Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Applied Radio Electronics

[RE-28] ELECTRONICS, MICROELECTRONICS

Curriculum of the academic discipline (Syllabus)

Course details

Level of higher education	First (bachelor's)
Field of knowledge	G - Engineering, manufacturing, and construction
Specialty	G5 - Electronics, electronic communications, instrument engineering, and radio engineering
Educational program	All
Discipline status	Elective (F-catalog)
Form of higher education	Full-time
Year of training, semester	Available for selection starting from the 2nd year, spring semester
Scope of the discipline	4 credits (Lectures 16 hours, Practical classes 30 hours, Laboratory work 30 hours, Independent work 74 hours)
Semester Control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian
Information about the course coordinator/teacher s	Lectures: I. M. Kyrpatenko, Labs: I. M. Kyrpatenko,
Course location	

Course program

1. Description of the course, its purpose, subject matter, and learning outcomes

The discipline "Electronics, Microelectronics" belongs to the group of basic disciplines designed to develop the knowledge and skills necessary for specialists in the field of radio engineering and telecommunications.

The aim of the discipline is to provide students with knowledge and skills in the field of circuit engineering using microelectronic devices (analog and digital microcircuits), physics of semiconductor element base of radio-electronic means, use of semiconductor and other sensors of physical quantities, etc.

2. Prerequisites and post-requisites of the discipline (place in the structural-logical scheme of training under the relevant educational program)

For successful mastery of the discipline material, students must have knowledge in the following areas of higher mathematics: integral and differential calculus, theory of linear differential equations, theory of automatic control, theory of circuits, and fundamentals of semiconductor physics.

The knowledge acquired in the discipline "Electronics, Microelectronics" should become the basis for studying such disciplines as "Power Supply of Radio Electronic Apparatus," "Radio Receiving Devices," "Digital Signal Processing in Communication Systems," etc.

3. Contents of the discipline

1. Introduction to the discipline.

1.1 The role of electronics and microelectronics in the development of modern science and technology.

1.2 History of electronics, scientists and engineers who have made significant contributions to the development of electronics.

1.3 Development of the element base: vacuum tubes, semiconductor devices.

2. Element base and its properties.

2.1 The transistor as the main active element of electronics and microelectronics.

2.2 The principle of operation of a bipolar transistor, structure, production technologies.

2.3 Field-effect transistors: transistors with a gate in the form of a pn junction, MDN transistors, principle of operation, structure, technologies.

3. Features of circuitry in analog microelectronic devices.

3.1 Structure of an operational amplifier.

3.2. Constant current generators, purpose, principle of operation.

3.3 Active load, current mirrors, types of current mirrors.

3.4 Types of amplifier stages, features of amplifier stages in microelectronics.

3.5 The problem of stability of microelectronic amplifiers, methods of frequency response correction

3.6 Operational amplifier with current feedback, features of circuitry, areas of application.

4 Semiconductor amplifiers, use of microelectronic devices for building amplifiers.

4.1 Low-frequency amplifiers, basic parameters, circuit design features. Use of operational amplifiers in low-frequency amplifiers.

4.2 Direct current amplifiers, basic parameters, zero drift, methods of reducing zero drift.

4.3 Video amplifiers, design principles, basic parameters, types of correction.

4.4 HF and UHF amplifiers, design principles, basic parameters.

5. Active filters.

5.1 Purpose, main characteristics, frequency response approximations.

5.2 Principles of active filter design.

5.3 Features of using operational amplifiers in active filters.

6. Generators, basic parameters.

6.1 High-frequency oscillation generators. Capacitive and inductive triacs.

6.2. Low-frequency sinusoidal oscillation generators.

6.3 Relaxation generators.

6.4 Functional generators.

7. Features of digital microelectronic device circuitry

7.1 Features of TTL circuitry of digital microelectronic devices.

7.2 Features of CMOS circuitry of digital microelectronic devices.

7.3 Features of EZL circuitry.

4. Teaching materials and resources

Basic literature

1. U. Tietze, Ch. Schenk The semiconductor circuit design (set of 2 books). Volume 1., Book on Demand Ltd., 2018. – 830 p.
2. B. Carter, R. Mancini Op Amps for Everyone 5th Edition ., Newnes; 5th edition, 2017. - 484 p.
3. D. I. Crecraft, S. Gergely Analog electronics: circuits, systems and signal processing. Elsevier LTD, 2005. – 375p.

Educational content

5. Methodology for mastering the academic discipline (educational component) Lecture No. 1. Introduction to the discipline.

Lecture No. 2. Element base and its properties.

Lecture No. 3. Features of circuitry of analog microelectronic devices.

Lecture 4. Semiconductor amplifiers, use of microelectronic devices for building amplifiers. Lecture No. 5. Active filters. Purpose, main characteristics, frequency response approximations.

Lecture No. 6 Principles of active filter design. Features of using operational amplifiers in active filters.

Lecture No. 7 Generators, basic parameters.

Lecture No. 8 Relaxation generators. Functional generators.
Lecture No. 9. Features of circuitry in digital microelectronic devices.

Laboratory work No. 1. Investigation of stable current generators.

Laboratory work No. 2. Investigation of the properties of a differential amplifier. Part 1.

Laboratory work No. 3. Investigation of the properties of a differential amplifier. Part 2.\ Laboratory work No. 4. Investigation of the Miller effect.

Laboratory work No. 5. Investigation of the properties of operational amplifiers.

6. Independent work

Independent work by students is an integral part of successfully completing the course. It consists of studying literature on the topics of the discipline, preparing for the module test, preparing for laboratory work, and analyzing the results of laboratory work. One week is allocated for analyzing the results of laboratory work.

Policy and control

7. Policy of the academic discipline (educational component)

Attendance at both lectures and laboratory work is mandatory. In the case of distance learning, students must join the conference on time; tardiness of more than five minutes is not permitted. Laboratory work is performed by each student independently in accordance with the individual assignment. Before the lab work, the instructor may check the students' level of competence in the topic of the lab work. During the lab work and its defense, students are allowed to use any reference materials. The defense of lab work is conducted on an individual basis. One week is allocated for the completion and defense of laboratory work. Penalty points are imposed for failure to meet the deadlines for the defense of laboratory work: for each day beyond the deadline, the maximum number of points that a student can receive for laboratory work is reduced by one.

8. Types of control and rating system for assessing learning outcomes (RSO)

The RSE provides for the following types of control and assessment of learning outcomes:

Current control:	Maximum number of points
MCR-1	25
MCR-2	25
Calendar control (certification)	
Semester control (credit)	20
Defense of laboratory work: Laboratory work No. 1, No. 2, No. 4 Laboratory work No. 3, No. 5	10 for each work 20 for each work

Table of correspondence between rating points and grades on the university scale

Number of points	Grade
100-95	Excellent
94	Very good
84	Good
74-65	Satisfactory
64-60	Sufficient
Less than 60	Unsatisfactory
Admission requirements not met	Not admitted

9. Additional information on the discipline (educational component)

Description of material, technical, and informational support for the discipline

Laboratory work is carried out in a computer lab using appropriate software.

The working program of the academic discipline (syllabus):
Compiled by I. M. Kirpatenko;
Approved by the PRE Department (Minutes No. 06/2025 dated 06/24/2025)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 25.06.2025)