№	Field name	Detailed content, comments
1.	Name of the faculty	Information Radio Technologies and Technical Information Security
2.	The level of higher education	Master's
3.	Code and title of specialty	172 Telecommunications and Radio Engineering
4.	The type and title of the educational program	Media Engineering
5.	Code and title of the discipline	VB 2.4. Methods of decision making in information and measuring systems
6.	Number of ECTS credits	5
7.	The structure of the course (distribution by type and hours of training)	Lectures - 24, practical training - 10, laboratory work - 16, consultations -12, independent work – 88, semester control - combined exam
8.	Schedule (terms) of study of the subject	Fifth year, semester - 9
9.	Prerequisites for learning the discipline	Higher mathematics, physics
10.	Abstract (content) of the discipline	**MODULE 1. BASIC CONCEPTS OF THEORY OF DECISION MAKING.** **Theme 1. Lecture №1.** Introduction. Basic concepts of decision theory. Terms and definitions. **Theme 2. Lecture №2.** Quality criteria in decision-making tasks in conditions of risk. **Practical lesson №1**. The criterion of maximum plausibility in the problems of synthesis of the optimal receiver of the radar system. **Laboratory work №1.** Construction and research of optimal solutions based on the criterion of maximum plausibility. **Independent work №1**. Introduction. Basic concepts of decision theory. Terms and definitions. Study of theoretical material using abstracts and textbooks. **Independent work №2**. Quality criteria in decision-making tasks in conditions of risk. Study of theoretical material

		using abstracts and textbooks. Preparation for practical classes. **MODULE 2. METHODS OF OPTIMIZATION OF TARGET FUNCTIONS.** **Theme 1. Lecture №3.** Statement of the conditional optimization problem. Additive and multiplicative objective functions. Criteria and functional limitations. **Laboratory work №2.** Optimization of signal processing in the land survey radar. **Independent work №3**. Statement of the conditional optimization problem. Additive and multiplicative objective functions. Criteria and functional limitations. Study of theoretical material using abstracts and textbooks. Preparation for practical classes. **Theme 2. Lecture №4.** Extremum search methods for unconditional parametric optimization. **Laboratory work №3.** Optimization of space-time signal processing in adaptive antenna arrays. **Independent work №4**. Extremum search methods for unconditional parametric optimization. Study of theoretical material using abstracts and textbooks. Preparation for practical classes. **Theme 3. Lecture №5.** Random search methods. **Independent work №5**. Random search methods. Study of theoretical material using abstracts and textbooks. Preparation for practical classes. **Theme 4. Lecture №6.** Methods for finding local extrema. **Practical lesson №2**. Zero order methods. Gauss-Seidel method.

		Rosenbrock method. Class of gradient algorithms. **Theme 5. Lecture №7.** Methods for finding global extrema. **Independent work №6**. Methods for finding local extrema. Study of theoretical material using abstracts and textbooks. Preparation for practical classes. **Practical lesson №3**. Independent global search. Random search with managed exam density. Wandering global search. **Independent work №7.** Methods for finding global extrema. Study of theoretical material using abstracts and textbooks. Preparation for practical classes. **MODULE 3. EDITING INPUT DATA.** **Theme 1. Lecture №8.** Edit data with implausible values. **Practical lesson №4**. Editing data with improbable values in the problems of synthesis of optimal electronic systems. **Independent work №8.** Editing data with improbable values in the problems of synthesis of optimal electronic systems. Study of theoretical material using abstracts and textbooks. Preparation for practical classes. **Theme 2. Lecture №9.** Tukey-53X procedure in problems of synthesis of optimal RES. **Laboratory work №4.** Research of methods of optimization of objective functions. **MODULE 4. GAME THEORY.** **Theme 1. Lecture №10.** Game models of decision making.

		Independent work №9. Game models of decision making. Study of theoretical material using abstracts and textbooks. **Practical lesson №5**. Player strategy. The ultimate and endless game. Payment matrix. **Theme 2. Lecture №11.** Player strategy. The ultimate and endless game. Payment matrix. Principles of mathematical formalization of games on the examples of the simplest games. **Independent work №10.** Player strategy. The ultimate and endless game. Payment matrix. Principles of mathematical formalization of games on the examples of the simplest games. Study of theoretical material using abstracts and textbooks. Preparation for practical classes. **Theme 3. Lecture №12.** Solving games in mixed strategies. The basic theorem of game theory. Analytical and geometric solution of games. **Independent work №11.** Solving games in mixed strategies. The basic theorem of game theory. Analytical and geometric solution of games. Study of theoretical material using abstracts and textbooks. Preparation for practical classes.
11.	Competencies, knowledge, skills, understanding that a higher education acquirer has in the learning process	**Be able to know.** 1. Statement of the conditional optimization problem. Additive and multiplicative objective functions. Criteria and functional limitations. 2. Methods of finding local extrema. Zero order methods. Gauss-Seidel method. Rosenbrock method. Optimization of one-dimensional unimodal functions. 3. Completely random search. Managed random search. Implementation of algorithms in discrete mathematics. Terms of use and characteristics.

		Advantages and disadvantages of random search algorithms. 4. Class of gradient algorithms. The fastest descent method. Multi-step methods of the first order. Terms of use and characteristics. 5. Newton's method. Terms of use and characteristics. Advantages and disadvantages of second-order algorithms. 6. Methods for finding global extrema of objective functions. 7. Filter method. Tukey-53X procedure. The concept of robustness. 8. Player strategy. The ultimate and endless game. Payment matrix. Principles of mathematical formalization of games on the examples of the simplest games. **Be able to do.** 1. Perform mathematical formulation of the optimization problem. 2. Make a choice of criteria according to the purpose of the problem to be solved. 3. Be able to build algorithms for finding the extrema of objective functions according to the methods of Gauss-Seidel, Rosenbrock, completely random search, controlled random search, the fastest descent, multi-step first-order methods, and Newton's method. 4. Be able to implement the filter method and the Tukey-53X procedure when editing input data. 5. Use the principles of mathematical formalization of games on the examples of the simplest games.
12.	Learning outcomes of a Higher Education applicant	1. To analyze the functional and circuit construction of the electronic system in terms of its optimization. 2. Perform the necessary calculations to determine the characteristics of devices

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<tr><td></td><td></td><td>and systems, evaluate the effectiveness of structural construction of the system.
3. Carry out computer modeling to determine the parameters of individual devices and the system as a whole.</td></tr>
<tr><td>13.</td><td>Assessment system in accordance with each task for taking tests/exams</td><td>As a form of final control for the discipline "Methods of decision making in information and measurement systems" the combined exam is used.
The final score is calculated by the formula: $O_{Д}^{екз} = 0{,}6 \cdot O_{сем} + 0{,}4 \cdot O_{екз}$, where $O_{сем}$ – assessment for the semester in a 100-point system, $O_{екз}$ – score for the exam in a 100-point system.
The ticket for the exam consists of two questions of theoretical material and a task. Theoretical questions are evaluated in 30 x 2 = 60 points, and the task – in 40 points (at sum – 100 points). To evaluate the student's work during the semester, the final rating assessment Осем calculated as the sum of grades for different types of classes and control measures.
<table>
<tr><th>Type of lesson / control measure</th><th>Rating</th></tr>
<tr><td>Practical training № 1,2,3</td><td>10x3=30</td></tr>
<tr><td>Laboratory work №1,2</td><td>10x2=20</td></tr>
<tr><td>Checkpoint 1</td><td>50</td></tr>
<tr><td>Practical training № 4,5</td><td>5x2=10</td></tr>
<tr><td>Laboratory work №3,4</td><td>10x2=40</td></tr>
<tr><td>Checkpoint 2</td><td>50</td></tr>
<tr><td>Total for the semester</td><td>100</td></tr>
</table></td></tr>
<tr><td>14.</td><td>The quality of the educational process</td><td>The policy of academic integrity, updating the content of the discipline on the basis of modern practices, scientific achievements, recommendations of employers</td></tr>
<tr><td>15.</td><td>Methodological support</td><td>Basic literature.</td></tr>
</table>

		1. Polyak B.T. Introduction to Optimization — M.: Nauka, 1983. (in Russian) 2. Sytnik O.V., Kartashov V.M. Radio engineering systems — Kharkov.: SMIT, 2009. (in Ukraine) 3. Ilyin V.N., Frolkin V.T., Butko A.I. et al. Automation of circuit design — M.: Radio & Svyaz, 1987. (in Russian) 4. Batischev D.I. Methods of optimal design — M.: Radio & Svyaz, 1984. (in Russian) 5. Orlov A.I. Decision theory. Textbook.— M.: Publishing house "Mart", 2014. (in Russian) 6. Otnes P., Enokson L. Applied analysis of time series — M.: Mir, 1982. (in Russian). 7. Petrosyan L.A. Game theory. Textbook — M.: «Vyshaya schcola», 2014. (in Russian). **Supporting literature.** 1. Larichev O.I. Theory and methods of decision making — M.: Logos, 2000. (in Russian). 2. Vorobyev N.N. Fundamentals of game theory. Non-coalition games — M.: Fizmatlit, 1984. (in Russian). **Methodical materials for independent work.** 1. Summary of lectures on the subject "Methods of decision-making in information, multimedia systems" for students majoring in 172

		"Telecommunications and Radio Engineering" educational training program "Media Engineering" master's degree. [Electronic edition] / author. O.V. Sytnik – Kharkov: XNURE, 2020. – 211 c. (in Ukraine). 2. Methodical instructions for independent work in the discipline "Methods of decision-making in information, multimedia systems" for students majoring in 172 "Telecommunications and Radio Engineering" educational training program "Media Engineering" master's degree. [Electronic edition] / author O.V. Sytnik – Kharkov: XNURE, 2020. – 21 c. (in Ukraine). 3. Exam questions in the discipline "Methods of decision making in information, multimedia systems" for students majoring in 172 "Telecommunications and Radio Engineering" educational training program "Media Engineering" master's degree. [Electronic edition] / author O.V. Sytnik – Kharkov: XNURE, 2020. – 6 c. (in Ukraine). 4. Methodical instructions for practical work in the discipline "Methods of decision-making in information-measuring systems" for students majoring in 172 "Telecommunications and Radio Engineering" educational program training "Media Engineering" master's degree. [Electronic edition] /

		author O.V. Sytnik – Kharkov: XNURE, 2020. – 43 c. (in Ukraine).
16.	The developer of the Syllabus	Professor, Doctor of Physical and Mathematical Sciences **Oleg Viktorovich Sytnik** oleh.sytnik@nure.ua