



MIHICTEPCTBO OF EDUCATION AND SCIENCE
OF UKRAINE CENTRAL UKRAINIAN
NATIONAL TECHNICAL UNIVERSITY
Department of Electrical Engineering
Systems and Energy Management



COURSE SYLLABUS

Course Title	Telemechanics and Automated Control Systems for Power Supply Systems
Instructor 	Vasyl ZINZURA, Candidate of Technical Sciences, Associate Professor, Associate Professor, Department of Electrical Engineering Systems and Energy Management
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Scope and Characteristics of the Course	Elective course, consisting of 2 content modules. Assessment: course exam. Total number of credits: 4; total hours: 120. Format: in-person (offline / face-to-face) / distance learning (online). Language of instruction: English.
Consultations	Consultations are held according to the schedule posted on the information resource moodle.kntu.kr.ua; via Zoom video conferences, via email, Viber, Messenger, or Telegram by arrangement.
Prerequisites	There are no specific requirements.

1. Course Objectives and Goals

The objective of the course “Telemechanics and Automated Control Systems for Power Supply Systems” is to master the fundamentals of telemechanics and automatic control of electrical power consumption systems and to help students develop a body of theoretical knowledge and acquire skills in the field of designing effective telemechanics systems

Objectives of the course:

- to master the basic principles of the theory of telemechanical signal transmission

and the principles of designing remote control, remote regulation, remote signaling, and remote measurement systems;

- to gain knowledge regarding the technical and operational characteristics of modern telemechanics systems and to learn how to work with them;
- to acquire practical skills in calculating automated dispatch control systems for distribution networks and automated power supply control systems (ASK).

2. Learning Outcomes

Upon completion of this course, the student should

be familiar with:

- the fundamentals of telemechanics and automatic control of electrical power consumption systems;
- the principles of dispatching electrical power consumption systems;
- the main technical means for creating communication communication and principles their operation;
- the basic principles of transmitting telemechanical information between objects in electrical power consumption systems;

be able to:

- calculate the parameters of technical equipment for transmitting telemechanical information–high-frequency blockers and filters for connection to power transmission lines (PTLs);
- configure and operate modern telemechanics systems used in electrical power consumption systems;

acquire soft skills:

- communicate professionally;
- effectively explain and present material;
- collaborate on project work.

3. Course Policy and Academic Integrity

Students are expected to adhere to the principles of academic integrity and to be aware of the consequences of violating them.

In organizing the educational process at the Central Ukrainian National Technical University, students, faculty, and administration act in accordance with: the Regulations on the Organization of the Educational Process; the Regulations on the Organization of Elective Courses and the Development of Individual Study Plans at the University; and the Central Ukrainian National Technical University Code of Academic Integrity.

4. Course Syllabus

Content Module 1.

Topic 1. Telemechanics: Functions, Objectives, Typical Structures, and Functional Blocks of Its Systems.

Topic 2. Telemechanical communications, physical characteristics of telemechanical signals, and telemetry errors.

Topic 3. Noise immunity of discrete signals. Noise immunity of a threshold detector and a Kotelnikov detector.

Topic 4. Phase-detecting receiver. Signal quality control.

Topic 5. Information and control. The Relationship the quantity information and the uncertainty of events.

Topic 6. The amount of information in events with outcomes of varying probabilities; entropy. Determining the amount of information in telemechanical messages in telemechanical systems.

Topic 7. Basic concepts, definitions, and characteristics of codes. Numeric codes.

Content Module 2.

Topic 8. Telemechanics channel modems, communication channels, features of message transmission, formats, and transmission efficiency of code formats.

Topic 9. Devices and circuits for connecting high-frequency equipment to power lines.

Topic 10. Calculation of high-frequency paths in 35–500 kV distribution networks.

Topic 11. Basic components, their classification. Electromagnetic relays.

Integrated circuits. Logic elements. Flip-flops.

Topic 12. Decoders. Encoders. Counters. Registers, distributors, and switches. Code converters. Comparators. Frequency selectors.

Topic 13. Automatic frequency and power control systems.

Topic 14. Automated dispatch for control of power grid districts.

5. Assessment System and Requirements

Assessment methods: observation of students' learning activities, oral questioning, tests, and defense of laboratory assignments. Form of final assessment: course credit.

The objectivity of the assessment of higher education students is ensured through the use of a cumulative system of assigning points for learning outcomes on each topic of the educational component throughout the semester. During the semester, a student may earn a maximum of 100 points, including: 50 points for the first module and 50 points for the second module.

The following results are taken into account during assessment:

- classroom work (lab sessions);
- independent work (review of lecture material and literature);
- tests;
- quizzes;
- presentations.

The range of grades for completed work is shown in the table:

Type of work	Score Range
Completion and defense of a lab assignment	3...6
Completion of tests	0.5...2
Quiz	1...2
Completing independent assignments	1...3
Delivering a presentation	2...4

Calculation of of maximum points is by the types of of work, as specified in the table:

Topic Title	Completion and Defense of Laboratory Assignments	Completion of tests	Quizzes	Completion of independent work	Giving a presentation	Total
Content Module 1						
Topic 1. Telemechanics: Functions, Objectives, Typical Structures, and Functional Blocks of Its Systems.	4	-	1	2	-	7
Topic 2. Telemechanical communications, physical characteristics of telemechanical signals, and telemetry errors.	-	-	1	2	4	7
Topic 3. Noise Immunity of Discrete Signals.	4	2	1	3	-	10
Topic 4. Phase-Controlled Receiver. Signal Quality Control.	-	-	1	2	-	3
Topic 5. Information and Control. The Relationship Between the Amount of Information and the Uncertainty of Events.	-	-	1	2	-	3
Topic 6. Information content in events with outcomes of different probabilities; entropy.	6	-	1	3	-	10
Topic 7. Basic concepts, definitions, and characteristics of codes. Numeric codes. Binary code protection.	6	2	-	2	-	10
Total for Module I	20	4	6	16	4	50
Content Module 2						
Topic 8. Telemechanics Channel Modems, Communication Channels, and Features of Message Transmission	5	-	1	2	-	8
Topic 9. Devices and Connection Schemes for Connecting High-Frequency Equipment to Power Lines.	5	-	1	2	-	8
Topic 10. Calculation of High-Frequency Paths in 35–500 kV Distribution Networks.	5	2	-	3	-	10
Topic 11. Basic elements and their classification. Electromagnetic relays...	-	-	1	2	-	3
Topic 12. Decoders. Encoders. Counters. Registers, distribution, and switches...	-	-	1	2	-	3
Topic 13. Automatic Frequency and Power Control Systems.	-	-	1	2	4	7
Topic 14. Automated Dispatch Control Systems for Power Grid Areas.	5	2	1	3	-	11
Total for Module II	20	4	6	16	4	50
Total for the semester	40	8	12	32	8	100

Grading Scale: National and ECTS

Total points for all types of academic activities	ECTS Grade	Grade on the national scale
		for a passing grade
90–100	A	Pass
82–89	B	
74–81	C	
64–73	D	
60–63	E	
35–59	FX	Failed, with the option to retake the exam
0–34	F	Fail, with mandatory retake of the course

6. Recommended Reading

Teaching Materials

1. Telemechanics and Automated Control Systems in the Electric Power Industry: Textbook / [P.G. Pleshkov, S.V. Serebrennikov, K.G. Petrova]. – Kirovograd: RVL KNTU, 2016. – 152 pp. (*Recommended by the Academic Council of KNTU, Minutes No. 4 dated December 21, 2015*).
2. Methodological Guidelines “Telemechanics and Automated Control Systems” for Laboratory Work for Full-Time and Part-Time Students in the Field of Study 7.050301 “Electrical Engineering and Electrical Technologies.” Part II. / Compiled by: P.G. Pleshkov, S.V. Serebrennikov, O.I. Sirikov, V.V. Zinzura – Kirovograd: KNTU, 2010 – 61 pp.
3. Instructions for Conducting Laboratory Work for the Course “Telemechanics and Automatic Control Systems.” / [P.G. Pleshkov, S.V. Serebrennikov, et al.]. – Kirovograd: KNTU, 2001. – 102 pp.

Core Literature

1. Plieshkov, P. H., Serebrennikov, S. V., & Petrova, K. H. (2016). *Telemechanics and automated control systems in power engineering* [Study guide]. RVL KNTU.
2. Abood, S. I., & Fuller, J. (2024). *Power system protection and relaying: Computer-aided design using SCADA technology*. CRC Press. <https://doi.org/10.1201/9781003394389>
3. Diab, A. A. Z., Eltamaly, A. M., Sultan, H., & Elghaffar, A. N. A. (Eds.). (2024). *Power systems and smart grids* (Vol. 2). IET. <https://doi.org/10.1049/PBPO264G>

Supplementary Literature

1. Plieshkov, P., Zinzura, V., Plieshkov, S., & Soldatenko, V. (2023). Determination of the optimal point of connection of the solar power plant to the electrical network by computer simulation. *Central Ukrainian Scientific Bulletin. Technical Sciences*, 2(8), 48–57. [https://doi.org/10.32515/2664-262X.2023.8\(39\).2.48-57](https://doi.org/10.32515/2664-262X.2023.8(39).2.48-57)
2. Plieshkov, P., Soldatenko, V., Zinzura, V., Sirikov, O., & Plieshkov, S. (2025). Optimal control of active power generation levels by renewable energy plants. *Central Ukrainian Scientific Bulletin. Technical Sciences*, 1(12), 308–315. [https://doi.org/10.32515/2664-262X.2025.12\(43\).1.308-315](https://doi.org/10.32515/2664-262X.2025.12(43).1.308-315)
3. Sachenko, A., Plieshkov, S., Plieshkov, P., & Zinzura, V. (2022). Optimal control of the modes of distribution electrical networks with solar power plants under unbalanced load. *Central Ukrainian Scientific Bulletin. Technical Sciences*, 1(6), 37–44. [https://doi.org/10.32515/2664-262X.2022.6\(37\).1.37-44](https://doi.org/10.32515/2664-262X.2022.6(37).1.37-44)
4. Zinzura, V., Voitenko, V., Halushka, S., & Lahno, I. (2024). Automatic control of distribution electrical networks mode parameters under voltage asymmetry conditions. In *Problems of energy efficiency and automation in industry and agriculture: Collection of abstracts of the All-Ukrainian scientific and practical online conference* (pp. 51–53). CNTU. <https://kntu.kr.ua/file/content/13789/zbirnyk-tez.pdf>
5. Leontiev, D., Oliinyk, V., & Zinzura, V. (2022). Mathematical model of a fuzzy automatic control system for voltage level in distribution electrical networks. In *Automation*,

computer-integrated technologies and energy efficiency problems in industry and agriculture (ACIT-2022): Proceedings of the international scientific and technical conference (pp. 121–122). PP "Exclusive-System". <http://kntu.kr.ua/doc/science/zahody/vikl/2022/10-tez.pdf>

Information Resources

1. Central Ukrainian National Technical University. (n.d.). *CNTU distance learning system*. Retrieved from <https://moodle.kntu.kr.ua/course/view.php?id=182>
2. Vernadsky National Library of Ukraine. (n.d.). *Home*. Retrieved from <https://www.nbuv.gov.ua/>
3. Scientific Periodicals of Ukraine. (n.d.). *Home*. Retrieved from <https://journals.uran.ua/>
4. Google. (n.d.). *Google Scholar*. Retrieved from <https://scholar.google.com/>