NON-P JOINT STOCK COMPANY
ABYLKAS SAGINOV KARAGANDA TECHNICAL UNIVERSITY

THE PROGRAM
OF ENTRANCE EXAM

For admission to doctoral studies
Educational program 8D07104 - "Electric Power"

Department: «Automation of manufacturing processes»

Compeled by:
Yugay V.V., head of the department, Ph.D.
Ivanov V.A., acting associate professor, Ph.D.

Karaganda 2024

1. List of disciplines of the entrance exam according to the educational program 8D07103"Electric power industry"

Item no.	Name of disciplines within the framework of the Curriculum Programs 7M07107 “Power engineering”. 7M07101 “Automation and control”	Number of loans in Curriculum Program 7M07107 Number of questions	Recom-mended reading
1	**Module 1 "Modern problems of electric power industry»** Disciplines: 1. “Energy-saving technologies in electric power and automation”; 2. “Non-traditional and renewable energy sources.”	5/5/5 38	Questions 1-11: [1,…4]; Questions 12-30: 5,…,8]; Questions 31-40: [9,…,22];
2	**Module 2 “Scientific and technical problems of energy”.** Disciplines: 1. “Theory of experiment”; 2. “Electric drive control systems”; 3. “Modeling of electric drives.”	5/5/5 43	Questions 1-50: [23,…,31]
3	**Module 3 “Programming industrial controllers”.** Disciplines: 1. “Programming industrial controllers.” **"Design of electric drive systems."** Disciplines: 1. “Modern theories, methods and means of creating automation and control systems”; 2. “Automation of electrical complexes of mining and metallurgical production”;	5/5/5 48	Questions 1-30: [32, 33, 34] Questions 31-42: [1,35,,39] Questions 43-50: [1,6, 27, 32,36,39, 42]

1. **Module 1 "Modern Problems of the Electric Power Industry".**

###1.
Classification of electrical complexes and electrical systems.
###2.
The concept of "Electric power engineering". Objects of analysis and research in the specialty "Electric power engineering". Electrical engineering complexes. Electrical engineering systems.
###3.
Ways and technologies of utilizing electrical energy.
###4.
Methods and technologies of power transmission.

###5.
Theoretical foundations of electrical engineering. Methods of calculation of alternating current circuits.
###6.
Theoretical foundations of electrical engineering. Calculation methods for DC circuits.
###7.
Theoretical foundations of electrical engineering. Transients in electric circuits.
###8.
Theoretical foundations of electrical engineering. Principles of operation and regularities of conversion of electrical energy into mechanical energy. Electric motors.
###9.
Theoretical fundamentals of electrical engineering. Three-phase circuits and systems. Principle of operation of asynchronous electric motors.
###10.
Theoretical foundations of electrical engineering. Electromagnetic induction. Principles of action and regularities of conversion of mechanical energy into electrical energy. Electric generators.
###11.
Conventional electric power generation technologies.
###12.
Automation of technological processes on the basis of frequency-controlled electric drive as a means of resource and energy saving. The main ways to increase the energy efficiency of electric drives.
###13.
Active and reactive power balance in an electrical system.
###14.
Effect of power quality on the performance of electrical receptors.
###15.
Classification of renewable sources of electrical energy.
###16.
Electricity quality control. Automated systems of metering and parameters of electricity consumption.
###17.
Features of solid-state frequency converters.
###18.
Principles of utilizing solar energy for electrical power generation.
###19.
Ways to reduce power consumption when using electric drives.
###20.
Ways and technical means of ensuring power quality.
###21.
Means of measurement of power quality indicators.
###22.
Types of adjustable asynchronous electric drives and their energy performance.
###23.
Characterization of power quality. The influence of the network on the propagation of conductive interference.

###24.
Energy efficiency of asynchronous electric drives of fans and turbochargers.
###25.
Energy efficiency of asynchronous electric drives of kinematically coupled electric drives.
###26.
Energy efficiency of asynchronous electric drives of conveyors and conveyors.
###27.
Energy efficiency of asynchronous electric drives of reciprocating machines.
###28.
Energy efficiency of asynchronous electric drives of centrifugal pumps.
###29.
Energy efficiency of arc steelmaking furnace control.
###30.
Efficiency of conversion systems in housing and communal facilities.
###31.
Principles of electric power generation based on hydrogen energy.
###32.
Principles of utilization of biological waste for electricity generation.
###33.
Principles of utilizing geothermal energy for electrical power generation.
###34.
Principles of utilizing marine tides for electrical power generation.
###35.
Principles of using fusion to generate electrical energy.
###36.
Principles of utilizing wind energy for electrical power generation.
###37.
Principles of using nuclear fission energy to generate electrical energy.
###38.
Principles of construction of energy storage devices when using non-conventional sources of electric energy.

References

1. Elektrotekhnicheskij spravochnik. V 3 tomah. T. 1. Obshchie voprosy. Elektrotekhnicheskie materialy./Pod obshchej redakciej professorov MEI: I.N. Orlova (gl. red.) i dr.- 7-e izd., isp. i dop.. – M.: Energoatomizdat, 1988, –616 p.

2. Popov V.S. Teoreticheskaya elektrotekhnika. – M.: Energiya, 1978. –560 p.

3. Shimoni K. Teoreticheskaya elektrotekhnika. – M.: Mir, 1964. – 774 p.

4. Andre Ango. Matematika dlya elektro i radioinzhenerov. – M.: Nauka, 1967. – 778 p.

5. Upravlenie kachestvom elektroenergii / I.I. Kartashev, V.N. Tulskij, R.G. Shamonov i dr.; pod red. Yu.V. Sharova. – M.: – Publ. MEI, 2006. – 320 p.

6. O metrologii sinhronnyh izmerenij elektricheskoj energii i moshchnosti v cifrovyh ASKUE [Tekst] / A. L. Gurtovcev // Promyshlennaya energetika. - 2009. - no.10. - pp. 11-22.

7. Braslavskij I.Ya. Energosberegayushchij asinhronnyj elektroprivod/ I.Ya.Braslavskij, Z.Sh. Ishmatov, V.N. Polyakov. Pod red. I.Ya. Braslavskogo, – M.: – Publ. centr «Akademiya», 2004. – 256 p.

8. Avdeev L.A. Energosberegayushchie tekhnologij v ugolnyh shahtah. – Karaganda: KarGTU Publ., 2018. – 100 p.

9. Bolotov A.V., Shepel G.A. Elektrotekhnologicheskie ustanovki. - M.: Publ."Vysshaya shkola", 1988. - 336 p.

10. Bezrukih P.P., Bezrukih P.P.(ml.) Chto mozhet dat energiya vetra? Energiya: ekono-mika, tekhnika. // Ekologiya. - M.: 2000.- no.1.- pp. 11 - 24.

11. Vozobnovlyaemaya energiya. Ezhekvartalnyj informacionnyj byulleten. – M.: Intersolarcentr Publ.

12. Gerasimenko A.A., Fedin V.T. Peredacha i raspredelenie elektricheskoj energii. – Rostov na Donu:. «Feniks» Publ. 2006.

13. Lykin L.V. Elektricheskie seti i sistemy. M.: Logos. 2007.

14. Zhelezko Yu.S., Artemev A.V., Savchenko O.V. Raschet, analiz i normirovanie poter elektroenergii v elektricheskih setyah. M.: NC ENAS Publ., 2006.

15. Bolotov A.V. Sokolov S.L. Bolotov S.L. Razvitie vetroenergetiki Respubliki Kazahstan, energeticheskie sistemy elektrosnabzheniya avtonomnyh obektov, // Vestnik Almatinskogo instituta energetiki i svyazi, Almaty: – 2009. - no.3, pp. 3 – 19.

16. Bolotov A.V., Bolotov S.A. K programme razvitiya vetroenergetiki Kazahstana. // Energetika i toplivnye resursy Kazahstana, Almaty: – 2009. – no.1. pp 33 - 37.

17. Bolotov A.V. Sidelkovskij V.S., Bolotov s.A. Tendencii razvitiya vetroenerge-tiki v mire. //Vestnik Nacionalnoj inzhenernoj akademii Respubliki Kazahstan, no. 4 (18) ISSN 1606-146H, str.78- 84

18. Bezrukih P.P., Bezrukih P.P. (ml.) Chto mozhet dat energiya vetra? Energiya: ekono-mika, tekhnika. /Ekologiya . - M.: 2000. - No.1. - pp. 11-24.

19. Energetika i toplivnye resursy Kazahstana. Otraslevoj zhurnal. Izdatel OAO «KazNIIenergegetiki» im. akademika Sh.Ch. Chokina. Almaty.

20. Vozobnovlyaemaya energiya. Ezhekvartalnyj informacionnyj byulleten. Izdanie Rossijskogo centra solnechnoj energii. OPET SNG. Moskow: Publ. "Intersolarcentr"

21. Gerasimenko A.L., Fedin VT. Peredacha i raspredelenie elektricheskoj energii. Rostov na Donu: Publ. «Feniks» 2006.

22. Tyoldeshi Yu., Lesny Yu. Mir ishchet energiyu: Per. so slovackogo/ M.: Mir, 1981. – 439 p.

23. Feshin B.N. Kompyuternoe modelirovanie i identifikaciya elektrotekhnicheskih kompleksov: Ucheb. posobie. Chast 1 / Yu.F. Bulatbaeva, G.S. Nurmagambetova, Sh.Z. Telbaeva, G.I. Parshina, B.N. Feshin; Karagandinskij gosudarstvennyj tekhnicheskij universitet. – Karaganda: KarGTU Publ., 2010. – 98 p.

24. Feshin B.N. Kompyuternoe modelirovanie i identifikaciya elektrotekhnicheskih kompleksov: Ucheb. posobie. Chast 2 / Yu.F. Bulatbaeva, G.S. Nurmagambetova, Sh.Z. Telbaeva, G.I. Parshina, B.N. Feshin; Karagandinskij gosudarstvennyj tekhnicheskij universitet. – Karaganda: Izd-vo KarGTU, 2010. – 86 p.

25. Feshin B.N. Kompyuternoe modelirovanie i identifikaciya elektrotekhnicheskih kompleksov: Ucheb. posobie. Chast 3 / Yu.F. Bulatbaeva, G.S. Nurmagambetova, Sh.Z. Telbaeva, G.I. Parshina, B.N. Feshin; Karagandinskij gosudarstvennyj tekhnicheskij universitet. – Karaganda: Izd-vo KarGTU, 2010. – 64 p.

26. Brejdo I.V., Feshin B.N. Imitacionnoe modelirovanie i parametricheskaya optimizaciya avtomatizirovannyh elektroprivodov. ; Karagandinskij gosudarstvennyj tekhnicheskij universitet. – Karaganda: Izd-vo KarGTU, 2003. – 130 p.

27. Inzhiniring elektroprivodov i sistem avtomatizacii /M.P. Belov i dr. ; pod red. V.A. Novikova, L.M. Chernigova. M. Izdatelskij centr «Akademiya», 2006. – 368 p.

28. Dombrovskij V.V., Zajchik V.M. Asinhronnye mashiny: Teoriya, raschet, elementy proektirovaniya. – L.: Energoatomizdat. Leningr. otd-nie, 2009. – 368 p.

29. Limonov L.G. avtomatizirovannyj elektroprivod promyshlennyh mekhanizmov. – Harkov: - Izd-vo «FORD», 2009. -272 p.

30. Sistemy avtomatizirovannogo upravleniya elektroprivodami /G.I. Gulkov i dr.– Minsk: Novoe znanie , 2007. – 395 p.

31. Terekhin V.B. Kompyuternoe modelirovanie sistem elektroprivoda postoyannogo i peremennogo toka v Simulink: uchebnoe posobie /V.B. Terekhin, Yu.N. Dementev: Tomskij politekhnicheskij universitet. – Tomsk: Izd-vo Tomskogo politekhnicheskogo universiteta, 2015. – 307 p.

32. Yazyki programmirovaniya promyshlennyh logicheskih kontrollerov standarta IEC 61131-3 [Tekst]: uchebnoe posobie prednaznacheno dlya izucheniya disciplin \"Promyshlennye kontrollery\", \"Prikladnoe programmnoe obespechenie sistem upravleniya\" / E. V. Andreev [i dr.] ; M-vo obrazovaniya i nauki RK, Karagandinskij gosudarstvennyj tekhnicheskij universitet. - Karaganda: KarGTU, 2008. - 64 p.

33. Feshin B.N. Sistemy operativno-dispetcherskogo upravleniya avtomatizirovannyh tekhnologicheskih kompleksov : Ucheb. posobie. / B.N. Feshin, G.I. Parshina, ; Karagandinskij gosudarstvennyj tekhnicheskij universitet. – Karaganda: Izd-vo KarGTU, 2017. – 97 p.

34. Feshin B.N. Sistemy upravleniya i kontrolya avtomatizirovannyh tekhnologicheskih kompleksov : Chast 1. Ucheb. posobie. / B.N. Feshin, K.M. Tohmetova; Karagandinskij gosudarstvennyj tekhnicheskij universitet. – Karaganda: Izd-vo KarGTU, 2017. – 107 p.

35. Spravochnik po avtomatizirovannomu elektroprivodu / Pod red. V.A. Eliseeva i A.V. Shinyanskogo. – M.: Energoatomizdat, 1983. – 616 p.

36. Avtomatizirovannyj elektroprivod tipovyh proizvodstvennyh mekhanizmov i tekhnologicheskih kompleksov/Belov M.P., Novikov V.A., Rassudov L.N.- M.: Akademiya, 2004. – 576 p.

37. Basharin A.V., Novikov V.A., Sokolovskij G.G. Upravlenie elektroprivodami. – L.: Energoizdat, 1982.- 391 p.

38. Brejdo I.V., LapinaL.M., Sistemy upravleniya elektroprivodami: – Karaganda: KarGTU. – 2006. – 64 p.

39. Elektrotekhnicheskij spravochnik. V 3 t. T.3: Kn.2. Ispolzovanie elektricheskoj energii/ Pod red. I.N.Orlova– M.: Energoatomizdat, 1988. – 616 p.

40. Moskalenko V.V. Sistemy avtomatizirovannogo upravleniya elektroprivoda.- M.: INFRA-M, 2004. – 208 p.

41. Dorf R. Bishop R. Sovremennye sistemy upravleniya: - M.: Laboratoriya Bazovyh znanij, 2002.- 832 p.

42. Dyakonov V.V. Kompyuternoe upravlenie tekhnologicheskim processom eksperimentom, oborudovaniem. - M.: Goryachaya liniya -Telekom, 2009.- 608 p.

2. Module 2"Scientific and technical problems of energy".

###1.

Mathematical modeling as a means of cognition and analysis of technical systems. Purpose, types and functions of models.

###2.

Mathematical models, mathematical modeling, basic concepts and definitions.

###3.

Problems of studying electrical systems using mathematical and simulation modeling methods.

###4.

Identification. Basic concepts and definitions. Mathematical foundations for modeling dynamic systems.

###5.

Features of technological processes as objects of modeling and identification.

###6.

Concepts about methods for identifying technical systems in static modes.

###7.

Concepts about methods for identifying technical systems in dynamic modes.

###8.

Methods for obtaining and forms of presentation of mathematical models of dynamic systems (using examples of a DC motor with an independent field winding.
###9.
Algorithms and software for solving problems of modeling dynamic systems on a PC.
###10.
Mathematical modeling of dynamic systems in the WINDOWS environment in the algorithmic language TURBO-BASIC.
###11.
Modeling of dynamic systems by the method of reducing the order of the derivative in the environment of problem-oriented application software packages.
###12.
MATLAB-SIMULINK software system. MATLAB PPP extensions for identifying dynamic objects and systems.
###13.
MATLAB PPP extensions for the study of electrical objects and systems. Simulink library - prototypes of electrical blocks.
###14.
Features of modeling power electronics circuits. Circuit modeling software systems Proteus and Multisim.
###15.
Symbolic modeling software system MathCAD.
###16.
Adaptive systems for automatic control of technical objects with modeling and identification contours.
###17.
Adaptive automatic control systems with model identification based on monitoring results using SCADA systems.
###18.
Design diagrams of an automated electric drive. Basic equation of motion of an electric drive.
###19.
Design diagrams of the mechanical part of the electric drive. Typical static loads of an electric drive.
###20.
Dynamic processes in the mechanical part of the electric drive.
###21.
Classification of automatic control system of electric drive and automated control system of electric drive.
###22.
Relay control systems for electric drives.
###23.
Principles of constructing automatic control systems for adjustable electric drives.
###24.
Basic design parameters of DC motors in automated electric drive systems.
###25.
Mathematical models of DC motors.
###26.
Typical circuits of an automated DC electric drive.
###27.
Irreversible electric drive TPD.
###28.
Mathematical modeling of elements and systems of automated AC electric drive.
###29.

Principles of construction of automated AC electric drive systems.
###30.
Parametric optimization of dynamic systems.
###31.
Methodology for planning full factorial experiments and steep ascent in the direction of the antigradient of the goal function.
###32.
Stages of design and composition of projects of electric drives and automation systems.
###33.
Technical means of automated electric drive systems.
###34.
Calculation of operating modes and selection of automated electric drives.
###35.
Software for automated electric drives.
###36.
Technical means of automation systems.
###37.
Automation systems software.
###38.
Technologies for increasing the reliability of automated electric drive and automation systems.
###39.
Technologies for designing automated electric drives and automation systems.
###40
Technologies for carrying out installation, commissioning, and operational work with automated electric drives and process automation systems.
###41.
Concept of integrated technologies for creating electric power systems. Complete DC electric drives.
###42.
Concept of integrated technologies for creating electric power systems. Complete AC electric drives.
###43.
Electromechanical and electrical complexes as components of integrated automation systems.

References

1. Elektrotekhnicheskij spravochnik. V 3 tomakh. T. 1. Obshchie voprosy. Elektrotekhnicheskie materjaly./Pod obshchei redaktsiei professorov MEI: I.N. Orlova (gl. red.) i dr.- 7-e izd., isp. i dop.. Moskow: Energoatomizdat, 1988, 616 p.

2. Popov V.S. Teoreticheskaja elektrotekhnika. Moskow: Energija, 1978. 560 p.

3. SHimoni K. Teoreticheskaja elektrotekhnika. Moskow: Mir, 1964. 774 p.

4. Andre Ango. Matematika dlja elektro i radioinzhenerov. Moskow: Nauka, 1967. 778 p.

5. Upravlenie kachestvom elektroenergij / I.I. Kartashev, V.N. Tulskij, R.G. Shamonov i dr.; pod red. IU.V. SHarova. MoskowPubl. MEI, 2006. 320 p.

6. O metrology sinkhronnykh izmerenij elektricheskoj energii i moshchnosti v tsifrovykh ASKUE [Tekst] / A. L. Gurtovtsev // Promyshlennaja energetika. 2009. No.10. pp. 11-22.

7. Braslavskij I.IA. Energosberegaiushchij asinkhronnyi elektroprivod / I.IA.Braslavskij, Z.SH. Ishmatov, V.N. Poljakov. Pod red. I.IA.Braslavskogo, Moskow: Publ. tsentr «Akademija», 2004. 256 p.

8. Avdeev L.A. Energosberegaiushchie tekhnologij v ugolnykh shakhtakh. – Karaganda: Publ.KarGTU, 2018. – 100s.

9. Bolotov A.V., SHepel G.A. Elektrotekhnologicheskie ustanovki. - Moskow: "Vysshaja shko-la", 1988. - 336 p.

10. Bezrukikh P.P., Bezrukikh P.P.(ml.) CHto mozhet dat energija vetra? Energija: ekono-mika, tekhnika. // Ekologija. - Moskow: 2000. no.1. pp. 11 - 24.

11. Vozobnovljaemaja energija. Ezhekvartalnyi informatsionnyi biulleten. Izda-nie Rossijskogo tsentra solnechnoi energij. OPET SNG. - Moskow: "Intersopartsentr.

12. Gerasimenko A.A., Fedin V.T. Peredacha i raspredelenie elektricheskoi energij. Rostov na Donu: Publ. «Feniks» 2006.

13. Lykin L.V. Elektricheskie seti i sistemy. Moskow: Logos. 2007.

14. ZHelezko IU.S., Artemev A.V., Savchenko O.V. Raschet, analiz i normirovanie po-ter elektroenergij v elektricheskikh setjakh. Moskow: «Izd. NTS ENAS», 2006.

15. Bolotov A.V. Sokolov S.L. Bolotov S.L. Razvitie vetroenergetiki Respubliki Kazakhstan, energeticheskie sistemy elektrosnabzhenija avtonomnykh obektov, Vestnik Almatinskogo instituta energetiki i svjazi, no.3, 2009, pp. 19-23.

16. Bolotov A.V., Bolotov S.A. K programme razvitija vetroenergetiki Kazakhstana. Energetika i toplivnye resursy Kazakhstana, - Almaty: 2009. No.1, pp. 22 - 37.

17. Bolotov A.V. Sidelkovskij V.S., Bolotov p.A. Tendentsij razvitija vetroenerge-tiki v mire. Vestnik Natsionalnoi inzhenernoi akademij Respubliki Kazakhstan, - Almaty: 2009. No.4 (18), pp.78- 84

18. Bezrukikh P.P., Bezrukikh P.P. (ml.) CHto mozhet dat energija vetra? Energija: ekono-mika, tekhnika. /Ekologija . - Moskow: No.1 2000. pp. 11-24.

19. Energetika i toplivnye resursy Kazakhstana. Otraslevoi zhurnal. Publ. OAO «KazNIIenergegetiki» im. akademika SH.CH. Chokina. Almaty:.

20. Vozobnovljaemaja energija. Ezhekvartalnyi informatsionnyi biulleten. – Moskow: "Intersolartsentr"

21. Gerasimenko A.L., Fedin VT. Peredacha i raspredelenie elektricheskoi energij. Rostov na Donu: Publ. «Feniks» 2006.

22. Teldeshi IU., Lesny IU. Mir ishchet energiju: Per. so slovatskogo/ Moskow: Mir, 1981. – 439 p.

23. Feshin B.N. Kompiuternoe modelirovanie i identifikatsija elektrotekhnicheskikh kompleksov: Ucheb. posobie. Vol. 1 / IU.F. Bulatbaeva, G.S. Nurmagambetova, SH.Z. Telbaeva, G.I. Parshina, B.N. Feshin. – Karaganda: Publ. Kar GTU, 2010. – 98 p.

24. Feshin B.N. Kompiuternoe modelirovanie i identifikatsija elektrotekhnicheskikh kompleksov: Ucheb. posobie. Vol. 2 / IU.F. Bulatbaeva, G.S. Nurmagambetova, SH.Z. Telbaeva, G.I. Parshina, B.N. Feshin. – Karaganda: Publ. Kar GTU, 2010. – 86 p.

25. Feshin B.N. Kompiuternoe modelirovanie i identifikatsija elektrotekhnicheskikh kompleksov: Ucheb. posobie. Vol. 3 / IU.F. Bulatbaeva, G.S. Nurmagambetova, SH.Z. Telbaeva, G.I. Parshina, B.N. Feshin. – Karaganda: Publ. Kar GTU, 2010. – 64 p.

26. Breido I.V., Feshin B.N. Imitatsionnoe modelirovanie i parametricheskaja optimizatsija avtomatizirovannykh elektroprivodov. – Karaganda: Publ. Kar GTU, 2003. – 130 p.

27. Belov et al. Inzhiniring elektroprivodov i sistem avtomatizacii / pod red. V.A. Novikova, Moskow Publ. centr «Akademiya», 2006. 368 p.

28. Dombrovskij V.V., Zajchik V.Moskow Asinxronnye mashiny: Teoriya, raschet, elementy proektirovaniya. L.: Energoatomizdat. Leningr. otd-nie, 1900. 368 p.

29. Limonov L.G. Avtomatizirovannyj elektroprivod promyshlennyh mexanizmov. – Harkov: - Publ. «FORD», 2009. -272 p.

30. Gulkov G.I. et al. Sistemy avtomatizirovannogo upravleniya elektroprivodami /. Minsk: Novoe znanie. 2007. 395 p.

31. Terexin V.B. Kompyuternoe modelirovanie sistem elektroprivoda postoyannogo i peremennogo toka v Simulink: uchebnoe posobie /V.B. Terexin, Yu.N. Dementev: Tomskij politexnicheskij universitet. – Tomsk: Publ. Tomskogo politexnicheskogo universiteta, 2015. 307 p.

32. Andreev E. V. et al. Yazyki programmirovaniya promyshlennyx logicheskix kontrollerov standarta IEC 61131-3 [Tekst]: uchebnoe posobie prednaznacheno dlya izucheniya disciplin "Promyshlennye kontrollery", "Prikladnoe programmnoe obespechenie sistem upravleniya. - Karaganda:Publ. Kar GTU, 2008. 64 p.

33. Feshin B.N. Sistemy operativno-dispetcherskogo upravleniya avtomatizirovannyx texnologicheskix kompleksov : Ucheb. posobie. / B.N. Feshin, G.I. Parshina, – Karaganda: Publ. Kar GTU, 2017. – 97s.

34. Feshin B.N. Sistemy upravleniya i kontrolya avtomatizirovannyx texnologicheskix kompleksov : Chast 1. Ucheb. posobie. / B.N. Feshin, K. M. Toxmetova. – Karaganda: Publ. Kar GTU, 2017. – 107 p.

35. Spravochnik po avtomatizirovannomu elektroprivodu / Pod red. V.A. Eliseeva i A.V. Shinyanskogo. – Moskow: Energoatomizdat, 1983. – 616 p.

36. Avtomatizirovannyj elektroprivod tipovyn proizvodstvennyn mexanizmov i texnologicheskix kompleksov/Belov M.P., Novikov V.A., Rassudov L.N.- Moskow: Akademiya, 2004. – 576 p.

37. Basharin A.V., Novikov V.A., Sokolovskij G.G. Upravlenie elektroprivodami. – Leningrad: Energoizdat, 1982. 391 p.

38. Brejdo I.V., LapinaL.Moskow, Sistemy upravleniya elektroprivodami: Ucheb.posobie / .- Karaganda: Kar GTU, 2006. 64 p.

39. Elektrotexnicheskij spravochnik. V 3 tomah. T.3: Kn.2. Ispolzovanie elektricheskoj energii/ Pod red. I.N.Orlova– Moskow: Energoatomizdat, 1988. – 616 p.

40. Moskalenko V.V. Sistemy avtomatizirovannogo upravleniya elektroprivoda.- Moskow: INFRA-M, 2004. – 208 p.

41. Dorf R. Bishop R. Sovremennye sistemy upravleniya. - Moskow: Laboratoriya Bazovyx znanij, 2002. 832 p.

42. Dyakonov V.V. Kompyuternoe upravlenie texnologicheskim processom eksperi-mentom, oborudovaniem. - Moskow: Goryachaya liniya -Telekom, 2009. 608 p.

Module 3 “Programming of industrial controllers”, “Design of electric drive systems”.

###1.
Operation of industrial logic controllers with analog input signals, standard input signal ranges.
###2.
ESC 61131-3 standard, general information about programming languages for industrial controllers.
###3.
Language FBD (functional block diagrams), LAD (relay automatics).
###4.
Structure of a modern industrial controller.
###5.
Interfaces of industrial controllers.
###6.
Types of inputs and outputs of industrial controllers.
###7.
Performance of industrial logic controllers.
###8.
Physical interfaces of industrial networks.
###9.
Standardization of signals. Operating conditions for industrial logic controllers.
###10.
The main differences between an industrial computer and industrial controllers.

###11.
Basic requirements for industrial logic controllers.
###12.
Distributed control systems with industrial logic controllers.
###13.
Structural design of industrial logic controllers.
###14.
Programmable controller SIEMENS Simatic S7-300. Nomenclature, composition of modules.
###15.
Degrees of protection of industrial logic controller housings.
###16.
IBM-compatible logic controllers.
###17.
Standard interfaces RS-232, RS-422, RS-485.
###18.
Real-time modes and restrictions on the use of industrial logic controllers.
###19.
Industrial networks.
###20.
The main disadvantages of control systems based on PC (personal computers).
###21.
Features of unified current signals.
###22.
LD programming language.
###23.
AC current measurement modules.
###24.
Standardization of input signals of industrial logic controllers.
###25.
Direct current measurement modules.
###26.
Industrial networks, their features and main differences from office networks.
###27.
The main advantages and disadvantages of serial data transmission.
###28.
Historical review, current state and prospects for the development of equipment for electrical complexes (EEC).
###29.
Purpose and classification of components of equipment of electrical complexes and requirements for them.
###30.
Power switching equipment.
###31.
Controlled power converters of electrical energy as elements of equipment of electrical complexes.
###32.
Electromechanical energy converters.
###33.
Classification and general characteristics of sensors in an electric drive.
###34.
Equipment for protection and signaling circuits.
###35.

Electrical, mechanical, thermal and structural calculations of insulating structures.

###36.

Technical characteristics of cables and wires.

###37.

Protective protection against electrical corrosion.

###38.

Power cables up to 1000 V, types, design, scope.

###39.

High-voltage cables (over 1000 V), types, design, scope of application

###40.

Digital communications in the management of electric power facilities. Information and communications.

###41.

Digital communications in the management of electric power facilities. Model of the communication process.

###42.

Digital communications in the management of electric power facilities.

###43.

Communications in technical process management.

###44.

Digital communications in the management of electric power facilities. Hierarchical structure of technical processes.

###45.

Digital communications in the management of electric power facilities. Protocols of automated electrical power facilities.

###46.

System integration in the electric power industry. Integration of electric power systems.

###47.

System integration in the electric power industry. Levels of integration.

###48.

System integration in the electric power industry. Selecting the level of integration.

References.

1. Elektrotexnicheskij spravochnik. V 3 tomax. T. 1. Obshhie voprosy. Elektrotexnicheskie materialy./Pod obshhej redakciej professorov MEI: I.N. Orlova (gl. red.) i dr.- 7-e izd., isp. i dop.. Moskow: Energoatomizdat, 1988, 616 p.

2. Popov V.S. Teoreticheskaya elektrotexnika. Moskow: Energiya, 1978. 560 p.

3. Shimoni K. Teoreticheskaya elektrotexnika. Moskow: Mir, 1964. 774 p.

4. Andre Ango. Matematika dlya elektro i radioinzhenerov. Moskow, Nauka, 1967. 778 p.

5. Upravlenie kachestvom elektroenergii / I.I. Kartashev, V.N. Tulskij, R.G. Shamo-nov i dr.; pod red. Yu.V. Sharova. Moskow: Izdatelskij dom MEI, 2006. 320 p.

6. O metrologii sinxronnyx izmerenij elektricheskoj energii i moshhnosti v cifro-vyx ASKUE [Tekst] / A. L. Gurtovcev . Promyshlennaya energetika. - 2009. - N 10. - pp. 11-22.

7. Braslavskij I.Ya. Energosberegayushhij asinxronnyj elektroprivod/ I.Ya.Braslavskij, Z.Sh. Ishmatov, V.N. Polyakov. Pod red. I.Ya.Braslavskogo, Moskow: Publ. centr «Akademiya», 2004. 256 p.

8. Avdeev L.A. Energosberegayushhie texnologii v ugolnyx shaxtax. – Karaganda: Publ. KarGTU, 2018. 100 p.

9. Bolotov A.V., Shepel G.A. Elektrotexnologicheskie ustanovki. - Moskow: Publ. "Vysshaya shkola", 1988. - 336 p.

10. Bezrukix P.P., Bezrukix P.P.(ml.) Chto mozhet dat energiya vetra? Energiya: ekonomika, texnika. . - Moskow: Ekologiya. 2000. no.1. pp. 11 - 24.

11. Vozobnovlyaemaya energiya. Ezhekvartalnyj informacionnyj byulleten. - Moskow: "Intersoparcentr".

12. Gerasimenko A.A., Fedin V.T. Peredacha i raspredelenie elektricheskoj energii. Rostov na Donu: Publ. «Feniks», 2006.

13. Lykin L.V. Elektricheskie seti i sistemy. Moskow: Logos. 2007.

14. Zhelezko Yu.S., Artemev A.V., Savchenko O.V. Raschet, analiz i normirovanie poter elektroenergii v elektricheskih setyah. Moskow: Publ. ENAS», 2006.

15. Bolotov A.V. Sokolov S.L. Bolotov S.L. Razvitie vetroenergetiki Respubliki Kazaxstan, energeticheskie sistemy elektrosnabzheniya avtonomnyx obektov. Vestnik Almatinskogo instituta energetiki i svyazi, , 2009. No.3, pp. 19 -23.

16. Bolotov A.V., Bolotov S.A. K programme razvitiya vetroenergetiki Kazaxstana. Energetika i toplivnye resursy Kazaxstana, Almaty: 2009. No.1, pp. 33 - 37.

17. Bolotov A.V. Sidelkovskij V.S., Bolotov s.A. Tendencii razvitiya vetroenerge-tiki v mire. Vestnik Nacionalnoj inzhenernoj akademii Respubliki Kazaxstan, Almaty: 2009. No.4 (18). pp.78-84

18. Bezrukix P.P., Bezrukix P.P. (ml.) Chto mozhet dat energiya vetra? Energiya: ekono-mika, texnika. / Moskow: Ekologiya. 2000. No.1. pp. 11-24.

19. Energetika i toplivnye resursy Kazaxstana. Otraslevoj zhurnal. Publ. OAO «KazNIIenergegetiki» im. akademika Sh.Ch. Chokina. Almaty.

20. Vozobnovlyaemaya energiya. Ezhekvartalnyj informacionnyj byulleten.. OPET SNG. Moskow: Publ. "Intersolarcentr"

21. Gerasimenko A.L., Fedin VT. Peredacha i raspredelenie elektricheskoj energii. Rostov na Donu: Publ. «Feniks» 2006.

22. Tyoldeshi Yu., Lesny Yu. Mir ishhet energiyu: trans. from slovac/ Moskow: Mir, 1981. – 439 p.

23. Feshin B.N. Kompyuternoe modelirovanie i identifikaciya elektrotexnicheskih kompleksov: Ucheb. posobie. Vol 1 / Yu.F. Bulatbaeva, G.S. Nurmagambetova, Sh.Z. Telbaeva, G.I. Parshina, B.N. Feshin; Karagandinskij gosudarstvennyj texnicheskij universitet. – Karaganda: Publ. KarGTU, 2010. – 98 p.

24. Feshin B.N. Kompyuternoe modelirovanie i identifikaciya elektrotexnicheskix kompleksov: Ucheb. posobie. Vol. 2 / Yu.F. Bulatbaeva, G.S. Nurmagambetova, Sh.Z. Telbaeva, G.I. Parshina, B.N. Feshin. – Karaganda: Publ. Kar GTU, 2010. 86 p.

25. Feshin B.N. Kompyuternoe modelirovanie i identifikaciya elektrotexnicheskix kompleksov: Ucheb. posobie. Vol. 3 / Yu.F. Bulatbaeva, G.S. Nurmagambetova, Sh.Z. Telbaeva, G.I. Parshina, B.N. Feshin. – Karaganda: Publ. Kar GTU, 2010. 64 p.

26. Brejdo I.V., Feshin B.N. Imitacionnoe modelirovanie i parametricheskaya optimizaciya avtomatizirovannyx elektroprivodov. – Karaganda: Publ. Kar GTU, 2003. 130 p.

27. Belov et al. Inzhiniring elektroprivodov i sistem avtomatizacii / pod red. V.A. Novikova, Moskow Publ. centr «Akademiya», 2006. 368 p.

28. Dombrovskij V.V., Zajchik V.Moskow Asinxronnye mashiny: Teoriya, raschet, elementy proektirovaniya. L.: Energoatomizdat. Leningr. otd-nie, 1900. 368 p.

29. Limonov L.G. Avtomatizirovannyj elektroprivod promyshlennyh mexanizmov. – Harkov: - Publ. «FORD», 2009. -272 p.

30. Gulkov G.I. et al. Sistemy avtomatizirovannogo upravleniya elektroprivodami /. Minsk: Novoe znanie. 2007. 395 p.

31. Terexin V.B. Kompyuternoe modelirovanie sistem elektroprivoda postoyannogo i peremennogo toka v Simulink: uchebnoe posobie /V.B. Terexin, Yu.N. Dementev: Tomskij politexnicheskij universitet. – Tomsk: Publ. Tomskogo politexnicheskogo universiteta, 2015. 307 p.

32. Andreev E. V. et al. Yazyki programmirovaniya promyshlennyx logicheskix kontrollerov standarta IEC 61131-3 [Tekst]: uchebnoe posobie prednaznacheno dlya izucheniya disciplin

"Promyshlennye kontrollery", "Prikladnoe programmnoe obespechenie sistem upravleniya. - Karaganda:Publ. Kar GTU, 2008. 64 p.

33. Feshin B.N. Sistemy operativno-dispetcherskogo upravleniya avtomatizirovannyx texnologicheskix kompleksov : Ucheb. posobie. / B.N. Feshin, G.I. Parshina, – Karaganda: Publ. Kar GTU, 2017. – 97s.

34. Feshin B.N. Sistemy upravleniya i kontrolya avtomatizirovannyx texnologicheskix kompleksov : Chast 1. Ucheb. posobie. / B.N. Feshin, K. M. Toxmetova. – Karaganda: Publ. Kar GTU, 2017. – 107 p.

35. Spravochnik po avtomatizirovannomu elektroprivodu / Pod red. V.A. Eliseeva i A.V. Shinyanskogo. – Moskow: Energoatomizdat, 1983. – 616 p.

36. Avtomatizirovannyj elektroprivod tipovyn proizvodstvennyn mexanizmov i texnologicheskix kompleksov/Belov M.P., Novikov V.A., Rassudov L.N.- Moskow: Akademiya, 2004. – 576 p.

37. Basharin A.V., Novikov V.A., Sokolovskij G.G. Upravlenie elektroprivodami. – Leningrad: Energoizdat, 1982. 391 p.

38. Brejdo I.V., LapinaL.Moskow, Sistemy upravleniya elektroprivodami: Ucheb.posobie / .- Karaganda: Kar GTU, 2006. 64 p.

39. Elektrotexnicheskij spravochnik. V 3 tomah. T.3: Kn.2. Ispolzovanie elektricheskoj energii/ Pod red. I.N.Orlova– Moskow: Energoatomizdat, 1988. – 616 p.

40. Moskalenko V.V. Sistemy avtomatizirovannogo upravleniya elektroprivoda.- Moskow: INFRA-M, 2004. – 208 p.

41. Dorf R. Bishop R. Sovremennye sistemy upravleniya. - Moskow: Laboratoriya Bazovyx znanij, 2002. 832 p.

42. Dyakonov V.V. Kompyuternoe upravlenie texnologicheskim processom eksperi-mentom, oborudovaniem. - Moskow: Goryachaya liniya -Telekom, 2009. 608 p.