The syllabus of the discipline

Fundamentals of decision making theory

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Field name	**Detailed content, comments**
Name of the faculty	Faculty of Infocommunications
Level of higher education	Second (master's)
Code and name of the specialty	172 Telecommunications and radio engineering
Type and name of educational program	ESP, EPP "Information and Network Engineering"
Name of the discipline	Fundamentals of decision making theory
Number of ECTS credits	3
Discipline structure (distribution by types and hours of study)	26 hours - 13 lectures, 8 hours - 4 practical classes, 16 hours - 4 laboratory classes, 10 hours - 5 consultations, 90 hours - independent work, **type of control:** credit
Schedule (terms) of studying the discipline	2-nd year, II semester
Prerequisites for studying the discipline	Basic concepts of disciplines 1. Technologies of data processing in IC 2. Discrete mathematics 3. Telecommunication theory 4. Basics of information and communication technologies
Competences, knowledge, skills, understanding, which is acquired by the applicant in higher education in the learning process	Be able to apply modern methodology and mathematical apparatus of decision theory to develop optimal (rational) technical and managerial decisions; to compile statistical and deterministic mathematical models used in decision theory; to assess the degree of risk and effectiveness of the decision; to assess the degree of risk and effectiveness of the decision; to conduct research of models and methods of the theory of decision-making on a PC in order to obtain optimal (rational) decisions.
The quality of the educational process	Educational-methodical and material-technical resource provision of the educational program, within the framework of which the discipline is studied, meets the licensing requirements and accreditation conditions of the educational activity of the university. Annual monitoring and revision of the curriculum of the discipline in accordance with the requirements and recommendations of the Ministry of Education and Science, state certification of acquired competencies of graduates, standards of cooperation with employers to ensure a competitive level of training. Adherence to the principles of academic integrity (https://lib.nure.ua/plagiat). Contains public information on the requirements, competencies, level of education within the current educational program.

Description and content of the discipline

According to the qualification requirements for higher education in specialty 172 "Telecommunications and Radio Engineering" the purpose of the discipline "Fundamentals of Decision Theory" is to reveal the theoretical foundations of decision-making patterns, methods and models for finding optimal (rational) decisions and skills in their practical implementation in professional activities.

The main tasks of studying the discipline are learning students to classify the main tasks of decision theory; study of the peculiarities of rational decision-making, including collective decision-making; study of a wide range of tasks to be solved in planning and management, pattern recognition, in conditions of uncertainty, etc .; study of modern statistical, deterministic and multicriteria theoretical methods of decision theory; gaining skills and mastering practical techniques for developing mathematical models for making optimal (rational) decisions; gaining skills and mastering practical techniques of using computing tools to support optimal (rational) decisions.

Content

Content module 1.

Topic 1. General foundations of decision theory

Decision making process. Tasks and methods of decision making. Scales and methods of measurements. Decision making in distribution tasks. Decision making in ordering problems. Optimal stop method.

Dynamic programming method. The task of the picky bride.

Topic 2. Decision making in conflict (game theory)

History, tasks and classification of games. Lower and upper game prices. The principle of minimax. Nash equilibrium points. Pure and mixed strategies. Basic methods of solving games. Games 2□2 and 2□n. Geometric solution of games. Solving games by the method of successive approximations. Solving games by linear programming. Methods for solving some endless games.

Topic 3. Decision making in conditions of uncertainty (games with nature)

Games with nature. Statistical criteria and decisions in the game with nature. The concept of pattern recognition. Axioms of rational choice. Choice based on experiment in conditions of interaction and uncertainty.

Content module 2.

Topic 4. Estimation of probability distributions and parameters of signals

The concept of point and interval estimation of parameters. Loss functions. Properties of estimates. Obtaining estimates by the method of moments. Obtaining estimates of maximum plausibility. Least squares method and its application, in particular in regression analysis. Estimation of radio pulse parameters against the background of Gaussian white noise.

Topic 5. Multicriteria choice of alternatives, Pareto set and method of analysis of Saati hierarchies

General information about multicriteria selection. Pareto plural. Specifics of a multicriteria problem. The method of the main criterion. The method of successive actions. Mathematical foundations of the Saati method.
Topic 6. Methods of collective decision making
The task of forming collective decisions. Voting method. Bayesian models of collective decision making. Interval generalization of models.

Learning outcomes of higher education

As a result of studying the discipline, students must:

know:

- methodological bases of decision making;
- basic classes of problems of decision theory;
- axiomatics of rational decision making;
- basic methods of decision theory;
- psychological aspects of human behavior in decision making.

be able:

- apply modern methodology and mathematical apparatus of decision theory to develop optimal (rational) technical and managerial decisions;
- to compile statistical and deterministic mathematical models used in decision theory; to assess the degree of risk and effectiveness of the decision;
- to assess the degree of risk and effectiveness of the decision;
- to study the models and methods of the theory of decision making on a PC in order to obtain optimal (rational) decisions.

Assessment system according to each task for passing the test / exam.

To evaluate the student's work during the semester, the final rating score sem Q is calculated as the sum of grades for different types of classes and grades for control activities. The maximum rating during the semester is 100 points.

Вид заняття / контрольний захід	Оцінка
Лабораторна робота № 1	9-15
Лабораторна робота № 2	9-15
Практичні заняття № 1	3-5
Практичні заняття № 2	3-5
Контрольна точка 1	24-40
Лабораторна робота № 1	9-15
Лабораторна робота № 2	9-15
Практичні заняття № 1	3-5
Практичні заняття № 2	3-5
Контрольна робота	12-20
Контрольна точка 2	**36-60**
Всього за семестр	**60…100**

To control the knowledge of the discipline, a test is provided.
With this type of control, the total score is calculated by the formula: $P_{п} = 0,6Q_{сем} + 0,4Q_{исп}$, where $Q_{исп}$ - the score for the exam on a 100-point system; $Q_{сем}$ - assessment for the semester on a 100-point system.

Qualitative evaluation criteria in the national scale and ECTS

Satisfactory, D, E (60-74). Show the required minimum of theoretical knowledge. Know the ways and methods of solving practical problems and be able to use them in practice.

Good, C (75-89). Firmly know a minimum of theoretical knowledge. Demonstrate the ability to solve a practical problem and justify all stages of the proposed solution.

Excellent, A, B (90-100). Show complete knowledge of basic and additional theoretical material. Unmistakably solve a practical problem, explain and justify the chosen method of solution.

Assessment scale: national and ECTS

<table>
<tr><td rowspan="2">The sum of points for all types of educational activities</td><td rowspan="2">ECTS assessment</td><td colspan="2">Score on a national scale</td></tr>
<tr><td>for exam, course project (work), practice</td><td>for offset</td></tr>
<tr><td>90 – 100</td><td>A</td><td>perfectly</td><td rowspan="5">credited</td></tr>
<tr><td>82-89</td><td>B</td><td rowspan="2">fine</td></tr>
<tr><td>74-81</td><td>C</td></tr>
<tr><td>64-73</td><td>D</td><td rowspan="2">satisfactorily</td></tr>
<tr><td>60-63</td><td>E</td></tr>
<tr><td>35-59</td><td>FX</td><td>unsatisfactory with the possibility of reassembly</td><td>not credited with the possibility of re-assembly</td></tr>
<tr><td>0-34</td><td>F</td><td>unsatisfactory with mandatory re-examination</td><td>not credited with compulsory re-study of the discipline</td></tr>
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Methodical support

Basic literature

1. Fainzilberh L.S., Zhukovska O.A., Yakymchuk V.S. Teoriia pryiniattia rishen. K. 2018. - 246 s.
2. Voloshyn O.F., Mashchenko S.O. Modeli ta metody pryiniattia rishen: navch. posib. dlia stud. vyshch. Navch. zal. – K.: Vydavnycho-polihrafichnyi tsentr «Kyivskyi universytet», 2010. - 336 s.
3. Rodzyn S.Y. Teoryia pryniatyia reshenyi: lektsyy y praktykum: Uchebnoe posobye. – Tahanroh: Yzd-vo TTY YuFU, 2010. 336 s.
4. Tu Dzh., Honsales R. Pryntsypы raspoznavanyia obrazov. – M.: Myr, 1978.

Supporting literature

5. Hykhman Y.Y., Skorokhod A.V., Yadrenko M.Y. Teoryia veroiatnostei y matematycheskaia statystyka. – K.: Vyshcha shkola, 1979.—408s.
6. Tykhonov V.Y. Optymalnыi pryem syhnalov. – M.: Radyo y sviaz,1983. – 320 s.
7. Kulykov E.Y. Metodы yzmerenyia sluchainыkh protsessov.1986. 272 s
8.Seber Dzh. Lyneinыi rehressyonnыi analyz. M.: Myr. 1980.

Methodical instructions for different types of classes

9. Komplekt slaid-lektsii z dystsypliny «Osnovy teorii pryiniattia rishen» [Elektronnyi dokument] / Uporiad.: A.V. Omelchenko. – Kharkiv: KhNURE, 2019.
10. Metodychni vkazivky do laboratornykh robit z kursu " Osnovy teorii pryiniattia rishen " [Elektronnyi dokument] /Uporiad.: A.V. Omelchenko, S.V. Omelchenko. – Kharkiv: KhNURE, 2019.
11. Metodychni vkazivky do laboratornykh robit z kursu " Osnovy teorii pryiniattia rishen" [Elektronnyi dokument] /Uporiad.: A.V. Omelchenko, S.V. Omelchenko. – Kharkiv: KhNURE, 2019.

Information support

1. Mathcad
2. The R Project for Statistical Computing
3. Rstudio