**syllabus for the internship**

**Master degree educational program**

**‘Data Sciences’**

|  |  |  |  |
| --- | --- | --- | --- |
|  | | Approved by  Academic council of the programme  Protocol N 1, 15.06.2017 | |
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| Course credit (ECTS) | *For example: 6 ects* | |
| Duration in academic hours, including duration in contact hours, or internship duration in weeks | *For example*:  *228 academic hours, including 2 contact hours*  *or*  *2 weeks, including 2 contact hours* | |
| Year | *1* | |
| Form of internship | *professional* | |
| Type of internship | *professional (research)* | |

# GENERAL PROVISIONS

## Purpose and objectives of the internship

The purpose of the internship is to provide students with the opportunity to consolidate and develop professional competences in engineering and research work.

During the internship students consolidate and deepen their theoretical knowledge, acquire and develop practical skills and competences, as well as experience in independent research and knowledge of the industry in data science sphere.

Main objectives of the internship are consolidation of theoretical knowledge obtained during the training and development of practical skills in:

- automotive systems and data-processing tools;

- analysis of data obtained from various resources and presenting the results through information artifact;

- development and solving of mathematical models in accordance with the direction of ongoing research;

- development of algorithms, data models, software libraries and packages, system and application software;

- creating, analysis, and support of data- and knowledge bases;

- development and implementation of automotive systems tools in research and practice.

## Scope of Use

The internship is included in the unit Б.ПД (Project and research work) “Project Work, Research and Internships”.

Before the internship students are expected to accomplish the following disciplines:

1. *Modern Methods of Data Analysis*.
2. *Modern Methods in Decision Making*.

To master the internship a student should:

**Know**:

- theoretical aspects and methods of data analysis;

- theoretical aspects and methods of machine learning;

- theoretical aspects and methodsof modern decision making theory;

- methodology of software building.

**Be able to**:

- analyze big data using statistical and neural network approaches;

- develop and analyze behavior of the simplest machine learning algorithms;

- design and build software.

**Have the following knowledge and competences**:

- a good command of the English for specific purposes, sufficient for reading technical texts;

- methodology of applying data analysis methods to real-life tasks.

## Forms of internship

The internship can be conducted in the form of on-the-job training or field practice*.*

## Forms of internship organization

## The internship is organized on a discretionary basis by types of internships – continuous two weeks period of time described in the academic calendar.

# The list of the planned learning outcomes developed during the internship, correlated with the planned results of completing educational program (competences).

The internship is organized with the aim of developing professional and project-based competences:

Table 1

|  |  |  |
| --- | --- | --- |
| Competences | Descriptors (indicators of achievement of the result) | Type of professional tasks that require the competence |
| PC 4 | The ability to analyze and reproduce the meaning of interdisciplinary texts using the language and tools of applied mathematics and IT. | Research  Engineering  Analytical |
| PC 9 | The ability to collect, clean, analyze, and visualize big amount of data. | Research  Analytical |
| PC 10 | The ability to implement applied mathematics models and algorithms in a form of computer programs. | Engineering |
| PC 11 | The ability to verify and assess reproducibility of applied mathematics and IT methods. | Research  Engineering |

# Internship content

Table 2

|  |  |  |  |
| --- | --- | --- | --- |
| № | Type of student practical work | Activity\* | Code of formed competencies |
| 1 | Research work | - collection and processing data (both quantitative and qualitative) to conduct the research;  - preparing research papers for publication in scientific journals;  - participation in workshops, academic, or research-to-practice conferences. | PC-4, PC-9, PC-11 |
| 2 | Engineering work | - preparing the planned events in accordance with the internship syllabus;  - performing assignments (orders) given by the head of internship; | PC-4, PC-10,  PC-11 |
| 3 | Analytical work | - acquaintance with the scope of the organization, its laws and regulations, operating mode, document and record management, and structure of the organization;  - collection and compilation of material necessary for preparation of reporting documents. | PC-4, PC-9 |

The internship is held in the fourth module of the first year, the exact dates are set every year by the working curricula. In accordance with the working curricula of master’s program ‘Data Sciences’ the internship duration is two calendar weeks (6 working days per week). In agreement with the head of the department, a student may undergo the internship at other times during the year outside studying hours. The internship is held in specialized structural units of the University, including research units and departments of the Faculty of Computer Science in NRU HSE, as well as in specialized state, municipal, commercial, and non-profit organizations, institutions, companies.

Students may find their own placements and coordinate it with the internship supervisor from the faculty. In this case, the students submit to the faculty a letter from the organization (company, institution) confirming that it agrees to host internship for the student specifying its duration and the name of the internship supervisor. The content of internship is determined by the specificity of organization hosting the internship, therefore, a strong requirement for organizations is to provide student with assignments suitable in the field of ‘Data Sciences’ program. In the absence of agreement on the internship placement from the internship supervisor from the faculty, the latter has the right to claim the internship not valid. Once students become interns, they must observe occupational safety guidelines and internal regulations established at the company, institution, or organization, which they are assigned to.

# Reporting internship results

Once the internship is completed students are to submit the following documents relating to internship arrangement and completion:

* a summary internship report – a document which reflects all the work completed during the internship, obtained skills and knowledge. The report should demonstrate student compliance with internship goals.

A summary report includes:

− either the results of research work (free-form) (research internship);

− or the description of practical task performed during the internship (professional internship).

Supervisor from the organization/institution put the final mark on the cover page of the report (in any grading scale). Internship supervisor from the faculty put the final internship mark on the cover page of the report in 10-point grading scale. A template from Appendix 1 can be used.

# Interim internship assessment

Internship results are evaluated by the internship supervisor from the University after interviewing the student.

If student is not satisfied with the final mark, the head of department of Data Analysis and Artificial Intelligence NRU HSE appoints a committee evaluating the public defense of the internship results.

## Grading scale and the criteria for interim internship assessment

|  |  |
| --- | --- |
| 10 - Perfect  9 - Excellent  8 - Almost excellent | The internship purpose is fulfilled, including either the significant progress in research work, or consolidation and application of knowledge and skills obtained during the study in NRU HSE. To obtain the perfect mark students are expected to have authorized published (or ready for publication) results (affiliation with NRU HSE is preferable). There are not critiques from the organization or institution agents. |
| 7 - Very good  6 - Good | The internship purpose is almost fulfilled, including either the acceptable progress in research work, or partial consolidation and application of knowledge and skills obtained during the study in NRU HSE. There are slight critiques from the organization or institution agents. |
| 5 - Highly pass  4 - Pass | The internship goal is partially fulfilled, including either some progress in research work, or insufficient consolidation and application of some knowledge and skills obtained during the study in NRU HSE. There are critiques from the organization or institution agents. |
| 3 - No pass  2 - Bad  1 - Very bad | The internship goal is not fulfilled, even partially: including either no progress in research work (or the authorship of the research results is doubtful), or there is no consolidation and application of knowledge and skills obtained during the study in NRU HSE (the results of work are absent). There are significant critiques from the organization or institution agents. |

Final mark is obtained from the following formula:

О*final* = 0,5·Grade obtained from the supervisor from NRU HSE + 0,5·Grade obtained from the supervisor from organization hosting the internship.

All grades, having a fractional part greater than 0.5, are rounded up.

Both plagiarism‎ and documents falsification are graded by 0 points.

## Evaluation Resources for Interim Practice Assessment (Attestation)

The evaluation resource fund (set) includes individual assignments in accordance with the objectives of the practice (internship), students' reports on the internship, review from the supervisor of the internship.

Selected examples of the control (test) questions and tasks on specific stages of the practice (internship), which are mastered by students individually in the course of practical training and report preparation, can be as follows:

1. Definitions of the science?
2. Main criteria of scientific character?
3. What are models, mathematical models?
4. Application of mathematical methods?
5. What are the most important branches of modern applied mathematics, computers science?
6. Determine the most salient distinction between computer science and other science.
7. Link of information technologies and mathematics. Mathematicians and data scientist.
8. Types of artificial intelligence?
9. Main features of *Data Science*.
10. Falsifiability in science.

# Literature

**The list of educational and electronic resources required for completing the internship**

|  |  |
| --- | --- |
| **№** | **Name** |
| Recommended basic literature | |
| 1. | Radaev V.V. How to Organize and Present Your Research Project (75 simple rules) / V.V. Radaev. – M.: SU-HSE : INFRA-M, 2001. – 203 pp. (in Russian) (access from the NRU HSE library. Index – 316 Р15) |
| Recommended additional literature | |
| 2. | Dekking F. M. et al. A Modern Introduction to Probability and Statistics: Understanding why and how. – Springer Science & Business Media, 2005. – 488 pp. (access from the NRU HSE library) |
| Electronic educational resources | |
| 1. | [https://www.datascience.com](https://www.datascience.com/blog/time-series-forecasting-machine-learning-differences) |
| 2. | [https://blog.statsbot.co](https://blog.statsbot.co/time-series-prediction-using-recurrent-neural-networks-lstms-807fa6ca7f) |

**The list of technologies used, including a list of software and information reference systems (if necessary)**

During the internship students can use information technology, including computer simulation, computer-aided design and software development tools used in the organization, internet-based technology, et al.

# Description of material and technical resources necessary for the internship

Material and technical resources description is included in the agreement with the organization (institution, company) hosting the internship (if the latter agrees to conclude the agreement). The mentioned material and technical resources should meet the existing health and safety regulations, fire regulations, and also satisfy safety requirements.

**Appendix 1**

***Sample cover page for the internship report***

GOVERNMENT OF THE RUSSIAN FEDERATION

NATIONAL RESEARCH UNIVERSITY

HIGHER SCHOOL OF ECONOMICS

Faculty\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Name of education program)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(level of education)

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

(Specialization (if exists)

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Internship Report**

*(type of internship)*

Student \_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(*first name, family name*)

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

*(signature)*

**Supervisors:**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*(title, first name and family name of supervisor from organization)*

*\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*(mark) (signature)*

*\_\_\_\_\_\_\_\_\_\_\_\_\_*

*(date)*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*(title, first name and family name of supervisor from faculty)*

*\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*(mark) (signature)*

*\_\_\_\_\_\_\_\_\_\_\_\_\_*

*(date)*

**Components of the report.**

1. Introduction (internship objectives and tasks should be included in the section).
2. Main Body.
   1. Brief characteristics of the organization (placement hosting the internship) including the scope description, organizational set-up, economic indicators.
   2. Description of professional tasks performing by student during the internship (in accordance with the internship purpose, objectives, and individual assignment).
3. Fulfilled individual assignment.
4. Conclusion (including self-evaluation of the developed competences).
5. Appendices (diagrams, plotting, tables, algorithms, pictures etc.).

**Appendix 2**

*Supervisor’s review template*

**REVIEW**

**on internship results from businesses, organizations, or institutions**

The internship supervisor from the organization writes a review on student performance by the end of internship.

The review should include student’s family and first name, internship location and duration.

The review should reflect:

* professional tasks performed by the student;
* efficiency and quality of internship plan fulfillment;
* student’s attitude to performing the assignments given during the internship;
* evaluation of the planned competences development (descriptors of their achievement);
* conclusion reflecting student employability; the comments about student’s personal and professional qualities can be included if necessary.

The review should be signed by the internship supervisor from organization (business, institution) and certified by seal.