



[RE-22] ORGANIZATION OF RESEARCH AND DEVELOPMENT OF RADIOELECTRONIC DEVICES



Work program of the academic discipline (Syllabus)

Details of the academic discipline

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 4th year, spring semester
Scope of the discipline Independent work 74 hours)	4 credits (Lectures 16 hours, Practical 30 hours, Lab hours,
Semester control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction about course coordinator/teacher s	Ukrainian Information Lecturer: O. Titenko
Course location	

Curriculum

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

The program of the academic discipline "Organization of Research and Development of Electronic Equipment" has been developed in accordance with the educational and professional program of the first (bachelor's) level of higher education in the specialty 172 Telecommunications and Radio Engineering.

The academic discipline is elective.

Subject of the academic discipline:

Study of the organization of research and development of radio-electronic means.

The purpose of the credit module is to develop students' abilities *to solve the main issues of conducting R&D and preparing the relevant documentation.*

As a result of studying the discipline, students should **know**:

the sequence of creating new electronic equipment products, the procedure for conducting research and development work and design and engineering work, the functions of participants, and the structure of technical documentation;

Upon completion of the course, students should **be able to**:

develop the main documents for research and development and design and development.

General competencies

GC 01 Ability to think abstractly, analyze, and synthesize

GC 04 Knowledge and understanding of the subject area and understanding of professional activity.

GC 07 Ability to learn and master modern knowledge. Professional competencies

PC 01 Ability to understand the essence and significance of information in the development of a modern information society

PC 03 Ability to use basic methods, means and tools for obtaining, transmitting, processing and storing information.

PC 04 Ability to perform computer modeling of devices, systems, and processes using universal application software packages

PC 12 Ability to perform work related to managing traffic flows in information and telecommunications networks

PC 14 Readiness to study scientific and technical information, domestic and foreign experience on the subject of investment (or other) projects in the field of telecommunications and radio engineering

PC 15 Ability to perform calculations in the process of designing structures and means of information and telecommunications networks, telecommunications and radio engineering systems, in accordance with technical specifications using both standard and independently developed methods, techniques, and software tools for design automation

PC 16 Ability to apply standard calculation methods in the design of telecommunications and radio engineering devices and systems

PC 20 Ability to select methods and means of information processing using intelligent technologies

PC 21 Ability to apply a comprehensive approach to the development of radio-electronic equipment

Program learning outcomes

PLO 01 Analyze and make informed decisions when solving specialized tasks and practical problems in telecommunications and radio engineering, which are characterized by complexity and incomplete certainty of conditions

PLO 02 Apply the results of personal search and analysis of information to solve qualitative and quantitative problems of a similar nature in information and communication networks, telecommunications and radio engineering systems

PLO 13 Apply fundamental and applied sciences to analyze and develop processes occurring in

telecommunications and radio engineering systems

PLO 14 Application of understanding of the basic properties of the component base to ensure the quality and reliability of telecommunications, radio engineering systems and devices.

PLO 20 Explain the principles of construction and functioning of hardware and software complexes of control and maintenance systems for the development, analysis, and operation of information and telecommunications networks, telecommunications, and radio engineering systems.

PLO 23 Explain the principles of construction and operation of hardware and software complexes of control and maintenance systems for the development, analysis, and operation of information and telecommunications networks, telecommunications, and radio engineering systems.

PLO 24 Implement methods of digital signal processing at the software and hardware levels

PLO 25 Select and implement means and methods of information transmission in communication networks and apply network technologies

PLO 26 Design and implement elements of intelligent technologies using software-configurable equipment

PLO 27 Apply basic methods and techniques for obtaining information

PLO 29 Select the configuration, structure, main components, and elements of radio- electronic equipment depending on its purpose;

PLO 30 Apply a comprehensive approach to the design of telecommunications and radio- electronic equipment

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

The credit modules that provide for the study of ODR REZ are: "Radio Transmission Devices," "Radio Receiving Devices"

3. Contents of the discipline

Topic 1. Product life cycle. Planning and management

The current stage of development of production and economic relations. Product life cycle. Product life cycle in regulatory and technical documentation. Life cycle management

Topic 2. Research and development

The place, role, and main tasks of R&D. R&D participants. Functions of R&D participants. R&D procedure. R&D methodology. R&D documentation

Topic 3. General provisions for the implementation of design and research work

The place, role, and main tasks of R&D. Functions of R&D participants. Rules for product development. Scope of work at the stages of development and implementation of R&D. Registration and accounting of R&D. Implementation of R&D results. Technical specifications for R&D. Design documents. Operational documents.

Topic 4. Testing of REA at the stages of the life cycle

Basic concepts of testing and control. Classification of tests. Organization of tests. Test program and methodology

Topic 5. Student qualification work

General provisions. Organization of qualification work. Rights and obligations of students when performing qualification work. Topics of qualification work. Tasks for qualification work. Requirements

for the structure and content of a thesis (work). Basic requirements for the presentation of text documents.

Approximate topics for practical classes:

- 1) Computer software
- 2) Creating software life cycle development models
- 3) Documentation of telecommunications networks
- 4) UML diagrams
- 5) Principles of radio communication network design

4. Training materials and resources

Recommended reading

1. Terletskyi, T.V. Fundamentals of Technical Documentation [Text]: Textbook for students of technical specialties / Terletskyi, T.V., Kaidyk, O.L., Tkachuk, A.A., Rechun, O.Yu.; edited by Terletskyi T.V. – Lutsk: IVV Lutsk NTU, 2021. – 126 p.
2. Dubova S.V. Scientific and Technical Documentation: Methodological Recommendations for Studying the Discipline. / S.V. Dubova. – Kyiv: Center for Educational Literature, 2017. – 54 p.
3. Vazhynskyi, S. E. Methodology and Organization of Scientific Research: Textbook. /S. E. Vazhynskyi, T. I. Shcherbak. – Sumy: Sumy State Pedagogical University named after A. S. Makarenko, 2016. – 260 p.
4. Birta, G. O. Methodology and Organization of Scientific Research. [text]: textbook / G. O. Birta, Yu. G. Burgu- Kyiv: Center for Educational Literature, 2014. – 142 p.
5. Kyrylenko, O. P. Methods and Organization of Scientific Research: Textbook. / [O. P. Kyrylenko, V. V. Pysmennyi, N. M. Tkachuk, et al.]; edited by O. P. Kyrylenko. – Ternopil: Publishing and Printing Center of TNEU "Economic Thought," 2012. – 196 p.
6. Mokin, B. I. Methodology and Organization of Scientific Research: Textbook / B. I. Mokin, O. B. Mokin. – 2nd ed., rev. and expanded. – Vinnytsia: VNTU, 2015. – 317 p.
7. DSTU 3973-2000 "System for the development and delivery of products to production. Rules for performing scientific research. General provisions."
8. DSTU 3974-2000 "System for the development and delivery of products for production. Rules for the use of research and development work. General provisions."
9. DSTU 2391:2010 "System of technological documentation. Terms and definitions of basic concepts."
10. DSTU 3321:2003 "Design documentation system. Terms and definitions of basic concepts."
11. DSTU 3008:2015 "Documentation. Reports in the field of science and technology. Structure and rules of design."
12. DSTU 3.1001:2014 "Unified system of technological documentation. General provisions."
13. [GOST 3.1129-93 "Unified system of technological documentation. General rules for recording technological information in technological documents for technological processes and operations."](#)

14. [GOST 3.1130-93 "Unified system of technological documentation. General requirements for forms and templates of documents."](#)
15. [DSTU GOST "3.1102:2014 Unified system of technological documentation. Stages of development and types of documents. General provisions \(GOST 3.1102-2011, IDT\)".](#)
16. DSTU GOST "3.1103:2014 Unified system of technological documentation. Main inscriptions. General provisions (GOST 3.1103-2011, IDT)".
17. DSTU GOST 2.601:2006. "Unified system of design documentation. Operational documents (GOST 2.601-2006, IDT)".
18. Regulations on the final certification of students of Igor Sikorsky KPI [Electronic resource] / Compiled by: V. P. Golovenkin, V. Yu. Ugolnikov. – Kyiv: Igor Sikorsky KPI, 2018. – 98 p.
- 19 Lecture notes on the discipline "Organization of Research and Development of Electronic Equipment"

Educational content

5. Methodology for mastering the academic discipline (educational component)

Lectures

No	Lecture topic and list of main questions (list of teaching aids, references to literature and assignments for independent study)
1	Topic 1. Product life cycle, planning, and management <i>The current stage of development of production and economic relations. The product life cycle in regulatory and technical documentation. Life cycle management</i>
2	Topic 2. Research and development <i>The place, role, and main tasks of R&D. R&D participants. Functions of R&D participants. R&D procedure. R&D methodology. R&D documentation</i>
3	Topic 3. General provisions for the implementation of design and development work <i>The place, role, and main tasks of design and development work. Functions of participants in design and development work. Rules for product development. Content of work at the stages of design and development and at the stages of implementation of design and development work. Registration and accounting of design and development work. Implementation of the results of design and development work.</i>
4	Topic 3. General provisions for the implementation of R&D (continued) <i>Technical specifications for design and development work. Design documents.</i>
5	Topic 3. General provisions for the implementation of R&D (continued) <i>Operational documents.</i>
6	Topic 4. Testing of radio-electronic equipment at life cycle stages <i>Basic concepts of testing and control. Classification of tests. Organization of tests. Test program and methodology</i>
7	Topic 5. Student qualification work <i>General provisions. Organization of qualification work. Rights and obligations of students when performing qualification work. Topics for qualification work. Tasks for qualification work.</i>

8	Topic 5. Student qualification work (continued) <i>Requirements for the structure and content of a thesis (project). Basic requirements for presenting text documents.</i>

Practical classes

Practical classes are held for better assimilation and in-depth study of lecture material. The topic of the practical class is communicated to students in advance, during the previous class or lecture.

At the end of the class, each student may receive an individual assignment to be completed independently on the topic of the practical class to assess the quality of their understanding of the material.

No.	Name of the class topic and list of main questions (list of teaching aids, references to literature, and assignments for Independent work)
1	Computer software
2	Creating software life cycle development models
3	Documentation of telecommunications networks
4	UML diagrams
5	Principles of radio communication network design

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6. Independent work by students

Policy and control

7. Policy of the academic discipline (educational component)

Attendance at lectures and practical classes is mandatory....

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

9. Rating system for assessing learning outcomes

1 A student's rating for a credit module consists of points awarded for:

1. Attending lectures and taking notes.
2. Attendance and independent work in practical classes.
3. Taking the exam.

2 Rating system and assessment criteria:

1. Attendance at lectures and note-taking.

Attendance at lectures and note-taking:

1. Attendance and answers in practical classes.

Attendance at practical classes: 5 points × 8 = 40 points.

3) Bonus points

Creative approach and high level of knowledge: *up to*

+10 points. 3 Calculation of the rating scale

Total weighted points for control measures during the semester:

= 10 + 40 + 10 = 60 points.

Exam: (four theoretical questions: $10+10+10+10=40$ points).

The rating scale for the discipline is:

In order for a student to receive the corresponding grades (ECTS and traditional), their rating is converted according to the table:

- A prerequisite for admission to the exam is the absence of debts on the course, as well as a **starting rating** of at least 30 *points*.
- A student who scores less than 10 points on the exam (or scores *points* on one of the three questions) is considered to have received a final grade of "unsatisfactory" regardless of their semester rating.
- The student's **calendar assessment** is based on their current rating at the time of assessment. If this rating is at least 50% of the maximum possible at the time of assessment, the student is considered to have passed.

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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

10. Additional information on the discipline (educational component)

...List of questions for the test

- 1 Characteristics of the current stage of development of production and economic relations
- 2 Project management
- 3 Product life cycle. Life line of technical systems
- 4 Stages of the life cycle of technical systems, general characteristics
- 5 Signs of stage 1 of the LJTS
- 6 Signs of stage 2 of the LJTS
- 7 Signs of stage 3 of the LJTS
- 8 Signs of stage 4 of the LJTS
- 9 Product life cycle in regulatory and technical documentation
- 10 Technical systems life cycle management. General information
- 11 Technical system life cycle management. Configuration process
- 12 Technical system life cycle management. Planning process

- 13 Technical system life cycle management. Decision-making process
- 14 Technical systems life cycle management. Resource management process
- 15 Technical systems lifecycle management. Risk management process
- 16 Technical systems lifecycle management. Information management process
- 17 Technical systems life cycle management. Quality management, control, and assessment process
- 18 The place, role, and main tasks of R&D
- 19 Participants in R&D. Functions of R&D participants
- 20 Procedure for conducting R&D. Stages of R&D
- 21 R&D. Scope of work at the stage "Selection of research direction"
- 22 R&D. Content of work at the stage "Theoretical and experimental research"
- 23 R&D. Content of work at the stage "Generalization and evaluation of research results, preparation of reporting documentation"
- 24 R&D. Content of work at the stage "Acceptance of R&D"
- 25 Research methodology
- 26 R&D documentation, technical specifications
- 27 R&D documentation, report
- 28 The place, role, and main tasks of the DCR
- 29 Functions of participants in R&D implementation
- 30 Typical product development scheme
- 31 Scope of work at the development stages and implementation phases of R&D, technical proposal
- 32 Scope of work at the development stages and implementation phases of the R&D project, preliminary design
- 33 Scope of work at the development stages and implementation phases of the R&D project, technical design
- 34 Scope of work at the development stages and implementation phases of the R&D project, working design documentation
- 35 Registration and accounting of R&D. Implementation of R&D results
- 36 Technical specifications of R&D
- 37 Types of R&D documents
- 38 Methods of execution and nature of use of R&D documents
- 39 Completeness of design documents
- 40 R&D documentation, explanatory note

- 41 R&D documentation, technical specifications
- 42 R&D documentation, specifications, list of specifications
- 43 R&D documentation, list of reference documents
- 44 R&D documentation, list of purchased products, list of permits for the use of purchased products
- 45 R&D documentation, list of original owners
- 46 R&D documentation, technical proposal information, preliminary and technical designs
- 47 R&D documentation, testing program and methodology
- 48 R&D documentation, types of operational documents
- 49 R&D documentation, nomenclature of ED
- 50 Operational documents, manual (instructions, guide) for operation
- 51 Operational documents, instructions for installation, start-up, adjustment, and running-in of the product
- 52 Operational documents, form, passport, label
- 53 Operational documents, catalog of parts and assembly units
- 54 Operating documents, spare parts consumption rates, material consumption rates
- 55 Operational documents, list of spare parts, tools, and accessories
- 56 Operational documents, special operating instructions, list of operational documents
- 57 Basic concepts of testing and control
- 58 Classification of tests, test methods
- 59 Classification of tests by purpose
- 60 Classification of tests, tests at the stages of design, manufacture, and release of products.
- 61 Classification of tests, testing of finished products
- 62 Classification of tests by duration
- 63 Classification of tests by type of impact
- 64 Classification of tests by result of impact
- 65 Classification of tests by specified characteristics
- 66 Organization of tests. Test equipment
- 67 Organization of tests. Test procedure
- 68 Testing process. Testing program and methodology
- 69 Student qualification work. General provisions
- 70 Organization of qualification work

71 Rights and obligations of students when performing qualification work

72 Topics for qualification work

73 Assignments for qualification work

74 Requirements for the structure and content of a thesis project (work)

75 Basic requirements for the presentation of text documents

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

Laboratory 508-17

Work program for the academic discipline (syllabus):

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Approved by the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 26.06.2025)