THE MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of Higher Education
«Ural Federal University named after the first President of Russia B.N.Yeltsin»

APPROVED BY
Deputy vice rector for academic affairs
_____ E.S. Avramenko
«27» апреля 2020

PROGRAM OF ENTRANCE TESTS TO MASTER'S PROGRAM

List of information about program of entrance tests to magistracy	Registration data
Area of Studies Applied Informatics	**Code** 09.04.03
Educational program IT innovations in business	**Code of educational program** 09.04.03/33.02
Level of training Master	
Self-established educational standard UrFU in education Engineering, technology and technical science	**Adopted at the meeting of the Academic Council of UrFU** **Protocol №9 dated 26.11.2018** **Approved by order of the rector of UrFU** **№ 1069/01 dated 28.12.2018**

Ekaterinburg, 2020

Program of entrance test to magistracy composed by the authors:

№	Full name	Academic degree, academic title	Position	Department
1	Berg Dmitry Borisovich	D.Sc. of Physics and Mathematics, Full Professor	Professor	Big Data Analytics and Video Analysis Methods
2	Medvedeva Marina Alexandrovna	Ph.D. of Physics and Mathematics, Docent	Associate Professor	Big Data Analytics and Video Analysis Methods

Program approved:

Educational and Methodological Council of Engineering School of Information Technologies, Telecommunications and Control Systems

Protocol № 3 dated 07.04.2020

Chairman of EMC of ESITTCS _____ T. I. Alfereva

Director of ESITTCS _____ I. N. Obabkov

ANNOTATION:

The program is compiled in accordance with the requirements of the Self-established Educational Standard, applicable to the preparation of applicants to the magistracy in the direction 09.04.03 Applied Informatics.

The exam is fourfold and held in a test form in accordance with the requirements of the Order of the Rector of UrFU №221/03 of 07.03.2019 «About entrance tests for master's programs».

The purpose of the entrance examinations – to provide persons applying for admission to UrfU for the development of the educational master's program equal conditions, regardless of the previous document on higher education.

The task of the entrance tests is to identify the preparedness of the incoming applicant to study in the master's program in terms of the formation of information and communication competence which is not lower than the basic level and knowledge of the main content of specialized disciplines.

CONTENT OF ENTRANCE TESTS TO MASTER'S DEGREE IN THE DIRECTION OF TRAINING

09.04.03 Applied Informatics

1. The structure of the content of the entrance test includes 3 sections

	Section	Mode, time	Points
1.	Identification of the level of formation of communicative competence in the English language. For the solution, tasks of a **basic level of complexity** are proposed (Threshold **level** on a scale of the Council of Europe). **The basic level** provides language proficiency to solve the minimum number of communicative tasks sufficient for limited professional communication in standard situations. **Task type**: answers to questions to the scientific text (answers in the form of words // phrases // sentences // numbers are suggested to be copied from a scientific text of 1-3 pages A4).	Computer testing 15 minutes	0 - 20
2.	Multidisciplinary test in basic disciplines 25 tasks on knowledge/recognition of the most important concepts, laws, concepts contained in basic disciplines, the solution of standard problems (Mathematics, Computer Science). Types of test tasks: tasks with a choice of the correct answer from 3-5 offered, tasks with a choice of several correct answers from 3-5 offered.	Computer testing 45 minutes	0 - 30
3.	Multidisciplinary test in core disciplines 34 tasks on the knowledge of fundamental concepts, laws, concepts, solution of standard problems of applied informatics (Information Systems Lifecycle, Databases, Business process modeling, Programming, Project management). Types of test tasks: tasks with a choice of the correct answer from 3-6 offered, tasks with a choice of several correct answers from 3-6 offered, tasks with short response.	Computer testing 60 minutes	0 - 50
	Maximum final score		**100**

2. CONTENTS of testing, revealing the presence of advanced communicative competence in the English language

IDENTIFICATION OF THE MAIN DOSE-FORMING RADIONUCLIDES IN NPP EMISSIONS

A.A. Ekidin, M.V. Zhukovsky, M.E. Vasyanovich

The main dose-forming radionuclides must be taken into account in order to determine the impact of radiation on man and the environment [1]. They are not known at present. One reason for the impossibility of picking them is that only a limited number of radionuclides are controlled in NPP emissions. In Russia, the emissions of seven radionuclides – 134,137Cs, 58,60Co, 51Cr, 54Mn, and 131I – and the total β-activity and total emissions of inert radioactive gases [2] are controlled.

An electronic database on the radioactive emissions and discharges from NPP with different types of reactors has been developed in European countries [3]. The content of 101 radionuclides and four total indices are monitored: β-, α-activity, inert radioactive gases, and iodine isotopes (Table 1). Analysis of these data permits determining the contribution of each radionuclide to dose formation and formulating a list of radionuclides for each type of reactor that determine the 95% contribution the effective dose for the public. The results of ranking the radionuclides in the emissions from European NPP according to their contribution to the radiation exposure of the public are presented below.

The contribution of the controlled radionuclides was determined for the five most common types of reactors used in NPP: water moderated and cooled power reactors PWR, boiling water BWR, advanced gas-cooled AGR, high-power channel reactors LWGR, and heavy-water CANDU. The conditions for the formation of the radiation exposure – the relief, half-life structure, and food ration in the general population in the action zone of the emissions and the meteorological conditions – are assumed to be the same. The effective emission height in the calculation was 120 m. The activity of the radionuclides entering the atmosphere was averaged over 10 years of observations at NPP and led to the number of reactors in the sample. Thus, the average yearly activity of the emissions of each radionuclide for one reactor was obtained.

Five samples for the emissions of five types of reactors over the last 10 years of operation were formed in order to determine the dose loads on the general population:
19 NPP with PWR in France, three NPP with BWR in Sweden, eight NPP with AGR in Great Britain, one NPP with LWGR in Lithuania, and one NPP with CANDU in Rumania. Each sample included radionuclides which are monitored in at least 50% of the NPP (Table 2).

- How many parameters are under control at Russian nuclear power plants?
  - In Russia nine parameters are controlled: seven radionuclides, the total β-activity and total emissions of inert radioactive gases.
  - In Russia there is no limits for controlled parameters.
  - In Russia only the total a- and β-activity and total emissions of inert radioactive gases are controlled.
  - In Russia nuclear power plants control from seven up to fifteen radionuclides.
- How authors have got information about 101 radionuclides and other parameters?
  - Authors have got the information during their experiments on the European nuclear power plants with different types of reactors

- Authors have got the information by collecting it from each European nuclear power plant.
- Authors have got the information from the European electronic database on the radioactive emissions and discharges from NPP with different types of reactors

- What amount of release activity have been chosen to estimate contribution of each radionuclide?
- How many types of reactors have been considered in this article?
- What is the main aim of this work?
- What conditions have been chosen to estimate radiation exposure?
  - Meteorological conditions were assumed the same for all cases.
  - All mentioned below.
  - Relief of environment was assumed the same for all cases.
  - Food ration in the general population in the action zone of the emissions was assumed the same for all cases.
- What was the effective emission height in calculations?

3. CONTENT of the multidisciplinary test in basic disciplines

Section «Mathematics»

Topics:

Differential calculus of a single variable function:

- Differentiation of a single variable function;
- Applications of the differential calculus of a single variable function. Intervals of monotony, extremum of functions.

Multi Variable Functions:

- Partial derivatives of the first order of function of two variables.

Matrices and determinants:

- 2^{nd} order determinants;
- 3^{rd} order determinants;
- Matrix addition;
- Multiplication and inversion of matrices.

Literature to prepare:

Nokhrin S. E. Mathematics for economists: a course of lectures / S. E. Nokhrin [scientific editor O. Ya. Shevaldin]. - Ekaterinburg: Publishing house Ural. University, 2014. - 120 p. Access mode: https://study.urfu.ru/Aid/ViewFiles/12951

Shevaldina O. Ya. Mathematics in economics: study guide / O. Ya. Shevaldina. - Ekaterinburg: UrFU Publishing House, 2016. - 188 p. Access Mode: http://hdl.handle.net/10995/43906

Shevaldina O. Ya. Beginning of mathematical analysis: study guide / O. Ya. Shevaldina, E. V. Strelkova; [scientific editor V. T. Shevaldin]. - Ekaterinburg: Publishing house Ural. University, 2014. - 99 p. Access mode: http://study.urfu.ru/Aid/ViewFiles/13051

Section «Computer Science»

Topics:

Application software:

- Microsoft Excel Spreadsheet;
- Word processor.

Literature to prepare:

Electronic educational and methodical complex “Computer science. Part 1 "[Electronic resource]. Portal of information and educational resources of UrFU. Access mode: http://study.urfu.ru/Aid/ViewMeta/6828

Electronic educational and methodical complex “Computer science. Part 2 "[Electronic resource]. Portal of information and educational resources of UrFU. Access mode: http://study.urfu.ru/Aid/ViewMeta/7837

Paklina V. M. Preparation of documents by means of Microsoft Office 2013: teaching aid / V. M. Paklin, E. M. Paklina; [scientific editor I. N. Obabkov]. - Ekaterinburg: Publishing house Ural. University, 2014. - 111 p. Access mode: http://elar.urfu.ru/handle/10995/28822

4. CONTENT of the multidisciplinary test in core disciplines

Section «Information Systems Lifecycle»

Literature to prepare:

Ageev Yu. D. Agile and Scrum project management methodologies: study guide / Yu. D. Ageev, Yu. A. Kavin, I. S. Pavlovsky, and others – Moscow: Aspect Press, 2018 – 160 p.

Berg D. B. Life cycle models: study guide / D. B. Berg, E. A. Ulyanova, P. V. Dobryak. – Ekaterinburg: Publishing house Ural. University, 2014. – 74 p. Access mode: http://elar.urfu.ru/bitstream/10995/28886/1/978-5-7996-1311-2_2014.pdf

M. Sanin. Management Accounting: Textbook / M. K. Sanik – St. Petersburg: ITMO St. Petersburg State University, 2014. – 88 p. Access mode: https://books.ifmo.ru/file/pdf/1567.pdf

Medvedev V.P. Morphological box. Methodical recommendations for practical exercises on the topic Morphological analysis and synthesis of a technical object [Electronic resource]. TAVIAC named after V. M. Petlyakov. Access mode: https://clck.ru/G2Dcj

Zhivitskaya E.N. System analysis and design. Lecture 3: Systems. System models [Electronic resource]. Victor Safronov. Access mode: http://victor-safronov.ru/systems-analysis/lectures/zhivickaya/05.html

Section «Project management»

Literature to prepare:

Dubovik M. F. Project Management. Full course MBA / M. F. Dubovik, A.V. Polkovnikov. – Moscow: Olimp-Business, 2018. – 552 p.

Higny Joseph. Basics of project management. Classic Guide / D. Higny. – Moscow: Mann, Ivanov and Ferber, 2018. – 240 p.

Matveeva L. G. Management of IT projects: study guide / L. G. Matveeva, A. Yu. Nikitaeva – Rostov-on-Don: Publishing House of Southern Federal University, 2016. – 228 p.

Mazur I. I. Project Management: study guide / I. I. Mazur, N. G. Olderogge, V. D. Shapiro. – Moscow: Omega-L, 2013. – 960 p.

Novikov D. A Project Management: Organizational Mechanisms / D. A. Novikov. – Moscow: PMSOFT, 2007. – 140 p.

Project management: fundamental course: textbook / A. V. Aleshin, V. M. Anshin, K. A. Bagrationi and others; by ed. V. M. Anshin, O. N. Ilina; National Research University "Higher School of Economics". – Moscow: Pub. House of the Higher School of Economics, 2013. – 620 p.

Section «Databases»

Literature to prepare:

Electronic teaching and methodical complex "Databases" [Electronic resource]. Portal of information and educational resources of UrFU. Access mode: http://study.urfu.ru/view/Aid_view.aspx?AidId=11098

Interactive tutorial on SQL [Electronic resource]. SQL Tasks and Solutions. Textbook. Sergey Moiseenko. Access mode: http://sql-tutorial.ru/

Kara-Ushanov V. Yu. SQL – the language of relational databases: a tutorial / V. Yu. Kara-Ushanov; [scientific editor V.I. Rogovich]. – Ekaterinburg: Ural University Publishing House, 2016. – 156 p. Access Mode: http://hdl.handle.net/10995/40612

Reference language MySQL [Electronic resource]. MySQL Access mode: http://www.mysql.ru/docs/man/Reference.html

Sovetov B. Ya. Databases: Theory and Practice: A Tutorial for University Students Studying in Computer Science and Computing and Information Systems / B. Ya. Sovetov, V. V. Tsekhanovsky, V. D. Chertovsky . – 2nd edition – Moscow: Uright, 2012. – 464 p.

Section «Business process modeling»

Literature to prepare:

Dolganova O. I. Business process modeling: a textbook and a workshop for academic bachelor / O. I. Dolganova, E. V. Vinogradova, A. M. Lobanova; Edited by O. I. Dolganova. – Moscow: Yurait Publishing House, 2017. – 289 p. Access mode: https://www.biblio-online.ru/bcode/399296

Kvatrani T. Rational Rose 2000 and UML. Visual modeling / T. Kvatrani – Moscow: DMK Press, 2009. – 176 p. Access mode: https://e.lanbook.com/book/1237

R 50.1.028-2001. Methodology of functional modeling [Electronic resource]. Machine learning. Access mode: http://www.machinelearning.ru/wiki/images/9/99/P_50-IDEF0.pdf

Silich M. P. Modeling and analysis of business processes: study guide / M. P. Silich, V. A. Silich. – Moscow: TUSUR, 2011. – 213 p. Access mode: https://e.lanbook.com/book/11794

Tebaykina N. I. CASE-tools: a teaching aid / N. I. Tebekina; [Scientific Editor A. V. Lutsenko] – Ekaterinburg: USTU-UPI, 2007. – 88 p. Access mode: https://study.urfu.ru/Aid/Publication/7246/1/Tebayikina.pdf

Section «Programming»

Literature to prepare:

Dolgov A. I. Algorithmization of applied problems / A. I. Dolgov. – Moscow: FLINTA, 2016. – 136 p. Access mode: http://www.studentlibrary.ru/book/ISBN9785976500860.html

Electronic educational and methodical complex "Programming" [Electronic resource]. Portal of information and educational resources of UrFU. Access mode: https://learn.urfu.ru/subject/index/card/subject_id/2404

Electronic educational-methodical complex "Object-oriented analysis and programming" [Electronic resource]. Portal of information and educational resources of UrFU. Access mode: https://learn.urfu.ru/subject/index/card/subject_id/2405

Kudinov Yu. I. A practical work on the basics of modern computer science / Yu. I. Kudinov, F. F. Paschenko, A. Yu. Kelina. – Moscow: Lan, 2011. – 352 p. Access mode: http://e.lanbook.com/books/element.php?pl1_cid=25&pl1_id=1799

Nikolaev E. I. Object-Oriented Programming: A Tutorial / E. I. Nikolaev. – Stavropol: SKFU, 2015. - 225 c. Access mode: http://biblioclub.ru/index.php?page=book_red&id=458133&sr=1

Potopakhin V. V. The Art of Algorithmization / V. V. Potopakhin. – Moscow: DMK Press, 2011. – 320 p. Access mode: http://e.lanbook.com/books/element.php?pl1_cid=25&pl1_id=1269

Zykov S.V. Introduction to the theory of programming. Object-oriented approach / S. V. Zykov. – Moscow: National Open University "INTUIT", 2016. – 189 p. Access mode: http://biblioclub.ru/index.php?page=book_red&id=429073&sr=1

Demo version of the complex test is posted on https://magister.urfu.ru/ru/programs/