**Course Syllabus**

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| Title of the course | **Predictive Theory of Behaviour, Social Physics, and Social Systems Management (offered in English)** |
| Title of the Academic Programme  | Modern Social Analysis |
| Type of the course  | Elective |
| Prerequisites | Foundations of calculus, Probability Theory and Mathematical Statistics |
| ECTS workload | 4 |
| Total indicative study hours | Directed Study | Self-directed study  | Total |
| 32 | 120 | 152 |
| Course Overview | Social physics is a new branch of social science that uses ideas and mathematical principles from physics for describing, forecasting and engineering of social processes. Rapid development of digital technology has led to emergence of a large number of mathematical models able to describe the behavior of various social systems based on big data. This allows a social system to be viewed as a set of a large number of social agents influenced by external factors. Different types of interaction of agents with the external environment correspond to different ensembles of agents, the study of which is possible both with the help of elements borrowed from statistical physics and with various types of social experiments. |
| Intended Learning Outcomes (ILO) | By the end of the course the students will be able:* To collect data from the Internet for social science research;
* To analyze them with machine learning tools;
* To visualize results of the analysis;
* To present the resulting project.
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| Teaching and Learning Methods | Seminars, team work, project work |
| Content and Structure of the Course |
| **№** | **Topic / Course Chapter** | **Total** | **Directed Study** | **Self-directed Study** |
| **Lectures** | **Tutorials** |
| 1 | Complexity in Social Worlds (introduction to the course) | 12 |  | 2 | 10 |
| 2 | Introduction to differential equations (methods of solution), Introduction to Monte Carlo method | 16 |  | 2 | 14 |
| 3 | Introduction to matrix analysis, calculation of eigenvalues and eigenvectors. | 16 |  | 2 | 14 |
| 4 | Fractal theory (the concept of scaling, methods for calculating the fractal dimension, the problem of determining power-law distributions) | 16 |  | 2 | 14 |
| 5 | Studying and modeling crowd behavior (models of pedestrian traffic, panic modeling, herd behavior). | 17 |  | 4 | 13 |
| 6 | Modeling in social interaction networks and studies of the sustainability of social structures. Principles of construction of scale-free networks. Phase states and conditions of network decay. | 15 |  | 4 | 11 |
| 7 | Studies of the dynamics of public opinion on the basis of various mathematical models. Application of the concept of social field for the analysis of elections. The use of stochastic models to analyze electoral preferences. | 15 |  | 4 | 11 |
| 8 | Mathematical models of cultural studies (Schelling, Axelrod models etc). | 15 |  | 4 | 11 |
| 9 | Application of statistical physics models for the analysis of large text collections from social networking sites (models of Ising, Potts, the principle of entropy maximization). | 15 |  | 4 | 11 |
| 10 | Application of the model of self-organized criticality for sociology and political science (Self-Organization of Social Movements). | 15 |  | 4 | 11 |
| **Total study hours** | 152 |  | 32 | 120 |
| Indicative Assessment Methods and Strategy  | * 80% - class work
* 20% - Presentation of project

The final grade is rounded according to the rules of Arithmetic. There is no exam in this course. |
| Readings / Indicative Learning Resources | Mandatory1. Daniela Baglieri Concetta Metallo Cecilia Rossignoli Mario Pezzillo Iacono (2014) Information Systems, Management, Organization and Control <http://www.bookmetrix.com/detail/book/317c808d-76e6-45e1-ac43-c95af7c776eb#citations>

Optional1. Jan Achterbergh, Dirk Vriens (2009) Organizations. Social Systems Conducting Experiments [https://link.springer.com/book/10.1007%2F978-3-642-00110-9#about](https://link.springer.com/book/10.1007/978-3-642-00110-9#about)
2. Social Physics: How Good Ideas Spread, The Lessons from a New Sciencent: <https://www.microsoft.com/en-us/research/video/social-physics-how-good-ideas-spread-the-lessons-from-a-new-science/>
3. Social physics: <https://www.youtube.com/watch?v=lRgpUMwyz2o>
4. The Return of Social Physics?: <https://www.researchgate.net/publication/274388297_The_Return_of_Social_Physics>
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| Indicative Self- Study Strategies | **Type** | **+/–** | **Hours** |
| Reading for seminars / tutorials (lecture materials, mandatory and optional resources) | + | 50 |
| Assignments for seminars / tutorials / labs | + | 20 |
| E-learning / distance learning (MOOC / LMS) | - |  |
| Fieldwork | - |  |
| Project work | + | 50 |
| Other (please specify) | - |  |
| Preparation for the exam | - |  |
| Academic Support for the Course | Academic support for the course is provided via LMS, where students can find: guidelines and recommendations for doing the course; guidelines and recommendations for self-study; samples of assessment materials |
| Facilities, Equipment and Software | R Studio  |
| Course Instructor | Sergei Koltcov |