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

Department of Applied Radio Electronics

[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	17 - Electronics, Automation, and Electronic Communications
Specialization	172 - Electronic Communications 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	4 credits (Lectures 18 hours, Practical 36 hours, Laboratory hours, Independent work 66 hours)
Semester Control/control measures	Credit
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian Information
course director / lecturers	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 radio-electronic products, the procedure for conducting research and development work, the functions of participants, and the structure of technical documentation;

As a result of studying the discipline, students should **be able to**:

develop basic documents for research and development work.

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 on managing the load flows of 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 Apply understanding of the basic properties of the component base to ensure the quality and

reliability of telecommunications and radio engineering systems and devices.

PLO 20 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 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, nodes, 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

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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 development work

The place, role, and main tasks of design and development work. Functions of participants in the implementation of design and development work.Rules for product development. Content 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 radio-electronic equipment at different stages of its 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]: A 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. Methodology 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 research work. General provisions."

8. DSTU 3974-2000 "System for the development and delivery of products to 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 science and technology. Structure and formatting rules."

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. Basic 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 at Igor Sikorsky Kyiv Polytechnic Institute [Electronic resource] / Compiled by: V. P. Golovenkin, V. Yu. Ugolnikov. - Kyiv: Igor Sikorsky Kyiv Polytechnic Institute, 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*** *The current stage of development of production and economic relations. The product life cycle in regulatory and technical documentation. Life cycle management*
2	**Topic 2*. Research work*** *The place, role, and main tasks of research and development work. Participants in research and development work. Functions of participants in research and development work. Procedure for conducting research and development work. Methodology of research and development work. Documentation of research and development work*
3	**Topic 3*. General provisions for the implementation of design and development work*** *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 work and at the stages of implementation. Registration and accounting of design and development work. Implementation of the results of design and development work.*
4	**Topic 3*. General provisions for the implementation of R&D (continued)*** *Technical specifications for R&D. Design documents.*
5	**Topic 3*. General provisions for the implementation of R&D (continued)*** *Operational documents.*
6	**Topic 4*. Testing of radio-electronic equipment at life cycle stages*** *Basic concepts of testing and control. Classification of tests. Organization of tests. Test program and methodology*
7	**Topic 5. *Student qualification work*** *General provisions. Organization of qualification work. Rights and obligations of students when performing qualification work. Topics for qualification work. Tasks for qualification work.*

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

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, at the previous class or lecture.

At the end of the class, each student may receive an individual assignment for independent work 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 SRC)
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

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

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. Attending and independent work in practical classes.
3. Taking the exam.

2 Rating point system and assessment criteria:

1. Attending lectures and taking notes.

Attending lectures and taking notes:

1. Attendance and answers in practical classes.

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

3) Incentive 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 receives less than 10 points on the exam (or receives *points* for 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 university scale grades

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)

...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 systems 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 lifecycle management. Quality management, control, and evaluation process

18 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. Content of work at the stage "Selection of research direction"

22 R&D. Scope of work at the "Theoretical and experimental research" stage

23 R&D. Scope of work at the stage of "Generalization and evaluation of research results, preparation of reporting documentation"

24 R&D. Scope of work at the stage of "Acceptance of R&D"

25 Research and development methodology

26 R&D documentation, technical specifications

27 R&D documentation, report

28 Place, role, and main tasks of the design and development work

29 Functions of R&D participants

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 R&D, preliminary design

33 Scope of work at the development stages and implementation phases of the design and development project, technical design

34 Scope of work at the stages of development and implementation of R&D, 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 conditions

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, draft and technical designs

47 R&D documentation, testing program and methodology

48 R&D documentation, types of operational documents

49 R&D documentation, ED nomenclature

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 Operating documents, special operating instructions, list of operating 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. Test 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):
Compiled by Titenko O. T.; Yezersky N. V.;
Approved by the PRE Department (Minutes No. 06/2024 dated 06/27/2024)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2024 dated 28.06.2024)