Syllabus
Course Program

Electric Equipment of Electric Vehicle

Specialty
141 Electric Power Engineering, Electrical Engineering and Electromechanics

Institute
Institute of Power Engineering, Electronics and Electromechanics

Educational program
Electric Drive, Mechatronics and Robotics

Department
Automated Electromechanical Systems (129)

Level of education
Bachelor's level

Course type
Optional

Semester
8

Language of instruction
English

Lecturers and course developers

Oleksii Semikov

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Candidate of technical sciences, senior lecturer at the Department of “AEMS”.

Experience is 8 years. An author is over 20 scientific works.
More about the lecturer on the department's website

General information

Summary

The discipline is aimed at mastering the theoretical foundations and practical skills in the field of electrical equipment for modern electric vehicles with both direct current and alternating current electric motors.

Course objectives and goals

Provide knowledge on electric, electromechanical, and mechatronic systems of electric vehicles and automobiles, including the study of typical system faults and methods for troubleshooting and rectification of these faults.

Format of classes

Lectures, consultations, self-study. Final control in the form of tests.

Competencies

The ability to solve complex specialized tasks and practical problems related to metrology issues, electrical measurements, the operation of automatic control devices, relay protection, and automation; the ability to address comprehensive specialized challenges and practical problems related to the operation of electrical machines, devices, and automated electric drives; acquiring and utilizing professional knowledge and understanding related to the development and operation of mechatronic devices and systems while adhering to specified parameters of technological processes; the ability to perform relevant calculations for the analysis of transient and steady-state operating modes of electric drives and mechatronic modules and systems; the ability to create and design electrical installations for various purposes, determine their equipment composition, and optimize their operating modes.

Learning outcomes

To understand the principles of operation of electrical machines, devices, and automated electric drives and be able to apply them to solve practical problems in professional activities; to analyze processes in electrical power, electrical engineering, and electromechanical equipment, relevant complexes, and systems; to solve professional tasks related to the design, installation, and operation of electrical power, electrical engineering, and electromechanical complexes and systems; to know and comprehend the principles of organizing the development and operation of mechatronic devices and systems while adhering to specified parameters of technological processes; to conduct calculations for the analysis of transient and steady-state operating modes of electric drives and mechatronic modules and systems; to know and understand the principles of composing and calculating schemes of electrical installations for various purposes, determining their equipment composition, and optimizing their operating modes.

Student workload

The total volume of the course is 90 hours (3 ECTS credits): lectures - 30 hours, self-study - 60 hours.

Course prerequisites

Previous courses (that are necessary for successful course completion): Higher Mathematics, Physics, Theoretical Foundations of Electrical Engineering, Fundamentals of Electronics, Technical Mechanics, Theory of Automatic Control, Electric Machines, Theoretical Basic of Electric Drive, Microprocessor Technology in Mechatronics, Modelling of Mechatronic Systems.

Features of the course, teaching and learning methods, and technologies

Lectures are conducted interactively using multimedia technologies. Distributed lecture texts are utilized during lectures. During self-studies, the project method is applied using physical and simulation models in a computer environment.

Program of the course

Topics of the lectures

Topic 1. Vehicle Power Supply Systems.
Topic 2. On-Board Control and Measurement Devices.
Topic 3. Automatic Vehicle Motion Control Systems and Some Navigation Systems.
Topic 4. Batteries and Energy Storage Systems for Electric Vehicles.
Topic 5. Principles of Construction and Schematic Solutions for AC Electric Drives in Electric Vehicles.
Topic 6. Principles of Construction and Schematic Solutions for DC Electric Drives in Electric Vehicles.
Topic 7. Construction Principles of Hybrid Vehicle Drives.
Topic 8. Schematic Solutions for the traction Electric Drive of an Electric Vehicle.

Topics of the workshops

Workshops are not included in the curriculum.

Topics of the laboratory classes

Laboratory classes are not included in the curriculum.

Self-study

Processing of lecture materials. Preparation for practical studies. Independent study of topics and questions not covered in lectures. The calculated task includes the analysis of static and dynamic characteristics of the excitation current regulation loop of an AC motor. Analysis of dynamic processes in the torque loop of the motor. Synthesis of a modal regulator for the regulation system of an AC motor.

Course materials and recommended reading

1. Wilhelm Lehmann. Die Elektrotechnik und die elektrischen Antriebe Lehr- und Nachschlagebuch für Studierende und Ingenieure. — 6th ed. — Springer-Verlag, 1962. — 433 p.
2. Aizerman M. A. Theory of Automatic Control. — Pergamon, 1963. — 519 p.
3. Beaty H.W., Kirtley J. Electric Motor Handbook. — McGraw Hill, 1998. — 398 p.
4. Krishnan R. Electric Motor Drives. Modeling, Analysis, and Control. — Pearson, 2001. — 650 p.
5. Leonhard W. Control of Electrical Drives. — 2nd ed. — Springer, 1996. — 680 p.
6. Krishnan R. Electric Motor Drives. Modeling, Analysis, and Control. — Pearson, 2001. — 652 p.
7. Austin Hughes. Electric Motors and Drives. — 3rd ed. — Newnes, 2006. — 410 p.
8. Stan Gibilisco. Electricity and Electronics. — 4th ed. — McGraw-Hill/TAB Electronics, 2006. — 699 p.
9. John M. Miller. Propulsion Systems for Hybrid Vehicles. — IET, London, 2008. — 455 p.
10. Chapman Stephen J. Electric Machinery Fundamentals. — 5th ed. — McGraw-Hill, 2012. — 680 p.

Assessment and grading

Criteria for assessment of student performance, and the final score structure

The final grade consists of the results of the evaluation of control task (30%), calculated task (30%), and tests (40%).

Grading scale

Total points	National	ECTS
90–100	Excellent	A
82–89	Good	B
75–81	Good	C
64–74	Satisfactory	D
60–63	Satisfactory	E
35–59	Unsatisfactory (requires additional learning)	FX
1–34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.
Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/

Approval

Approved by

Date, signature — Head of the department
Bohdan VOROBIOV

Date, signature — Guarantor of the educational program
Mykola ANISHCHENKO