**Рабочая программа дисциплины**

**«Теория игр и принятие политических решений / Game Theory and Political Decision-making»**

для образовательной программы «Политические науки»

направления подготовки 41.06.01 Политические науки и регионоведение

уровень: аспирантура

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*Настоящая программа не может быть использована другими подразделениями университета и другими вузами без разрешения разработчика программы.*

# Course description

The program of the course builds up the minimum requirements to the knowledge and skills of an PhD student and determines the content and types of classes and assessment. The program is designed for teachers of this discipline, learning assistants and students of political science PhD programs.

The program is developed according to:

•Educational Program «Political science»

•University Academic Plan of NRU HSE for PhD level education

# Course goals

The course aims to study methods of modern political decision-making and receive political analysis skills. The main topics covered include: (1) Game theory, (2) Voting Procedures and Social Choice, (3) other special methods of decision-making like fair division, matching, etc.

Many real world examples are presented like power distribution analysis in Russian Parliament and International Monetary Fund, analysis of structural balance in parliaments, etc. This course will help students internalize practical and effective mathematical methods and tools of political decision-making, and apply them to solve many real world problems.

# Learning objectives, expected learning outcomes

**Course objectives:**

After completing the course the student:

• will know and understand basics of game theory, voting theory, social choice theory, theory of power distribution and structural balance, matching theory, fair division theory, and basics of mathematical modeling;

• will be able to apply methods and algorithms for practical purposes, i.e. to find collective decisions by different rules, Nash equilibria, stable matchings, fair divisions, etc.;

• will be able to model and analyze real-life problems from the politics, social issues and everyday life.

# Competencies:

After completing the course the student develops the following competencies:

* ability for critical analysis and evaluation of current scientific achievements including interdisciplinary fields,
* ability to plan and solve problems of their own professional and personal development,
* ability to carry out theoretical and experimental research in the field of political science and regional studies, using modern research methods including information and communication technologies,
* the ability adapt the results of current research in the field of political science and regional studies to solve the problems arising from the activities of organizations and public policy.

The course is aimed at giving students the following skills: UK-1, UК-5, ОPК-1

# Course placement in the Program

The course is delivered to the second year PhD students, as a part of their professional development. The course is elective.

**Prerequisites**

All course is nontechnical. Technical details will be given in the most simplest way. Basic notions of elementary mathematics is needed.

**Description of course methodology and forms of assessment to be used**

|  |  |  |  |
| --- | --- | --- | --- |
| Type of grading | Type of work | Semester | Characteristics |
| 1 |
| Final  | Examination  | At the end | 80 min. |

At the end of the course student should know the basic mathematical models and methods of decision theory, be able to construct and evaluate the formal mathematical models describing the real situation, evaluate the data, identify patterns in them, apply decision-making model in real applications.

Grades on all forms of monitoring will be given in a 10-point scale.

Exam consists of tasks that are equivalent or similar to those that have been given to students in homework and for self-study. The duration of examination test is 80 minutes. Any fact of cheating will result in assessment of "0" for this work.

**Grading system**

Grading in the course will be based on the following criteria:

* + Work in class 20%
	+ Final exam 80%

Total 100%

Grades criteria:

|  |  |  |
| --- | --- | --- |
| From | To | Mark |
| 0 | 4 | Not passed |
| 4 | 5 | Satisfactory |
| 6 | 7 | Good |
| 8 | 10 | Excellent |

# Course outline

**Lecture 1.** **Introduction**

Introduction lecture: how do we make decisions? Individual preferences and social decisions. Voting models.

**Lecture 2.** **Non-cooperative game theory**

Games 2х2: strategies, payoffs, payoff matrix. Dominant strategies. Nash equilibrium. Examples of 2х2 games: Prisoner's dilemma, etc. Examples of games with and without Nash equilibrium, and with infinitely many Nash equilibria. Probability of event and expected payoff. Mixed strategies. Nash's Existence Theorem. Arms race and security.

**Lecture 3.** **Cooperative game theory**

Main notions. Core, Shapley value. Coalition formation.

**Lecture 4.** **Theories of strategic interests**

Theories of strategic interests, promises, main features of talks. Coordination games. Focal points. Arms race, invasion, bargaining. Misunderstanding and the application in politics.

**Lecture 5.** **Mechanism design**

Main notions. Most interesting mechanisms. Auctions. Public procurement.

**Lecture 6.** **Power indices**

Power distribution in elected bodies. Shapley-Shubik and Banzhaf indices. Power indices taking into account voters’ preferences to coalesce. Power distribution in Russian Duma and other parliaments.

**Lecture 7.** **Polarization**

Main notions. Polarization in one-dimensional case. Polarization in multi-dimensional case. Polarization in Russian Parliament and US Congress. Ethnolinguistic polarization.

**Lecture 8.** **Balance**

Structural balance. Signed graphs. Structural balance in Russian Duma and other parliaments.

**Lecture 9.** **Voting and Social Choice**

Condorcet Paradox, Arrow’s Paradox, Sen’s Paretian Liberal Theorem.

**Lecture 10.** **Voting procedures**

Some rules: position rules, rules based on majority relation, rules based on auxiliary number scale, rules based on tournament matrix, etc. Other aggregation models. Classification of procedures.

**Lecture 11.** **Spatial model of voting**

One-dimensional voting model. Median voter.

**Lecture 12.** **Manipulation**

Main notions. Gibbard-Satherswaite Theorem. A degree of manipulability of aggregation procedures. Gerrymandering.

**Lecture 13.** **Paradoxes of voting**

Paradoxes in social choice.

**Lecture 14.** **Voting patterns and how to analyze them**

Pattern models. Application to voting. Electoral patterns in Russian, British and Finnish elections.

**Lecture 15.** **Results of elections and how to evaluate them**

Distortion of the preferences of voters. Representativity of parliament. Main indices for the analysis of the results of election.

**Lecture 16.** **History of voting**

Voting in ancient, medieval, modern times.

**Lecture 17.** **Network models**

Main notions. Game-theoretic approach to network analysis. Centrality indices. Application to religion, migration, international trade, foreign claims, export of food and technologies.

**Lecture 18.** **Multicriterial decisions**

Main notions. Linear convolution. Threshold aggregation. Different solution concepts. Application to the analysis of administrative reform.

**Lecture 19.** **Fair Division**

History of fair division problem. «Cut-and-choose» procedure. Manipulability in fair division problem. Criteria of fairness. «Adjusted winner» procedure and its properties. Divorce settlements. Fair division in case of more than two players. Fair division in case of indivisible items.

**Lecture 20.** **Matching and assignment**

Main notions. Gale-Shapley algorithm for double-sided matching. One-to-many and many-to-many matchings. Examples of matching with preferences: roommates problem, job opening, etc. Assignment as linear programming problem. Application to conflict zones in Arctic region.

**Teaching method**

Classes are conducted in the form of lectures and seminars with the elements of a discussion, which requires a good self-study of students motivated by their homework. Students must be focused on the issues of self-study performance of tasks provided for this course. Self-study of students is an important part of their activities in this course. For the understanding of the course material and preparation for the exam students are required to solve the homework.

In seminars it is supposed to discuss the topics of PhD dissertations of students from the perspective of the course proposed.

**Texts, readings and other informational resources**

**Main texts:**

1. Hinich M., Munger M. Analitical Politics. – Cambridge University Press, Cambridge, 1997.
2. Roth A., Sotomayor M.O. Two-sided matching. – Cambridge University Press, 1990
3. Ordeshook P. Game theory and political theory. An introduction. − Cambridge University Press, 1986.

**Supplementary texts:**

1. Suzumura K. Rational Choice, Collective Decisions and Social Welfare. – Cambridge University Press, 1983.
2. Reilly B. Democracy in divided societies: electoral engineering for conflict management. – Cambridge University Press, 2001

**The other texts:**

1. Aizerman M., Aleskerov F. Theory of Choice. - Amsterdam: Elsevier, 1995.
2. Aizerman M.A. Dynamical Aspects of Voting Theory (A Review of the Problem), Automation and Remote Control. – 1981.
3. Aleskerov F. Arrovian Aggregation Models. – Kluwer Academic Publishers, Dordercht, 1999.
4. Aleskerov F., Avci G., Iacouba I., Turem Z.U. European Union enlargement: power distribution implications of the new institutional arrangements // Eur. J. Politic. Res. 2002. V. 41. P. 379-394.
5. Aleskerov F.T., Andrievskaya I.K., Permjakova Е.Е. Key borrowers detected by the intensities of their short-range interactions / Working papers by NRU Higher School of Economics. Series FE "Financial Economics". 2014. No. WP BRP 33/FE/2014.
6. Aleskerov F., Boyssou D., Monjardet B. Utility Maximization, Choice and Preference. – Berlin: Springer-Verlag, 2008.
7. Aleskerov F.T., Chistyakov V.V., Kalyagin V. The threshold aggregation // Economic Letters. – 2010. – Vol. 107. – P. 261 – 262.
8. Aleskerov F., Ersel H., Sabuncu Y. Power and coalitional stability in the Turkish Parliament (1991-1999) // Turkish Studies. 2000. V. 1, 2. P. 21-38.
9. Aleskerov F., Kalyagin V., Pogorelskiy K. Actual voting power of the IMF members based on their political-economic integration // Math. a. Comput. Modell. 2008. V. 48. P. 1554-1569.
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11. Aleskerov F., Karabekyan D., Remzi Sanver M., Yakuba V. An individual manipulability of positional voting rules, SERIEs, 2011, v. 2, 431–446.
12. Aleskerov F., Karabekyan D., Remzi Sanver M., Yakuba V. “On the manipulability of voting rules: The case of 4 and 5 alternatives” // Mathematical Social Sciences, 2012, v.64, #1, 67-73.
13. Aleskerov F.T., Karpov A.V. A new single transferable vote method and its axiomatic justification // Social Choice and Welfare. – 2013. – Vol. 40, N 3. – P. 771 – 786.
14. Aleskerov F.T., Yakuba V.I., Yuzbashev D.A. A “threshold aggregation” of three-graded rankings // Mathematical Social Sciences. – 2007. – Vol. 53. – P. 106 – 110.
15. Aumann R. Rationality and bounded rationality // Nancy L. Schwartz Memorial Lecture. – J.L. Kellogg School of Management, Northwestern University, 1986.
16. Banks J.S. Sophisticated voting outcomes and agenda control // Social Science and Welfare. – 1985. – Vol.1. – P. 295 – 306
17. Banzhaf J.F. Weighted Voting Doesn't Work: A Mathematical Analysis // Rutgers Law Rev. 1965. V. 19. P. 317-343.
18. Barr J., Passarelli F. Who has the power in the EU? // Working Papers Rutgers University, Newark,  2004-005, Department of Economics, Rutgers University, Newark, 2004. (<http://www.rutgers-newark.rutgers.edu/econnwk/workingpapers/2004-005.pdf>).
19. Black D. The theory of committees and elections. – Cambridge University Press, 1958. – 242 p.
20. Bonacich P. Power and centrality: A family of measures// American journal of sociology, 92(5), 1987, pp.1170-1182.
21. Brams S.J., Taylor A.D. Fair division. From cake-cutting to despute resolution. – Cambridge University Press, 1996.
22. Brams S., Kilgour M. Game Theory and national Security. Basil Blackwell, Oxford, 1988.
23. Brams S., Fishburn P. Approval voting // American Political Science Review. – 1978. – Vol. 72, N 3. – P. 831 – 847.
24. Brin S., Page, L. The anatomy of a large-scale hypertextual Web search engine// Comput. Netw., 30, 1998, pp.107-117.
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37. Handbook of Optimization in Complex Networks: Communication and Social Networks. – M.T. Thai and P. Pardalos (eds), Springer Publisher, 2011.
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81. Aleskerov F., Chistyakov V., Kalyagin V. The threshold aggregation // Econ.Lett. 2010. V. 107. P. 261-262.
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101. Sen A. Collective Choice and Social Welfare. – San Francisco: Holden-Day, 1970.
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# Required equipment

Computer or laptop, multimedia projector, text editing software.