**Syllabus of the course**

“Advances in Decision Making Theory and Applications”

Moscow, 2021

**Lecturers** – Professor, Dr. Fuad Aleskerov, Associated Professor Aleksey Myachin (National Research University Higher School of Economics and Institute of Control Sciences of Russian Academy of Sciences)

*Lectures 1* (2 hours). **Decision Making – why, when and under which circumstances?**

Main notions and phases of decision making process are presented. All notions and the process are illustrated via examples. An analysis of the COVID-19 spread.

Lectures 2-3 (4 hours) **Aggregation Models**

Main models on multicriterial and collective decision making are given. Tornado prediction.

*Lecture 4-5* (4 hours). **Efficiency on Micromarkets. Cost-benefit Analysis**

Analysis of customers’ behavior for large network. Efficiency of bank branches. Location of branches of a firm. Efficiency of retail network. Analysis of living conditions in settlements and regions. Cost-benefit analysis. An analysis of COVID-19 spread and efficiency of quarantine measures.

*Lecture 6-7.* (2 hours) **In which circumstances and why political decisions are made?**

Public goods. Elections and referenda. Participation in elections. Informing voters. Party platforms and voting.

Lecture 8-9. (4 hours) **Main concepts in game theory**

Definition of game, dominant strategies, concept of equilibrium, Nash equilibrium, focal points.

Examples of games.

*Lectures 10-12.* (4 hours) **Voting and Manipulation in Voting**

Some excursion in history. How a voter's opinion is described? Arrow's Paradox. Sen's Paradox. Voting procedures in elections. The interchange of votes (log rolling). Voting by feet. Pattern analysis in elections. Manipulation in voting. Jerrymandering.

*Lecture 13-14.* (4 hours). **Power distribution in organizational bodies.**

Main notions. Coalitions. Classic power indices. Power indices taking into account preferences of agents to coalesce. Applications to banks, IMF, Security Council of UNO, European Parliament, German Reichstag (1918-1933), Russian Duma.

Lecture 15 (2 hours). **Polarization in parliaments**

Different concepts of polarization. Analysis of polarization in Russian Duma, European Parliament, USA House of Representatives.

Lecture 16 (2 hours). **How to measure the results of election?**

To which extent does a parliament represent opinion of people? Different measures of representation. Examples of real parliaments.

Lectures 17-18 (4 hours). **Networks**

Classic centrality measures in networks. New centrality measures. Application of indices to migration processes, food security, conflict networks, foreign claims networks, students’ mobility networks, international trade, terroristic organizations, etc.

**Prerequisites:** Math at high school level.

All presentations will be distributed after each lecture among students. A piece of the Lectures 2-3 is attached.

Each lecture is accompanied by a home work.

Students are invited using the methods developed in the course to make some projects concerning real-life examples. Team projects are allowed as well.

**Examples of the projects.**

1. Power distribution among factions in the parliament of your country.
2. An analysis of the network among universities in your country.

**The final grade FG is evaluated as**

FG = 0.3\*Home works evaluation + 0.3\*Project evaluation + 0.4\*Final exam grade

**Exemplary literature**

**(for those who would like to get deep understanding of the models)**

**Books**

1. Aizerman, M., and F.Aleskerov (1995) 'Theory of Choice', North Holland, Elsevier
2. Aleskerov, F. *Arrovian Aggregation Models*. Kluwer, Dordrecht, 1999.
3. Arrow, K. *Social Choice and Individual Values*. Yale University Press, 1963, 2d ed.
4. Dixit A.K., Nalebuff B.J. Thinking Strategically. W. Norton & Company. New York, London. 1993
5. Nurmi H. Comparing Voting Systems. Dordrecht, Boston, Lancaster, Tokyo. Reidel Publishing Company. 1987.
6. Shwartz T. The Logic of Collective Choice. New York. Columbia University Press. 1986.

**Articles**

1. Aleskerof F. ‘Procedures of multicriterial choice.’ Proceedings of the IFAC/IFORS Conference on Control Science and Technology for Development, Beijing, China, 1985, v.2, 858-869
2. Aleskerov F. ‘Multicriterial Interval Choice Models,’ Information Sciences, v. 80, nos. 1 and 2, 1994, 25-41
3. Aleskerov F., Ersel H., Yolalan R. ‘Personnel allocation among bank branches using a two-stage multicriterial approach’, European Journal of Operational Research, 2003, vol 148/1, 116 – 125
4. Aleskerov F., Ersel H. and Yolalan R. ‘Multicriterial Ranking Approach for Evaluating Bank Branch Performance’, International Journal of Information Technology and Decision Making, v.3, no.2, 2004, 321-335
5. Aleskerov F., Karpov A. A new single transferable vote method and its axiomatic justification, [Social Choice and Welfare](http://link.springer.com/journal/355), March 2013, Volume 40, #3, 771-786
6. Aleskerov F., Nurmi H. ‘A Method for Finding Patterns of Party Support and Electoral Change:An Analysis of British General and Finnish Municipal Elections,’ Mathematical and Computer Modelling, 2008, 1225-1269
7. Aleskerov F., Chistyakov V., Kalyagin V. ‘Social threshold aggregations’, *Social Choice and Welfare, v.* 35, # 4, 2010, 627-646
8. Aleskerov F., D.Karabekyan, M.Remzi Sanver, V.Yakuba ‘On the degree of manipulability of multi-valued social choice rules’, Homo Oeconomicus, 28(1/2), 2011, 205-216
9. Fuad Aleskerov, Daniel Karabekyan, M. Remzi Sanver, Vyacheslav Yakuba “On the manipulability of voting rules: The case of 4 and 5 alternatives”, Mathematical Social Sciences, 2012, v.64, #1, 67-73
10. Fuad Aleskerov, Manfred J. Holler, Rita Kamalova. Power distribution in the Weimar Reichstag in 1919–1933, Annals of Operations Research. April 2014, Volume 215, Issue 1, pp 25-37.
11. Aleskerov F.T., Mescheryakova N.G., Shvydun S.V. Centrality Measures in Networks based on Nodes Attributes, Long-Range Interactions and Group. : Working paper WP7/2016/04. Moscow: State University— Higher School of Economics. 2016. 44 p.
12. F. Aleskerov, N. Meshcheryakova, A. Rezyapova, S. Shvydun. Network analysis of interna-tional migration: Working paper WP7/2016/06. Moscow: State University— Higher School of Economics. 2015. 56 p.
13. Leech D. Voting Power in the Governance of the International Monetary Fund. Annals of Operations Research. 2002. 109. P. 375 – 397.