42

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Associates to apply modern communicative technologies, including in foreign language (s), for academic and professional interaction; *regarding the following learning results*:
uses modern information-communications for communication
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency
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
is able to carry out professional activities, taking into account the regional features and needs of employers; *regarding the following learning results*:
has an idea of ??regional development features and knows the specifics Professional Labor Market

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

uses modern information-communications for communication	
2. UK-4. 3 3. Uses modern information communications for communication	Lections; Seminars; Independent work
has an idea of ??regional development features and knows the specifics Professional Labor Market	
3. PC-1.V / PR. 3 3. It has an idea of ??the peculiarities of regional development and knows the specifics of the labor market in the field of professional activity	Lections; Seminars; Independent work
demonstrates knowledge of objects of professional activity	
4. PC-2.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Seminars; Independent work
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency	
5. PC-3.V / PR. 3 3. Applies methods for analyzing options, develop and search for compromise solutions with an assessment of the project implementation efficiency	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: Search for literature in the specialty in the NSTU library system				
1. Basic prerequisites concept of innovative development of electric power industry. Features of the concept of the concept of Smart Grid in various countries of the world		2	1, 2, 3, 4, 5	Review of information and discussion discussion with the teacher
Didactic unit: Development and implementation of the SMART Grid concept abroad				
2. Main goals and stages of development and implementation of the concept of Smart Grid abroad		2	1, 2, 3	Review of information and discussion discussion with the teacher
3. Programs and projects for implementing Smart Grid abroad. Barriers in the implementation of the SMART Grid concept abroad	2	2	1, 2, 4	Review of information and discussion discussion with the teacher
Didactic unit: Concept development capabilities				
4. Prerequisites for the modernization and innovative development of the electric power industry in Russia. Global and Local Projects Implementation of the SMART Grid Concept in Russia		4	1, 2	Review of information and discussion discussion with the teacher
Didactic unit: Technological basis SMART Grid concept				
5. Innovative instruments and SMART GRID devices	2	2	2, 4	Review of information and discussion discussion with the teacher
6. Modern innovative equipment Smart Grid	2	4	1, 2, 3, 4, 5	Review of information and discussion discussion with the teacher

7. Intellectual measurements and metering of electricity	2	2	1, 2, 3, 4, 5	Review of information and discussion discussion with the teacher

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Search for literature in the specialty in the NSTU library system				
1. Key values of new energy and economic evaluation effects from its implementation	2	8	1, 4	Review of information and discussion discussion with the teacher
Didactic unit: Development and implementation of the SMART Grid concept abroad				
2. Organization and management of the development process and implementation of the SMART Grid concept abroad	2	8	1, 4	Review of information and discussion discussion with the teacher
Didactic unit: Concept development capabilities				
3. Principal approaches to the development of the concept of Smart Grid in Russia	2	8	1, 2, 3, 4, 5	Review of information and discussion discussion with the teacher
4. International Consortium Smart City - Smart Cities	2	4	1, 4	Review of information and discussion discussion with the teacher
Didactic unit: Technological basis SMART Grid concept				
5. Innovative technologies and components of the electric power system	2	8	1, 2, 3, 4, 5	Review of information and discussion discussion with the teacher

Literary sources

Main literature

1. Манусов В. З. Применение методов искусственного интеллекта в задачах управления режимами электрических сетей Smart Grid : [монография] / В. З. Манусов, Н. Хасанзода, П. В. Матренин. - Новосибирск, 2019. - 238, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000241039. - Доп. тит. л., огл. англ..

2. Удалов С. Н. Возобновляемые источники энергии : [учебное пособие для вузов по направлению подготовки 140400 - "Электроэнергетика и электротехника", модуль "Электроэнергетика"] / С. Н. Удалов. - Новосибирск, 2013. - 457, [1] с., [6] л. цв. ил. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000178055

Additional literature

1. Манусов В. З. Нейронные сети: прогнозирование электрической нагрузки и потерь мощности в электрических сетях. От романтики к прагматике : [монография] / В. З. Манусов, С. В. Родыгина. - Новосибирск, 2018. - 301, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000240028. - Доп. тит. л., огл. англ..

2. Лыкин А. В. Распределительные электрические сети : [учебное пособие] / А. В. Лыкин ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 113, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000237890

3. Лыкин А. В. Электрические системы и сети : [учебник] / А. В. Лыкин. - Новосибирск, 2017. - 361, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233296

Internet resources

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

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

3. Электронно-библиотечная система НГТУ [Электронный ресурс] : электронно-библиотечная система. – [Россия], 2011. – Режим доступа: http://elibrary.nstu.ru/. – Загл. с экрана.

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

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

6. http://znanium.com/

Methodical support and software

Methodological support

1. Учет электрической энергии : методические указания к лабораторным работам для ФЭН по специальности "Электроэнергетические системы и сети" заочного отделения / Новосиб. гос. техн. ун-т ; [сост. А. В. Лыкин]. - Новосибирск, 2009. - 53, [2] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000125648

2. Электрооборудование концерна АББ напряжением до 1000 В : методические указания по выполнению лабораторных работ по специальности "Электроснабжение" для 5 курса факультета энергетики / Новосиб. гос. техн. ун-т ; [сост.: Н. П. Гужов, Д. А. Павлюченко, Н. А. Стрельников]. - Новосибирск, 2012. - 75, [2] с. : ил., схемы, табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000172457

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

Energy use in power engineering and technologies

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	49
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	11
9	Independent work, hours	95

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Formulates the objectives and objectives of the study
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
uses automation tools when designing
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
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
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	

2. PC-1.V / PR. 2 2. Solving professional tasks in enterprises and organizations of the profile industry of their region.	Seminars
demonstrates knowledge of objects of professional activity	
3. PC-2.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Independent work
uses automation tools when designing	
4. PC-2.V / PR. 3 3. Uses automation tools when designing	Seminars
analyzes serial objects of professional activity	
5. PC-3.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Seminars
Formulates the objectives and objectives of the study	
6. PC-3.V / PR. 2 2. Forms design solutions for new objects of professional activity	Lections; Seminars

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Role, place and purpose of studying the course "Industrial Automation" in the training system of specialists in the specialty 1402112. Basic terms, concepts and definitions.				
1. The purpose and task of studying discipline.		4	1	lecture
Didactic unit: Definitions and classification of elements.				
2. Types of standard input functions (single, step and pulsed function, harmonic input). Transmission function. Transitional and impulse transitional functions. Amplitude phase frequency characteristic. Types of typical links are aperiodic, irregular, oscillatory, integrating, differentiating, amplifying.		0,5	1, 6	lecture
3. Differential equations of elements. Types of standard input functions (single, step and pulsed function, harmonic input). Transmission function. Transition and impulse re-running functions. Amplitude phase frequency characteristic. Type types of links are aperiodic, irregular, oscillatory, integrity, differentiating, amplifying.		0,5	1, 3, 6	lecture
4. Installation lecture.		2	1, 6	lecture
Didactic unit: Kinematics				

5. Classification and main characteristics of primary converters. Parametric transducers. Resistor converters: Cyometric potential, strain gauge, thermistor, coal, photo-electric. Inductive, transformer, capacitive convert-tel. Generator transducers: thermoelectric (thermocouples), in-ducidation, piezoelectric, valve photocells. Neelectric transducers: force and pressure, speed, acceleration, temperature, flow, fluid level. Analog-digital and digital-analog pre-educatives.		3,5	1, 5, 6	lecture
6. Classification of sensors. Types of sensors: with a serial connection of elements, differential, compensation. Current sensors and on-branches. Temperature sensors: resistor, dilatometric. Pressure Sensors. Fluid and gas flow sensors. Energy consumption sensors based on induction and electronic counters. Other Automatic Elements: Amplifiers, Relays, Logic Elements, Memory Options, Executive Devices, Regulators		1	1, 6	lecture
7. The concept of a structural scheme. The chain of impact on the automation object. Classification of structural schemes: functional, algorithmic, structural. Types and principles of management.		0,5	1, 6	lecture
8. The main stages of the design: the description of the object and functions of the automation device, the compilation of structural schemes, the development of the concept of electrical circuit, the layout of the device, drafting the diagram of the components of the elements (mounting circuit). Typical fragments of circuit solutions when constructing relay-contact devices. Principles of layout of elements in construct. Rules for compiling installation schemes and marking of conductors.	1	1	1, 6	lecture
9. Summary of the study results.	1	0,5	1, 6	lecture
Didactic unit: The main stages of design				

10. 1. Description of the automation object. 2. Development of structural schemes. 3. Development of the automation device schema. 4. Common device automation. 5. Development of the automation device connections.	1	4,5	1, 6	lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Classification and main characteristics. Primary converters				
1. General provisions of the theory of automation devices.	6	6	1, 4, 6	practical lesson
Didactic unit: Concept of structural scheme				
2. Development of a structural scheme.	6	6	1	Practical annia
Didactic unit: The main stages of design				
3. Development of the concept of automation device.	3	3	1	practical lesson
Didactic unit: Summary of the study of the course.				
4. Development of the electrical connections of the automation device.		3	1	practical lesson
5.			2, 5	practical lesson

Literary sources

Main literature

1. Стрельников Н. А. Промышленная автоматика : учебное пособие / Н. А. Стрельников ; Новосиб. гос. техн. ун-т. - Новосибирск, 2006. - 105, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000063518

2. Электроэнергетика. Релейная защита и автоматика электроэнергетических систем [Электронный ресурс] : учеб. пособие / Ю. А. Ершов, О. П. Халезина, А. В. Малеев и др. - Красноярск: Сиб. Федер. ун-т, 2012. - 68 с. - ISBN 978-5-7638-2555-8. - Режим доступа: http://znanium.com/catalog.php?bookinfo=492157 - Загл. с экрана.

Additional literature

1. Малахов, А. П. Элементы систем автоматики и автоматизированного электропривода : учебно-методическое пособие / А. П. Малахов, А. П. Усачёв. — Новосибирск : Новосибирский государственный технический университет, 2011. — 106 с. — ISBN 978-5-7782-1770-6. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/45460.html (дата обращения: 23.02.2021). — Режим доступа: для авторизир. пользователей

Internet resources

1. Промышленные АСУ и контроллеры [Электронный ресурс] : журнал // Научная электронная библиотека. eLIBRARY.RU : российский информационный портал. – Режим доступа: http://elibrary.ru/issues.asp?id=7970. – Загл. с экрана.

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

3. ОМУ 42-21-35-91. Правила эксплуатации и требования безопасности при работе на паровых стерилизаторах [Электронный ресурс] : Приказ Минздрава РФ : утв. от 01.02.99 № 31 // Медтехника НТ. – 2007–2011. – Режим доступа: http://medtechnika-nt.ru/learn/omuster.php. – Загл. с экрана.

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

5. Концепция стратегии ОАО РАО "ЕЭС России" на 2003-2008 гг. 5+5 [Электронный ресурс] – М., 2003. – Режим доступа: http://yandex.ru/yandsearch?text=%D0%9A%D0%BE%D0%BD%D1%86%D0%B5%D0%BF%D1%86%D0%B8%D1%8F+%D1%81%D1%82%D1%80%D0%B0%D1%82%D0%B5%D0%B3%D0%B8%D0%B8+%D0%9E%D0%90%D0%9E+%D0%A0%D0%90%D0%9E+%22%D0%95%D0%AD%D0%A1+%D0%A0%D0%BE%D1%81%D1%81%D0%B8%D0%B8%22+%D0%BD%D0%B0+2003-2008+%D0%B3%D0%B3.+-+%D0%9D.%3A+%D0%A0%D0%90%D0%9E%2C+2003.+&lr=65. – Загл. с экрана.

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Купарев М. А. Автоматика электрических станций. Автоматика энергосистем [Электронный ресурс] : электронный учебно-методический комплекс / М. А. Купарев ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233592. - Загл. с экрана.

2. Стрельников Н. А. Промышленная автоматика [Электронный ресурс] : электронный учебно-методический комплекс / Н. А. Стрельников ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242841. - 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
Electrical lighting

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	63
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	18
8	Consultations, hours	7
9	Independent work, hours	45

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Formulates the objectives and objectives of the study
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
uses automation tools when designing

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; Independent work
demonstrates knowledge of objects of professional activity	
2. PC-2.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Independent work
uses automation tools when designing	

3. PC-2.V / PR. 3 3. Uses automation tools when designing	Laboratory works; Independent work
analyzes serial objects of professional activity	
4. PC-3.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Independent work
Formulates the objectives and objectives of the study	
5. PC-3.V / PR. 2 2. Forms design solutions for new objects of professional activity	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: Organization of lighting systems.				
1. Organization of design of lighting systems. Stadium		2	1, 2	Features Organization of Designing Lighting Systems
2. Regulations. Initial data. Output documentation.		2	1, 2	Regulations. Initial data. Output documentation.
Didactic unit: Solution of the standard calculated data. Tasks				
3. Light values. Types and lighting systems.		2	2, 4, 5	Light values. Types and lighting systems.
4. Sources of light and lighting installations.	2	2	2, 4, 5	Sources of light and lighting installations.
5. Calculation of electrical lighting.		2	2, 4, 5	Methods for calculating electrical lighting.
6. Evaluation quality of lighting. Power industry in lighting. Operation of the lesion system.		2	2, 4, 5	Evaluation quality of lighting. Power industry in lighting. Operation of the lesion system.
Didactic unit: Electrotechnical calculation.				
7. Voltages and power supplies. Power Schemes. Calculation of lighting load.		2	2, 4, 5	Voltages and power supplies. Power Schemes. Calculation of lighting load.
8. Selection of brand, section and method of laying conductors. Selection of protective switching equipment.		2	2, 4, 5	Selection of brand, section and method of laying conductors. Selection of protective switching equipment.
9. Calculation of CW currents and verification of devices and conductors		2	2, 4, 5	Calculation of CW currents and verification of devices and conductors

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Design automation.				

1. Acquaintance with the automated drawing and design system - AutoCAD. Perform drawing work		4	3, 5	Acquaintance with the implementation of basic operations on setting up the area of drawing construction Acquaintance with basic teaching techniques Creating a template with standard stamp
2. Perform drawing work. Plan and scheme of the facility of the object		8	3, 5	Familiarity with standard designations of the main elements of electrical drawings Plan and scheme of the facility of the object
3. Calculation of electrical lighting	8	8	3, 5	Execution of the calculation of electrical lighting in the Dialux program
4. Perform drawing work. Plan and Lighting Scheme		4	3, 5	Plan and Lighting Scheme
5. Analysis of the object lighting system	8	8	3, 5	Analysis of the current state and the formation of measures to modernize the lighting system of the learning audience
6. Designing the lighting network		4	3, 5	Choosing and checking electrical apparatus and conductors

Literary sources

Main literature

1. Гужов Н. П. Системы электроснабжения : [учебник] / Н. П. Гужов, В. Я. Ольховский, Д. А. Павлюченко. - Новосибирск, 2015. - 257 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221990

2. Клочкова, Н. Н. Электрическое освещение : учебное пособие / Н. Н. Клочкова, А. В. Обухова. — Самара : Самарский государственный технический университет, ЭБС АСВ, 2016. — 95 с. — ISBN 2227-8397. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/91159.html (дата обращения: 22.02.2021). — Режим доступа: для авторизир. пользователей

Additional literature

1. Стрельников Н. А. Энергосбережение : [учебное пособие] / Н. А. Стрельников ; Новосиб. гос. техн. ун-т. - Новосибирск, 2019. - 70, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000240966

2. Родыгина С. В. Проектирование и эксплуатация систем электроснабжения. Проектирование СЭС : учебное пособие / С. В. Родыгина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2016. - 61, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233655

Internet resources

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

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

3. Электронно-библиотечная система НГТУ [Электронный ресурс] : электронно-библиотечная система. – [Россия], 2011. – Режим доступа: http://elibrary.nstu.ru/. – Загл. с экрана.

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

5. Электронный фонд правовой и нормативно-технической документации : консорциум Кодекс [Электронный ресурс] : сайт. - Режим доступа: http://docs.cntd.ru/. - Загл. с экрана.

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Павлюченко Д. А. Проектирование электрического освещения [Электронный ресурс] : электронный учебно-методический комплекс / Д. А. Павлюченко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000157080. - Загл. с экрана.

2. Грамолина Г. В. Внутреннее электрическое освещение, силовое электрооборудование, внешнее электроснабжение [Электронный ресурс] : учебно-методическое пособие / Г. В. Грамолина ; Новосиб. гос. техн. ун-т. - Новосибирск, [2011]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000162011. - Загл. с экрана.

Specialized software

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

ANNOTATION OF THE PROGRAM
Communication culture of the Internet

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	63
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	36
7	of them in an active and interactive form, hours	18
8	Consultations, hours	7
9	Independent work, hours	45

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Formulates the objectives and objectives of the study
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
uses automation tools when designing

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; Laboratory works; Independent work
2. Analytically represent the most important events of the history of science and technology, the role and importance of scientists and engineers.	Lections; Laboratory works; Independent work
3. To be able to analyze the payback period, analyze the cost of operation, to carry out a comparative analysis of the results on the use of various use of renewable energy sources	Lections; Laboratory works; Independent work

demonstrates knowledge of objects of professional activity	
4. PC-2.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Laboratory works; Independent work
uses automation tools when designing	
5. Know the methods and means of a feasibility study of the project	Lections; Laboratory works; Independent work
6. systems for designing power supply systems based on both autonomous energy sources and in centralized power supply	Lections; Laboratory works; Independent work
7. PC-2.V / PR. 3 3. Uses automation tools when designing	Lections; Laboratory works; Independent work
8. to be able to use the main software. Understand the interface, be able to restore load graphs and get the result.	Laboratory works; Independent work
9. possession of advanced software for the design of power supply systems	Laboratory works; Independent work
10. knowledge of automatic design programs for the automatic design of the ethermetry systems and Removing the analysis of modeling results.	Laboratory works; Independent work
analyzes serial objects of professional activity	
11. PC-3.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Laboratory works; Independent work
12. to be able to obtain the basic components of the composition of the power supply system based on the RES with the provision of economic feasibility and reliability based on the receipt of primary energy carriers	Lections; Laboratory works; Independent work
13. to know the basic mathematical models in professional activities	Lections; Laboratory works; Independent work
14. Know the formation of system operation modes Power supply based on renewable energy supply • to know the nature of the flow of electromagnetic, thermal and mechanical processes in electrical technological complexes	Lections; Laboratory works; Independent work
Formulates the objectives and objectives of the study	
15. PC-3.V / PR. 2 2. Forms design solutions for new objects of professional activity	Lections; Laboratory works; Independent work
16. To be able to apply and design components of generation from renewable energy sources based on a common feasibility	Lections; Laboratory works; Independent work
17. The orateness of the composition of the system generation of electrical energy according to the type of energy resource (renewable / non-renewable)	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: Trends in the development of power supply systems				
1. Technology development trends in power engineering	2	2	12, 17, 2, 3, 5	Abstract for the proposed educational dadagtic unit
Didactic unit: Types of renewable energy sources				
7. Wind power	2	2	12, 13, 14, 17	Presentation on the form of wind power systems in the form of audit classes
8. Solar energy	2	2	12, 14	Presentation on the form of photoelectric systems in the form of audit classes

9. Physical and technical features of renewable energy	2	2	12, 13, 14, 16	The idea of the composition of the main types of renewable sources of electrical energy based on the physical principles of its transformation.
10. Power Supply Hybrid Systems Modes	2	4		
11. Mathematical models of elements of power supply systems based on renewable	2	4	1, 13, 14, 15, 17, 4, 5, 6	
12. Optimization of power supply systems based on renewable	0	2	1, 11, 13, 14, 4, 5, 6, 7	

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Types of renewable sources of electrical energy				
1. Development of imitation model of energy drive	3	8	10, 15, 4, 6, 7, 9	Understanding and composition and form of batteries
Didactic unit: Specialized software for designing autonomous fleet systems.				
2. The formation of electronic energy supply systems based on autonomous sources of electrical energy and the implementation of funds to increase the supply of sustainability on the basis of mathematical models.	3	4	10, 12, 14, 2, 6	Conducting audit classes on visualization of computer modeling. Conducting numerical experiments to solve the problems of power sustainability.
3. Analysis of the mode of operation of the photoelectric panel	0	4	11, 13, 14, 15, 16, 2	
Didactic unit: Types of renewable sources of electrical energy				
4. Development of a simulation model of a hybrid power supply system	0	8	1, 11, 13, 14, 15, 2, 4, 5, 6, 7, 8	
5. Management mode of operation of the DES system + BN using the PID control algorithm	0	4	1, 15, 16, 17, 2, 4, 6, 7	
6. Calculation of the discounted payback period of the hybrid power supply system		8	1, 11, 2, 3, 8	

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 2				
Didactic unit: Specialized software for designing autonomous fleet systems.				
3. Software design and analyzing systems for flying systems		20	6, 8	Conducting the analysis of the possibilities of the program Homer 2.11
Didactic unit: Analysis of existing electrical problems of autonomous energy sources				

4. Abstract for analyzing the problems of autonomous power supply systems		14	12, 14	Essay by choice

Literary sources

Main literature

1. Удалов С. Н. Возобновляемые источники энергии : учебное пособие для вузов по направлению подготовки 140400 - "Электроэнергетика и электротехника", модуль "Электроэнергетика" / С. Н. Удалов. - Новосибирск, 2014. - 457, [1] с., [6] л. ил. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000184901

2. Гужов Н. П. Системы электроснабжения : [учебник] / Н. П. Гужов, В. Я. Ольховский, Д. А. Павлюченко. - Новосибирск, 2015. - 257 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221990

Additional literature

1. ГЭС : искусство управления : [монография / А. Г. Русина и др. ; под ред. А. Г. Русиной]. - Новосибирск, 2019. - 224, [1] с., [2] л. ил. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000242222. - Доп. тит. л., огл. англ..

2. Лыкин А. В. Электрические системы и сети : [учебник] / А. В. Лыкин. - Новосибирск, 2017. - 361, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233296

Internet resources

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

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

3. Web of Science [Electronic resource]. - Thomson Reuters, 2016. - Mode of access: http://apps.webofknowledge.com. - Title from screen.

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

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

6. http://znanium.com/

Methodical support and software

Methodological support

1. Коробейников С. М. Нетрадиционные и возобновляемые источники энергии [Электронный ресурс] : электронный учебно-методический комплекс / С. М. Коробейников ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234888. - Загл. с экрана.

2. Возобновляемые источники энергии : методические указания к выполнению лабораторных работ для ФЭН очного и заочного отделений по направлению 13.04.02 - "Электроэнергетика и электротехника" / Новосиб. гос. техн. ун-т ; [сост.: С. Н. Удалов и др.]. - Новосибирск, 2017. - 34, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000236552

3. Автономные системы электроснабжения : контрольные задания и методические указания к их выполнению для магистрантов очного и заочного отделений направления 13.04.02 "Электроэнергетика и электротехника" / Новосиб. гос. техн. ун-т ; [сост.: С. В. Митрофанов, Н. В. Зубова]. - Новосибирск, 2017. - 72, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234484

Specialized software

1 Microsoft Office Application Pack

2 Development of cross-platform applications Microsoft Visual Studio 2015

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

ANNOTATION OF THE PROGRAM
Power Supply

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	66
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	10
9	Independent work, hours	78

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Formulates the objectives and objectives of the study
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
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
analyzes the problem situation and makes it decomposition for individual tasks .	
1. On the latest system design techniques Energy supply of enterprises	Lections; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
2. Basics of constructing rational schemes Energy supply of enterprises	Lections; Laboratory works

demonstrates knowledge of objects of professional activity	
3. Optimize the mode of operation of mixed power systems	Lections
analyzes serial objects of professional activity	
4. highlight leading motifs and take into account them in activities	Lections; Independent work
Formulates the objectives and objectives of the study	
5. software products for designing electrical and heat supply schemes. Lessing	Lections; Independent work
analyzes the problem situation and makes it decomposition for individual tasks .	
6. to be able to install and quickly solve design tasks in modern quickly In developing conditions	Lections; Seminars; Laboratory works; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
7. to know about the methods of designing modern iis	Lections; Seminars; Laboratory works; Independent work
demonstrates knowledge of objects of professional activity	
8. To be able to designate the optimal modes of operation of thermal electric stations and power systems	Lections; Seminars; Laboratory works; Independent work
9. know modern approaches and learning techniques , including in groups	Lections; Laboratory works
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	
10. to know the approaches and methods of designing rational energy supply schemes of household and industrial consumer	Lections; Seminars; Laboratory works; Independent work
11. To be able to apply various learning techniques in groups and individually	Lections; Seminars; Laboratory works; Independent work
analyzes the problem situation and makes it decomposition for individual tasks .	
12. To be able to solve problems due to a critical image and methods of problem learning to solve problems by combining several creative teams	Lections; Seminars; Laboratory works
Formulates the objectives and objectives of the study	
13. to know the latest design technologies Consumer circuits of electrical and heat supply using renewable energy sources	Lections; Seminars; Laboratory works
analyzes serial objects of professional activity	
14. to know the latest design technologies Consumer circuits of electrical and heat supply using renewable energy sources	Lections; Seminars
Formulates the objectives and objectives of the study	
15. to be able to determine Required resources for the implementation of design tasks	Lections; Laboratory works; Independent work
16. Know the latest achievements in the field of automation of energy supply systems of industrial industries	Lections; Seminars; 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: General issues of energy supply of industrial and consumer				
1. Basics of Energy Saving Industrial Enterprises.	4	6	1, 10, 11, 12, 13, 14, 15, 16, 2, 3, 4, 5, 6, 7, 8, 9	Lecture
Didactic unit: Construction of rational energy supply schemes				

1. Calculation of heat load	0	2	1, 10, 2, 3, 6, 7, 8	Lecture
Didactic unit: The main issues of heat supply systems				
1. Types of heat supply systems. Designing heating systems and their work mode.	4	4	11, 12, 15, 6	Lecture
Didactic unit: Design of thermal networks				
1. Heating network. Modes of thermal networks.	3	3	10, 12, 13, 14, 6	Lecture
Didactic unit: Input Impedance of the Loaded Line.				
2. automation of heat supply systems	3	3	1, 12, 15, 2, 3, 4, 5, 8	Lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Construction of rational energy supply schemes				
1. Microclimate of premises and the calculation of the thermal balance of the building	2	5	10, 11, 12, 15, 2, 6, 7, 8, 9	Laboratory work
Didactic unit: The main issues of heat supply systems				
1. Systems of ventilation and air conditioning (basic concepts)	2	4	15, 6, 7	Laboratory work
Didactic unit: Design of thermal networks				
1. Reliability and redundancy of thermal networks		4	10, 13, 6	Laboratory work
Didactic unit: Input Impedance of the Loaded Line.				
1. Modern software products for integrated processing of power supply systems		5	12, 13, 16, 6, 9	Laboratory work

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Construction of rational energy supply schemes				
1. Optimization of the operating mode of the energy project using renewable energy sources		4	14, 7, 8	Practice
Didactic unit: The main issues of heat supply systems				
1. Calculation of water heating systems. CTP and ITP (conceptual circuit solutions and thermal equipment).		5	10, 13, 16, 7	Practice
Didactic unit: Design of thermal networks				
1. Hydraulic and thermal calculation of thermal networks		5	10, 6	Practice
Didactic unit: Input Impedance of the Loaded Line.				

1. Creation and design of the drawing of the part, assembly unit, specifications.		4	11, 12, 14, 16, 6	Practice

Literary sources

Main literature

1. Чекалина Т. В. Энергоснабжение промышленных предприятий : учебное пособие / Т. В. Чекалина ; Новосиб. гос. техн. ун-т. - Новосибирск, 2011. - 135, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000152733

2. Бирюков В. В. Импульсные системы управления транспортными средствами. [В 2 ч.]. Ч. 1 : учебник / В. В. Бирюков ; Новосиб. гос. техн. ун-т. - Новосибирск, 2018. - 210, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000238438

Additional literature

1. Бирюков В. В. Автоматизированный тяговый электропривод : [учебник] / В. В. Бирюков. - Новосибирск, 2019. - 321, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000241608

2. Чекалина Т. В. Энергоснабжение [Электронный ресурс] : электронный учебно-методический комплекс / Т. В. Чекалина ; Новосиб. гос. техн. ун-т. - Новосибирск, [2010]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000149219. - Загл. с экрана.

Internet resources

1. Экологический менеджмент предприятия [Электронный ресурс] // Infomanagement. - 2009-2013. - Режим доступа: http://infomanagement.ru/lekciya/ekologicheskii_menedzhment_predpriyatiya. - Загл. с экрана.

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

3. Шаншуров Г. А. Специальные электрические машины [Электронный ресурс] : электронный учебно-методический комплекс / Г. А. Шаншуров, Т. В. Дружинина, А. Г. Приступ ; Новосиб. гос. техн. ун-т. - Режим доступа: http:// http://dispace.edu.nstu.ru/didesk/course/show/5236. - Загл. с экрана.

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

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

6. http://znanium.com/

Methodical support and software

Methodological support

1. Энергоснабжение : методические указания к выполнению практических и лабораторных работ для 4-5 курсов ФЭН по специальности 140200 (Электроэнергетика) дневного и заочного отделений / Новосиб. гос. техн. ун-т ; [сост. Т. В. Чекалина]. - Новосибирск, 2007. - 26, [1] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000066822

2. Энергоснабжение промышленных предприятий. Ч. 1 : методические указания к выполнению практических работ для 4-5 курсов ФЭН по специальности 140200 - Электроэнергетика / Новосиб. гос. техн. ун-т ; [сост. Т. В. Чекалина]. - Новосибирск, 2009. - 46, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000090584

Specialized software

1 Scientific and Technical Computing Program Mathworks Matlab

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

ANNOTATION OF THE PROGRAM

Electrical equipment of power supply systems

Course: 1, semester : 1

		Semester
№	**Kind of activity**	**1**
1	Total credits	4
2	Total hours	144
3	Total classes in the contact form, hours	66
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	10
9	Independent work, hours	78

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Formulates the objectives and objectives of the study
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
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
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; Laboratory works; Independent work
knows how to solve professional tasks in enterprises and in the profile industry organizations His region.	

2. PC-1.V / PR. 2 2. Solving professional tasks in enterprises and organizations of the profile industry of their region.	Lections; Seminars; Laboratory works; Independent work
demonstrates knowledge of objects of professional activity	
3. PC-2.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Seminars; Laboratory works; Independent work
analyzes serial objects of professional activity	
4. PC-3.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Seminars; Laboratory works; Independent work
Formulates the objectives and objectives of the study	
5. PC-3.V / PR. 2 2. Forms design solutions for new objects of professional activity	Laboratory works; Independent work

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results
Semester: 1			
Didactic unit: Protective-switching equipment			
1. Circuit breakers. general information		1	1, 2, 3, 4
2. Circuit breakers. Specifications. Calculation of settles		2	1, 2, 3, 4
3. Automatic switches avway Emax		2	1, 2, 3, 4
4. Emax automatic circuitors		2	1, 2, 3, 4
5. Automatic switches of ABV Tmax		2	1, 2, 3, 4
6. Quick Switches for automatic switches of AVA TMAX		2	1, 2, 3, 4
7. Wireless data transmission (Bluetooth) protection devices		1	1, 2, 3, 4
8. Selectivity protection devices		2	1, 2, 3, 4
Didactic unit: Measuring equipment			
9. Electric energy meters. general information		1	1, 2, 3, 4
10. Modular electricity meters avway		2	1, 2, 3, 4
Didactic unit: Equipment management and automation equipment			
11. Automatic activation of the reserve. ATS ATS unit		1	1, 2, 3, 4

Table 3.2

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

1. Calculation and analysis of the characteristics of electrical equipment and modes of power supply systems	4	8	1, 5	Simulation of electrical apparatus and calculations in the software complex on the example of ABB DOC2
Didactic unit: Measuring equipment				
2. Electric Energy Quality Analyzers	2	4	2, 3, 4	Studying the parameters and principle of operation of three-phase analyzers of electrical energy for the example of Fluke and Chavin Arnoux
3. Realmanding pliers	2	2	2, 3, 4	Studying the parameters and principle of the current ticks on the example of Fluke devices
4. Modular Electric Energy Counters	2	4	2, 3, 4	Studying the parameters and principle of operation of a modular electrical energy meter on the example of ABV devices

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 1				
Didactic unit: Protective-switching equipment				
1. Modular circuit breakers	2	6	2, 3, 4	Studying the parameters and principle of operation of modular circuit breakers on the example of ABV devices
2. Modular oversight protection devices	2	4	2, 3, 4	Study of the parameters and principle of operation of the Uzip on the example of ABV devices
3. Modular Differential Current Devices	2	4	2, 3, 4	Study of the parameters and principle of the action of differential current devices on the example of ABV devices
Didactic unit: Equipment management and automation equipment				
4. Modular control and automation devices	2	4	2, 3, 4	Studying the parameters and principle of operation of control and automation devices on the example of ABV devices

Literary sources

Main literature

1. Гужов Н. П. Системы электроснабжения : [учебник] / Н. П. Гужов, В. Я. Ольховский, Д. А. Павлюченко. - Новосибирск, 2015. - 257 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221990

2. Синюкова, Т. В. Электрические аппараты : учебное пособие / Т. В. Синюкова. — Липецк : Липецкий государственный технический университет, ЭБС АСВ, 2019. — 49 с. — ISBN 978-5-88247-976-2. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/101458.html (дата обращения: 22.02.2021). — Режим доступа: для авторизир. пользователей

Additional literature

1. Попов, Е. В. Устройство и эксплуатация электрических аппаратов. Часть 1. Коммутационные электрические аппараты : конспект лекций / Е. В. Попов. — Москва : Московская государственная академия водного транспорта, 2015. — 49 c. — ISBN 2227-8397. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/46877.html (дата обращения: 22.02.2021). — Режим доступа: для авторизир. пользователей

2. Электрические аппараты : методические указания к практическим работам / составители Т. В. Синюкова. — Липецк : Липецкий государственный технический университет, ЭБС АСВ, 2015. — 13 c. — ISBN 2227-8397. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/57625.html (дата обращения: 22.02.2021). — Режим доступа: для авторизир. пользователей

Internet resources

1. http://elibrary.nstu.ru/

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

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

4. Электронно-библиотечная система НГТУ [Электронный ресурс] : электронно-библиотечная система. – [Россия], 2011. – Режим доступа: http://elibrary.nstu.ru/. – Загл. с экрана.

5. Техэксперт: электронный фонд правовой и нормативно-технической документации : [сайт]. - Санкт-Петербург, 2015 - . URL: https://cntd.ru/ (дата обращения: 03.02.2021).

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

7. http://znanium.com/

Methodical support and software

Methodological support

1. Электрооборудование концерна АББ напряжением до 1000 В : методические указания по выполнению лабораторных работ по специальности "Электроснабжение" для 5 курса факультета энергетики / Новосиб. гос. техн. ун-т ; [сост.: Н. П. Гужов, Д. А. Павлюченко, Н. А. Стрельников]. - Новосибирск, 2012. - 75, [2] с. : ил., схемы, табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000172457

2. Абрамов Е. Ю. Электрические и электронные аппараты : учебно-методическое пособие / Е. Ю. Абрамов, Л. А. Нейман ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 45, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234930

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
Accounting and control of electricity

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	65
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	9
9	Independent work, hours	79

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Formulates the objectives and objectives of the study
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
uses automation tools when designing

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; Laboratory works; Independent work
demonstrates knowledge of objects of professional activity	
2. PC-2.V / PR. 1 1. Demonstrates knowledge of the objects of professional activity	Lections; Seminars; Laboratory works; Independent work
uses automation tools when designing	

3. PC-2.V / PR. 3 3. Uses automation tools when designing	Seminars; Laboratory works; Independent work
analyzes serial objects of professional activity	
4. PC-3.V / PR. 1 1. Analyzes serial objects of professional activity	Lections; Seminars; Laboratory works; Independent work
Formulates the objectives and objectives of the study	
5. PC-3.V / PR. 2 2. Forms design solutions for new objects of professional activity	Lections; Seminars; Laboratory works; Independent work
uses automation tools when designing	
6. To be able to calculate additional electricity loss with a deterioration in the quality of electricity	Lections; Laboratory works; Independent work
Formulates the objectives and objectives of the study	
7. to know the types of contracts for the transfer of exclusive rights to objects of intellectual property	Lections; Laboratory works; Independent work
analyzes the problem situation and makes it decomposition for individual tasks .	
8. to know the requirements for the quality indicators of electrical energy	Lections; Laboratory works; Independent work
demonstrates knowledge of objects of professional activity	
9. be able to collect, analysis of scientific and technical information	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: 3				
Didactic unit: Accounting for electrical energy				
1. Electricity metering rules	2	2	2, 7, 8	General provisions and basic definitions. Objectives and objectives of accounting and control of electrical energy in power supply systems. Organization of accounting and control of electrical energy at electric stations, in electrical networks and consumers. .
2. Basic coverage of electricity in its production, transmission and distribution. Structure of wholesale and retail electricity markets	2	2	2, 7, 9	Accounting for active electricity at power plants, substations of power system and consumer substations. Organization of commercial accounting on the wholesale market of electrical energy. Organization of commercial accounting on the retail market of electrical energy.

3. Organization of commercial accounting on Orhem.	2	2	1, 2, 4, 7, 9	Types of automated electricity metering systems. Functions of AIIS KUE. Determination of accounting indicators in cases of incompatibility of delivery points and accounting.
4. Accuracy of electrical and power measurement.	2	2	1, 2, 6, 7	Error of electrical energy measurements. Maximum permissible measurement errors. Methods of performing measurements of the amounts of electrical energy.
Didactic unit: Quality control Electric energy				
5. The main indicators of the quality of electrical energy. Requirements for electrical energy quality indicators.	4	4	2, 4, 8	Study of the possibilities of obtaining and processing images when using the OpenCV library.
6. Control and monitoring of electrical energy in power supply systems of general purpose	2	2	1, 2, 4	Scope GOST 33073-2014. Select control points. Requirements for the duration of measurements during CE control. Registration of test results.
7. A brief analysis of the main provisions of GOST 30804.4.30-2013 and GOST 30804.4.7-2013	2	2	1, 2, 4	the scope of standards. Classes of characteristics of the measurement process. Organization of measurements. Combining time measurement results. Measuring electricity quality indicators.
8. Information and its properties	2	2	1, 2, 4, 5	The main reasons for the appearance of voltage distortion. Types of distortion and protection against them. The influence of nonsense modes. The effect of asymmetric modes.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Accounting for electrical energy				
1. Electrical measurements		2	5, 6, 7, 9	Ways to connect measuring instruments into an electrical network. Measuring and calculated parameters of the electrical network.
2. Accounting of electricity by a modular ABB DeltaPlus meter		4	1, 2, 4, 5, 6, 7, 9	studies methods for analyzing nonlinear SAU 2nd order

3. Automated electricity accounting		4	1, 3, 5, 6, 7	The design elements of the meter are studied.
Didactic unit: Quality control Electric energy				
4. Measurement of the quality indicators of the electricity registrar LPW-305		4	1, 2, 5, 6, 7, 8, 9	are studied norms and requirements for the quality of electrical energy in accordance with the GOST 32144-2013. The characteristics, features and capabilities of electrical energy analyzers are studied. The quality indicators of electrical energy from the LPW-305 instrument are measured.
5. Measurement of quality indicators of electric power registrar Parma RK3.01		4	1, 2, 5, 7, 8, 9	The characteristics, features and capabilities of electrical energy quality analyzers are studied. The performance indicators are measured using the Parma RK3.01 recorder.

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Accounting for electrical energy				
1. Electric power structure. The main terms and concepts for the accounting of electrical energy. Electrical Accounting Rules		2	1, 2, 4, 5	Studying material Methodical instructions, search for answers to the questions set.
2. Electrical energy balance at the substation		4	1, 2, 3	Work is performed at two substations - with two-winding and three-dimensional transformers in two practical classes.
Didactic unit: Quality control Electric energy				
3. Checking the compliance of quality indicators of electrical energy requirements set by GOST 32144		4	1, 2, 4, 5	Determination of the frequency deviation, positive and negative deviations of the voltage, the total coefficient of harmonic components, the non-psychia coefficients over the return and zero sequence according to the expressions presented in GOST 32144; - Proceed to the test results of electrical energy tests according to annex in GOST 33073

4. Calculate the parameters of the filter-com-pensing device in the power supply system of the industrial enterprise		4	3, 4, 5	It is estimated to apply the capacitors battery to compensate for reactive power. The parameters of the FCE based on a power resonance filter configured to the frequency of the greatest harmonic in the transducer current spectrum;
5. Calculation of positive and negative voltage deviations in Electrical network of power supply system		4	3, 4, 5	1. Calculate voltage loss in maximum load mode to the remote electrical receipt. 2. Calculate the loss of voltage in the mode of minimum loads to the nearest electrical receiving. 3. Build the stress aid in the electrical network of the power supply system. 4. Enter the voltage mode to the permissible area by using the transformer PBV device. 5. Reply to test questions.

Literary sources

Additional literature

1. Лыкин А. В. Учет и контроль электроэнергии [Электронный ресурс]. Ч. 1 : конспект лекций / А. В. Лыкин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221143. - Загл. с экрана.

2. Лыкин А. В. Электрические системы и сети : [учебник] / А. В. Лыкин. - Новосибирск, 2017. - 361, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000233296

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

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

5. http://znanium.com/

6. Электронно-библиотечная система НГТУ [Электронный ресурс]. - Новосибирск : Новосибирский государственный технический университет, 2011-2017. - Режим доступа: http://elibrary.nstu.ru/. - Загл. с экрана.

Methodical support and software

Methodological support

1. Учет и контроль электроэнергии : методические указания к лабораторным работам для магистрантов 1 курса по направлению 13.04.02 "Электроэнергетика и электротехника" факультета энергетики / Новосиб. гос. техн. ун-т ; [сост. А. В. Лыкин]. - Новосибирск, 2017. - 54, [2] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234805

2. Учет и контроль электроэнергии : методические указания к лабораторным работам для магистрантов 1 курса, обучающихся по напавлению 13.04.02 "Электроэнергетика и электротехника" факультета энергетики / Новосиб. гос. техн. ун-т ; [сост.: А. В. Лыкин]. - Новосибирск, 2015. - 54, [2] с. : ил., табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000216626

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
Industrial practice: Technological practice

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	65
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	9
9	Independent work, hours	79

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
analyzes serial objects of professional activity
Formulates the objectives and objectives of the study
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
uses automation tools when designing

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; Independent work
demonstrates knowledge of objects of professional activity	
2. Demonstrates knowledge of objects of professional activity	Lections; Independent work
uses automation tools when designing	

3. How the heat transfer on the steps of the turbine is distributed.	Seminars; Laboratory works; Independent work
analyzes serial objects of professional activity	
4. 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	Lections; Independent work
Formulates the objectives and objectives of the study	
5. forms design solutions for new objects of professional activities	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: Types of failures				
1. Thermodynamic properties of water on tables and deframs	2	2	1, 2, 4	Introduction of basic concepts.
2. Checking the health, performance and correctness of operation. The effectiveness of diagnostics, the accuracy of the results, the degree of automation, completeness and depth of diagnostation.	2	2	1, 2, 4	Entering basic concepts, consideration of the main opposites of equipment diagnostics.
Didactic unit: Electrical equipment SES as an object of diagnostics				
3. Study of electrical equipment with a system approach	4	4	1, 2, 4	work as an expert using the principles of a systematic approach and regulatory and technical documentation for electrical network equipment.
4. Measurement and control of the quality of contact connections of current-host electrical installations. Measurement and control of moisture content MBI of power transformers	4	4	1, 2, 4	Using diagnostic information processing techniques, Developing a diagnostic conclusion about the status of equipment.
5. Analysis and construction of diagnostic models and diagnostic algorithms	4	4	1, 2, 4	Building diagnostic models.
Didactic unit: Methods for finding damage VL				
6. Methods and means of finding places of damage to electric transmission air lines. The concept of remote and topographical methods for finding locations of damage. Fixting FIP Series, Lifts, FPT, FNP	2	2	1, 2, 4	Studying literature. Solving tasks

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Methods for finding damage VL				
3. Determination of the place of damage to the airline for the measured FPT device of the reverse sequence		4	3, 5	- is calculated by the parameters of the network substitution scheme containing the air lines of the transmission; - the current sequence currents are calculated at two-phase KZ on VL at different points of the line; - the dependence of the current reverse sequence of the distance on which the two-phase KZ occurred; - According to the well-known currents of the reverse sequence, a frozen FIP, the distance from the substation to the place of KZ is determined.
4. Determination of the place of damage to the airline on the measured device of the FPT and FPN current and the inverse sequence voltage		4	3, 5	on the well-known current and the voltage of the reverse sequence measured by FPT and FPN devices, the distance is determined. From the substation to the place of the KZ and the search area for two cases: - the working voltage on the sub-station tires before the KZ was not measured; - The working voltage before the KZ was measured.
5. Definition Bilateral Power Damage Places for Bilateral Power Measured Instrument Lifts-A and FPT currents of zero and reverse sequence		4	3, 5	- the calculation of the currents of zero and reverse sequence with single-phase KZ on VL at different points; - the dependence of the relationships of these currents from the distance of the KZ point is constructed; - according to the specified ratio of the current sequence currents to the current sequence currents, the distance to the place of damage is determined; - The error of measurement of the distance to the place of damage is determined due to the inaccuracy of measuring currents.

6. Diagnostics of insulation of high voltage equipment		6	3, 5	Methods for the diagnosis and detection of defects of isolation. Measurement of the tangent angle of dielectric losses and containers of isolation. The non-equilibrium compensation method of diagnostics. Measurement of insulation resistance.

Table 3.3

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Electrical equipment SES as an object of diagnostics				
1. Determination of reliability indicators		4	3, 5	
2. Calculate the reliability indicators of the RU scheme for the most severe types of accidents		4	3, 5	Make a table of settlement links of events, modes and accidents for a given RU schema without taking into account the failures of the RZA devices; Calculate the reliability indicators of the RU scheme for the most severe types of accidents.
3. Definition of mathematical expectation of electricity failure in the system		4	3, 5	Calculate the mathematical expectation of electricity failure in the system by the method of "reducing coefficients".
4. to determine the optimal amount of the power reserve.		6	3, 5	The emergency power reserve of the power system

Literary sources

Main literature

1. Диагностика электрооборудования электрических станций и подстанций : учебное пособие / А. И. Хальясмаа, С. А. Дмитриев, С. Е. Кокин, Д. А. Глушков. — Екатеринбург : Уральский федеральный университет, ЭБС АСВ, 2015. — 64 с. — ISBN 978-5-7996-1493-5. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/68237.html (дата обращения: 22.02.2021). — Режим доступа: для авторизир. пользователей

2. Михеев, Г. М. Электростанции и электрические сети. Диагностика и контроль электрооборудования / Г. М. Михеев. — 2-е изд. — Саратов : Профобразование, 2019. — 297 с. — ISBN 978-5-4488-0089-4. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/88012.html (дата обращения: 22.02.2021). — Режим доступа: для авторизир. пользователей

Additional literature

1. Шлейников, В. Б. Электроснабжение силовых электроприемников цеха промышленного предприятия : учебное пособие / В. Б. Шлейников, Т. В. Сазонова. — Оренбург : Оренбургский государственный университет, ЭБС АСВ, 2012. — 110 с. — ISBN 2227-8397. — Текст : электронный // Электронно-библиотечная система IPR BOOKS : [сайт]. — URL: http://www.iprbookshop.ru/30146.html (дата обращения: 22.02.2021). — Режим доступа: для авторизир. пользователей

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

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

5. Электронно-библиотечная система НГТУ [Электронный ресурс] : электронно-библиотечная система. – [Россия], 2011. – Режим доступа: http://elibrary.nstu.ru/. – Загл. с экрана.

6. http://znanium.com/

Methodical support and software

Methodological support

1. Электрооборудование концерна АББ напряжением до 1000 В : методические указания по выполнению лабораторных работ по специальности "Электроснабжение" для 5 курса факультета энергетики / Новосиб. гос. техн. ун-т ; [сост.: Н. П. Гужов, Д. А. Павлюченко, Н. А. Стрельников]. - Новосибирск, 2012. - 75, [2] с. : ил., схемы, табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000172457

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
Reliability of Power Supply Systems

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	44
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	36
8	Consultations, hours	6
9	Independent work, hours	100

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency
Can plan and perform physical and mathematical research, interpret and submit results in the form of articles or Patents; *regarding the following learning results*:
Develop research plan
Interprets and presents results in the form of articles or patents
performs physical and mathematical research.

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
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency	
2. PC-3.V / PR. 3 3. Applies methods for analyzing options, develop and search for compromise solutions with an assessment of the project implementation efficiency	Lections; Seminars; Independent work

Develop research plan	
3. PC-4.V / PR. 1 1. Develop research plan	Lections; Seminars; Independent work
performs physical and mathematical research.	
4. PC-4.V / PR. 2 2. Performs physical and mathematical studies	Seminars; Independent work
Interprets and presents results in the form of articles or patents	
5. PC-4.V / PR. 3 3. Interprets and represents results in the form of articles or patents	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: Reliability of elements and groups of elements				
1. Indicators of reliability of elements of the electric power system	4	4	1	lecture
Didactic unit: Evaluation of the reliability of power supply schemes				
1. Calculation of the reliability of the network scheme	2	2	1, 3, 5	lecture
Didactic unit: Reliability of distribution device circuit breakers				
9. Power supplies. Linear stabilizers. Specifications. Pulse power sources. Sources of reference voltage. Varieties. Parameters.	2	2	1	lecture
Didactic unit: Sustainability				
8. Types of power reserves in the power system and the criteria for choosing their optimal value	4	4	1, 2, 3	lecture
Didactic unit: Consequences of the failures of electric power plants				
9. Damage to the power system	2	2	1	lecture
11. Evaluation of damage from power supply	4	4	1, 3, 5	lecture

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Reliability of elements and groups of elements				
2.	2	2	2, 4	practical lesson
3. Features of the reliability indicators of protection and automation devices	2	2	1, 2, 5	practical lesson
Didactic unit: Evaluation of the reliability of power supply schemes				

11. Calculation and analysis of power supply	2	2	1, 2, 4	practical lesson
Didactic unit: Reliability of distribution device circuit breakers				
10. Determining the reliability indicators of distribution devices	2	2	3, 4, 5	practical lesson
Didactic unit: Sustainability				
10. Calculation and assessment of the mathematical expectation of electricity failure in power system	8	8	2, 4, 5	practical lesson
Didactic unit: Consequences of the failures of electric power plants				
12. Calculation of mathematical expectation of consumer damage by the method of statistical tests	2	2	2, 4, 5	practical lesson

Literary sources

Main literature

1. Малафеев, С. И. Надежность электроснабжения : учебное пособие / С. И. Малафеев. — 2-е изд., испр. — Санкт-Петербург : Лань, 2018. — 368 с. — ISBN 978-5-8114-1876-3. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/101833 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

Additional literature

1. Ситуационное управление энергетическими объектами и процессами электроэнергетической системы / [Ю. А. Секретарев и др.]. - Новосибирск, 2007. - 306 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000066909

2. Березкин, Е. Ф. Надежность и техническая диагностика систем : учебное пособие / Е. Ф. Березкин. — Санкт-Петербург : Лань, 2019. — 260 с. — ISBN 978-5-8114-3375-9. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/115514 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

3. Сапожников, В. В. Основы теории надежности и технической диагностики : учебник / В. В. Сапожников, В. В. Сапожников, Д. В. Ефанов. — Санкт-Петербург : Лань, 2019. — 588 с. — ISBN 978-5-8114-3453-4. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/115495 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

Internet resources

1. Шеметов, А. Н. Надежность электроснабжения : учебное пособие для студентов специальности 140211 «Электроснабжение» / А. Н. Шеметов. – Магнитогорск : ГОУВПО «МГТУ им. Г. И. Носова», 2006. – Текст : электронный. – URL: http://magtu-epp.narod.ru/literature/Nadejnost_el_snab.pdf (дата обращения: 15.02.2021).

2. Александров, Д. С. Надёжность и качество электроснабжения предприятий : учебное пособие / Д. С. Александров, Е. Ф. Щербаков. – Ульяновск : УлГТУ, 2010. – 155 с. – ISBN 978 – 5 – 9795 –0828-3. – Текст : электронный. – URL: http://venec.ulstu.ru/lib/disk/2012/Alexandrov.pdf (дата обращения: 15.02.2021).

3. Савина Н. В. Надежность систем электроэнергетики: учебное пособие [Электронный ресурс] / Н. В. Савина. - Благовещенск: Амурский гос. университет, 2011 - URL: https://irbis.amursu.ru/DigitalLibrary/AmurSU_Edition/3060.pdf. – Загл. с экрана.

4. http://elibrary.nstu.ru/

5. Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

6. https://e.lanbook.com/

7. Электронно-библиотечная система НГТУ [Электронный ресурс] : электронно-библиотечная система. – [Россия], 2011. – Режим доступа: http://elibrary.nstu.ru/. – Загл. с экрана.

8. http://www.iprbookshop.ru/

9. http://znanium.com/

Methodical support and software

Methodological support

1. Секретарев Ю. А. Надежность электроснабжения : [учебное пособие по направлению подготовки магистров 140400 "Электроэнергетика и электротехника"] / Ю. А. Секретарев ; Новосиб. гос. техн. ун-т. - Новосибирск, 2010. - 101, [3] с. : ил., табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000151423

2. Шилин, А. Н. Надежность электроснабжения : учебно-методическое пособие / А. Н. Шилин, А. Г. Сошинов, О. И. Елфимова. — Волгоград : ВолгГТУ, 2019. — 104 с. — ISBN 978-5-9948-3271-4. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/157260 (дата обращения: 17.02.2021). — Режим доступа: для авториз. пользователей.

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

Automation of the design of power supply systems

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	44
4	Lectures, hours	18
5	Practical lessons, hours	18
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	36
8	Consultations, hours	6
9	Independent work, hours	100

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 .
Able to choose serial or design new objects of professional activity; *regarding the following learning results*:
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency
Can plan and perform physical and mathematical research, interpret and submit results in the form of articles or Patents; *regarding the following learning results*:
Develop research plan
Interprets and presents results in the form of articles or patents
performs physical and mathematical research.

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. to know the methods for calculating the power supply systems	Lections; Seminars; Laboratory works
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency	
2. to know the principles of construction and specific electrical network elements, the structural execution of air and Cable power lines	Lections; Independent work

performs physical and mathematical research.	
3. To be able to calculate the parameters of the reference schemes of elements of power supply systems; Calculate CC currents in the power supply system	Lections; Seminars; Independent work
Interprets and presents results in the form of articles or patents	
4. to know the range of electronic components manufactured by industry.	Lections; Seminars; Laboratory works; Independent work
Develop research plan	
5. To be able to develop self-learning skills on practical examples to improve technical systems using non-standard solutions	Lections; Independent work
Applies methods for analyzing options, develop and search for compromise decisions with assessment Project Implementation Efficiency	
6. can be able to exploit and select equipment of electric power systems and networks	Lections; 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: Design of electrical networks, including selection of circuit solutions, parameters of the main electrical equipment.				
1. General principles for designing power supply systems	2	4	1	The main terms, design stages, definition of equipment parameters in the design process.
2. The overall characteristics of the transmission and distribution systems of electrical energy. Simulation of electrical elements.	1	2	4	Basic concepts, terms, definitions; characteristics of the electrical energy transmission system; rated voltages of feeding networks; characteristics of the distribution systems of electrical energy; System of transmission and distribution of electrical energy.
Didactic unit: Constructive performance of power supply systems				
3. Principles of structural performance of the power line.	1	1	2	Features Building feed networks, structural elements VL, selection of wire sections.
4. Cable power lines. Toppers 6-35 square meters.	1	1	2	Constructive features and methods of laying CL 6-35 kV, features of CL 110-220 kV, selection of cable sections. Tackings 6-35 sq.: Design, scope, selection of cross-section of tires and conductive wires.
Didactic unit: Schemes of transmission systems and distribution of electrical energy. Schemes of distribution devices.				
5. Basics of constructing transmission and distribution of electrical energy systems. Methods for connecting substations to the electrical network.	1	1	3, 6	Requirements for electrical networking schemes; network designs; Methods for connecting substations to the electrical network.

6. Typical schemes of distribution devices (RU).	1	1	3, 6	High and medium voltage switchgear (RU VN and RU CH); Low voltage switchgear (RU NN).
Didactic unit: Structures, Schemes GPP and CHP, main electrical equipment, operation modes and constructive execution.				
7. Heat electric centers (CHP). Power supply according to the diagrams of deep inputs.	2	3	6	Structural schemes of CHP; power supply circuit with CHP. Schemes of deep inputs: goals, features, power sources, execution schemes.
Didactic unit: Calculations of the main modes and regulation of voltage				
8. Tasks for calculating and analyzing the established electrical network modes. The overall formulation and characteristics of the task of technical and economic calculations.	3	3	1, 5	Determining the parameters of the working steady mode. The task of choice in technical and economic calculations; Main economic indicators, choosing the optimal power option.
Didactic unit: frequency control.				
9. Indicators and quality rates of electricity. Frequency control; Automatic frequency unloading.	2	2	4	The level of frequency and voltage in the electric power system (EES): indicators and quality rates of electricity; Basic formulas. Frequency rationing, influence of the frequency of ED, static characteristics in terms of frequency, primary and secondary regulation. Principle of operation and category ACR, Chapes.

Table 3.2

Themes	Active forms, hours	Hours	Links to learning results	Learning activities
Semester: 3				
Didactic unit: Design of electrical networks, including selection of circuit solutions, parameters of the main electrical equipment.				
1. Analysis of power consumption power consumption systems.	0	0	1, 4	Construction of the power supply scheme, the calculation of the original mode, the construction of graphs of the Near and the calculation of their parameters, the calculation of the mode for the maximum load time
2. Compensation of reactive power.	0	0	4	In the circuits of the electrical network, select the power of the capacitor battery and select the locations of their installation to reduce the reactive power over the lines and transformers.

Table 3.3

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

Semester: 3				
Didactic unit: Constructive performance of power supply systems				
1. Determining the parameters of the schemes for replacement of electrical network elements (VL).	3	3	3	Calculation of the specific parameters of air lines with different location of wires. Constructing the dependences of the specific parameters of the VL for various sections of the wires.
Didactic unit: Schemes of transmission systems and distribution of electrical energy. Schemes of distribution devices.				
2. Determining the parameters of the schemes for replacing electrical network elements (transformers).	3	2,5	3	Determination of parameters of substitution schemes for power transformers and autotransformers of single-phase and three-phase versions.
Didactic unit: Calculations of the main modes and regulation of voltage				
3. Calculation of the steady transmission line mode with a different method of setting the source data.	3	2	4	It is required to perform electrical calculation of the power line and determine the structural parameters of the VL: the cross-section of the wires, the number of chains and the length of the power supply lines.
4. Calculation of the steady network mode containing several intermediate loads.	4	3	4	Perform the calculation of the installed network mode in which the load power is specified in nodes and the voltage of the balancing station (base voltage). The network mode calculation is performed in relation to its equivalent substitution scheme, the parameters of which are defined earlier.
5. Calculation of the steady regime of a closed electrical network.	4	3	4	It is required to determine the parameters of the installed electrical network mode with double-sided power.
6. Calculation of the electrical network mode containing various nominal voltages.	2	2	1, 4	Calculate the operating modes of a network of two nominal stresses, the sections of which are related to the TDN-16000/110 transformer.
Didactic unit: frequency control.				
7. Calculation of voltage deviations on consumer tires in maximum and minimum load modes. Building deviation chart.	3	2,5	4	It is necessary to characterize the difference between the actual voltage in the steady mode of operation of the power supply system from its nominal value.

Literary sources

Main literature

1. Родыгина, С. В. Проектирование и эксплуатация систем электроснабжения. Проектирование СЭС : учебное пособие / С. В. Родыгина. — Новосибирск : НГТУ, 2016. — 64 с. — ISBN 978-5-7782-3076-7. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/118119 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

2. Родыгина, С. В. Проектирование и эксплуатация систем электроснабжения. Передача, распределение, преобразование электрической энергии : учебное пособие / С. В. Родыгина. — Новосибирск : НГТУ, 2017. — 72 с. — ISBN 978-5-7782-3341-6. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/118101 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

3. ЭБС Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 1993. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

4. Гужов Н. П. Системы электроснабжения : [учебник] / Н. П. Гужов, В. Я. Ольховский, Д. А. Павлюченко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2007. - 257 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000080191. - Инновационная образовательная программа НГТУ "Высокие технологии".

Additional literature

1. Филиппова Т. А. Энергетические режимы электрических станций и электроэнергетических систем : [учебник] / Т. А. Филиппова ; Новосиб. гос. техн. ун-т. - Новосибирск, 2005. - 297 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000032665

2. Русина, А. Г. Режимы электрических станций и электроэнергетических систем : учебное пособие / А. Г. Русина, Т. А. Филиппова. — Новосибирск : НГТУ, 2016. — 400 с. — ISBN 978-5-7782-2695-1. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/118099 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

Internet resources

1. http://elibrary.nstu.ru/

2. https://e.lanbook.com/

3. http://www.iprbookshop.ru/

4. http://znanium.com/

5. Родыгина, С. В. Проектирование и эксплуатация систем электроснабжения. Передача, распределение, преобразование электрической энергии : учебное пособие / С. В. Родыгина. – Новосибирск : Изд-во НГТУ, 2017. – 72 с. – Текст : электронный // AvidReaders.ru : сайт. – URL: https://avidreaders.ru/book/proektirovanie-i-ekspluataciya-sistem-elektrosnabzheniya-peredacha.html (дата обращения: 15.02.2021).

6. Издательство «Лань» [Электронный ресурс] : электронно-библиотечная система. - [Россия], 2010. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

Methodical support and software

Methodological support

1. Электроснабжение потребителей и режимы. Лабораторный практикум : учебно-методическое пособие / составители В. М. Завьялов [и др.]. — Томск : ТПУ, 2017. — 122 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/106740 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

2. Электроснабжение потребителей и режимы. Лабораторный практикум : учебно-методическое пособие / составители В. М. Завьялов [и др.]. — Томск : ТПУ, 2017. — 122 с. — Текст : электронный // Лань : электронно-библиотечная система. — URL: https://e.lanbook.com/book/106740 (дата обращения: 23.02.2021). — Режим доступа: для авториз. пользователей.

3. Родыгина С. В. Проектирование и эксплуатация систем электроснабжения : учебно-методическое пособие / С. В. Родыгина, Д. А. Павлюченко ; Новосиб. гос. техн. ун-т. - Новосибирск, 2017. - 45, [1] с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000236136

4. Родыгина С. В. Проектирование и эксплуатация СЭС [Электронный ресурс] : электронный учебно-методический комплекс [для ЗО] / С. В. Родыгина ; Новосиб. гос. техн. ун-т. - Новосибирск, [2015]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000221652. - Загл. с экрана.

5. Проектирование и эксплуатация систем электроснабжения : методические указания к выполнению расчетно-графического задания "Проектирование и эксплуатация СЭС" для ФЭН направления магистерской подготовки 13.04.02 "Электроэнергетика и электротехника" / Новосиб. гос. техн. ун-т ; [сост.: С. В. Родыгина, Д. А. Павлюченко]. - Новосибирск, 2016. - 30, [1] с. : табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000229165

6. Электропитающие системы и электрические сети : методические указания к выполнению лабораторных работ для ФЭН (специальность 140211 - Электроснабжение) / Новосиб. гос. техн. ун-т ; [сост.: Д. А. Павлюченко, С. В. Хохлова]. - Новосибирск, 2006. - 51 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000059931

7. Электропитающие системы и электрические сети : методические указания к выполнению расчетно-графического задания для ФЭН (специальность 140211 "Электроснабжение" / Новосиб. гос. техн. ун-т ; [сост. Д. А. Павлюченко, С. В. Хохлова]. - Новосибирск, 2007. - 26, [1] с. : табл., схемы. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000070194

Specialized software

1 Microsoft Office Application Pack

2 on the analysis of electro-energy systems NEPLAN AG NEPLAN 360 Web Student Version

ANNOTATION OF THE PROGRAM
Special Issues of Power Supply

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	29
4	Lectures, hours	18
5	Practical lessons, hours	0
6	Laboratory studies, hours	0
7	of them in an active and interactive form, hours	0
8	Consultations, hours	9
9	Independent work, hours	115

External requirements

Creative a critical analysis of problematic situations based on a systematic approach, to develop a strategy of actions; *regarding the following learning results*:
analyzes the problem situation and makes it decomposition for individual tasks .
Associates to apply modern communicative technologies, including in foreign language (s), for academic and professional interaction; *regarding the following learning results*:
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
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
analyzes the problem situation and makes it decomposition for individual tasks .	
1. Basic concepts for electromogtor compatibility	Lections; Independent work
performs academic and professional Interaction, including in a foreign language	
2. on electromagnetic interaction of the system "Power supply network - Electrical Acceptor"	Lections; Independent work

translates academic texts (abstracts, annotations, reviews, articles, etc.) from a foreign language or a foreign language	
3. Basic requirements of GOST 32144-2013, as well as foreign guests for the quality of electricity	Lections; Independent work
demonstrates knowledge of objects of professional activity	
4. Be able to ensure the compatibility of the electrical receiving and the power supply systems with the external environment	Lections; Independent work
analyzes serial objects of professional activity	
5. about the conductive electromagnetic interference	Lections

Content and structure of the discipline

Table 3.1

Themes	Active forms, hours	Hours	Links to learning results
Semester: 2			
Didactic unit: General presentation and basic concepts of electromagomy compatibility			
1. Digitalization and electromagnetic compatibility		2	1, 5
Didactic unit: An idea of ??GOSTs			
2. Comparative assessment of the reliability of two different connection schemes		3	3
Didactic unit: Conductive electromagnetic interference			
3. What is conductive electromagnetic interference		3	5
Didactic unit: Modern means of reducing noise immunity			
4. Automation of technological processes and analysis of the quality analysis tool		3	4
Didactic unit: External and internal sources of interference			
5. External and internal interference sources and ranges of their parameters		3	2, 5
Didactic unit: Mechanisms of electromagnetic phenomena			
6. Mechanisms of electromagnetic phenomena and measures to reduce them		2	1, 2, 3
Didactic unit: The concept of noise immunity			
7. Noise immunity of various automation devices		2	2, 3, 4, 5

Literary sources

Main literature

1. Куклин О. Г. Элементы устройств силовой электроники [Электронный ресурс] : конспект лекций / О. Г. Куклин ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000236169. - Загл. с экрана.

2. Энергосберегающие технологии в транспортном электротехническом комплексе : монография / Новосиб. гос. техн. ун-т ; [Н. И. Щуров и др. ; под ред. В. В. Бирюкова]. - Новосибирск, 2020. - 159, [2] с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243316

Additional literature

1. Овсянников А. Г. Электромагнитная совместимость в электроэнергетике : учебник / А. Г. Овсянников, Р. К. Борисов. - Новосибирск, 2011. - 196 с. : ил., табл.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000170479

2. Овсянников А. Г. Электромагнитная совместимость в электроэнергетике : [учебник] / А. Г. Овсянников, Р. К. Борисов. - Новосибирск, 2010. - 196 с. : ил.. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000141941

Internet resources

1. Атабеков Г. И. Теоретические основы электротехники. Линейные электрические цепи [Электронный ресурс] : учеб. пособие / Г. И. Атабеков. - 7-е изд. — Санкт-Петербург : изд-во «Лань», 2009. — 592 с. - Режим доступа: http://e.lanbook.com. - Загл. с экрана.

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

3. Шаншуров Г. А. Специальные электрические машины [Электронный ресурс] : электронный учебно-методический комплекс / Г. А. Шаншуров, Т. В. Дружинина, А. Г. Приступ ; Новосиб. гос. техн. ун-т. - Режим доступа: http:// http://dispace.edu.nstu.ru/didesk/course/show/5236. - Загл. с экрана.

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

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

6. http://znanium.com/

Methodical support and software

Methodological support

1. Мюльбаер А. А. Электромагнитная совместимость в электроэнергетике. Теория и практика [Электронный ресурс] : электронный учебно-методический комплекс / А. А. Мюльбаер, Н. А. Черненко, Ю. В. Целебровский, С. С. Шевченко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2021]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243558. - Загл. с экрана.

2. Электромагнитная совместимость в электроэнергетике [Электронный ресурс] : электронный учебно-методический комплекс / Н. А. Черненко, А. А. Мюльбаер, Ю. В. Целебровский, С. С. Шевченко ; Новосиб. гос. техн. ун-т. - Новосибирск, [2020]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000243365. - Загл. с экрана.

3. Мятеж Т. В. Энергоснабжение (Power Supply) [Электронный ресурс] : электронный учебно-методический комплекс / Т. В. Мятеж, О. С. Атаманова, В. Я. Ольховский ; Новосиб. гос. техн. ун-т. - Новосибирск, [2017]. - Режим доступа: http://elibrary.nstu.ru/source?bib_id=vtls000234481. - Загл. с экрана.

Specialized software

Использование специализированного программного обеспечения для изучения дисциплины не требуется