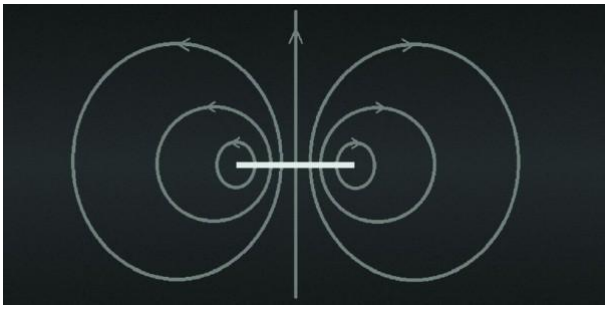
Національний технічний університет України
«КИЇВСЬКИЙ ПОЛІТЕХНІЧНИЙ ІНСТИТУТ
імені ІГОРЯ СІКОРСЬКОГО»

Department of Radio Engineering

[RE-51] ELECTROMAGNETIC COMPATIBILITY OF RADIOELECTRONIC SYSTEMS



Curriculum (Syllabus)

Course details

Level of higher education	First (bachelor's)
Field of knowledge	G - Engineering, manufacturing, and construction
Specialization	G5 - Electronics, electronic communications, instrument engineering, and radio engineering Educational programAll
Discipline status	Elective (F-catalog)
Form of higher education Full-time	
Year of training, semester	Available for selection starting from the 3rd year, spring semester
Scope of the discipline	4 credits (Lectures 16 hours, Practical classes 30 hours, Laboratory work 74 hours)
Semester control/control measures	Test
Class schedule	https://schedule.kpi.ua
Language of instruction	Ukrainian/English
Information about the course coordinator / lecturers	Lecturer: O. Y. Sushko, Lab: O. Y. Sushko,
Course location	https://drive.google.com/drive/folders/1z4P2owpOWuXgHFWShbNvcm_o4Jzu2rDk?usp=sharing

Curriculum

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

With the active development and miniaturization of electronics, EMC issues are becoming increasingly relevant.

The course reveals the essence of the causes of EMC problems in modern radio-electronic systems and ways to overcome them, as well as the basics of radio frequency spectrum management.

The aim of the course is to familiarize students with EMC issues, examine the analysis of the electromagnetic environment, ensure the EMC of radio-electronic systems, and teach the basics of RF spectrum management.

In this course, students will learn to assess the susceptibility of radio-electronic devices and systems to various types of interference and to determine the basic technical methods of compensating for an interfering environment. Using modern technical means, they will determine the level of unwanted emissions from radio-electronic devices and systems and establish their compliance with standards.

After successfully completing the course, students will acquire the following skills and knowledge:

- the structure of international and national radio frequency tables and the main approaches to radio frequency spectrum management;
- the main mechanisms and characteristics of the propagation of useful radio signals and interference in different frequency bands;
- technical methods for reducing interference in radio-electronic systems;
- principles of frequency-territorial separation and frequency planning of communication networks;
- methods of modeling electromagnetic compatibility in modern software;
- assess electromagnetic compatibility in the case of interference from two or more radio systems of different types
- calculate the energy characteristics of radio interference and useful signals propagation;
- assess the electromagnetic compatibility of single- and multi-layer printed circuit boards.

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

Before taking this course, students are recommended to master the material of the course "Antennas and Microwave Devices" and understand the principle of operation and basic characteristics of receiving and transmitting devices.

3. Contents of the discipline

1. BASICS OF RADIO FREQUENCY RESOURCE MANAGEMENT
2. TECHNICAL BASICS OF ELECTROMAGNETIC COMPATIBILITY ANALYSIS OF RADIOELECTRONIC DEVICES
3. METHODS OF ENSURING EMC OF RADIOELECTRONIC DEVICES (RED)
4. METHODS OF FREQUENCY PLANNING FOR RADIO COMMUNICATION AND BROADCASTING NETWORKS
5. TECHNICAL MEANS OF ENSURING EMC OF RES UNDER THE INFLUENCE OF INTERFERENCE IN COMMUNICATION SYSTEMS
6. OPTIMIZATION OF RES AND COMPUTER MODELING OF EMC
7. ORGANIZATION OF RADIO CONTROL SERVICES
8. METHODS OF ANALYSIS AND TECHNOLOGIES FOR ENSURING EMC OF RES LOCATED AT A SINGLE FACILITY
9. INDUSTRIAL RADIO EQUIPMENT

The EMC RED course is supported by a full cycle of 5 laboratory works conducted at the antenna laboratory, namely:

1) Research on the antenna coupling coefficient, where students measure the mutual interference of two RED and study the effect of shielding on interference.

2) Research on the spurious emissions of signal formation and generation devices, where the frequency response of the signal generator and the full spectrum of spurious emissions and their characteristics are measured.

3) Research on WI-FI coverage and the susceptibility of WI-FI connections on mobile phones to interference, where students measure signal attenuation with distance, WI-FI signal levels using mobile phones, and experimentally determine the interference immunity of WI-FI connections.

4) Research on the radiation level of radio-electronic devices, where the level of such devices as microwave ovens and mobile phones is studied.

5) Research on the electromagnetic spectrum up to 1.7 GHz using a software-defined radio (SDR) and a selective voltmeter, where students use a laptop and an SDR receiver to study the characteristics of radio and television broadcast signals using different antennas.

4. Teaching materials and resources

1) Ivanov V.O. "Electromagnetic Compatibility of Radio Electronic Equipment," 2014, ISBN: 978-966-598-859-5

2) Electromagnetic Compatibility in Power Supply Systems: Textbook / I.V. Zhezhelenko, A.K. Shidlovsky, G.G. Pivnyak, Yu.L. Saenko.-D, National Mining University, 2009.-319 p.: ill. ISBN 978-966-350-153-6

3) Chernikhov Yu.V. Electromagnetic compatibility of technical means in automated control systems: Teaching aid. - Dnipropetrovsk: HIPOPROM, 2007. - 80 p.

4) Volodymyr V.I., Doktrov A.L., Elizarov F.V. et al., Electromagnetic Compatibility of Radio Electronic Devices and Systems. Edited by N.M. Tsarkov.

Educational content

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

Relevant literature sources are indicated for each topic of the course. Students are encouraged to independently study the relevant materials after the lecture. During practical classes, the practical aspects of the course are explained in detail, and students are encouraged to actively participate in discussions and ask clarifying questions. Practical classes also include a review of relevant webinars on EMC topics. The coursework includes two assignments based on the materials from both lectures and practical classes. The coursework is completed in writing, and assessment takes place through an individual interview with the student to evaluate their understanding of the material.

In addition, for better assimilation of the material, appropriate consultations are held during the semester, as well as before exams and laboratory work.

6. Independent work by students

Students must complete assignments to prepare for the completion and defense of laboratory work for the course.

Some topics are also assigned for independent study, with the opportunity to ask the instructor questions on these topics during consultations.

Policy and control

7. Academic discipline policy (educational component)

Class attendance

Attendance at lectures, practical classes, and laboratory classes is mandatory in accordance with the Regulations on the Organization of the Educational Process at Igor Sikorsky KPI. In case of illness, students are required to submit a duly completed certificate of treatment from the institution where they received treatment. In other cases (e.g., family circumstances), the issue is resolved on an individual basis with the instructor. Material from classes that were missed for these

For the convenience of students, links to video recordings of all lectures are available at http://dtsp.kiev.ua and *https://do.ipo.kpi.ua/course/view.php?id=454*.

Missed tests

Submission of laboratory work results is mandatory. Late submission will result in a zero grade. In case of late submission for valid reasons (e.g., illness) confirmed by relevant documents, the student has the opportunity to take the test at another time agreed with the teacher without a grade reduction.

Students can automatically receive a credit based on the points earned during the semester.

Announcement of test results

The results of independent work are posted in the Moodle LMS and announced to each student individually in person or remotely, accompanied by assessment sheets (in the Moodle LMS) in which students can see their grades according to specific criteria, as well as the main mistakes and comments on them.

The test is conducted in writing with a personal interview with the student. The test can also be conducted in the form of tests and assignments using the capabilities of the Moodle LMS.

Academic integrity

The policy and principles of academic integrity are defined in Section 3 of the Code of Honor of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute." For more details, see: https://kpi.ua/code.

Standards of ethical behavior

The standards of ethical conduct for students and employees are defined in Section 2 of the Code of Honor

of the National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute". For more details, please visit: https://kpi.ua/code.

Procedure for appealing the results of control measures

Students have the opportunity to ask any questions regarding the procedure for conducting and/or evaluating control measures and expect that they will be considered in accordance with pre-defined procedures.

Students have the right to appeal the results of control measures, but they must provide a reasoned explanation of which criteria they disagree with according to the assessment sheet and/or comments.

8. Types of assessment and the learning outcomes assessment rating system (LOAS)

To be admitted to the exam, it is mandatory to defend all laboratory work, HCW, and present a selected topic, which takes place during practical classes.
Laboratory work - 50 (5 pieces, 10 points each)
HCW- 25 points
Presentation of a selected topic - 25 points

Students who have earned more than 60 points during the semester and completed all laboratory work receive a grade according to the table.

Students who have earned less than 60 points, as well as those who want to improve their grade, will take a final exam, and their semester grade will be reset to zero.

Final exam

The final exam consists of two theoretical and two practical questions, each of which is worth 25 points. The test is written and includes an individual oral interview.

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

The EMC RED course includes a full cycle of five laboratory works conducted at the antenna laboratory, namely:

Research on the antenna coupling coefficient, where students measure the mutual interference of two RED and study the effect of shielding on interference.

Research on the spurious emissions of signal formation and generation devices, where the frequency response of the signal generator and the full spectrum of spurious emissions and their characteristics are measured.

Research on WI-FI coverage and the susceptibility of WI-FI mobile phone connections to interference, where students measure signal attenuation with distance, WI-FI signal level using a mobile phone, and experimentally determine the interference immunity of WI-FI connections.

Research on the radiation level of radio-electronic devices, where the level of such devices as microwave ovens and mobile phones is studied.

Research on the electromagnetic spectrum up to 1.7 GHz using a software-defined radio (SDR) and a selective voltmeter, where students use a laptop and an SDR receiver to study the characteristics of radio and television broadcast signals using different antennas.

Work program for the academic discipline (syllabus):
Compiled by O. Yu. Sushko;
Approved by the RI Department (Minutes No. 06/2025 dated 24.06.2025)
Approved by the methodological commission of the faculty/research institute (protocol No. 06/2025 dated 26.06.2025)