

Discipline Syllabus
«Theory of Choice and Decision Making»

1. Course Description

- a. Title of a Course: «Theory of Choice and Decision Making»
- b. Pre-requisites: basic courses in Calculus, Discrete Mathematics, Linear Algebra, Theory of Probability and Mathematical Statistics
- c. Course Type (compulsory, elective, optional): compulsory
- d. Abstract

The course includes main notions and stages of decision making, uni- and multicriterial models, rationality of individual and social decisions, main notions of utility theory, choice models, and their use in applied problems.

2. Learning Objectives: To familiarize students with the basic concepts, models and statements of the theory of choice and decision making.

3. Learning Outcomes:

- Know principles of models construction in decision analysis;
- Be able to choose rational options in practical decision-making problems
- Have skills in analysis of game-theoretic models.

4. Course Plan:

Topic 1. Mathematical Model of the Decision Making Situation:

Decision making, its participants and stages. Mathematical Model of Problem Situation. Sequential Method of Decision Making. Mathematical Theory of Measurement.

Topic 2. Preferences Modelling.

Utility function, value function, binary relations of preference and indifference, choice function. Optimal and undominated alternatives.

Topic 3. Multicriterial preferences and choice.

Vectorial criteria, criterial space, multicriterial preferences, indifference curves, additive value function, lexicographic preference.

Topic 4. Pareto optimality

Efficient alternatives, the structure of Edgeworth-Pareto set, approximation of Edgeworth-Pareto set, cost-benefit analysis.

Topic 5. How to solve multicriterial problems?

Linear convolution method, the method of main criterion, SMART and SMARTS methods, goal programming, proximity to ideal point, consistency of pairwise comparisons.

Topic 6. Importance of criteria

Homogeneous criteria, qualitative and quantitative importance, information basis of importance, decision rules.

Topic 7. Decision making under risk

Classification of problems, risk measures as criteria for decision making, utility models, comparison of decisions via expected utility.

Topic 8. Decision making under uncertainty

Optimality principles – guaranteed result, maxmin, pessimism, lexicographic maxmin, optimism, Hurwitz, Savage, Bernoulli-Laplace principles.

5. Reading List

a. Required

Aleskerov F., Bouyssou D., Monjardet B. ‘Utility Maximization, Choice and Preference’, Springer Verlag, Berlin, 2007

Fishburn P. Mathematics for Decision Theory, The Hague, Mouton, 1972

Kreps D. Notes on the theory of choice,

Luce R.D., Raiffa H. Games and Decisions, New York, Wiley, 1957

b. Optional

Aizerman M., Aleskerov F. Theory of Choice, Elsevier, 1995

Podinovski V. Decision making under uncertainty with unknown utility function and rank ordered probabilities // European journal of operational research. 2014. V. 239. P. 537 – 541.

Podinovski V. Non-dominance and potential optimality for partial preference relations // European journal of operational research. 2013. V. 229. P. 482 – 486.

Podinovski V. Set choice problems with incomplete information about the preferences of the decision maker // European journal of operational research. 2010. V. 207. P. 371 – 379.

Podinovski V. On the use of importance information in MCDA problems with criteria measured on the first ordered metric scale // European journal of operational research. 2010. V. 207. P. 371 – 379.

Roy B. Multicriteria methodology for decision aiding. – Dordrecht: Kluwer Academic Publishers, 1996

Saaty T. Multicriteria decision making. The analytic hierarchy process. – Pittsburgh: RWS Publications, 1990

Vincky Ph. Multicriteria decision aid. – Chichester: Wiley, 1992

Yu P.L. Multiple criteria decision making: concepts, techniques, and extensions. – New York: Plenum Press, 1985

6. Grading System

30% homework + 30% mid-term exam + 40% final exam

7. Guidelines for Knowledge Assessment

8. Methods of Instruction

The discipline is delivered through lectures seminars, including computer classes.

9. Special Equipment and Software Support (if required): Computer classes