Government of Russian Federation
Federal State Autonomous Educational Institution of High Professional Education
“National Research University Higher School of Economics”

Faculty of Computer Science
School of Data Analysis and Artificial Intelligence

Syllabus for the course
Project Seminar "Intelligent Systems and Structural Analysis"

01.04.02 "Applied Mathematics and Informatics" training direction of the "Data Science" master educational program

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The academic head of the educational program
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1 Scope of use

This program establishes the minimal requirements to students' knowledge and skills and defines the content of the discipline and the types of studies and reports.

The present syllabus is aimed at faculty staff teaching the Project Seminar "Intelligent Systems and Structural Analysis", teaching assistants and students studying 01.04.02 "Applied Mathematics and Informatics" of the educational program "Data Science".

This syllabus meets the standards required by:

- Educational standards of Federal State Autonomous Educational Institution of High Professional Education "National Research University "Higher School of Economics";
- Master educational program "Data Science" for 01.04.02 "Applied Mathematics and Informatics";
- University curriculum of the educational program for 01.04.02 "Applied Mathematics and Informatics" training direction of the "Data Science" master program, approved in 2018.

2 Summary

The discipline goal is to develop students' professional skills required for independent analytical work in applied fields of the computer science. Also, this course aims to improve skills of students in writing their scientific texts and preparing of their presentation at scientific events or on defense of the master's thesis.

This course focuses on analysis of interdisciplinary research papers and motivates visiting different scientific colloquium at the university, especially at the faculty of computer science. In addition, it is assumed that the course will help in choosing the topic of scientific research for those students who have not decided yet.

3 Learning Outcomes

The Project Seminar should help to form the basic skills training to make presentations on own research, motivate to engage in the scientific activity.

After completing the study of the Project Seminar the student should:

1) *be able to* adequately analyze and evaluate scientific activity;
2) *be able to* write a review on a scientific event;
3) *be able to* prepare a presentation based on a scientific text and its analysis and take part in a scientific discussion on the topic of the article;
4) *to have* the skills of working in MS PowerPoint/LaTeX layout system and forming the list of bibliographies according to given rules.

As a result of studying the course student develops the competencies shown at the table below:

Key	Competence	Forms and techniques of the study which lead to developing the competence	Form of control on competence level
	The ability to create new theories, invent	Seminar classes	

Key	Competence	Forms and techniques of the study which lead to developing the competence	Form of control on competence level
SC-2	new ways and tools of professional activity.		• Attendance and classroom work at the seminar, • preparation of presentation on a scientific article and reporting it at the seminar, • writing a review on a scientific event.
SC -3	The ability to independently understand new research methods, changing of the scientific and production profile of their activities.	Seminar classes	
SC -5	The ability to make managerial decisions and is ready to be responsible for them.	Seminar classes	
SC-7	The ability to organize and manage multilateral communication.	Seminar classes	
PC-1	The ability to translate the norms of a healthy lifestyle, to lead by example.	Seminar classes	
PC -2	The ability to translate legal and ethical norms in professional and social activities.	Seminar classes	
PC -5	The ability to consciously choose strategies for interpersonal interaction.	Seminar classes	
PC -7	The ability to build professional activity, business and make choices, guided by the principles of social responsibility.	Seminar classes	
PC -10	The ability to analyze and reproduce the meaning of interdisciplinary texts using the language and tools of applied mathematics.	Seminar classes	
PC -11	The ability to create interdisciplinary texts using the language and apparatus of applied mathematics.	Seminar classes	
PC -12	The ability to publicly represent the results of professional activity (including the use of information technology).	Seminar classes	
PC -13	The ability to carry out targeted multi-criteria search of information on the latest scientific and technological achievements in the Internet and in other sources.	Seminar classes	
PC -14	The ability to describe problems and situations of professional activity, using the language and apparatus of applied mathematics in solving interdisciplinary problems.	Seminar classes	
PC -15	The ability to create, describe and responsibly control the realization of technological requirements and regulatory documents in professional activities.	Seminar classes	
PC -16	The ability to use knowledge in the field of natural sciences, mathematics and	Seminar classes	

Key	Competence	Forms and techniques of the study which lead to developing the competence	Form of control on competence level
	computer science, understanding of the basic facts, concepts, principles of theories related to applied mathematics and computer science.		
PC -17	The ability to build and solve mathematical models in accordance with the direction of training and specialization.	Seminar classes	
PC -18	The ability to understand and apply modern mathematical tools in research and application.	Seminar classes	
PC -19	As a part of the research and production team, the ability to solve the tasks of professional activity in accordance with the profile of training, communicate with experts in other subject areas.	Seminar classes	
PC -20	The ability to apply modern programming languages and data manipulation languages, operating systems, electronic libraries and software packages, network technologies, etc. in research and application activities.	Seminar classes	

4 Place of the Discipline in the Postgraduate Program Structure

This is a compulsory course for specialization "Intelligent Systems and Structural Analysis", 01.04.02 “Applied Mathematics and Informatics”.

The following knowledge and competences are useful for better understanding of the course:

- basic English language, both oral and written;
- basic knowledge on higher mathematics and computer science.

5 Schedule

№	Topic	Total hours	Contact hours	Self-study
			Seminars	
1.	Ordered Sets in Data Analysis	38	10	28
2.	Applied tasks of Computer Science	76	20	56
3.	Reviewing	38	10	28
Total		152	40	112

6 Grading System. Guidelines for Knowledge Assessment

Control type	Assessment	1 year				Parameters
		1	2	3	4	
Current	Presentation 1	*				Report on the scientific article. Speaking time is no more 15 min.
	Test			*		Test based on topics of students' presentations
	Presentation 2		*	*		Report on the scientific article. Speaking time is no more 15 min.
	Reviews			*	*	3 reviews about scientific reports. Volume of each is no less 1 page.

The assessments consist only of tasks for the current control.

The current control includes one presentation during the first module based on a scientific article written in English and devoted to theory of formal concept analysis; and one similar presentation during the second module based on state-of-the-art article about applied computer science task. The article volume should be no less than 6 pages.

Test assignment is meant to verify students' involvement in the Project seminar by verifying their knowledge of basic Computer Science concepts, which were discussed during Students' presentation at Project seminar, and is used as discount factor for grade on Presentation 2 for those who fail to meet satisfactory requirements for the Test.

Also, students should participate in at least three scientific events (colloquium, workshop, conference, etc.) and write three reviews on them.

The final mark is evaluated into account of test grade:

$$O_{final} = 0.2 \cdot O_{pr1} + 0.6 \cdot q \cdot O_{pr2} \cdot + 0.2 \cdot (O_{rev1} + O_{rev2} + O_{rev3})/3,$$

where discount factor $q = 1$, if test grade $O_{test} \geq 4$ (out of 10), or $q = \frac{O_{test}}{10}$, otherwise.

Example: $O_{test} = 2.5 \rightarrow q = 0.25$

$$O_{final} = 0.2 \cdot O_{pr1} + 0.6 \cdot 0.25 \cdot O_{pr2} + 0.2 \cdot (O_{rev1} + O_{rev2} + O_{rev3})/3$$

All these marks are evaluated using 10 grade scale. All grades having a fractional part greater than 0.5 are rounded up.

Conversion of the concluding rounded grade to five-point scale grade is done in accordance with the following table:

Table of Grade Accordance

Ten-point Grading Scale	**Five-point Grading Scale**	

1 - very bad 2 – bad 3 – no pass	Unsatisfactory - 2	**FAIL**
4 – pass 5 – highly pass	Satisfactory – 3	**PASS**
6 – good 7 – very good	Good – 4	
8 – almost excellent 9 – excellent 10 – perfect	Excellent – 5	

7 Course description

The course consists of student presentations on the recent research in various fields of computer science and data mining. The course is divided into three sections: the first part refers to the compulsory course «Ordered Sets in Data Analysis», the second is organized to expand the horizons of students in the field of computer science and to test students' readiness to present scientific reports, and the third part is making a review on a scientific report.

1 Ordered Sets in Data Analysis

Student should choose a scientific article dedicated to formal concept analysis (FCA) or areas closely related to FCA such as data mining, information retrieval, knowledge management, data and knowledge engineering, logic, algebra and lattice theory. Then student should analysis chosen article and prepare its presentation for reporting at the Project Seminar.

For example, there are relevant articles at

- CLA 2018 http://ceur-ws.org/Vol-2123/
- ICFCA 2017 https://link.springer.com/book/10.1007%2F978-3-319-59271-8 (HSE students may receive a free access to electronic resources)

2 Applied tasks of Computer Science

Students should make a presentation (in Russian or English) on a scientific article with relevant theme to specialization of training. The report should consist of the following parts:

1) the formulation of the objectives of the study;
2) informative step-by-step review of the article;
3) analysis of the results presented in the article and their values (comparative analysis with other existing solutions);
4) your opinion about the relevance of the task and its further development.

These presentations are also held to help students find an interesting topic for further research in the framework of a Course Work/ Master Thesis or another project, motivate students to start working on the CW on time and help them to clearly understand what they want to receive as a result.

To select an article, student can use the conference proceedings in 2017 or 2018. For example:

Conference:	Link:
IJCAI 2017/2018	https://www.ijcai.org/proceedings/2017/ https://www.ijcai.org/proceedings/2018/
SIGGRAPH 2017/2018	2017: http://s2017.siggraph.org/technical-papers.html 2018: https://s2018.siggraph.org/conference/conference-overview/technical-papers/
TheWebConf 2018	https://dl.acm.org/citation.cfm?id=3178876
DL 2017	https://project.inria.fr/dl2017/
KESW 2017	http://dblp.org/db/conf/kesw/kesw2017

Or ICDM, KDD, WSDM (Data Mining); WEB, SIGIR (Information Retrieval, Network Analysis); ICML, NIPS, AISTATS (Machine Learning); CVPR, ECCV, ICCV (Computer Vision); RSS, ICAPS, AAMAS (Robotics); AAAI, IJCAI, KR (Artificial Intelligence); SIGGRAPH, ISMAR (Computer Graphics and Augmented Reality).

Also, student may choose an article from the **recommended list**. Full texts of suggested articles (50 items) are available via the link https://goo.gl/jiN5rm.

8 Educational technologies

The following educational technologies are used in the study process:

- discussion in the classes
- office hours

Methods of Instruction:
Individual course projects.

9 Guidelines for Knowledge Assessment

Basic rules for making presentation:

- Uniform style
- Contrast color scheme (optimum – black symbols on a white background)
- Outline
- Absence of points at the end of headers
- Different short slide titles
- Slide numbering
- Highlight keywords
- Font size: 24–54 points (heading), 18–36 items (plain text)
- Avoid overloaded or empty slides
- One idea per slide
- More examples – more clarity
- Conclusion
- Spell-check
- Save a presentation in .PDF format!

Basic rules for writing review:

- The structure includes:
  - Title – informs us it is a review
  - Informative Abstract – informs us this is a meta-analysis
  - Introduction - describes the area and theme of a report
  - Body – describes content, material and methods used in the survey
  - Conclusion – describes results
  - Discussion – includes own opinion on the report
- Do not use informal language. Academic writing should be formal and without slang words.

10 Materials

Resources:

(1) HSE Library e-resources https://library.hse.ru/en/e-resources/:
- Scopus
- Web of Science
- Science Direct
- IEEE Xplore
- Springer Link
- ACM (ACM Digital Library)
- ProQuest

(2) Colloquium in the Faculty of Computer Science https://cs.hse.ru/en/colloquium/

(3) Лабораторная ФКН https://cs.hse.ru/lab

(4) ФКН ВШЭ канал на YouTube: https://www.youtube.com/channel/UCumWurUBD-fUDxrlG0UvuyQ

(5) Editors: Overleaf https://www.overleaf.com

11 Equipment

Projector.